

VITAL and HEALTH STATISTICS
DATA FROM THE NATIONAL HEALTH SURVEY

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Hearing Levels of Adults

by Race, Region, and Area of Residence

United States - 1960 - 1962

Distribution by race, region, area, age, and sex of hearing thresholds for the better ear in excess of 15 decibels and 5 decibels or more below audiometric zero as determined by pure-tone air-conduction audiometric tests at frequencies of 500, 1000, 2000, 3000, 4000, and 6000 cycles per second.

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In accordance with specifications established by the National Health Survey, 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.

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IN THIS REPORT data are presented on the hearing threshold levels of American adults by race, region, and area of residence as determined through pure-tone audiometric testing at frequencies of 500, 1000, 2000, 3000, 4000, and 6000 cycles per second in the Health Examination Survey during 1960-62. For the survey a probability sample of 7,710 persons was selected to represent the 111 million adults in the civilian, noninstitutional population of the United States, aged 18-79 years. Of these, 6,672 adults, or more than 85 percent, were examined and tested.

Findings are limited here to those for the "better" ear and principally to trends observable at the extremes of the acuity range—those with better than "normal" hearing (thresholds of -5 decibels or more below audiometric zero) and those with presumably some hearing handicap (thresholds above 15 decibels).

Better than "normal" hearing was found to be more prevalent among Negro than white adults throughout the test range for men and at all but 3000 and 4000 cycles per second for women. Impaired hearing was more prevalent among white than Negro adults throughout the test range for both men and women.

Regional findings showed that relatively more adults in the South than in the Northeast or West had hearing thresholds more acute than "normal" throughout the test range, while these "better" hearing levels were less prevalent in the Northeast than elsewhere in the lower tones of 500-3000 cycles. No really distinct pattern of differences in rates for impaired hearing was observed among the regions.

Relatively more adults in rural than urban areas had better than "normal" hearing thresholds at lower frequencies below 4000 cycles, while throughout the test range rural residents were found somewhat more likely than their urban counterparts to have impaired hearing. Some slight differences in prevalence rates of better and less acute hearing but no really consistent pattern was observed among adults living in urban communities of various sizes.

Comparisons with available published findings from previous hearing surveys in this country which contained data by race, region, or area of residence are included.

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 RACE, REGION, AND AREA OF RESIDENCE

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INTRODUCTION

Hearing levels of American adults by race, region, and size of area of residence as estimated from findings of the Health Examination Survey in 1960-62 are presented in this report.

The Health Examination Survey is that part of the National Health Survey developed to secure statistics on the health status of the population of the United States through medical examinations, tests, and measurements on a scientifically selected random sample of the population. Other methods used in the National Health Survey to obtain data on the health status of the population are the Health Interview Survey in which data are secured through household interview and the Health Record Survey where health-related information is extracted from available hospital and other medical records.

In the first cycle, the Health Examination Survey was designed to determine the prevalence of certain chronic diseases, the status of dental health, auditory and visual acuity levels, and the distribution of certain anthropometric measurements among civilian adults living outside of institutions. 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 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.

General plans and the initial program of the Health Examination Survey, the sample population selected as well as those responding, and the effect of nonresponse on the findings are given in previous publications.^{1, 2}

HEARING LEVEL MEASUREMENT

As described in the first report on this phase of the examination findings—"Hearing Levels of Adults by Age and Sex"³—hearing thresholds, which correspond to the weakest intensity of a pure tone produced in the audiometer earphone that is just audible to the ear of the examinee being tested, were determined monaurally and individually for the right and left ear in an acoustically-treated booth within the mobile examining center. Pure-tone, air-conduction audiometers were used for testing at frequencies of 500, 1000, 2000, 3000, 4000, and 6000 cycles per second.

While speech-reception thresholds were not measured in the survey examination, estimates of these levels, determined as recommended by the American Medical Association Committee on Medical Rating of Physical Impairment and the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology,⁴ were 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. These data are in-

cluded in the detailed tables as well as some of the appropriate charts.

Acoustical surveys conducted at two of the examination locations indicated that under normal conditions the test booths provided attenuation of ambient noise well below the maximum allowable sound pressure level prescribed by the American Standards Association 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 cycles. Some slight masking, however, is evident at the 500-cycle frequency because the ambient noise level at this frequency was not sufficiently attenuated at all times in a few of the examination locations.

The quality of the test results was further controlled by the periodic factory calibration of the audiometers and other field checks, as previously described.³

FINDINGS

In analyzing the area and racial patterns of hearing levels among American adults for this report, the hearing thresholds were limited to those for the better ear and were combined into three groups of such a size that the estimates would be sufficiently reliable for this purpose: (1) those with better than "normal" hearing with thresholds of -5 decibels or more below audiometric zero, (2) those testing from -4 to +15 decibels above audiometric zero, or "normal" hearing, and (3) those with thresholds in excess of +15 decibels—this latter group generally assumed to be persons with some degree of hearing handicap ranging from difficulty only with faint speech to inability to understand even amplified speech.⁵ Within the range usually considered most essential for speech (500, 1000, and 2000 cycles per second), roughly one-half of the population had thresholds of -5 decibels or less, two-fifths were between -4 and +15 decibels, and one-tenth were greater than +15 decibels. In the higher frequencies, 3000 and over, hearing thresholds generally became progressively more elevated (hearing became worse). With the increase in frequency of the sound, the proportion of the population with better than normal hearing (-5 decibels or less re audiometric zero) decreased

from about one-fourth at 3000 cycles per second to less than one-tenth at 6000 cycles per second; while the proportion with thresholds in excess of +15 decibels increased from 24 to 44 percent.

Racial Differences

Comparison of racial differences in hearing is limited here to that for the Negro and white groups since the sample of examinees on which these national estimates are based is too small to adequately represent the other nonwhite races.

Better than "normal" hearing (thresholds of -5 decibels or less re audiometric zero) is generally more prevalent among Negro than white adults (table 1 and fig. 1). This pattern was consistent throughout the test range for men but became insignificant or reversed in the middle frequencies of 2000-4000 cycles per second for women.

Impaired hearing (thresholds in excess of +15 decibels re audiometric zero) was more prevalent among white than Negro adults throughout the test range. Here the differential was greater and more consistent among women throughout the test range but was maintained only in the high tones—from 3000 cycles on—for men.

A gross measure of the extent of these racial differences in hearing acuity over the age range tested is obtained by comparing the actual rates with expected rates derived by applying the age-sex-specific national rates to the population in the corresponding racial subgroup (fig. 2 and tables 1-4). Since about 90 percent of the population is white, the actual and expected rates among these persons with better than "normal" hearing and with some hearing handicap were in fairly good agreement. However, Negro adults tended to have somewhat better than expected hearing acuity—that is, relatively more than expected had thresholds at or below -5 decibels re audiometric zero (at all but 2000 and 4000 cycles per second) and fewer showed some hearing handicap at the higher frequencies (3000 cycles and over). This pattern reflects the greater than expected prevalence of better hearing among Negro men as well as the lower prevalence of some hearing handicap among Negro women throughout the test range and among Negro men at frequen-

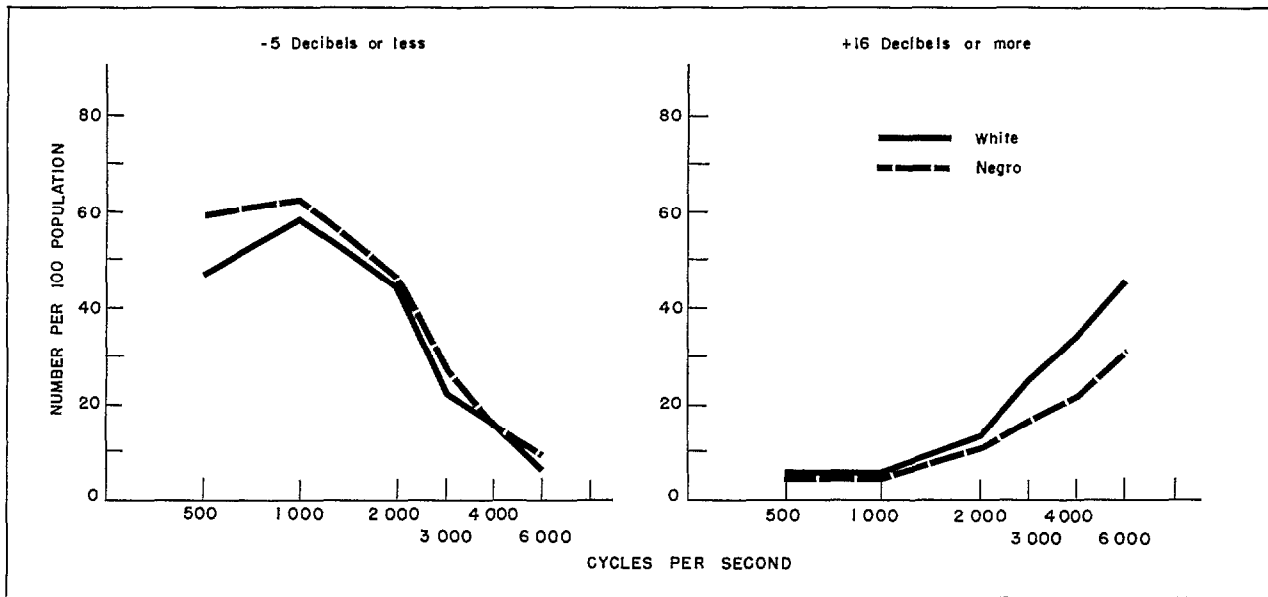


Figure 1. Rates for white and Negro adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second.

cies above 2000 cycles. Rates among Negro women were in somewhat better agreement with those expected (and hence with those for white women) than were rates for Negro men.

Comparison of the actual age-specific rates showed no consistent pattern of racial differences in hearing acuity throughout the test range for men or women, with one exception. At the higher frequencies (3000 cycles and over) white men were more likely than Negro men to have a hearing handicap (threshold in excess of +15 decibels), the racial difference increasing with age up to but not beyond 55 years (tables 2 and 3 and figs. 3 and 4).

The few previous studies in which racial differences in hearing acuity have been assessed are not in complete agreement among themselves or with the present study, possibly because of differences in testing methods or the populations studied.

One of the earliest of these studies of racial differences in hearing loss—that made in 1930 among patients in Johns Hopkins Hospital⁶—showed that hearing loss among women was similar for both races throughout the 20-59-year age span and the entire test range, as in the present study. Among men, racial differences were negligible at low tones but Negroes showed markedly superior hearing acuity to white men

at higher tones and older age levels. This superiority tended to increase both with ascending frequency and greater age, a finding consistent with those for the U.S. population in the present study as far as tone but not age is concerned.

Negroes tested in the 1939 World Fair Surveys^{7, 8} were found to have hearing acuity inferior to that for white persons at the lower frequencies (below 3520 cycles) and to have superior acuity at the higher frequencies—again somewhat at variance with present findings for the entire population.

Data on defective hearing from examination but not comparable audiometric test results from the Selective Service System⁹ and men drafted during World War II¹⁰ show a relative excess in the defective hearing rate of white over Negro men which apparently increases with age—similar to the finding in the present study up to 45 years of age or about the range included in the military population.

Regional Differences

Of the three regions into which the country was divided for the purposes of this survey—the Northeast, South, and West—relatively more adults in the South than in the remainder of the

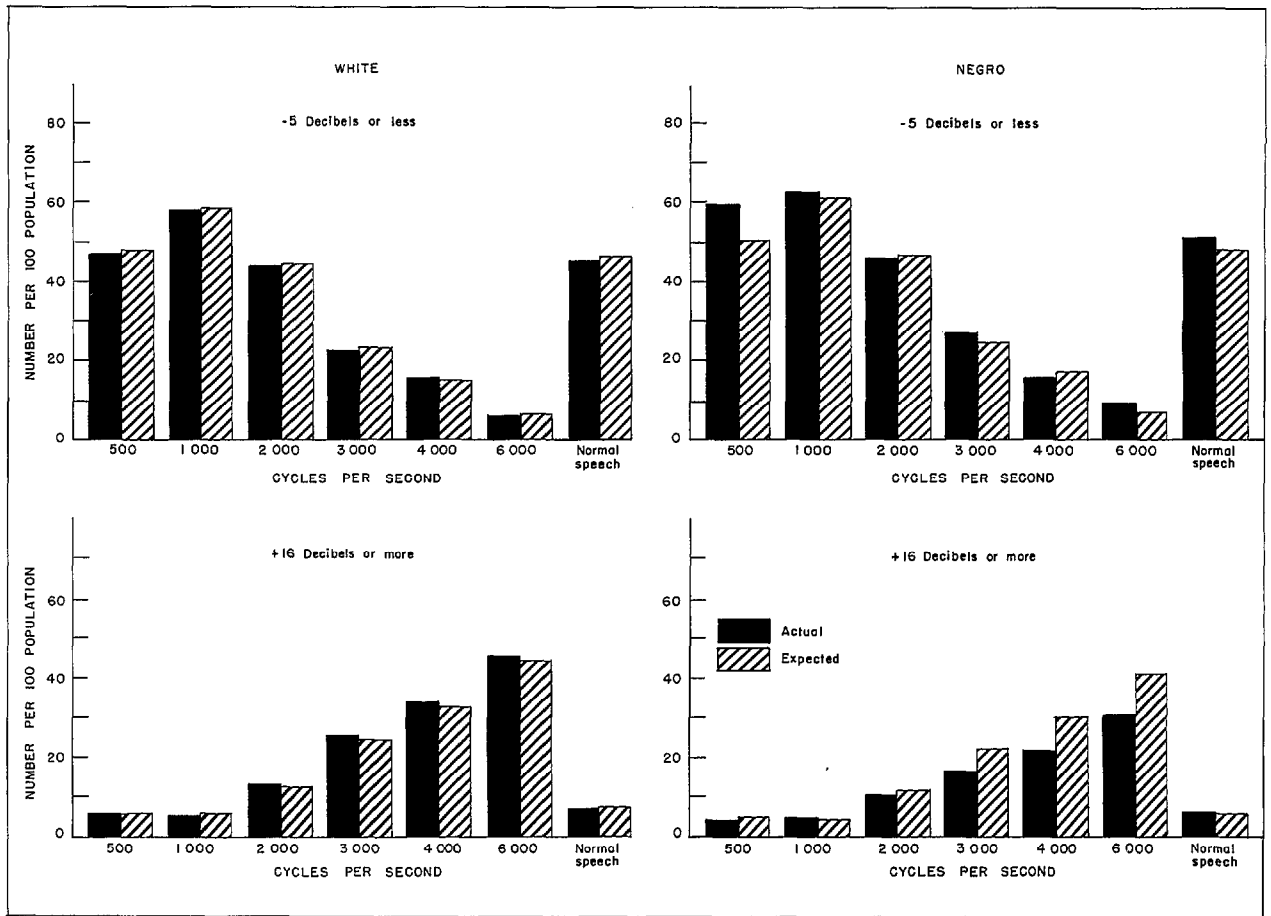


Figure 2. Actual and expected rates for white and Negro adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second.

country had hearing thresholds more acute than "normal" in their better ear (i.e., -5 decibels or less re audiometric zero) throughout the test range; while up to 4000 cycles per second these rates were lowest in the Northeast. Rates for those with some degree of hearing impairment in their better ear (i.e., thresholds of more than +15 decibels re audiometric zero) showed a somewhat less distinct pattern of regional differences with, in general, the only consistent trend being that proportionately more in the West than elsewhere had thresholds no better than +15 decibels at the higher frequencies over 2000 cycles per second (table 5 and fig. 5).

In comparison with what would have been expected if national age-specific rates applied in each region, the Northeast was found to have proportionately fewer persons than expected with at least "normal" hearing (thresholds) in the lower frequencies through 3000 cycles per second, while an excess existed in the South throughout the test range and at the middle tones (1000-3000 cycles) in the West. Among those with some hearing handicap any pattern of regional differences was less distinct, however, rates in the South were slightly but not significantly greater than expected throughout the test range (tables A, 5, and 6).

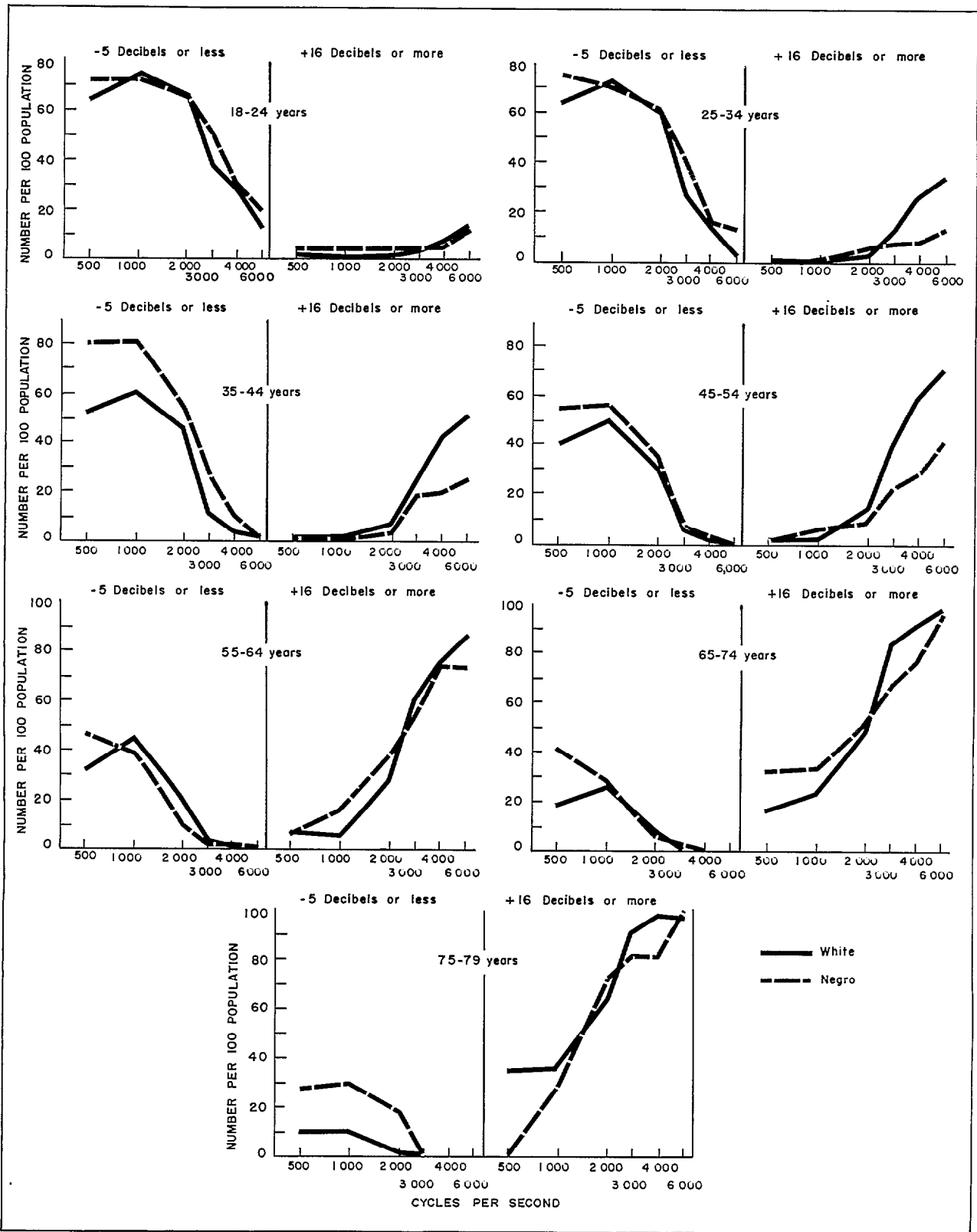


Figure 3. Rates for white and Negro men having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by age.

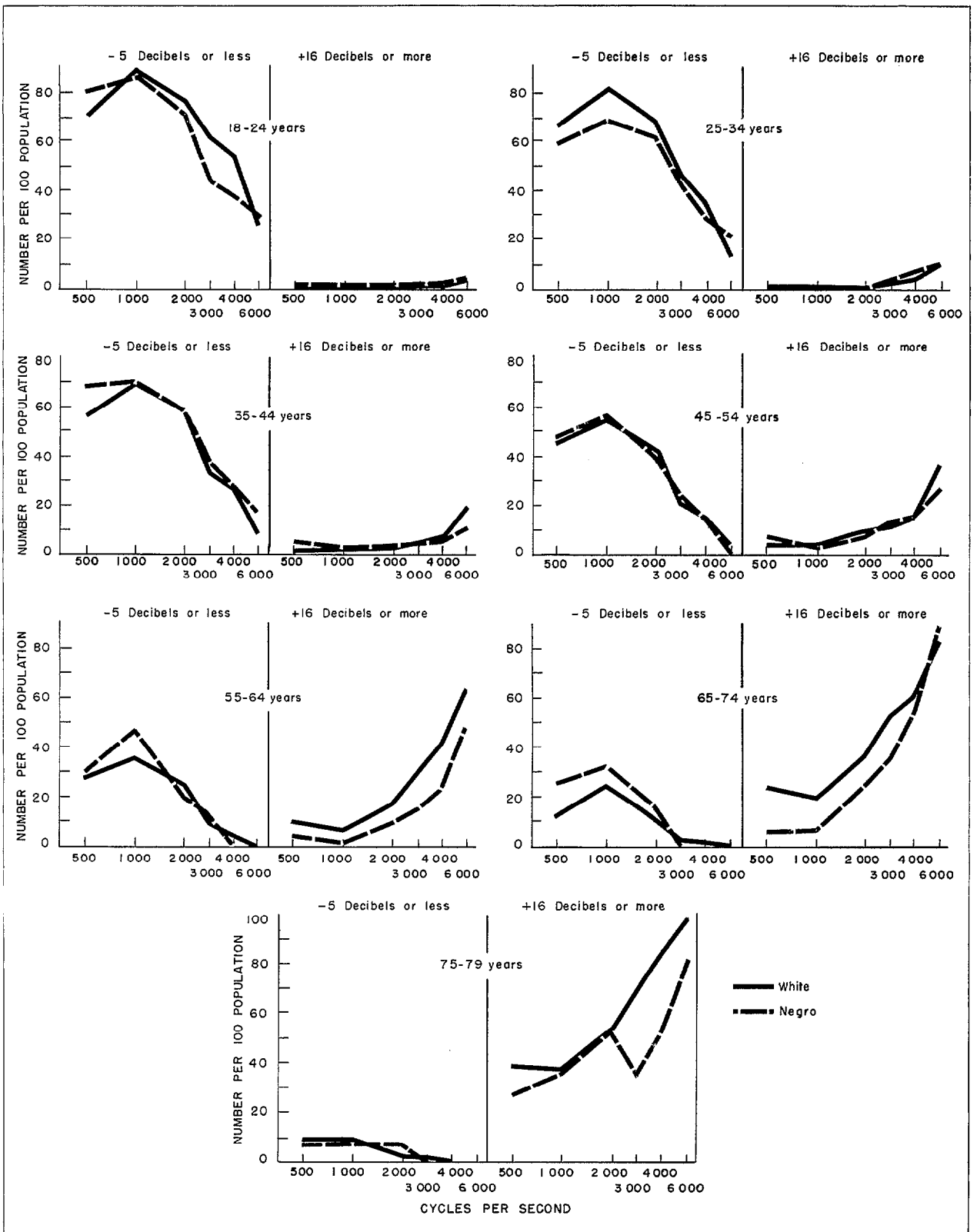


Figure 4. Rates for white and Negro women having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by age.

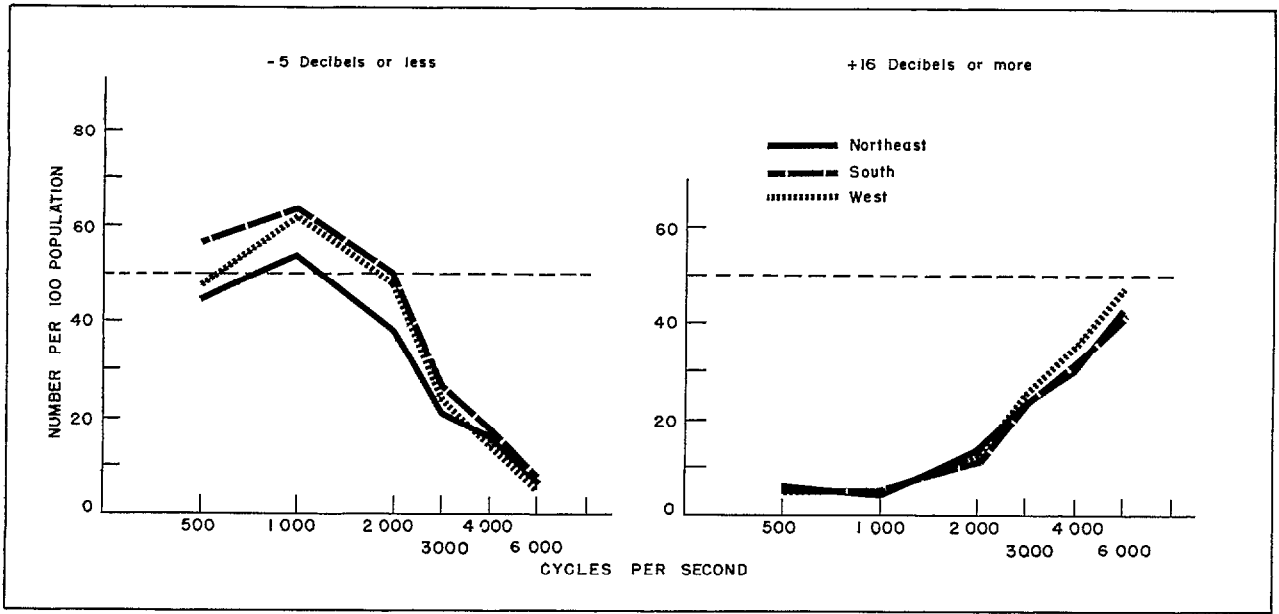


Figure 5. Rates for adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by geographic region.

Table A. Comparison of actual and expected rates for adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by geographic region: United States, 1960-62

Tonal frequency in cycles per second	Excess of actual over expected rates					
	Thresholds of -5 dB. or less			Thresholds of more than +15 dB.		
	North-east	South	West	North-east	South	West
500-----	-4.2	+6.5	-0.8	+0.2	+0.3	-0.4
1000-----	-5.2	+3.1	+2.9	-0.6	+0.7	-
2000-----	-6.8	+3.4	+4.2	+1.2	+0.1	-1.2
3000-----	-2.3	+1.9	+1.0	-0.6	+0.6	-
4000-----	+0.9	+0.1	-1.0	-2.1	+1.2	+1.1
6000-----	-	+0.4	-0.2	-1.2	+0.3	+0.9

The higher than expected prevalence of better than "normal" hearing and the slightly higher prevalence of some hearing handicap in the South reflected a pattern of larger age-specific rates at these levels in that region than elsewhere, particularly in the tones below 3000 cycles per second among men and to a lesser extent among women. Similarly, the deficit in better than "normal" hearing in the Northeast reflected lower age-specific rates in that region than elsewhere particularly in tones from 1000 to 4000 cycles.

The pattern of racial differences noted previously was present to some extent within each of the three regions of the United States. Better than "normal" hearing was more prevalent among Negro than white persons throughout the test range in the West but was less consistently so in the other two regions—at all but 1000 and 4000 cycles in the Northeast and at all but 2000 and 4000 cycles in the South (fig. 6 and table 7).

Impaired hearing was found more frequently among white than Negro adults throughout the test range in the West, but only at the higher frequencies in the other two regions—2000 cycles and over in the Northeast and from 3000 cycles on in the South.

Comparison with what would have been expected if regional age-sex-specific rates had applied in each of the two racial groups shows that the rates for those with some hearing handicap from 3000 cycles on were lower than expected among Negroes in all three regions (tables B, 7, and 8).

Urban-Rural Differences

To assess urban and rural differences in hearing levels of adults, urban areas of residence are considered here as a group and by population size of urban place in the following seven classes:

- Urbanized areas of
 - 3 million or more population
 - 1 to 3 million
 - 250,000 to 1 million
 - Under 250,000
- Urban places, outside of urbanized areas of
 - 25,000 or more
 - 10,000 to 25,000
 - 2,500 to 10,000

Relatively more adults in rural than in all urban areas combined had better than "normal" hearing thresholds (-5 decibels or less re audiometric zero) in the frequencies below 4000 cycles per second. The reversal found at 4000 and 6000 cycles was so slight it is probably due to sampling error rather than indicating any real trend (table 9 and fig. 7).

Within the various urban areas no consistent relationship of better hearing levels with population size of place of residence was evident, with three exceptions. Rates remained among the highest up to 6000 cycles for those living in urban places of 2,500 to 10,000 population and in the lower frequencies of 500 through 2000 cycles for those in urbanized areas of 1 to 3 million, while these rates were consistently among the lowest throughout the test range in urban places of 10,000 to 25,000 outside of urbanized areas. The reasons for these area differences are not apparent from the data available and they do not appear to be associated with age.

Adults in rural areas were found somewhat more likely to have a hearing handicap (a threshold of more than +15 decibels re audiometric zero) than those in all urban areas combined throughout the test range. Within the urban areas, a hearing handicap was more likely to be found among adults in urban places of 25,000 or more outside of urbanized areas and less likely in large metropolitan areas of 1 to 3 million.

In relation to what would have been expected if national age-specific rates had existed in the various areas, no consistent pattern emerged for those with better hearing levels (tables C, 9, and 10). Among those with a hearing handicap, fewer than expected were found in areas with 1 to 3 million population, while rates were higher than expected in the smaller urbanized areas of less than 1 million, in larger urban places of more than 10,000, and in rural areas. Hence this study provides no evidence of any consistent increase in defective hearing with greater population concentration in the urban areas.

Urban and rural areas were similar in the consistency and magnitude of racial differences in hearing thresholds. Better than "normal" hearing (thresholds of -5 decibels or less re audiometric zero) was generally more prevalent among

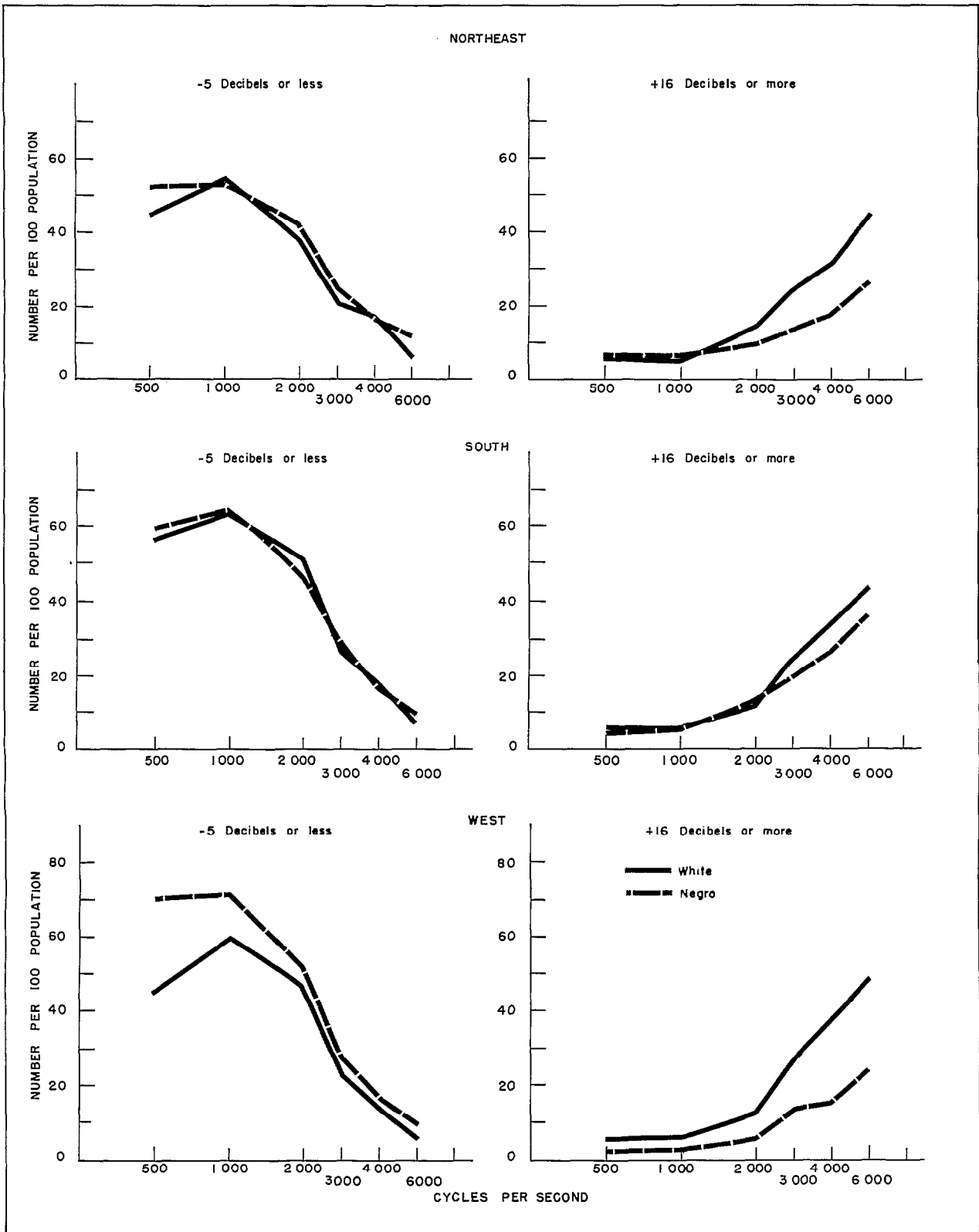


Figure 6. Rates for white and Negro adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by geographic region.

Table B. Comparison of actual and expected rates for adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by race and geographic region: United States, 1960-62

Race and tonal frequency in cycles per second	Excess of actual over expected rates					
	Thresholds of -5 dB. or less			Thresholds of more than +15 dB.		
	North- east	South	West	North- east	South	West
<u>White</u>						
Number per 100 population						
500-----	-0.4	-0.6	-1.8	-0.2	+0.2	-0.1
1000-----	+0.3	-0.3	-0.7	-0.2	+0.1	+0.1
2000-----	-0.2	+0.8	-0.6	+0.1	-0.2	+0.3
3000-----	-0.1	-0.5	-0.7	+0.6	+0.9	+0.6
4000-----	+0.2	+0.3	+0.2	+0.7	+1.6	+1.3
6000-----	-0.4	-0.4	+0.2	+1.0	+1.8	+1.0
<u>Negro</u>						
500-----	+4.0	+2.9	+18.5	+1.7	-1.0	-1.2
1000-----	-4.5	+1.0	+5.1	+2.5	-0.5	-1.4
2000-----	+0.9	-3.5	-1.1	-1.3	+1.0	-3.4
3000-----	+1.1	+1.6	+1.4	-6.4	-3.6	-7.8
4000-----	-2.3	-1.1	-	-7.5	-6.1	-16.4
6000-----	+4.9	+1.8	+2.5	-11.2	-6.7	-18.0

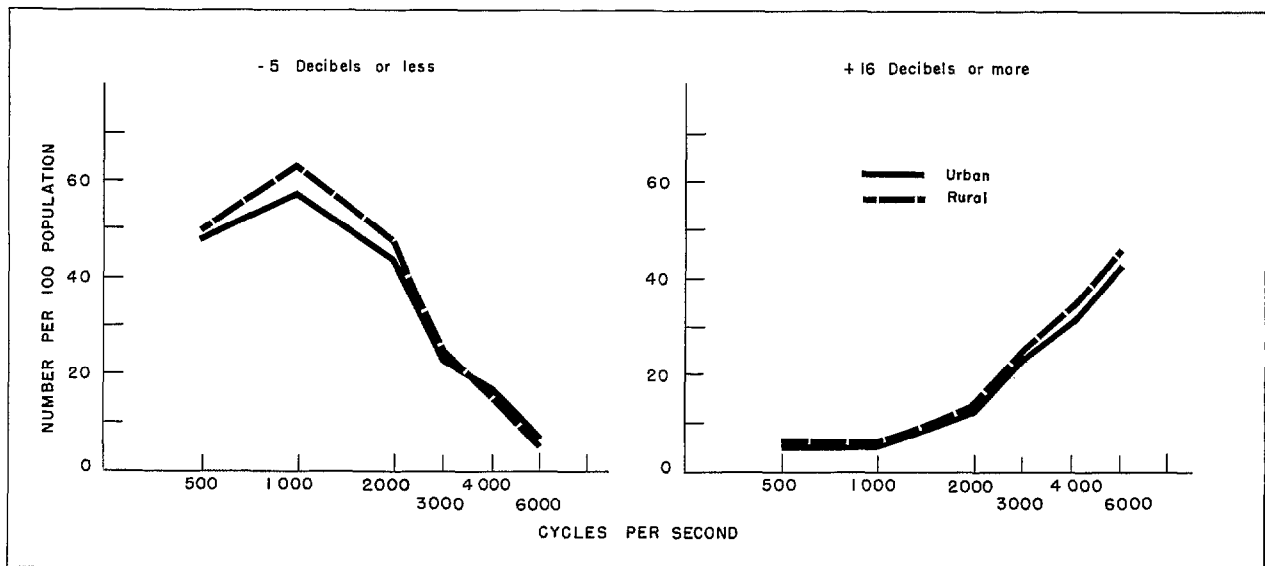


Figure 7. Rates for adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by urban and rural areas.

Table C. Comparison of actual and expected rates for adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by area of residence: United States, 1960-62

Hearing levels and area of residence	Excess of actual over expected rates for tonal frequencies in cycles per second					
	500	1000	2000	3000	4000	6000
<u>Thresholds of -5 decibels or less</u>	Number per 100 population					
Total urban-----	-0.2	-1.7	-1.0	-0.6	+0.2	+0.4
Urbanized areas:						
3 million or more-----	-5.2	-6.7	-2.6	+1.4	+1.4	+2.3
1 to 3 million-----	+4.8	+4.8	+4.8	-2.3	-2.7	+3.3
250,000 to 1 million-----	+4.4	-1.6	-0.7	+2.8	+2.0	+0.1
Under 250,000-----	-3.8	+0.4	-3.9	-4.4	-1.0	-2.0
Urban places outside of urbanized areas:						
25,000 or more-----	+2.9	-7.0	-5.6	+0.2	+3.9	-2.2
10,000 to 25,000-----	-9.6	-10.4	-5.9	-7.0	-2.1	-1.9
2,500 to 10,000-----	+4.6	+5.1	+3.6	+1.8	+0.8	-0.1
Rural-----	+0.5	+3.5	+2.0	+1.2	-0.3	-0.8
<u>Thresholds of more than +15 decibels</u>						
Total urban-----	-0.3	-0.1	-0.4	-0.3	-0.7	-1.0
Urbanized areas:						
3 million or more-----	-0.9	-	-0.9	-3.4	-2.7	-2.6
1 to 3 million-----	-2.9	-2.6	-3.1	-3.7	-4.1	-7.5
250,000 to 1 million-----	-0.5	+0.4	+1.1	+1.6	+0.9	+1.0
Under 250,000-----	+0.7	+0.1	+0.2	+1.4	-0.2	+2.8
Urban places outside of urbanized areas:						
25,000 or more-----	+2.0	+6.0	+5.0	+6.6	+5.2	+1.4
10,000 to 25,000-----	+0.8	-0.3	+0.3	+2.9	+2.5	-0.1
2,500 to 10,000-----	-1.6	-0.1	-2.3	-2.7	-1.7	-0.9
Rural-----	+0.6	+0.3	+0.9	+0.8	+1.4	+2.1

Negro than white adults in rural and in urban areas. This pattern was found throughout the test range for men in both types of areas, while for women it was inconsistent and less distinct at frequencies above 1000 cycles per second (fig. 8 and table 11).

In both urban and rural areas, impaired hearing (+16 decibels or more above audiometric zero) was more prevalent among white than Negro adults. The pattern was consistent for women over the entire test range in both kinds of areas and for men at frequencies above 2000 cycles per second.

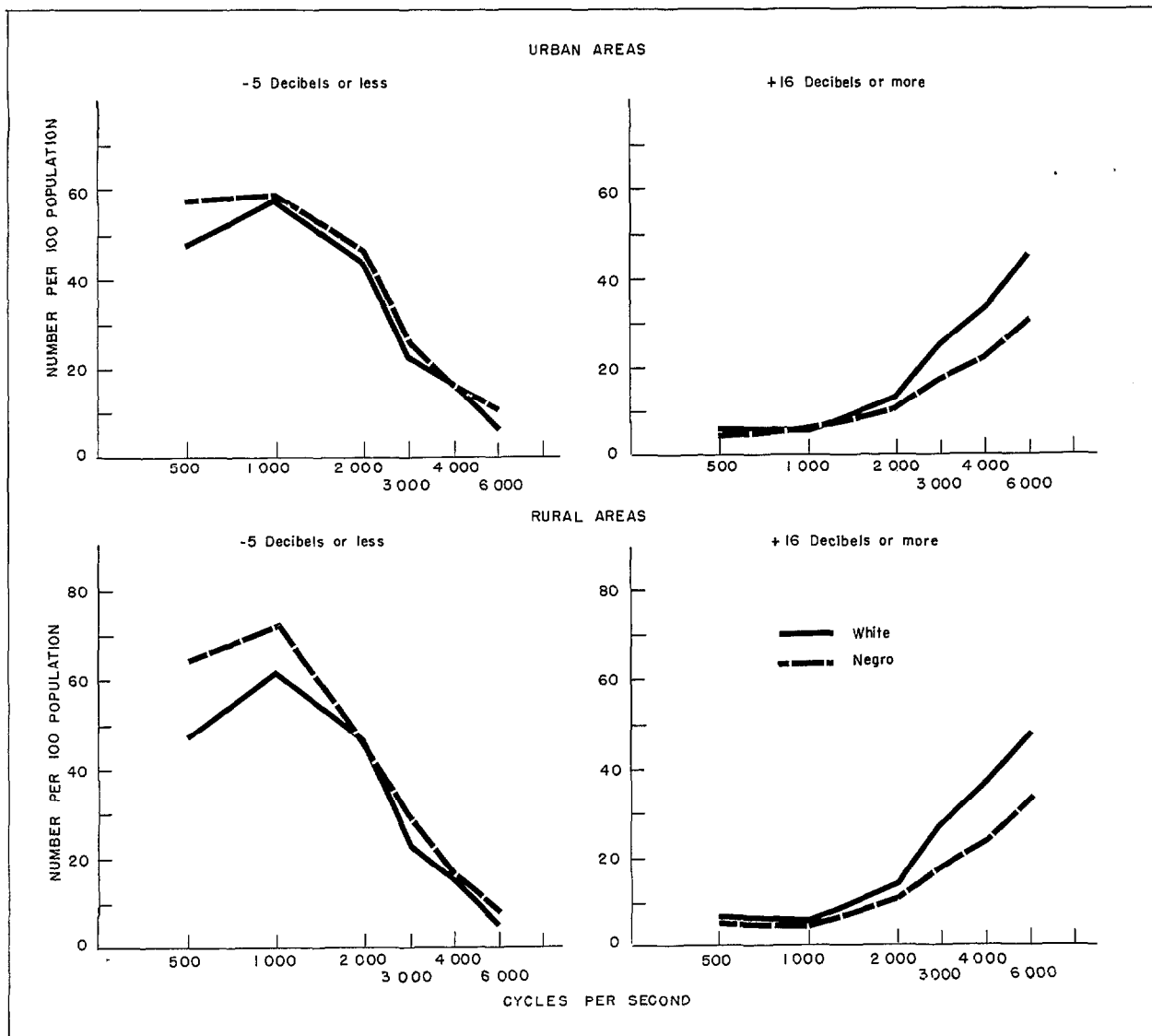


Figure 8. Rates for white and Negro adults having hearing levels (in decibels re audiometric zero) better than "normal" and with some hearing handicap in the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by urban and rural areas.

More Negro men than expected exhibited better than "normal" hearing over the test range in both urban and rural areas, while better hearing acuity in white men generally occurred less frequently than expected (tables 11 and 12). The excess of actual over expected rates for better than "normal" hearing was not found consistently throughout the test range for either white or Negro women.

Impaired hearing was found less frequently than expected over the test range among Negro women in both urban and rural areas and in general slightly more frequently than expected among white women. For men the pattern was less distinct and inconsistent at low frequencies up to 3000 cycles per second. In the higher frequencies Negro men were considerably less likely than expected to

have a hearing handicap and white men somewhat more likely than expected.

Previous surveys provided little, if any, comparable information on hearing levels among persons in urban and rural areas. Glorig et al., in the 1954¹¹ Wisconsin State Fair Survey found a pattern consistent with those in the present study among a sample of men 30-59 years of age in that area where the urban group showed more hearing loss than the rural at low frequencies. This pattern did not extend consistently to younger men nor to the higher frequencies for the Wisconsin group. Whether the latter reflects a local peculiarity, the possibility of bias in the Wisconsin sample, differences in urban-rural classification, environmental differences, differences in testing methods, or some other factor can only be a matter of conjecture.

SUMMARY

Racial, regional, and urban-rural differences in hearing threshold levels for the better ear among American adults at tonal frequencies of 500-6000 cycles per second are assessed in this report. These findings are based on pure-tone air-conduction tests in the Health Examination Survey of a national random sample of the civilian noninstitutional population 18-79 years of age.

In general these findings show:

1. Hearing tended to be somewhat less acute in general among white than Negro adults.

This finding is more consistent for men than women throughout the test range.

2. By age, however, no consistent pattern of racial differences was found except for men with some hearing handicap at frequencies of 3000 cycles or greater. From this point on, the racial differences for men but not women increased with age up to but not beyond 55 years.
3. By region, the rates for those with better than "normal" hearing (levels of -5 decibels or less re audiometric zero) were slightly greater in the South than elsewhere, while for those with some hearing handicap (threshold exceeding +15 decibels) the rates tended to be similar except for the slight excess at the higher frequencies in the West.
4. Rural residents were found to be somewhat more likely than their urban counterparts to have better than "normal" hearing below 4000 cycles per second and also more likely to have some hearing handicap throughout the test range. However, no consistent pattern of an increase in the prevalence of "defective" hearing with increased urbanization was found in this study.

REFERENCES

- ¹National 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.
- ²National 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, Apr. 1964.
- ³National Center for Health Statistics: Hearing levels of adults by age and sex, United States, 1960-1962. *Vital and Health Statistics*. PHS Pub. No. 1000-Series 11-No. 11. Public Health Service. Washington. U.S. Government Printing Office, Oct. 1965.
- ⁴Committee 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.
- ⁵National 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.
- ⁶Bunch, C. C., and Raiford, S. B.: Race and sex variations in auditory acuity. *Arch.Otolaryngology* 13:423-434, 1931.
- ⁷Montgomery, H. C.: Analysis of world's fairs hearing tests. *Bell Lab.Record* 18:98-103, 1939.
- ⁸Post, R. H.: Hearing acuity variation among Negroes and whites. *Eugenics Quart.* 11(2):65-81, June 1964.
- ⁹*United States Statistics*. Periodic Reports of Physical Examination. National Headquarters, Selective Service System, 1940-1944. 3:68, 1945.
- ¹⁰Office of the Surgeon General: *Tabulating Equipment and Army Medical Statistics*, by A. G. Love, E. L. Hamilton, and I. L. Hellman. Dept. of the Army, 1958. pp. 75-78.
- ¹¹Glorig, 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.



DETAILED TABLES

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Table	<p>1. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and race: United States, 1960-62-----</p> <p>2. Actual percentage of adults having hearing levels (in decibels re audiometric zero) within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by sex, age, and race: United States, 1960-62-----</p> <p>3. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and race: United States, 1960-62-----</p> <p>4. Number of adults having hearing levels (in decibels re audiometric zero) within specified ranges for the better ear at 2000 cycles per second, by sex, age, and race: United States, 1960-62-----</p> <p>5. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and region: United States, 1960-62-----</p> <p>6. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and region: United States, 1960-62-----</p> <p>7. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by race and region: United States, 1960-62-----</p> <p>8. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by race and region: United States, 1960-62-----</p> <p>9. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by size of area of residence: United States, 1960-62-----</p> <p>10. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by size of area of residence: United States, 1960-62---</p> <p>11. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by urban and rural areas, race, and sex: United States, 1960-62-----</p> <p>12. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by urban and rural areas, race, and sex: United States, 1960-62-----</p>	<p>16</p> <p>17</p> <p>19</p> <p>20</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p> <p>26</p> <p>27</p> <p>28</p> <p>29</p>
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Table 1. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and race: United States, 1960-62

Sex and tonal frequency in cycles per second	Hearing levels in decibels re audiometric zero											
	-5 decibels or less				-4 to +15 decibels				+16 decibels or more			
	All races	White	Negro	Other	All races	White	Negro	Other	All races	White	Negro	Other
<u>Both sexes</u>	Number per 100 population											
500-----	49.1	47.4	59.6	69.0	45.2	46.8	35.8	26.4	5.7	5.8	4.6	4.6
1000-----	59.3	58.5	62.8	77.2	35.4	36.1	32.3	19.8	5.3	5.4	4.9	3.0
2000-----	45.1	44.4	46.2	71.4	42.3	42.6	43.3	21.6	12.6	13.0	10.5	7.0
3000-----	23.5	22.7	27.0	40.2	52.3	52.0	56.2	44.0	24.2	25.3	16.8	15.8
4000-----	16.0	16.0	16.0	15.7	51.6	50.0	62.2	67.4	32.4	34.0	21.8	16.9
6000-----	6.4	6.1	9.7	4.1	49.9	48.5	59.4	64.2	43.7	45.4	30.9	31.7
Normal speech ¹ --	46.8	45.7	51.5	73.1	45.9	46.9	41.9	21.2	7.3	7.4	6.6	5.7
<u>Men</u>												
500-----	48.9	46.8	64.3	67.1	46.3	48.4	31.1	27.2	4.8	4.8	4.6	5.7
1000-----	57.0	56.1	62.3	71.9	37.5	38.6	30.1	22.4	5.5	5.3	7.6	5.7
2000-----	41.0	40.3	42.8	67.6	43.5	44.1	41.9	25.0	15.5	15.6	15.3	7.4
3000-----	15.8	14.7	22.8	30.3	49.8	49.6	51.3	48.9	34.4	35.7	25.9	20.8
4000-----	8.4	8.1	10.4	11.4	44.5	42.5	58.6	63.8	47.1	49.4	31.0	24.8
6000-----	3.2	3.0	5.4	3.4	40.9	38.9	55.9	59.0	55.9	58.1	38.7	37.6
Normal speech ¹ --	43.3	41.8	51.3	73.5	49.1	50.6	40.1	20.8	7.6	7.6	8.6	5.7
<u>Women</u>												
500-----	49.2	48.0	55.6	71.1	44.3	45.2	39.8	25.4	6.5	6.8	4.6	3.5
1000-----	61.4	60.8	63.2	82.9	33.6	33.7	34.2	17.1	5.0	5.5	2.6	0.0
2000-----	48.8	48.2	49.0	75.5	41.3	41.3	44.4	18.0	9.9	10.5	6.6	6.5
3000-----	30.5	30.1	30.5	50.6	54.5	54.1	60.2	38.9	15.0	15.8	9.3	10.5
4000-----	22.9	23.2	20.7	20.3	58.1	56.9	65.2	71.1	19.0	19.9	14.1	8.6
6000-----	9.3	8.9	13.2	4.8	58.0	57.3	62.3	69.7	32.7	33.8	24.5	25.5
Normal speech ¹ --	49.9	49.3	51.7	72.8	43.1	43.4	43.4	21.5	7.0	7.3	4.9	5.7

¹Average hearing level at 500-2000 cycles per second.

Table 2. Actual percentage of adults having hearing levels (in decibels re audiometric zero) within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by sex, age, and race: United States, 1960-62

Sex and age	500 cycles per second						1000 cycles per second					
	-5 dB or less		-4 to +15 dB		+16 dB or more		-5 dB or less		-4 to +15 dB		+16 dB or more	
	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro
Both sexes												
Number per 100 population												
All ages, 18-79 years--	47.4	59.6	46.8	35.8	5.8	4.6	58.5	62.8	36.1	32.3	5.4	4.9
18-24 years-----	68.0	77.0	31.3	19.5	0.7	3.5	83.2	80.9	16.5	15.6	0.3	3.5
25-34 years-----	65.3	66.1	33.3	33.9	1.4	-	77.6	70.0	21.2	30.1	1.2	-
35-44 years-----	54.5	74.3	43.5	21.9	2.0	3.8	64.9	75.4	32.6	22.9	2.5	1.7
45-54 years-----	43.4	51.7	53.1	43.8	3.6	4.5	53.5	57.4	43.1	38.0	3.4	4.5
55-64 years-----	29.4	38.7	61.6	56.1	9.0	5.2	40.2	43.3	53.8	48.4	5.9	8.3
65-74 years-----	15.4	32.7	64.1	50.0	20.5	17.2	24.6	30.3	54.8	52.1	20.6	17.6
75-79 years-----	8.7	16.3	55.2	68.4	36.2	15.4	9.6	17.4	54.0	50.5	36.4	32.1
Men												
All ages, 18-79 years--	46.8	64.3	48.4	31.1	4.8	4.6	56.1	62.3	38.6	30.1	5.3	7.6
18-24 years-----	64.5	72.4	34.4	22.7	1.1	4.9	76.3	73.9	23.4	21.2	0.3	4.9
25-34 years-----	64.2	76.6	34.6	23.4	1.1	-	73.9	71.3	25.2	28.7	1.0	-
35-44 years-----	52.4	80.6	45.6	18.0	2.0	1.4	60.3	81.2	36.8	18.0	2.9	0.8
45-54 years-----	41.6	55.2	56.1	43.0	2.3	1.8	50.2	57.6	47.4	35.3	2.4	7.1
55-64 years-----	31.5	46.4	61.4	47.5	7.0	6.1	44.8	38.8	50.1	45.4	5.1	15.8
65-74 years-----	18.7	41.4	64.5	27.2	16.8	31.4	25.1	27.7	52.1	39.9	22.8	32.4
75-79 years-----	9.2	27.5	56.4	72.5	34.4	-	10.2	30.1	54.1	41.4	35.8	28.5
Women												
All ages, 18-79 years--	48.0	55.6	45.2	39.8	6.8	4.6	60.8	63.2	33.7	34.2	5.5	2.6
18-24 years-----	71.0	80.4	28.6	17.1	0.4	2.5	89.1	86.2	10.6	11.3	0.3	2.5
25-34 years-----	66.3	59.2	32.1	40.8	1.6	-	81.1	69.0	17.5	31.0	1.4	-
35-44 years-----	56.4	68.9	41.6	25.2	2.0	5.9	69.2	70.3	28.6	27.1	2.2	2.6
45-54 years-----	45.0	48.1	50.2	44.6	4.8	7.3	56.6	57.2	39.0	40.8	4.4	2.1
55-64 years-----	27.4	30.8	61.8	64.6	10.8	4.6	36.1	47.7	57.2	51.3	6.7	1.1
65-74 years-----	12.6	25.5	63.7	68.6	23.6	5.9	24.2	32.6	56.9	61.9	18.8	5.5
75-79 years-----	8.1	7.4	53.8	64.9	38.1	27.7	8.9	7.4	53.9	57.4	37.2	35.1
2000 cycles per second						3000 cycles per second						
Both sexes												
Number per 100 population												
All ages, 18-79 years--	44.4	46.2	42.6	43.3	13.0	10.5	22.7	27.0	52.0	56.2	25.3	16.8
18-24 years-----	72.2	68.6	26.9	27.9	0.9	3.5	50.6	46.7	47.2	49.8	2.2	3.5
25-34 years-----	64.4	63.0	33.4	34.5	2.2	2.4	37.4	42.2	54.9	53.9	7.7	4.0
35-44 years-----	52.5	56.0	42.5	40.6	5.0	3.5	22.8	33.0	61.6	55.6	15.6	11.4
45-54 years-----	36.9	38.5	50.8	53.2	12.4	8.3	14.2	15.5	60.3	66.4	25.5	18.1
55-64 years-----	22.6	14.6	55.8	61.8	21.6	23.7	6.9	7.3	48.4	58.0	44.7	34.8
65-74 years-----	9.4	11.3	49.2	52.2	41.4	36.5	1.5	1.2	32.7	49.7	65.8	49.1
75-79 years-----	1.7	12.4	39.3	25.5	59.0	62.1	0.9	-	18.1	44.7	81.0	55.3
Men												
All ages, 18-79 years--	40.3	42.8	44.1	41.9	15.6	15.3	14.7	22.8	49.6	51.3	35.7	25.9
18-24 years-----	66.7	65.5	32.0	29.6	1.3	4.9	37.2	50.9	59.4	44.1	3.4	4.9
25-34 years-----	60.6	63.0	36.3	30.8	3.1	6.2	27.6	41.4	59.2	50.4	13.2	8.2
35-44 years-----	46.2	54.0	46.8	42.0	7.0	3.9	11.8	27.7	62.0	52.6	26.2	19.7
45-54 years-----	31.8	36.2	53.0	54.5	15.2	9.2	6.9	7.6	52.7	69.4	40.4	23.0
55-64 years-----	20.7	10.0	52.1	52.0	27.2	38.0	3.5	1.1	36.2	44.9	60.2	54.0
65-74 years-----	7.4	5.1	44.0	42.9	48.6	52.0	-	2.6	16.5	30.7	83.5	66.8
75-79 years-----	1.6	18.8	34.4	8.7	64.1	72.5	-	-	8.4	18.8	91.6	81.2

Table 2. Actual percentage of adults having hearing levels (in decibels re audiometric zero) within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second, by sex, age, and race: United States, 1960-62—Con.

Sex and age	2000 cycles per second						3000 cycles per second					
	-5 dB or less		-4 to +15 dB		+16 dB or more		-5 dB or less		-4 to +15 dB		+16 dB or more	
	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro
Women												
Number per 100 population												
All ages, 18-79 years--	48.2	49.0	41.3	44.4	10.5	6.6	30.1	30.5	54.1	60.2	15.8	9.3
18-24 years-----	76.9	71.0	22.4	26.6	0.7	2.5	62.2	43.5	36.6	54.0	1.2	2.5
25-34 years-----	68.0	63.0	30.6	37.0	1.4	-	46.5	42.8	50.9	56.1	2.6	1.2
35-44 years-----	58.4	57.5	38.4	39.4	3.2	3.1	33.0	37.6	61.2	58.0	5.8	4.4
45-54 years-----	41.6	40.7	48.6	51.8	9.7	7.5	21.0	23.3	67.5	63.3	11.4	13.3
55-64 years-----	24.3	19.1	59.0	71.4	16.7	9.5	9.9	13.5	59.5	70.9	30.6	15.6
65-74 years-----	11.0	16.4	53.3	59.6	35.6	24.0	2.8	-	45.8	65.1	51.5	34.9
75-79 years-----	1.9	7.4	44.4	38.4	53.8	54.2	1.9	-	28.2	64.7	69.9	35.3
Both sexes												
Number per 100 population												
All ages, 18-79 years--	16.0	16.0	50.0	62.2	34.0	21.8	6.1	9.7	48.5	59.4	45.4	30.9
18-24 years-----	42.3	35.0	52.8	61.5	4.9	3.5	19.9	24.7	70.4	66.9	9.6	8.4
25-34 years-----	25.4	23.0	59.8	69.1	14.7	7.9	8.7	18.2	69.1	70.3	22.1	11.5
35-44 years-----	15.4	19.6	59.6	67.9	25.0	12.5	5.4	10.2	59.3	72.0	35.3	17.8
45-54 years-----	8.4	8.4	54.9	69.5	36.7	22.0	2.8	0.3	43.8	65.5	53.4	34.2
55-64 years-----	2.9	0.6	39.5	50.3	57.6	49.2	0.1	-	25.4	39.5	74.5	60.5
65-74 years-----	0.7	-	25.9	36.4	73.4	63.6	-	-	11.8	8.4	88.2	91.6
75-79 years-----	-	-	8.4	35.9	91.6	64.1	-	-	2.5	10.6	97.5	89.4
Men												
All ages, 18-79 years--	8.1	10.4	42.5	58.6	49.4	31.0	3.0	5.4	38.9	55.9	58.1	38.7
18-24 years-----	28.5	31.5	63.0	63.5	8.5	4.9	12.6	19.6	71.9	68.1	15.5	12.4
25-34 years-----	14.9	15.6	58.6	75.8	26.5	8.5	3.6	13.4	61.8	73.1	34.6	13.5
35-44 years-----	3.8	10.3	52.3	69.2	43.8	20.5	2.2	1.2	45.6	72.8	52.2	26.0
45-54 years-----	2.1	2.9	38.2	67.9	59.7	29.2	0.6	-	27.3	57.8	72.1	42.2
55-64 years-----	1.1	1.1	23.6	24.4	75.3	74.5	-	-	13.6	26.6	86.4	73.4
65-74 years-----	-	-	9.2	24.4	90.8	75.6	-	-	3.6	5.1	96.4	94.9
75-79 years-----	-	-	1.4	18.8	98.6	81.2	-	-	3.0	-	97.0	-
Women												
All ages, 18-79 years--	23.2	20.7	56.9	65.2	19.9	14.1	8.9	13.2	57.3	62.3	33.8	24.5
18-24 years-----	54.2	37.6	43.9	59.9	1.9	2.5	26.2	28.5	69.2	66.0	4.6	5.5
25-34 years-----	35.2	27.9	61.0	64.6	3.8	7.5	13.5	21.3	76.0	68.4	10.5	10.3
35-44 years-----	26.1	27.5	66.4	66.8	7.5	5.7	8.3	17.8	72.1	71.3	19.6	10.9
45-54 years-----	14.3	13.9	70.7	71.1	15.0	15.0	4.9	0.6	59.3	73.1	35.8	26.3
55-64 years-----	4.5	-	53.8	76.2	41.6	23.8	0.2	-	36.1	52.4	63.7	47.6
65-74 years-----	1.2	-	39.3	46.2	59.5	53.8	-	-	18.3	11.1	81.7	88.9
75-79 years-----	-	-	15.7	49.1	84.3	51.0	-	-	1.9	18.8	98.1	81.2

Table 3. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and race: United States, 1960-62

Sex and tonal frequency in cycles per second	Hearing levels in decibels re audiometric zero								
	-5 decibels or less			-4 to +15 decibels			+16 decibels or more		
	White	Negro	Other	White	Negro	Other	White	Negro	Other
<u>Both sexes</u>	Number per 100 population								
500-----	48.8	50.7	56.6	45.4	44.3	39.9	5.8	5.0	3.5
1000-----	58.9	61.1	67.3	35.6	34.2	29.4	5.5	4.7	3.3
2000-----	44.7	47.0	53.8	42.5	41.8	38.5	12.8	11.2	7.7
3000-----	23.2	24.9	29.5	52.2	52.9	53.5	24.6	22.2	17.0
4000-----	15.7	17.2	20.4	51.4	52.8	54.7	32.9	30.0	24.9
6000-----	6.3	7.0	8.5	49.5	51.9	57.2	44.2	41.1	34.3
Normal speech ¹ -----	46.4	48.8	55.8	46.1	44.9	40.0	7.5	6.3	4.2
<u>Men</u>									
500-----	48.7	49.4	56.5	46.4	46.3	41.3	4.9	4.3	2.2
1000-----	56.7	57.6	65.2	37.6	37.4	32.5	5.7	5.0	2.3
2000-----	40.8	41.6	50.2	43.5	44.0	41.5	15.7	14.4	8.3
3000-----	15.6	15.8	21.0	49.6	50.9	55.8	34.8	33.3	23.2
4000-----	8.3	8.4	11.2	44.2	45.3	52.8	47.5	46.3	36.0
6000-----	3.2	3.2	4.1	40.6	41.5	51.0	56.2	55.3	44.9
Normal speech ¹ -----	43.0	43.9	52.7	49.1	49.3	44.0	7.9	6.8	3.3
<u>Women</u>									
500-----	48.8	51.7	56.8	44.6	42.7	38.5	6.6	5.6	4.7
1000-----	60.9	64.0	69.6	33.9	31.5	26.4	5.2	4.5	4.0
2000-----	48.2	51.5	57.5	41.5	40.0	35.4	10.3	8.5	7.1
3000-----	30.0	32.6	38.5	54.6	54.6	51.2	15.4	12.8	10.3
4000-----	22.5	24.6	30.0	57.9	58.9	56.8	19.6	16.5	13.2
6000-----	9.1	10.1	13.0	57.5	60.6	63.7	33.4	29.3	23.3
Normal speech ¹ -----	49.5	52.9	59.2	43.4	41.3	35.7	7.1	5.8	5.1

¹Average hearing level at 500-2000 cycles per second.

Table 4. Number of adults having hearing levels (in decibels re audiometric zero) within specified ranges for the better ear at 2000 cycles per second, by sex, age, and race: United States, 1960-62

Sex and age	All races				
	Total	-5 dB or less	-4 to +15 dB	+16 dB or more	
<u>Both sexes</u>		Number in thousands			
All ages, 18-79 years-----	111,086	50,096	47,028	13,962	
18-24 years-----	15,567	11,233	4,146	188	
25-34 years-----	21,573	13,971	7,134	468	
35-44 years-----	23,697	12,610	9,939	1,148	
45-54 years-----	20,577	7,682	10,439	2,456	
55-64 years-----	15,637	3,458	8,780	3,399	
65-74 years-----	11,164	1,067	5,511	4,586	
75-79 years-----	2,870	74	1,079	1,717	
<u>Men</u>					
All ages, 18-79 years-----	52,743	21,650	22,950	8,143	
18-24 years-----	7,138	4,771	2,251	116	
25-34 years-----	10,281	6,290	3,656	335	
35-44 years-----	11,372	5,398	5,212	762	
45-54 years-----	10,035	3,279	5,288	1,468	
55-64 years-----	7,517	1,510	3,897	2,110	
65-74 years-----	4,973	362	2,181	2,430	
75-79 years-----	1,427	40	465	922	
<u>Women</u>					
All ages, 18-79 years-----	58,342	28,445	24,078	5,819	
18-24 years-----	8,429	6,462	1,895	72	
25-34 years-----	11,292	7,681	3,478	133	
35-44 years-----	12,325	7,212	4,727	386	
45-54 years-----	10,542	4,403	5,151	988	
55-64 years-----	8,120	1,948	4,883	1,289	
65-74 years-----	6,191	705	3,330	2,156	
75-79 years-----	1,443	34	614	795	

Table 4. Number of adults having hearing levels (in decibels re audiometric zero) within specified ranges for the better ear at 2000 cycles per second, by sex, age, and race: United States, 1960-62—Con.

White				Negro			
Total	-5 dB or less	-4 to +15 dB	+16 dB or more	Total	-5 dB or less	-4 to +15 dB	+16 dB or more
Number in thousands							
97,744	43,449	41,672	12,623	11,412	5,269	4,941	1,202
13,493	9,738	3,628	127	1,704	1,170	476	58
18,655	12,018	6,229	408	2,272	1,432	785	55
20,678	10,859	8,779	1,040	2,574	1,440	1,045	89
18,052	6,658	9,165	2,229	2,309	889	1,228	192
13,991	3,162	7,803	3,026	1,467	214	906	347
10,273	970	5,049	4,254	848	96	442	310
2,596	45	1,020	1,531	233	29	59	145
46,561	18,761	20,528	7,272	5,194	2,222	2,176	796
6,264	4,180	2,005	79	738	484	219	35
8,999	5,450	3,271	278	902	569	278	55
9,956	4,598	4,660	698	1,184	640	498	46
8,766	2,790	4,647	1,329	1,147	416	626	105
6,659	1,381	3,472	1,806	736	74	383	279
4,589	342	2,017	2,230	382	20	164	198
1,325	21	456	848	102	19	9	74
51,183	24,688	21,144	5,351	6,218	3,047	2,765	406
7,229	5,558	1,623	48	966	686	257	23
9,656	6,568	2,958	130	1,370	863	507	-
10,722	6,261	4,119	342	1,390	800	547	43
9,286	3,868	4,518	900	1,162	473	602	87
7,332	1,781	4,331	1,220	731	140	523	68
5,684	628	3,032	2,024	466	76	278	112
1,271	24	564	683	131	10	50	71

Table 5. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and region: United States, 1960-62

Sex and tonal frequency in cycles per second	Hearing levels in decibels re audiometric zero								
	-5 decibels or less			-4 to +15 decibels			+16 decibels or more		
	North- east	South	West	North- east	South	West	North- east	South	West
<u>Both sexes</u>	Number per 100 population								
500-----	44.8	56.6	47.4	49.2	37.8	47.0	6.0	5.6	5.6
1000-----	54.0	63.8	61.2	41.2	30.6	33.2	4.8	5.6	5.6
2000-----	38.2	50.0	48.2	47.9	38.4	39.7	13.9	11.6	12.1
3000-----	21.0	26.8	23.4	55.3	50.1	51.0	23.7	23.1	25.6
4000-----	16.7	17.3	14.1	52.8	51.2	50.7	30.5	31.5	35.2
6000-----	6.3	7.4	5.8	51.1	50.8	47.9	42.6	41.8	46.3
Normal speech ¹ -----	40.6	53.1	48.2	51.7	40.1	44.5	7.7	6.8	7.3
<u>Men</u>									
500-----	42.7	57.9	48.6	52.7	36.4	47.0	4.6	5.7	4.4
1000-----	50.4	62.2	59.8	44.8	31.7	34.4	4.8	6.1	5.8
2000-----	33.8	44.4	45.8	49.7	41.7	38.7	16.5	13.9	15.5
3000-----	14.5	17.3	16.0	52.5	48.8	47.9	33.0	33.9	36.1
4000-----	9.6	7.6	7.7	47.0	44.1	42.3	43.4	48.3	50.0
6000-----	2.9	4.0	3.0	42.0	41.4	39.6	55.1	54.6	57.4
Normal speech ¹ -----	35.4	49.3	46.8	56.9	43.0	45.4	7.7	7.7	7.8
<u>Women</u>									
500-----	46.6	55.6	46.3	46.1	38.9	47.1	7.3	5.5	6.6
1000-----	57.2	65.0	62.5	38.0	29.7	32.1	4.8	5.3	5.4
2000-----	42.3	54.5	50.6	46.3	35.9	40.6	11.4	9.6	8.8
3000-----	26.9	34.4	30.8	57.8	51.1	54.0	15.3	14.5	15.2
4000-----	23.2	24.9	20.6	58.0	56.9	59.0	18.8	18.2	20.4
6000-----	9.4	10.0	8.6	59.4	58.2	56.3	31.2	31.8	35.1
Normal speech ¹ -----	45.2	56.2	49.5	47.0	37.7	43.6	7.8	6.1	6.9

¹Average hearing level at 500-2000 cycles per second.

Table 6. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by sex and region: United States, 1960-62

Sex and tonal frequency in cycles per second	Hearing levels in decibels re audiometric zero								
	-5 decibels or less			-4 to +15 decibels			+16 decibels or more		
	North- east	South	West	North- east	South	West	North- east	South	West
<u>Both sexes</u>	Number per 100 population								
500-----	49.0	50.1	48.2	45.2	44.6	45.8	5.8	5.3	6.0
1000-----	59.2	60.7	58.3	35.4	34.4	36.1	5.4	4.9	5.6
2000-----	45.0	46.6	44.0	42.3	41.9	42.7	12.7	11.5	13.3
3000-----	23.3	24.9	22.4	52.4	52.6	52.0	24.3	22.5	25.6
4000-----	15.8	17.2	15.1	51.6	52.5	50.8	32.6	30.3	34.1
6000-----	6.3	7.0	6.0	49.9	51.5	48.6	43.8	41.5	45.4
Normal speech ¹ -----	46.7	48.4	45.6	45.8	45.0	46.7	7.5	6.6	7.7
<u>Men</u>									
500-----	49.1	49.7	48.0	46.1	45.8	46.7	4.8	4.5	5.3
1000-----	57.1	58.0	56.1	37.4	37.0	38.0	5.5	5.0	5.9
2000-----	41.3	42.0	40.1	43.5	43.5	43.5	15.2	14.5	16.4
3000-----	15.8	16.3	15.3	50.1	50.5	49.0	34.1	33.2	35.7
4000-----	8.4	8.7	8.1	44.9	45.4	43.5	46.7	45.9	48.4
6000-----	3.2	3.4	3.1	41.3	42.0	39.9	55.5	54.6	57.0
Normal speech ¹ -----	43.6	44.4	42.3	48.8	48.6	49.4	7.6	7.0	8.3
<u>Women</u>									
500-----	48.9	50.5	48.4	44.4	43.5	44.9	6.7	6.0	6.7
1000-----	61.0	62.8	60.4	33.6	32.4	34.3	5.4	4.8	5.3
2000-----	48.5	50.2	47.8	41.2	40.6	41.9	10.3	9.2	10.3
3000-----	30.2	31.8	29.6	54.4	54.3	54.9	15.4	13.9	15.5
4000-----	22.6	24.0	22.1	57.8	58.2	58.1	19.6	17.8	19.8
6000-----	9.2	9.9	8.9	57.7	59.0	57.4	33.1	31.1	33.7
Normal speech ¹ -----	49.6	51.5	48.9	43.1	42.1	43.9	7.3	6.4	7.2

¹Average hearing level at 500-2000 cycles per second.

Table 7. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by race and region: United States, 1960-62

Race and tonal frequency in cycles per second	Hearing levels in decibels re audiometric zero								
	-5 decibels or less			-4 to +15 decibels			+16 decibels or more		
	North- east	South	West	North- east	South	West	North- east	South	West
<u>White</u>	Number per 100 population								
500-----	44.1	56.1	45.0	50.0	38.2	49.4	5.9	5.7	5.6
1000-----	54.0	63.6	59.7	41.3	30.7	34.3	4.7	5.7	6.0
2000-----	37.8	51.0	46.9	48.0	37.8	40.3	14.2	11.2	12.8
3000-----	20.7	26.4	22.2	54.6	49.6	50.9	24.7	24.0	26.9
4000-----	16.8	17.6	14.0	51.6	49.4	48.9	31.6	33.0	37.1
6000-----	5.8	7.0	5.8	50.1	49.4	46.1	44.1	43.6	48.1
Normal speech ¹ -----	39.9	53.6	46.3	52.2	40.0	46.0	7.9	6.4	7.7
<u>Negro</u>									
500-----	51.6	59.2	70.4	42.1	36.1	27.3	6.3	4.7	2.3
1000-----	52.4	64.2	71.4	41.4	30.4	26.3	6.2	5.4	2.3
2000-----	42.0	45.9	51.9	48.4	41.2	42.7	9.6	12.9	5.4
3000-----	24.0	28.0	27.6	62.8	52.1	59.0	13.2	19.9	13.4
4000-----	16.1	16.0	16.0	65.9	58.1	68.8	18.0	25.9	15.2
6000-----	11.3	9.0	9.4	62.6	55.2	67.0	26.1	35.8	23.6
Normal speech ¹ -----	46.0	51.5	58.3	46.7	40.6	39.4	7.3	7.9	2.3
<u>Other</u>									
500-----	71.5	53.0	70.0	28.5	33.4	25.4	-	13.6	4.6
1000-----	65.9	72.4	79.4	34.1	14.0	18.1	-	13.6	2.5
2000-----	71.3	60.7	72.4	28.7	25.7	20.2	-	13.6	7.4
3000-----	21.9	39.0	43.2	63.8	47.4	40.6	14.3	13.6	16.2
4000-----	15.0	25.4	15.0	85.0	61.0	65.2	-	13.6	19.8
6000-----	21.8	-	1.6	71.3	86.4	61.2	6.9	13.6	37.2
Normal speech ¹ -----	71.5	50.7	75.3	28.5	35.7	18.8	-	13.6	5.9

¹Average hearing level at 500-2000 cycles per second.

Table 8. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by race and region: United States, 1960-62

Race and tonal frequency in cycles per second	Hearing levels in decibels re audiometric zero								
	-5 decibels or less			-4 to +15 decibels			+16 decibels or more		
	North- east	South	West	North- east	South	West	North- east	South	West
<u>White</u>	Number per 100 population								
500-----	44.5	56.7	46.8	49.4	37.8	47.5	6.1	5.5	5.7
1000-----	53.7	63.9	60.4	41.4	30.5	33.7	4.9	5.6	5.9
2000-----	38.0	50.2	47.5	47.9	38.4	40.0	14.1	11.4	12.5
3000-----	20.8	26.9	22.9	55.1	50.0	50.8	24.1	23.1	26.3
4000-----	16.6	17.3	13.8	52.5	51.3	50.4	30.9	31.4	35.8
6000-----	6.2	7.4	5.6	50.7	50.8	47.3	43.1	41.8	47.1
Normal speech ¹ -----	40.2	53.2	47.4	51.8	40.0	45.0	8.0	6.8	7.6
<u>Negro</u>									
500-----	47.6	56.3	51.9	47.8	37.9	44.5	4.6	5.7	3.5
1000-----	56.9	63.2	66.3	39.4	30.9	30.0	3.7	5.9	3.7
2000-----	41.1	49.4	53.0	48.0	38.7	38.2	10.9	11.9	8.8
3000-----	22.9	26.4	26.2	57.5	50.1	52.6	19.6	23.5	21.2
4000-----	18.4	17.1	16.0	56.1	50.9	52.4	25.5	32.0	31.6
6000-----	6.4	7.2	6.9	56.3	50.3	51.5	37.3	42.5	41.6
Normal speech ¹ -----	43.8	52.5	53.2	50.6	40.4	42.2	5.6	7.1	4.6
<u>Other</u>									
500-----	54.9	64.0	55.9	43.1	33.1	40.9	2.0	2.9	3.2
1000-----	64.7	71.8	70.4	33.7	25.6	26.6	1.6	2.6	3.0
2000-----	48.9	57.8	58.2	45.4	36.4	34.6	5.7	5.8	7.2
3000-----	26.1	31.4	31.0	60.0	56.4	51.4	13.9	12.2	17.6
4000-----	20.8	18.9	19.4	59.0	61.3	53.7	20.2	19.8	26.9
6000-----	8.6	7.4	8.2	60.0	63.6	56.0	31.4	29.0	35.8
Normal speech ¹ -----	51.5	61.5	58.2	46.1	35.6	37.7	2.4	2.9	4.1

¹Average hearing level at 500-2000 cycles per second.

Table 9. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by size of area of residence: United States, 1960-62

Hearing levels re audiometric zero and tonal frequency in cycles per second	Total urban	Urbanized areas				Urban places outside of urbanized areas			Rural areas
		3 million or more	1 to 3 million	250,000 to 1 million	Under 250,000	25,000 or more	10,000 to 25,000	2,500 to 10,000	
Number per 100 population									
<u>-5 decibels or less</u>									
500-----	48.6	42.6	53.4	53.5	46.0	47.0	40.7	53.4	50.0
1000-----	57.4	51.4	63.6	57.8	60.6	46.7	50.3	64.4	63.1
2000-----	44.0	41.1	49.4	44.6	42.2	33.9	40.6	49.1	47.3
3000-----	23.0	23.9	20.9	26.8	20.2	19.4	17.0	26.6	24.4
4000-----	16.4	16.8	13.1	18.5	16.0	16.2	14.1	18.1	15.2
6000-----	6.9	8.4	9.5	6.9	5.0	2.4	4.6	6.9	5.4
Normal speech ¹ --	45.7	40.8	53.1	47.1	45.6	38.6	36.9	52.3	49.0
<u>-4 to +15 decibels</u>									
500-----	45.9	50.5	43.6	41.2	47.9	43.1	53.4	42.0	43.9
1000-----	37.3	43.1	33.4	36.4	34.3	40.0	45.3	30.0	31.4
2000-----	43.7	46.6	40.7	41.7	45.6	44.6	48.0	40.3	39.4
3000-----	53.2	54.4	58.3	47.5	55.2	44.1	57.7	52.5	50.4
4000-----	52.1	52.6	58.7	48.3	52.9	40.0	52.8	52.6	50.5
6000-----	50.5	49.1	54.2	48.7	49.8	45.6	53.6	51.6	48.6
Normal speech ¹ --	47.2	52.0	41.8	45.2	47.8	43.9	56.7	41.0	43.2
<u>+16 decibels or more</u>									
500-----	5.5	6.9	3.0	5.3	6.1	9.9	5.9	4.6	6.1
1000-----	5.3	5.5	3.0	5.8	5.1	13.3	4.4	5.6	5.5
2000-----	12.3	12.3	9.9	13.7	12.2	21.5	11.4	10.6	13.3
3000-----	23.8	21.7	20.8	25.7	24.6	36.5	25.3	20.9	25.2
4000-----	31.5	30.6	28.2	33.2	31.1	43.8	33.1	29.3	34.3
6000-----	42.6	42.5	36.3	44.4	45.2	52.0	41.8	41.5	46.0
Normal speech ¹ --	7.1	7.2	5.1	7.7	6.6	17.5	6.4	6.7	7.8

¹Average hearing level at 500-2000 cycles per second.

Table 10. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by size of area of residence: United States, 1960-62

Hearing levels re audiometric zero and tonal frequency in cycles per second	Total urban	Urbanized areas				Urban places outside of urbanized areas			Rural areas
		3 million or more	1 to 3 million	250,000 to 1 million	Under 250,000	25,000 or more	10,000 to 25,000	2,500 to 10,000	
<u>-5 decibels or less</u>									
Number per 100 population									
500-----	48.8	47.8	48.6	49.1	49.8	44.1	50.3	48.8	49.5
1000-----	59.1	58.1	58.8	59.4	60.2	53.7	60.7	59.3	59.6
2000-----	45.0	43.7	44.6	45.3	46.1	39.5	46.5	45.5	45.3
3000-----	23.6	22.5	23.2	24.0	24.6	19.2	24.0	24.8	23.2
4000-----	16.2	15.4	15.8	16.5	17.0	12.3	16.2	17.3	15.5
6000-----	6.5	6.1	6.2	6.8	7.0	4.6	6.5	7.0	6.2
Normal speech ¹ --	46.6	45.3	46.3	46.9	47.8	40.8	48.4	47.1	47.1
<u>-4 to +15 decibels</u>									
500-----	45.3	46.2	45.5	45.1	44.8	48.0	44.6	45.0	45.0
1000-----	35.5	36.4	35.6	35.2	34.8	39.0	34.6	35.0	35.2
2000-----	42.4	43.1	42.4	42.1	41.9	44.0	42.4	41.6	42.3
3000-----	52.2	52.4	52.3	51.9	52.2	50.9	53.6	51.6	52.4
4000-----	51.6	51.3	51.9	51.2	51.7	49.1	53.2	51.7	51.6
6000-----	49.9	48.8	50.0	49.8	50.6	44.8	51.6	50.6	49.9
Normal speech ¹ --	45.9	47.1	46.0	45.6	45.3	48.9	45.2	45.2	45.8
<u>+16 decibels or more</u>									
500-----	5.8	6.0	5.9	5.8	5.4	7.9	5.1	6.2	5.5
1000-----	5.4	5.5	5.6	5.4	5.0	7.3	4.7	5.7	5.2
2000-----	12.7	13.2	13.0	12.6	12.0	16.5	11.1	12.9	12.4
3000-----	24.1	25.1	24.5	24.1	23.2	29.9	22.4	23.6	24.4
4000-----	32.2	33.3	32.3	32.3	31.3	38.6	30.6	31.0	32.9
6000-----	43.6	45.1	43.8	43.4	42.4	50.6	41.9	42.4	43.9
Normal speech ¹ --	7.4	7.6	7.7	7.5	6.9	10.3	6.4	7.7	7.1

¹Average hearing level at 500-2000 cycles per second.

Table 11. Actual percentage of adults having hearing levels within specified ranges for the better ear at 500,1000,2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by urban and rural areas, race, and sex: United States, 1960-62

Sex and tonal frequency in cycles per second	Urban						Rural					
	-5 dB or less		-4 to +15 dB		+16 dB or more		-5 dB or less		-4 to +15 dB		+16 dB or more	
	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro
<u>Both sexes</u>	Number per 100 population											
500-----	47.4	57.6	47.0	38.1	5.6	4.3	47.4	64.1	46.3	30.7	6.3	5.2
1000-----	57.2	58.3	37.5	36.6	5.3	5.1	61.2	72.7	33.1	22.8	5.7	4.5
2000-----	43.5	46.2	44.0	43.2	12.5	10.6	46.5	46.1	39.8	43.4	13.7	10.5
3000-----	22.6	25.6	52.7	57.8	24.7	16.6	22.9	29.9	50.6	52.7	26.5	17.4
4000-----	16.5	16.0	50.6	62.8	32.9	21.2	15.0	16.2	48.9	60.7	36.1	23.1
6000-----	6.5	10.4	49.2	59.6	44.3	30.0	5.2	8.0	47.0	59.0	47.8	33.0
Normal speech ¹ ----	45.3	48.1	47.5	45.6	7.2	6.3	46.7	59.0	45.4	33.6	7.9	7.4
<u>Men</u>												
500-----	45.9	60.5	49.6	36.0	4.5	3.5	48.4	71.7	46.2	21.7	5.4	6.6
1000-----	54.5	56.4	40.5	35.7	5.0	7.9	59.1	73.5	35.0	19.4	5.9	7.1
2000-----	39.1	41.5	45.8	42.5	15.1	16.0	42.6	45.1	40.7	40.9	16.7	14.0
3000-----	14.1	21.0	52.0	52.6	33.9	26.4	15.8	26.0	45.2	49.1	39.0	24.9
4000-----	8.5	9.1	44.7	59.6	46.8	31.3	7.2	12.7	38.4	56.8	54.4	30.5
6000-----	3.3	6.4	40.0	54.3	56.7	39.3	2.4	3.5	36.6	58.8	61.0	37.7
Normal speech ¹ ----	41.3	46.0	51.6	45.9	7.1	8.1	42.7	61.4	48.6	28.9	8.7	9.7
<u>Women</u>												
500-----	48.7	55.4	44.7	39.7	6.6	4.9	46.5	56.4	46.4	39.8	7.1	3.8
1000-----	59.6	59.8	34.8	37.3	5.6	2.9	63.4	71.8	31.2	26.3	5.4	1.9
2000-----	47.3	49.7	42.4	43.9	10.3	6.4	50.4	47.1	38.8	45.9	10.8	7.0
3000-----	30.0	29.1	53.2	61.8	16.8	9.1	30.2	33.9	56.2	56.3	13.6	9.8
4000-----	23.3	21.2	55.8	65.4	20.9	13.4	22.8	19.7	59.5	64.6	17.7	15.7
6000-----	9.2	13.6	57.1	63.5	33.7	22.9	8.2	12.4	57.6	59.2	34.2	28.4
Normal speech ¹ ----	48.7	49.8	44.0	45.3	7.3	4.9	50.8	56.7	42.1	38.5	7.1	4.8

¹Average hearing level at 500-2000 cycles per second.

Table 12. Expected percentage of adults having hearing levels within specified ranges for the better ear at 500, 1000, 2000, 3000, 4000, and 6000 cycles per second and in the normal speech range, by urban and rural areas, race, and sex: United States, 1960-62

Sex and tonal frequency in cycles per second	Urban						Rural					
	-5 dB or less		-4 to +15 dB		+16 dB or more		-5 dB or less		-4 to +15 dB		+16 dB or more	
	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro	White	Negro
<u>Both sexes</u>	Number per 100 population											
500-----	48.3	51.0	46.1	44.3	5.6	4.7	49.6	50.4	44.1	43.8	6.3	5.8
1000-----	57.0	60.0	37.6	35.6	5.4	4.4	62.8	63.5	31.7	31.3	5.5	5.2
2000-----	43.6	46.7	43.9	42.7	12.5	10.6	47.0	47.3	39.5	40.1	13.5	12.6
3000-----	22.7	25.2	53.1	53.8	24.2	21.0	24.2	24.1	50.3	51.1	25.5	24.8
4000-----	16.1	18.2	51.9	53.7	32.0	28.1	14.9	15.3	50.4	50.6	34.7	34.1
6000-----	6.8	7.6	50.1	53.7	43.1	38.7	5.3	5.3	48.2	49.1	46.5	45.6
Normal speech ¹ ----	45.4	48.6	47.4	45.6	7.2	5.8	48.6	49.1	43.4	43.6	8.0	7.3
<u>Men</u>												
500-----	47.3	48.3	48.2	47.6	4.5	4.1	51.6	51.6	43.1	43.4	5.3	5.0
1000-----	54.4	55.5	40.2	39.8	5.4	4.7	61.1	61.8	32.7	32.9	6.2	5.3
2000-----	39.4	40.5	45.3	45.2	15.3	14.3	43.4	43.2	40.0	42.0	16.6	14.8
3000-----	14.7	15.4	52.0	53.0	33.3	31.6	17.4	16.2	45.0	47.4	37.6	36.4
4000-----	8.6	9.0	46.2	47.4	45.2	43.6	7.9	7.2	40.5	41.8	51.6	51.0
6000-----	3.6	3.8	41.5	42.9	54.9	53.3	2.4	2.1	39.0	39.8	58.6	58.1
Normal speech ¹ ----	41.8	42.9	50.9	50.6	7.3	6.5	45.4	45.3	45.6	47.2	9.0	7.5
<u>Women</u>												
500-----	49.0	53.1	44.4	41.8	6.6	5.1	48.1	49.1	45.2	44.2	6.7	6.7
1000-----	59.3	63.5	35.3	32.4	5.4	4.1	64.5	65.2	30.6	29.7	4.9	5.1
2000-----	47.2	51.5	42.6	40.7	10.2	7.8	50.6	51.4	39.1	38.2	10.3	10.4
3000-----	29.6	32.7	54.1	54.5	16.3	12.8	31.1	32.1	55.6	54.8	13.3	13.1
4000-----	22.7	25.2	56.8	58.5	20.5	16.3	14.9	15.3	60.5	59.5	24.6	25.2
6000-----	9.6	10.6	57.4	61.9	33.0	27.5	8.3	8.6	57.7	58.5	34.0	32.9
Normal speech ¹ ----	48.3	52.9	44.5	41.7	7.2	5.4	51.9	52.9	41.2	40.0	6.9	7.1

¹Average hearing level at 500-2000 cycles per second.

APPENDIX I

STATISTICAL NOTES

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

The methodological strength of the survey derives especially from its use of scientific probability sampling techniques and highly standardized and closely controlled measurement processes. This does not imply that statistics from the survey are exact or without error. 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. 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 the data were missing. Otherwise, projections were made on 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. Traditionally the role of the sampling error has been the determination of how imprecise the survey results may be because they come from a sample rather than from the measurement 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 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 I. 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 statistics, with 95 percent confidence.

Small Numbers

In some tables magnitudes are shown for cells for which the 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.

Table I. Standard error, expressed in percentage, for percent of persons with a specified hearing threshold level at 1000 and 4000 cycles per second: United States, 1960-62

Item	Both sexes		Men		Women	
	1000 cps.	4000 cps.	1000 cps.	4000 cps.	1000 cps.	4000 cps.
<u>Race</u>						
Standard error in percent						
White:						
-5 decibels or less-----	1.39	0.73	1.51	0.67	1.51	1.37
+16 decibels or more-----	2.70	1.50	3.00	1.30	3.00	2.40
Negro:						
-5 decibels or less-----	2.54	1.55	4.40	1.65	3.06	2.23
+16 decibels or more-----	5.00	3.10	8.00	3.20	6.00	4.50
Other:						
-5 decibels or less-----	8.47	5.73	19.11	7.79	9.01	8.02
+16 decibels or more-----	16.50	10.00	25.00	15.00	18.00	16.00
<u>Region</u>						
Northeast:						
-5 decibels or less-----	1.90	1.49	1.78	1.15	2.33	2.05
+16 decibels or more-----	3.50	2.90	3.50	2.30	4.50	4.10
South:						
-5 decibels or less-----	3.67	1.51	4.38	1.42	3.42	2.08
+16 decibels or more-----	7.20	3.00	8.50	2.50	6.50	4.00
West:						
-5 decibels or less-----	1.85	1.25	2.42	1.17	1.78	2.88
+16 decibels or more-----	3.60	2.50	4.50	2.30	2.50	5.50
<u>Region and race</u>						
Northeast—White:						
-5 decibels or less-----	1.90	1.45	1.97	1.14	2.04	1.98
+16 decibels or more-----	3.50	2.90	3.50	2.20	4.10	3.50
Northeast—Negro:						
-5 decibels or less-----	4.04	3.99	6.55	3.98	6.87	4.99
+16 decibels or more-----	8.10	7.50	12.50	7.30	12.00	10.00
South—White:						
-5 decibels or less-----	3.87	1.43	4.48	1.33	3.79	2.22
+16 decibels or more-----	7.50	2.50	9.00	2.50	7.40	4.40
South—Negro:						
-5 decibels or less-----	3.51	2.30	3.99	1.91	3.80	3.16
+16 decibels or more-----	6.50	4.50	7.00	3.50	7.50	6.00
West—White:						
-5 decibels or less-----	2.34	1.42	2.96	1.23	2.03	3.11
+16 decibels or more-----	4.50	2.50	5.80	2.50	4.00	6.00
West—Negro:						
-5 decibels or less-----	4.94	2.76	11.94	4.95	4.74	2.62
+16 decibels or more-----	9.00	5.00	20.00	9.00	9.00	4.50
<u>Area</u>						
Urban:						
-5 decibels or less-----	1.62	0.81	1.73	0.70	1.78	1.39
+16 decibels or more-----	3.20	1.50	3.40	1.40	3.20	2.50
Rural:						
-5 decibels or less-----	1.86	2.01	4.44	1.95	3.49	2.40
+16 decibels or more-----	3.50	4.00	8.00	3.90	6.50	4.50
<u>Race and selected ages</u>						
White— -5 decibels or less:						
18-24 years-----	---	---	2.14	2.95	2.00	2.59
35-44 years-----	---	---	2.85	0.69	2.70	2.90
55-64 years-----	---	---	2.96	0.68	2.54	1.23
75-79 years-----	---	---	2.91	---	3.37	---
Negro— -5 decibels or less:						
18-24 years-----	---	---	7.16	5.50	3.12	6.47
35-44 years-----	---	---	5.49	3.81	4.70	4.22
55-64 years-----	---	---	7.06	1.26	6.74	---
75-79 years-----	---	---	25.24	---	6.40	---

APPENDIX II

DEMOGRAPHIC TERMS

Age.—The age recorded for each person is the age at last birthday. Age is recorded in single years.

Race.—Race is classified here as "white," "Negro," or "other." "Other" includes American Indian, Chinese, Japanese, and other racial groups. Mexican persons are included with "white" unless definitely known to be American Indian or of another nonwhite race.

Region.—For the purpose of classifying the population by geographic area, the United States was divided into three major regions. The States included in each region are as follows:

<i>Region</i>	<i>States Included</i>
Northeast -----	Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Ohio, and Michigan
South -----	Delaware, Maryland, District of Columbia, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas
West -----	Washington, Oregon, California, Idaho, Nevada, Montana, Utah, Arizona, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, and Indiana

Urban and rural.—For the first six primary sampling units at which examinations were conducted, the definition of urban and rural was the same as that used in the 1950 census. These locations were Philadelphia, Pa., Valdosta, Ga., Akron, Ohio, Muskegon, Mich., Chicago, Ill., and Butler, Mo. For the remainder of the sampling units the 1960 census definitions were used.

The change from 1950 to 1960 definitions is of small consequence in the survey, since only six locations were affected, and the major difference is the designation in 1960 of urban towns in New England and of urban townships in New Jersey and Pennsylvania.

According to the 1960 definition, the urban population comprises all persons living in (a) places of 2,500 inhabitants or more incorporated as cities, boroughs, villages, and towns (except towns in New England, New York, and Wisconsin); (b) the densely settled urban fringe, whether incorporated or unincorporated, of urbanized areas; (c) towns in New England and townships in New Jersey and Pennsylvania which contain no incorporated municipalities as subdivisions and have either 25,000 inhabitants or more or a population of 2,500-25,000 and a density of 1,500 persons or more per square mile; (d) counties in States other than the New England States, New Jersey, and Pennsylvania that have no incorporated municipalities within their boundaries and have a density of 1,500 persons or more per square mile; and (e) unincorporated places of 2,500 inhabitants or more not included in any urban fringe. The remaining population is classified as rural.



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