VITAL HEALTH STATISTICS

Blood Pressure Levels in Persons 18–74 Years of Age in 1976–80, and Trends in Blood Pressure From 1960 to 1980 in the United States

This report presents blood pressure levels and prevalence rates of hypertension among U.S. adults in 1976–80 by age, sex, race, and education. Secular trends for blood pressure and hypertension in the period from 1960 to 1980 are also presented.

Data From the National Health Survey
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Under the legislation establishing the National Health Survey, the Public Health Service is authorized to use, insofar as possible, the services or facilities of other Federal, State, or private agencies. In accordance with specifications established by the National Center for Health Statistics, the U.S. Bureau of the Census participated in the design and selection of the sample and carried out the initial household interview stage of the data collection and certain parts of the statistical processing.

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Symbols

- - -	Data not available
. . .	Category not applicable
-	Quantity zero
0.0	Quantity more than zero but less than 0.05
Z	Quantity more than zero but less than 500 where numbers are rounded to thousands
*	Figure does not meet standard of reliability or precision
#	Figure suppressed to comply with confidentiality requirements

Blood Pressure Levels in Persons 18–74 Years of Age in 1976–80, and Trends in Blood Pressure From 1960 to 1980 in the United States

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Introduction

Essential hypertension is a major risk factor for cardiovascular disease. It markedly increases the risk of death from cerebrovascular accident, kidney failure, and coronary heart disease.[1] Clinical intervention trials have shown decreases in morbidity and mortality from hemorrhagic strokes, congestive heart failure, renal failure, and aortic dissections when blood pressure is reduced.[2] Cardiovascular mortality has decreased steadily in the United States since the mid-1960's[3] and, although the reasons for this decline have not been completely established, a reduction in uncontrolled hypertension is a leading hypothesis. Previous estimates suggest that in the early 1970's as many as 60 million Americans had elevated blood pressures.[4]

The objectives of this report are twofold. The first part presents current estimates of mean systolic and diastolic blood pressure and of the prevalence of hypertension in the civilian noninstitutionalized portion of the U.S. population between the ages of 18 and 75 years. Differences among age, race, sex, and educational groups are examined. These estimates can be used by (*a*) clinicians, to compare individual blood pressures against national norms, (*b*) epidemiologists, to compare local or special study samples against national norms, or (*c*) various public and private agencies in planning strategies to combat high blood pressure.

The second part of this report focuses on trends in blood pressure and hypertension in U.S. adults since 1960. These data and the age-standardized analyses derived from them specifically address changes in mean blood pressures and in the prevalence of various kinds of hypertension, particularly concerning differences by race, sex, and age. These data should be particularly useful in evaluating the effectiveness of various programs instituted to promote the detection and treatment of hypertension. These data may provide baseline information useful in documenting the proportion of the population under treatment for hypertension and, of particular concern, those under treatment for mild hypertension.[5]

Three cross-sectional surveys conducted by the National Center for Health Statistics during 1960–80 provide the data on which the report is based. The surveys included are the first National Health Examination Survey (1960–62) and the first and second National Health and Nutrition Examination Surveys (1971–74 and 1976–80, respectively). Each of the surveys was designed to assess the health of a nationally representative probability sample of the U.S. civilian noninstitutionalized population at the time the survey was conducted. Every examined person received a basic physical examination, and selected subsets of the samples of the later two surveys received additional examination components. Medical history data were collected for all examined persons. The standardized examinations were performed in specially constructed mobile examination centers that were moved about the country to each of a number of previously selected primary sampling areas. General descriptive data for each of the three surveys are as follows (for the subsets of examined persons used for this report):

National Health Examination Survey I:	
Time span	1960–62
Sample person ages	18–79 years
Sample size	7,710
Number of examined persons	6,672
Response rate	86.5
National Health and Nutrition Examination Survey I:†	
Time span	1971–74
Sample person ages	18–74 years
Sample size	19,572
Number of examined persons	13,645
Response rate	69.7
National Health and Nutrition Examination Survey II:	
Time span	1976–80
Sample person ages	18–74 years
Sample size	18,209
Number of examined persons	12,504
Response rate	68.7

†Data from the NHANES I Augmentation Survey were not included in these analyses.

A more detailed description of survey design and sampling procedures is in appendix I. Statistical notes on the sample design, including sample size and national population estimates, reliability of data, and sampling and measurement error are included in appendix II. Demographic and socioeconomic terms are defined in appendix III. Data limitations are described in appendix IV.

Highlights

The analyses presented in this report, which are summarized below, address questions concerning recent levels of blood pressure and trends in blood pressure levels and hypertension in the U.S. civilian noninstitutionalized population ages 18–74 years. Although the midpoints of the three surveys were 1961, 1972, and 1978, the three surveys spanned the period from 1960 to 1980. Because some segments of the U.S. population are not represented in this subsample (children, adults ages 75 years and over, military personnel, and institutionalized persons), the total number of hypertensives in the U.S. population cannot be estimated directly from these data. However, some researchers have used these and other data to develop such estimates.[6]

The recently published report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (called JNC III) has recommended new and more detailed definitions for a variety of hypertension categories.[7] In that report the traditional categories of borderline and definite hypertension have been merged and redefined as "mild" (diastolic blood pressure (DBP) of 90 to 104 mmHg), "moderate" (DBP of 105 to 114 mmHG), and "severe" (DBP of 115 or more mmHg) hypertension. In addition, newly created categories include "high normal" for adults with DBP between 85 and 89 mmHg, and other categories related to isolated systolic hypertension. The data presented in this report can be used to estimate prevalence rates for these new categories.

However, the major analyses of hypertension described in this report are based on the following definitions: (*a*) definite hypertension is defined as systolic blood pressure (SBP) equal to or greater than 160 mmHg and/or DBP equal to or greater than 95 mmHg and/or taking antihypertensive medication, (*b*) borderline hypertension is defined as SBP equal to or greater than 140 mmHg but less than 160 mmHg and/or DBP equal to or greater than 90 mmHg but less than 95 mmHg and not taking antihypertensive medication, and (*c*) isolated systolic hypertension is defined as SBP equal to or greater than 160 mmHg and DBP less than 90 mmHg. The decision to employ the traditional definitions was motivated primarily by a desire to facilitate the analyses of trends that constitute the latter part of this report and to enhance comparisons with previously published work.

The following conclusions highlight the findings from the NHANES II survey, conducted from 1976 to 1980, with March 1, 1978, as the midpoint of the survey:

- About 25 million U.S. adults (17.7 percent) had definite hypertension, either diagnosed or undiagnosed. Definite hypertension was more prevalent among black than white adults (25.7 versus 16.8 percent, respectively).
- Of the 25 million adults with definite hypertension, about 6.6 million (26.4 percent) had not been diagnosed; that is, told by a doctor that they had hypertension or high blood pressure.
- Another 17 million adults (12.0 percent) had borderline hypertension.
- Mean SBP levels were higher among black than white adults in most age groups.
- Mean DBP levels were generally higher among men than women and were generally higher among black than white adults.
- The prevalence rate for hypertension based on the newly created JNC III definition (DBP equal to or greater than 90 mmHg and/or SBP equal to or greater than 140 mmHg and/or medicated) was 29.7 percent (about 42 million adults), about two-thirds higher than the 17.7 percent estimated using the traditional definition (DBP equal to or greater than 95 mmHg and/or SBP equal to or greater than 160 mmHg and/or medicated).

Findings from the three surveys conducted in the period 1960–80 include the following:

- Mean SBP decreased by 5 mmHg among white adults and by 10 mmHg among black adults across the period spanned by the three surveys.
- The prevalence of elevated SBP decreased 5.3 percent among white adults and 12.6 percent among black adults.
- Improvements in mean SBP were greater among older than younger adults.
- The prevalence of definite hypertension among black adults decreased from 33.6 to 28.6 percent, but the difference did not reach statistical significance. No similar decline was observed among white adults.
- The prevalence of undiagnosed hypertension decreased from 52.0 to 29.2 percent, the proportion of hypertensives taking antihypertensive medication increased from 30.3 to 45.4 percent, and the proportion of medicated hypertensives whose hypertension was controlled increased from 39.3 to 51.7 percent.

Data sources and statistical methods

The three cross-sectional surveys that provided the data on which this report is based were quite similar in design and objectives, but differed in content, size, and response rates.[6] The first National Health Examination Survey (NHES I) had as its primary objectives establishing baseline or normative estimates for adults in a broad variety of medical subject matter areas and estimating the prevalence of certain disease conditions.[8] The first and second National Health and Nutrition Examination Surveys (NHANES I and II) also were designed to provide data for normative and disease prevalence estimates, but had as an additional focus the assessment of the nutritional status of the Nation.[9,10] Some blood pressure findings from these surveys have been published previously.[11-14]

All three surveys were designed to provide data on a nationally representative probability sample of the U.S. civilian noninstitutionalized population at the time the survey was conducted. To this end, specially constructed mobile examination centers were moved around the country to previously selected primary sampling units (PSU's, usually a county or group of counties). The selection of the PSU's was part of a stratified multistage probability design that assured, at the end of the survey and after appropriate statistical weighting, that the persons selected from within the PSU's and actually examined were as respresentative of the U.S. population as possible.

Not all of those persons selected to participate were examined and the response rates varied among the three surveys. In NHES I, 6,672 persons were examined out of the 7,710 adults selected, yielding a response rate of 86.5 percent. For NHANES I and II, comparable response rates were 69.7 (13,645 out of 19,572) and 68.7 percent (12,504 out of 18,209). Following the conclusion of each survey, statistical weights involving the probability of selection, adjustment for nonresponse, and poststratification by age, race, and sex were generated for each examined person.

Each examined person completed a medical history and other questionnaires, and each received a physical examination, including at least one blood pressure determination by a physician, body measurements, and blood testing. Selected subsets of the NHANES I and II samples received additional examination components such as electrocardiogram tests, hearing tests, and chest x rays. Further discussion of the content is limited to results important to this report.

Medical history

Specially trained interviewers obtained a medical history for each sample person. This history included questions on whether the individual had ever been told by a doctor that he or she had high blood pressure or other selected chronic conditions, including those commonly associated with long-term elevated blood pressure. Other questions were asked as to whether the individual was taking any medication for high blood pressure currently (or, in the case of NHANES I, within the previous 6 months) and/or was pursuing nonpharmacologic therapy.

Blood pressure measurement

Table A provides data relevant to the collection of blood pressure data for NHES I and NHANES I and II. In all three surveys a blood pressure reading was taken by the physician at the beginning of the physician's examination with the examinee seated. Additional readings were taken near the middle and at the end of the 20-minute examination in NHES I. In NHES I all blood pressure (BP) measurements were taken while the examinee was sitting, and all were taken by the physician. The NHANES I sample was divided into two groups: (*a*) the Nutrition sample—those examinees who received the general nutrition examination and a limited battery of physical tests, and (*b*) the Detailed sample—a one-fifth subsample of the Nutrition sample who received an additional battery of physical tests. In the Nutrition sample of the NHANES I survey, only a single sitting measurement was taken. In the Detailed sample of the NHANES I survey conducted from 1971–74 and in the NHANES II survey, a second measurement was taken while the examinee was supine and a third immediately after with the examinee sitting, both at the end of the examination. In some instances the nurse took the second or third measurements. (See the analysis of secular trends for more details.)

Blood pressure was measured indirectly using a standard clinical sphygmomanometer. The middle of the cuff was placed over the bulge in the upper right arm. Using the bell of the stethoscope, the physician noted and recorded the systolic pressure (when the sound was first heard) and the diastolic pressure (when the sounds disappeared or, if the sounds did not disappear, when they first became muffled). The following guidelines were provided for the physicians:

1. The manometer was at eye level for the reader to reduce the possibility of reading errors caused by parallax.
2. While measuring, the rate of fall in pressure was maintained at 2–3 mmHg per heartbeat, which was slow enough to detect the first and last sounds but sufficiently rapid to avoid the intermittent trapping of blood between systolic and diastolic levels.

Table A. Description of blood pressure measurement procedures for NHES I, NHANES I, and NHANES II

Procedure	Measurement		
	1st	2d	3d
	Time during examination		
NHES I	Beginning	Middle	End
NHANES I, Nutrition	Beginning	...	...
NHANES I, Detailed	Beginning	End	End
NHANES II	Beginning	End	End
	Examiner		
NHES I	Physician	Physician	Physician
NHANES I, Nutrition	Physician	...	...
NHANES I, Detailed	Physician	Physician/Nurse	Physician/Nurse
NHANES II	Physician	Physician/Nurse	Physician/Nurse
	Posture		
NHES I	Sitting	Sitting	Sitting
NHANES I, Nutrition	Sitting	...	...
NHANES I, Detailed	Sitting	Supine	Sitting
NHANES II	Sitting	Supine	Sitting

3. For diastolic pressure, the level was recorded either at the point of complete cessation of Korotkoff sounds (fifth sound) or, if no cessation occurred, at the point of muffling (fourth sound). In NHES I both the fourth and fifth Korotkoff sounds were recorded.
4. Measurements were recorded to the nearest even millimeter on the scale.

Statistical methods

The findings in this report are national estimates based on weighted observations. The data obtained for each examined person were weighted so that the sum of sampling weights for all persons drawn from a subuniverse is equal to the number of persons in that subuniverse at the midpoint of the survey, as estimated by the U.S. Bureau of the Census. The weights take into account the probability with which persons were drawn into the samples, and certain adjustments based on the known demographic characteristics of interviewed or examined persons versus all eligible persons, to minimize the effects of nonresponse and bias. The chance of bias is greater when a substantial proportion of the persons sampled from a particular age-sex-income class were not examined than when response rates are high. The additional bias that may be introduced by nonrandom measurement error is addressed in the discussion section and in appendix IV.

Unless otherwise specified, statistical significance was based on the 5-percent significance level. Most of the analyses presented here are based on t-tests comparing means or prevalence rates in two population subgroups. This test consists of dividing the difference between the two means or prevalences by the standard error of the difference. An approximation of the standard error of a difference $d = x - y$ of the two statistics x and y is given by the formula

$$S_d = [S_x^2 + S_y^2 - 2 \text{ cov } (x,y)]^{1/2}$$

where S_x and S_y are the standard errors, respectively, of x and y. The standard errors were calculated by a balanced replication technique appropriate to the complex survey design and estimation procedure.[15,16] For most of the analyses in this paper, covariances were assumed to be zero.

For tests of trends across age groups, standard errors were calculated using a method of Taylor series linearization of approximate formulas incorporated in the computer programs SURREGR[17] and SESUDAAN.[18] Statistical tests for multivariate categorical data were performed with a method of weighted least squares that produces statistics which are asymptotically chi-square,[19] using the computer program GENCAT.[20] This program makes possible the construction of multivariate tests of significance that take into account the full variance-covariance matrix. These tests have greater statistical power than tests based on comparison of paired estimates, as described above and in appendix II.

Detailed tables 3 and 4 present means that have been standardized for age by the direct method, as do tables 11–17. In tables 3 and 4 the age-standardized means have been calculated using the age-specific U.S. population estimates for 1978 for all educational groups combined. In tables 11–17 and in the sections of the text where comparisons are made between surveys, the age-standardized means have been calculated for the 1960–62 and 1971–74 surveys using the reference population estimates at the midpoint of the 1976–80 survey. The standardized means and proportions and the standard errors of these statistics were estimated by the SESUDAAN program, using Taylor series linearization.[18]

The reader should be cautioned against making any inferences of a longitudinal nature based on data from these cross-sectional surveys. These surveys did not reexamine study subjects, as would be necessary for making longitudinal comparisons. In a single cross-sectional survey, differences in mean blood pressures apparently related to increasing age are, in fact, differences between individuals in different birth cohorts

and cannot be taken as descriptive of a particular individual's or group's life experience. Apparent trends in the relationship between age and blood pressure, when based on cross-sectional data, are somewhat misleading.

Cohort analysis of data from the Framingham Heart Study, for instance, portrayed markedly different patterns in blood pressure for cohorts followed over time as compared with cross-sectional analysis of data for selected age groups.[21] In the Framingham data, cross-sectional mean blood pressures were lower in women than men in early ages, rose to meet the pressures of men at middle age, and crossed over thereafter to higher levels. In longitudinal analysis of the Framingham cohort, where pressures were followed as people actually aged, the crossover after middle age for women was not observed. Blood pressures in women stayed lower than blood pressures in men at all ages.[21] Because longitudinal inferences drawn from cross-sectional data may incorrectly portray the effect of aging, an attempt has been made to minimize the tendency to make such inferences.

Findings—National Health and Nutrition Examination Survey II, 1976–80

The principal findings in this section regarding the distribution of systolic blood pressure (SBP) and diastolic blood pressure (DBP) levels, and the estimates for the prevalence of hypertension derived from them for U.S. adults ages 18–74 years, are based on the mean of the three blood pressure measurements obtained on the adult examinees in the 1976–80 National Health and Nutrition Examination Survey (NHANES II). The mean of the three blood pressure measures generally provides a better predictor of future blood pressure and is less subject to regression toward the mean than a single measurement.[22] Hence, the mean provides a physiologically more representative measure than a single pressure for estimating the prevalence of hypertension.

Systolic blood pressure

As shown in table B, figure 1, and table 1, mean SBP levels were significantly higher for men than for women in the age groups 18–24, 25–34, and 35–44 years. However, for the age groups 45–54 and 55–64 years, no significant differences were observed between the sexes. By age 65–74 years the mean SBP level among women was significantly greater than that among men (146 versus 142 mmHg, respectively).

Observed mean SBP levels for black men were less than those for white men in the age groups 18–24 and 25–34 years, but the difference in the 25–34 year age group was not statistically significant (table B). In the age groups 35–44, 45–54, and 55–64 years, the mean SBP levels were significantly greater for black men. The mean SBP levels were equal for black and white men ages 65–74 years.

Racial differences in SBP between white and black women were very consistent: In every age group, the observed means for black women were greater than those for white women (table B). The differences in mean SBP between black and white women increased from a low of 1 mmHg for ages 18–24 years to a maximum of 11 mmHg for those ages 45–54 years and were statistically significant for the age groups 35 years and over.

The mean SBP levels were significantly higher across successive age groups for all four race-sex groups (table B). The difference in mean SBP between extreme age groups was greater for women than men (from 111 to 146 mmHg for women, and from 124 to 142 mmHg for men).

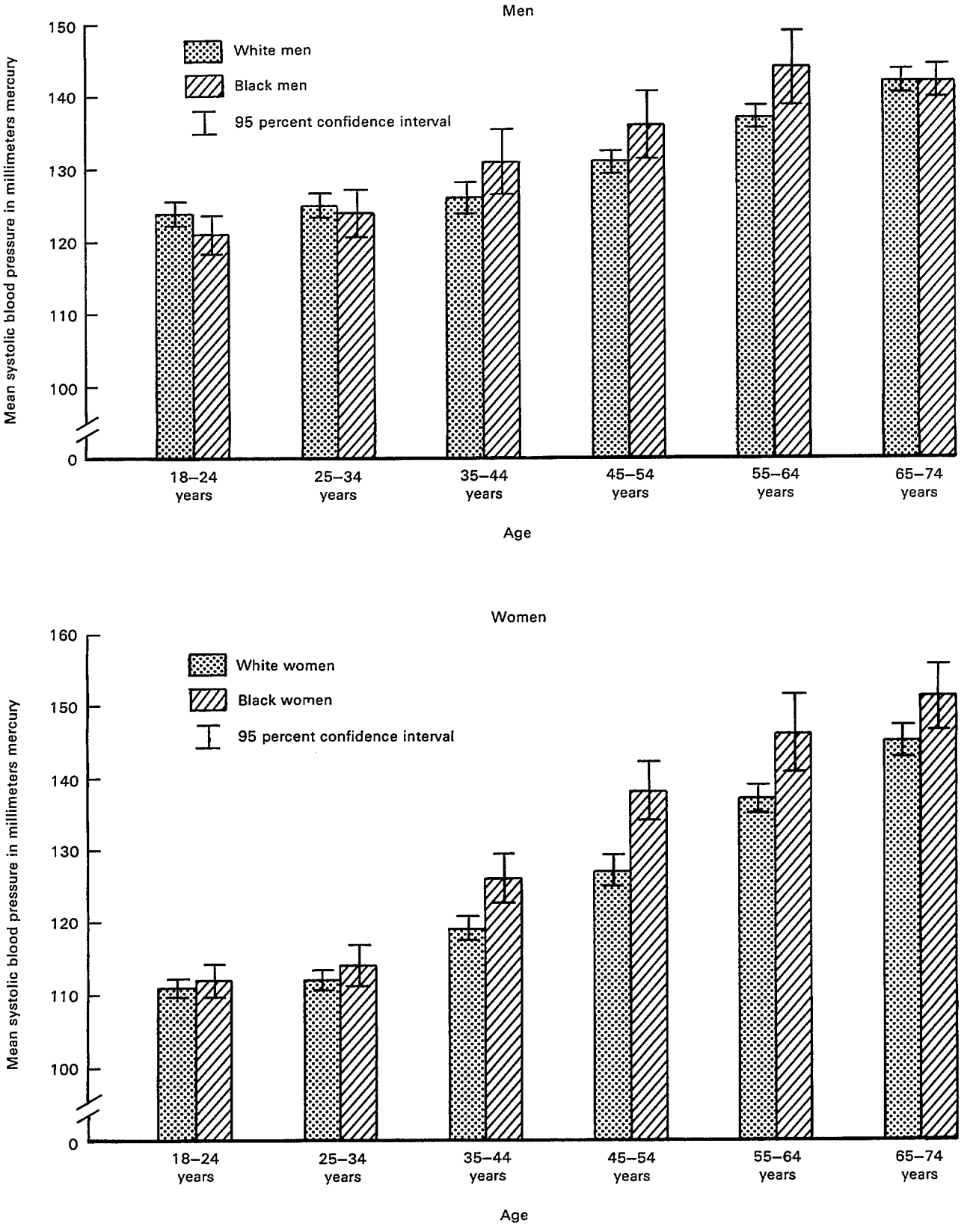
The difference in mean SBP between extreme age groups was greater for black adults than for white adults (table B). SBP means for black men changed from 121 to 142 mmHg over the age span studied, while the comparable figures for white men were 124 to 142 mmHg. Among black women, SBP means changed 39 mmHg across the age range studied (from 112 to 151 mmHg), while SBP means among white women increased 34 mmHg (from 111 to 145 mmHg).

Diastolic blood pressure

As shown in table C, figure 2, and table 2, mean DBP levels were significantly greater for black men than for white

Table B. Mean systolic blood pressure by race, sex, and age: United States, 1976–80

Race and sex	Age						
	18–74 years	*18–24 years*	*25–34 years*	*35–44 years*	*45–54 years*	*55–64 years*	*65–74 years*
	Systolic blood pressure in millimeters mercury						
All races							
Both sexes	126	117	118	123	130	137	144
Men	129	124	125	126	131	137	142
Women	123	111	112	119	129	137	146
White adults							
Both sexes	126	117	118	122	129	137	144
Men	129	124	125	126	131	137	142
Women	123	111	112	119	127	137	145
Black adults							
Both sexes	128	116	118	128	137	145	147
Men	130	121	124	131	136	144	142
Women	126	112	114	126	138	146	151



NOTE: Based on the average of 3 blood pressure measurements.

Figure 1. Mean systolic blood pressure among white and black men and women by age: United States, 1976–80

Table C. Mean diastolic blood pressure by race, sex, and age: United States, 1976–80

Race and sex	Age						
	18–74 years	18–24 years	25–34 years	35–44 years	45–54 years	55–64 years	65–74 years
	Diastolic blood pressure in millimeters mercury						
All races							
Both sexes	79	73	76	80	83	84	82
Men	81	76	79	82	85	85	83
Women	77	70	73	78	82	82	82
White adults							
Both sexes	79	73	76	79	83	83	82
Men	81	76	79	82	85	84	82
Women	77	70	73	77	81	82	81
Black adults							
Both sexes	81	73	77	84	89	88	85
Men	83	75	80	86	88	90	86
Women	80	71	75	82	89	87	85

men in all age groups 35–44 years and above. The amount by which the mean DBP for black men was greater than the mean DBP for white men varied between 3 mmHg for those ages 45–54 years (88 versus 85 mmHg, respectively) to 6 mmHg for those ages 55–64 years (90 versus 84 mmHg, respectively).

Mean DBP levels were significantly greater for black women than for white women in all age groups 35–44 years and above (table C). The difference in mean DBP levels between black and white women peaked at ages 45–54 years (89 versus 81 mmHg, respectively).

Mean DBP levels for all adults were significantly higher as age increased, changing from 73 mmHg for those ages 18–24 years to 82 mmHg for those ages 65–74 years (table C). After age 55, the mean DBP plateaued or decreased slightly. This pattern of a rise followed by a plateau was apparent for both men and women. Among men, the change in mean DBP between ages 18–24 years and 45–54 years was 9 mmHg. For women, the comparable change was 12 mmHg. In each age group from 18–24 years to 55–64 years, the mean DBP levels of men were significantly greater than those of women. The mean DBP levels for men and women ages 65–74 years were not significantly different.

The change in mean DBP among black men over the 18–74 year age span (from 75 to 86 mmHg) was greater than that among white men (from 76 to 82 mmHg). The change in mean DBP among black women (from 71 to 85 mmHg) was significantly greater than that among white women (from 70 to 81 mmHg). However, for each race-sex group the peak mean DBP occurred before ages 65–74 years, after which the means decreased. This flattening or downward turn to the DBP curve was not found in the Framingham longitudinal analysis,[21] and may be attributable to selective survival.

Education and blood pressure

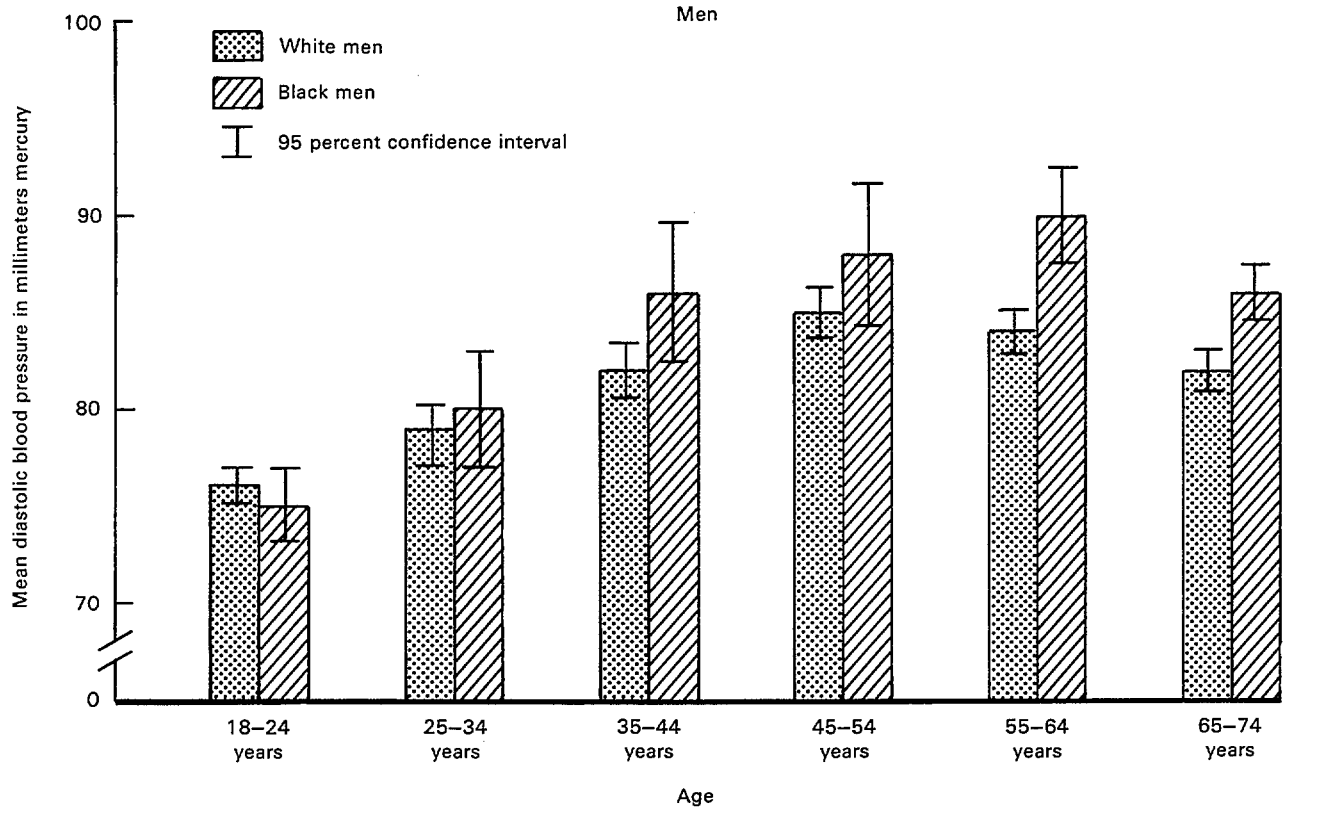
Several investigators have suggested that education is inversely associated with mean blood pressure level.[23–25] This relationship was also found in the NHANES II data reported here. Mean SBP levels were lowest among persons with the most years of formal education and highest among those with the least education (table 3). An exception to this relationship was found for black men, for whom no significant differences were observed between extreme educational groups. As education among adults ages 18–74 years increased from less than 9 years to more than high school, the age-standardized mean SBP decreased significantly, from 129 to 124 mmHg. This inverse relationship held for both men and women. The 7-mmHg difference between less than 9 and 13 or more years of education among women (from 127 to 120 mmHg) was more than twice that of men (from 131 to 128 mmHg), and both differences were statistically significant.

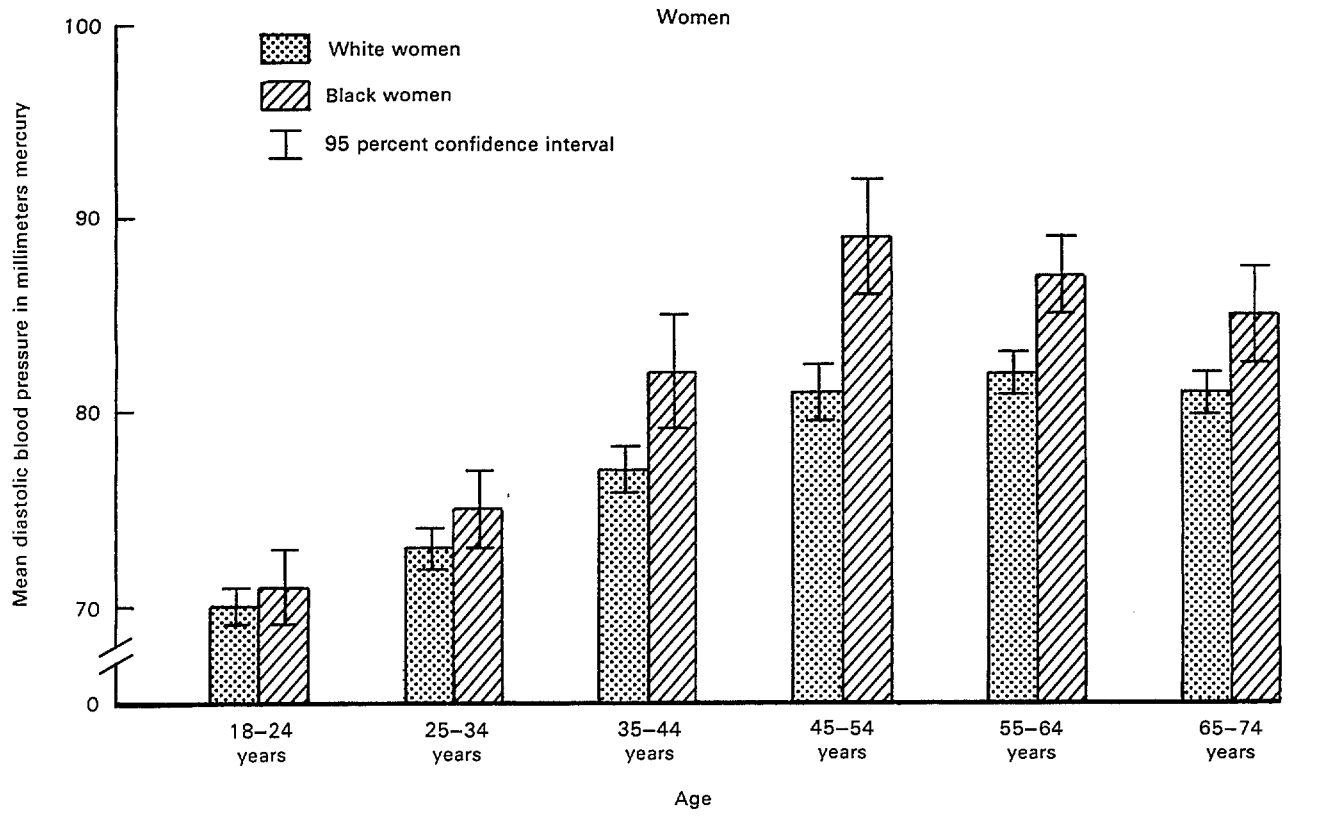
Mean DBP levels also showed an inverse relationship with educational level for adults 18–74 years of age (table 4). The mean, age-standardized DBP among adults at the highest educational level was 78 mmHg, 3 mmHg less than that among adults in the lowest educational level, 81 mmHg. The difference between women in the extreme educational categories was 3 mmHg (76 versus 79 mmHg), while that between men in the same categories was 2 mmHg (80 versus 82 mmHg). Both differences were statistically significant. Again, for black men an inverse relationship was not observed between mean DBP level and education.

The inverse relationship between education and blood pressure level was evident among both white and black adults. Among white adults, the mean SBP decreased 4 mmHg across the educational levels (from 128 to 124 mmHg), and the mean DBP decreased 2 mmHg (from 80 to 78 mmHg). Among black adults the comparable figures were 3 and 2 mmHg (SBP from 131 to 128 mmHg and DBP from 82 to 80 mmHg). For both races and for both SBP and DBP, the differences across educational levels among women substantially exceeded the differences among men.

Hypertension

Epidemiologic studies have established that elevated systemic arterial blood pressure increases the risk of coronary artery disease and cerebrovascular accident.[26–32] Studies con-





NOTE: Based on the average of 3 blood pressure measurements.

Figure 2. Mean diastolic blood pressure among white and black men and women by age: United States, 1976–80

ducted by the Veterans Administration have clearly demonstrated that this risk is reduced by lowering blood pressure.[33,34] The Hypertension Detection and Follow-Up Program (HDFP) has also demonstrated the benefit of lowering BP in reducing coronary events. The HDFP trial showed a 17-percent reduction in overall mortality, a 45-percent reduction in deaths from cerebrovascular diseases, and a 26-percent reduction in deaths from myocardial infarction for those in the stepped care (SC) group as compared with the referred care (RC) group, many of whom were also receiving medication.[35,36]

Prevalence estimates of the extent and distribution of hypertension in the U.S. adult population as determined from the average of the three blood pressure measures obtained in this study are shown in table 5. The following criteria were used for these estimates, irrespective of diagnostic status:

- *Definite hypertension:* SBP equal to or greater than 160 mmHg and/or DBP equal to or greater than 95 mmHg and/or currently taking antihypertensive medication.
- *Borderline hypertension:* SBP equal to or greater than 140 mmHg and less than 160 mmHg and/or DBP equal to or greater than 90 mmHg and less than 95 mmHg, and not taking antihypertensive medication.
- *Isolated systolic hypertension:* SBP equal to or greater than 160 mmHg and DBP less than 90 mmHg.
- *Normotension:* SBP less than 140 mmHg and DBP less than 90 mmHg, and not taking antihypertensive medication.

Definite hypertension

An estimated 25.1 million civilian noninstitutionalized U.S. adults ages 18–74 years had definite hypertension, based on the above definition. For all ages combined, the prevalence rate was 17.7 percent, increasing monotonically with age from a low of 2.0 percent for adults ages 18–24 years to a high of 45.1 percent for adults ages 65–74 years (table 5 and figure 3).

Definite hypertension was about equally prevalent among adult men and adult women (17.4 and 18.0 percent, respectively) (figure 3). The prevalence rates changed rapidly for men in the younger and middle ages, rising from 2.8 percent for those ages 18–24 years to 25.7 percent for those ages 45–54 years. The prevalence rates among men in the age groups 45–54 years and over changed less rapidly, rising from 25.7 percent for those ages 45–54 years to 38.1 percent for those ages 65–74 years.

Prevalence rates for definite hypertension among women increased in a stepwise fashion through the age span 18–74 years, rising from 1.4 percent for women ages 18–24 years to 50.4 percent for women ages 65–74 years.

The overall prevalence rate for definite hypertension among white adults was 16.8 percent (figure 3). The prevalence rate varied with age, changing from 1.9 percent for white adults ages 18–24 years to 43.7 percent for adults ages 65–74 years. The prevalence rates observed among white men (table 5) were significantly greater than those among white women in all age groups under 55 years. The rate for white women ages 65–74 years was significantly greater than that for white men in the same age group (48.3 versus 37.5 percent, respectively). The age-adjusted overall rate for white men, 17.1 percent for men ages 18–74 years, was not significantly different from that for white women, 16.6 percent.

The age-adjusted overall prevalence rate for definite hypertension among black adults was more than 1.5 times greater than that for white adults, 25.7 versus 16.8 percent (figure 3). Again, the rate increased with age, from 2.9 percent for black adults ages 18–24 years to 59.9 percent for black adults ages 65–74 years. In every age group 25–34 years and over the rate for black adults was significantly greater than that for white adults.

Most of the difference between black and white adults was attributed to the much higher rates observed for black women compared with white women (table 5). The age-adjusted overall prevalence rate for black men (21.1 percent) significantly exceeded that for white men (17.1 percent) by roughly one-fourth. In contrast, the overall rate for black women (29.5 percent) was almost 1.8 times greater than that for white women (16.6 percent). In the age groups 35–44 and 45–54 years, the rates observed for black women were approximately three times greater than the rates for white women, suggesting that hypertension may occur considerably earlier among the black female population than among the white female population. The tendency for an early rise in prevalence rates was mirrored in black men, although not as strongly.

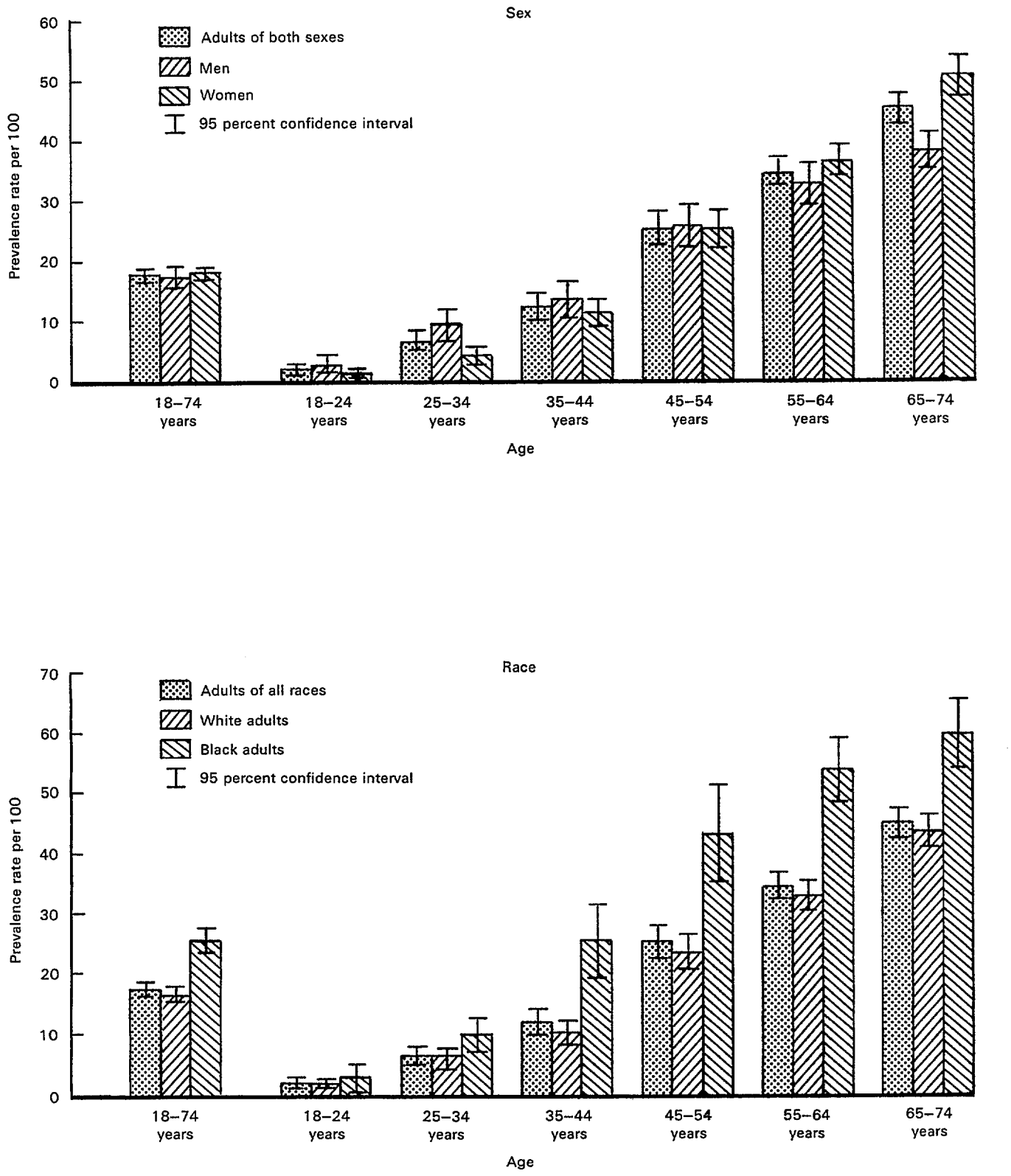
The relatively small number of younger black adults with definite hypertension in the sample limited conclusions about age-sex-specific differences between black men and women to those 45 years of age and over. Among the latter age groups, black women were significantly more likely to be classified as definite hypertensive than black men (table 5). Observed rates ranged from 26.0 to 46.4 percent for black men in the three older age groups, and from 58.3 to 72.8 percent for black women in the same age groups. The observed rates for black women in these age groups were at least 1.3 times greater than those for black men in the corresponding age groups. The prevalence rate for definite hypertension among black women ages 65–74 years, 72.8 percent, was the highest age-race-sex-specific rate found in the study. Definite hypertension afflicted black women over age 44 years more than any other population subgroup considered.

Borderline hypertension

In addition to the 25.1 million adults ages 18–74 years with definite hypertension, there were 17.1 million adults of those ages with borderline hypertension, a rate of 12.0 per 100 adults. Prevalence rates increased consistently throughout the age span 18–74 years (table 5 and figure 4).

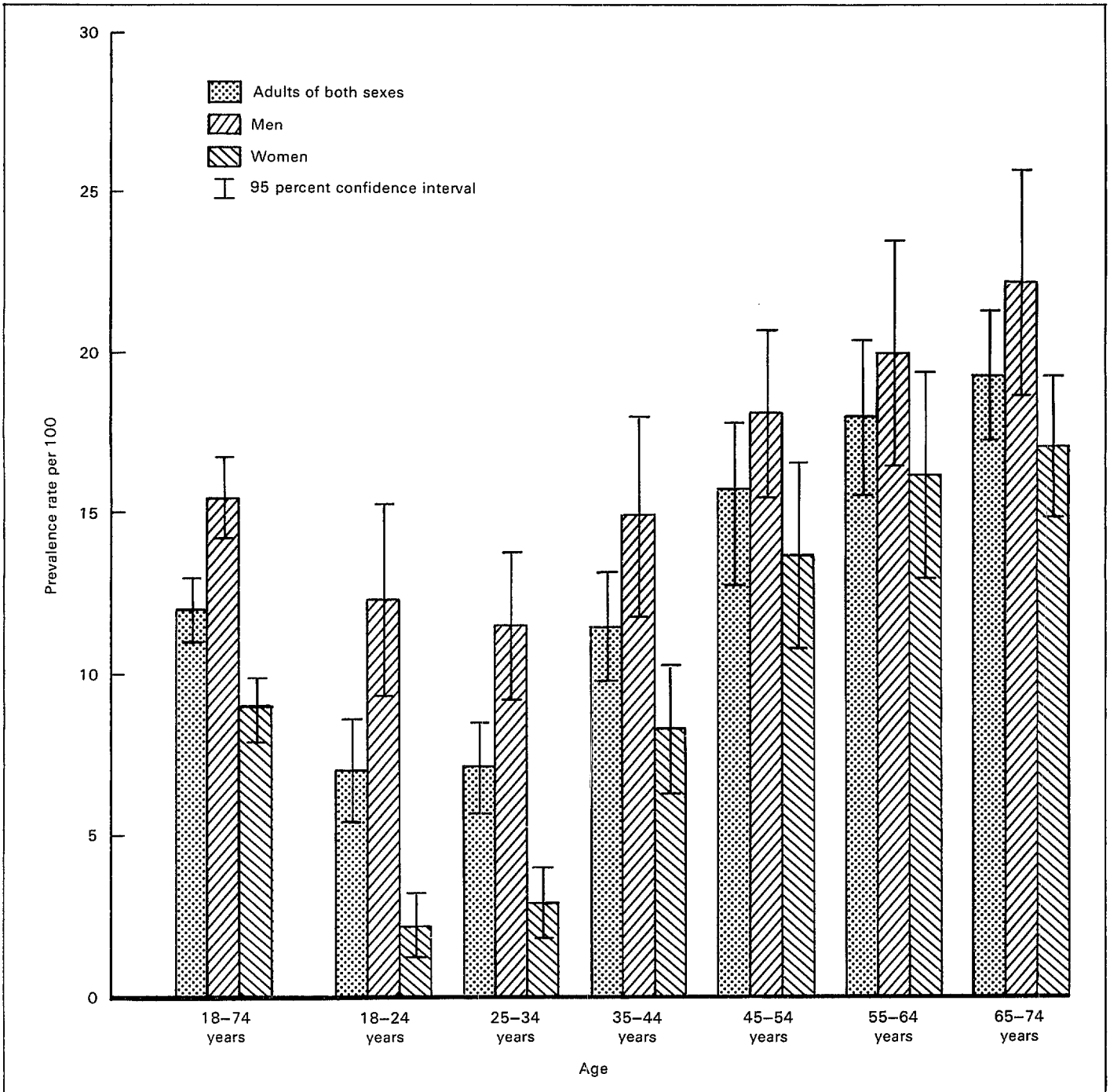
The observed rates for men significantly exceeded those for women in all but the 55–64-year age group (table 5). The overall rate for men was also significantly higher than that for women. As with definite hypertension, the increase in the prevalence of borderline hypertension with age was more rapid for women than men.

The overall age-adjusted prevalence rate for borderline hypertension for white adults ages 18–74 years was 11.9 percent, while that for black adults was 12.5 percent (table 5). The age-adjusted overall prevalence rate for black men was similar



NOTE: Based on the average of 3 blood pressure measurements. Definite hypertension is defined as systolic blood pressure ≥ 160 mmHg and/or diastolic blood pressure ≥ 95 mmHg and/or taking antihypertensive medication.

Figure 3. Prevalence of definite hypertension among adults 18–74 years of age by age and sex or race: United States, 1976–80



NOTE: Based on the average of 3 blood pressure measurements. Borderline hypertension is defined as systolic blood pressure ≥ 140 mmHg but less than 160 mmHg and/or diastolic blood pressure ≥ 90 mmHg but less than 95 mmHg, and not taking antihypertensive medication.

Figure 4. Prevalence of borderline hypertension among adults 18–74 years of age by age and sex: United States, 1976–80

to that for white men (16.9 versus 15.4 percent, respectively). The rate for black women was nearly identical to that for white women (8.9 versus 8.8 percent, respectively). None of the overall age-adjusted differences reached statistical significance. No age-specific comparisons were made between white and black adults or between black men and women because most of the age-specific rates for black adults did not meet National Center for Health Statistics standards of statistical reliability.

In contrast to definite hypertension, where the prevalence rates for black adults were markedly greater than those for white adults, race was not significantly associated with the prevalence of borderline hypertension. The ratio of age-adjusted overall prevalence rates for borderline hypertension for black and white adults was 1.05 (12.5/11.9), in contrast to the ratio of overall prevalence rates for definite hypertension of 1.53 (25.7/16.8). On the other hand, the difference in prevalence rates between the sexes was large for borderline hypertension and small for definite hypertension. The ratio of age-adjusted

prevalence rates for borderline hypertension for men and women was 1.74 (15.5/8.9), while that for definite hypertension was 0.97 (17.4/18.0).

Isolated systolic hypertension

Isolated systolic hypertension is a subcategory of definite hypertension, restricted to those definite hypertensives with an SBP equal to or greater than 160 mmHg but with a DBP of less than 90 mmHg.[7] As seen in table 5, this condition was rare below age 55 years; almost all the cases found in the NHANES II sample occurred in the age range 55–74 years. The condition was significantly more likely to occur in women than men in the age range 55–74 years (6.3 versus 4.5 percent, respectively). The prevalence rate was higher for black persons ages 55–74 years than for white persons in the same age group (8.1 versus 5.2 percent, respectively), but the difference did not reach statistical significance.

Diagnosed definite hypertension

Among the estimated 25.1 million U.S. adults 18–74 years of age with definite hypertension, 18.4 million (73.6 percent) reported that they had been told by a doctor that they had high blood pressure or hypertension (table 6). The proportion increased significantly with age, rising from about 44 percent for those ages 18–24 years to about 80 percent for those ages 65–74 years.

The age-adjusted prevalence of diagnosed hypertension was substantially greater among women than among men overall (80.5 versus 66.4 percent, respectively) (table 6). This sex differential was especially marked among adults under 45 years of age. The rates of diagnosed hypertension for each sex were essentially identical in the age groups 45–54, 55–64, and 65–74 years. The diagnosed rates for hypertensives in these age groups varied between 83 and 84 percent for women and between 71 and 72 percent for men. The diagnosis rates in these older age groups were higher than the diagnosis rates in the younger age groups.

The rates presented above suggest that undiagnosed hypertension is particularly a problem among adults under 45 years of age and is a somewhat more significant problem for men than for women. However, an analysis of the absolute number of persons with undiagnosed hypertension suggests a different pattern (table 5 and figure 5). Among women, the number of hypertensives in the United States who were not diagnosed rose with age from a low of 69,000 in the age group 25–34 years to about 661,000 in the age group 65–74 years. Among men, the number of undiagnosed hypertensives tripled between those in the age group 18–24 years and the age group 25–34 years (247,000 and 783,000, respectively). Within the four age groups 25–34 years to 55–64 years, the number of undiagnosed male hypertensives was markedly greater than the number of undiagnosed female hypertensives. These data suggest that, from a public health perspective, the most benefit would be gained by focusing available resources on programs that insure that men begin regular blood pressure checkups in early adulthood.

The probability of being diagnosed was somewhat higher for black adult hypertensives than for white adult hypertensives (80.9 versus 72.3 percent, respectively) (table 6). This was true for men (69.1 versus 65.9 percent for black and white hypertensives, respectively), as well as for women (87.6 versus 79.3 percent for black and white hypertensives, respectively), although only the latter difference was statistically significant. The more favorable diagnostic experience for black adult hypertensives overall was due primarily to the higher diagnosis rate among black female hypertensives. Black female hypertensives ages 35 years and over represent a group of particular interest, reporting a remarkable average diagnostic rate of nearly 90 percent. The relatively small number of black adults with definite hypertension in the sample prevented conclusions about age-specific differences between white and black adults of a given sex or between black men and black women.

Medication usage by hypertensives

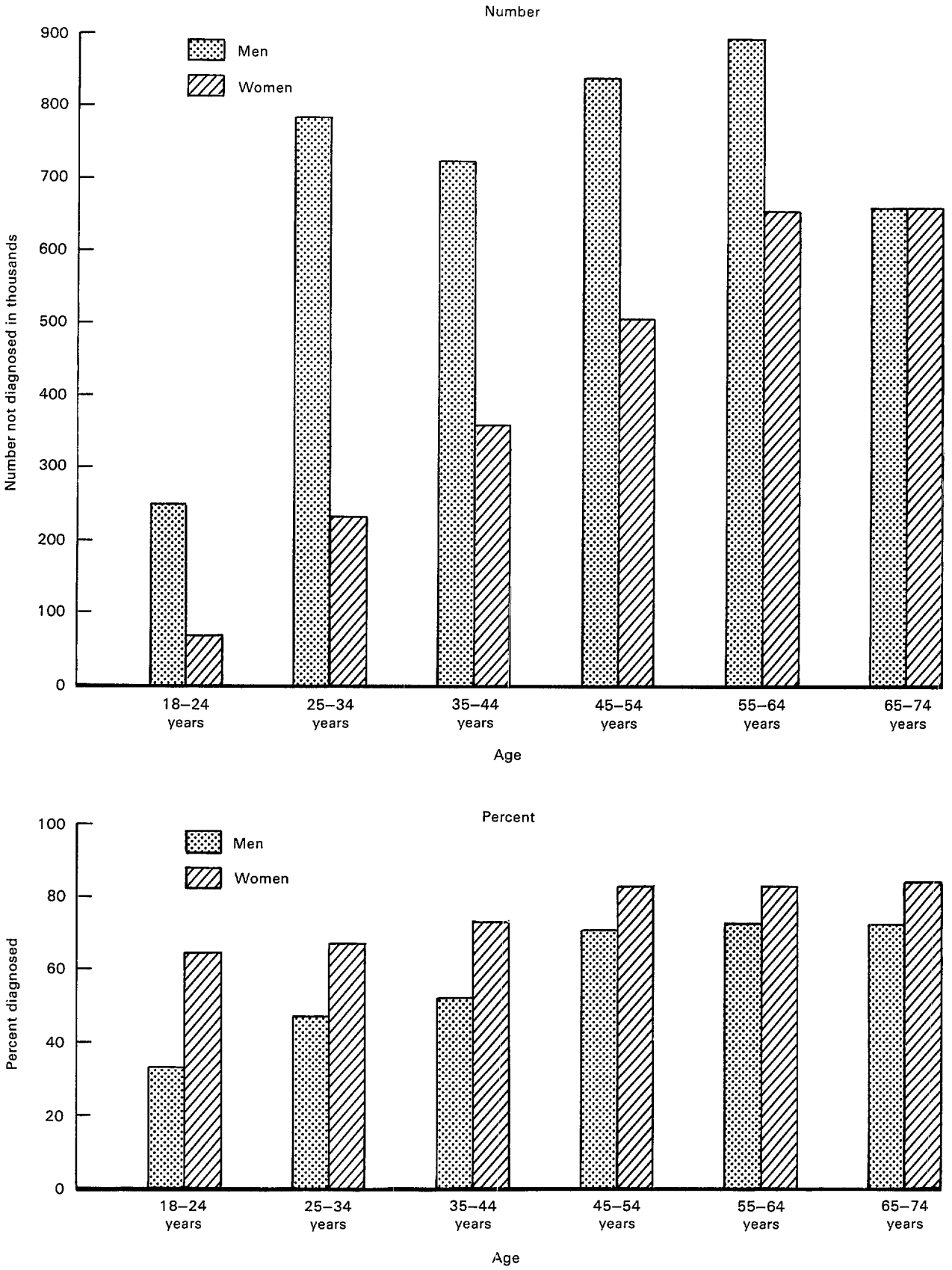
Over three-fourths of all diagnosed definite hypertensives reported taking antihypertensive medication "always," "often," or "sometimes" (table 6). The proportion varied with age; 40.9 percent of definite hypertensives ages 18–24 years took medication compared with 85.4 percent of those ages 65–74 years.

Female adult definite hypertensives who had been diagnosed were more likely than their male counterparts to be medicated (79.3 versus 68.9 percent, age-adjusted to the combined population) (table 6). The proportion of male hypertensives taking medication increased from a low of 37.6 percent for those ages 18–24 years to a high of 81.8 percent for men ages 65–74 years. The pattern for women was not as consistent as that for men, but again the proportion increased with age, from a low of 44.0 percent for women in the 18–24 year age group to a high of 87.2 percent for women in the 65–74 year age group. In every age group, the observed proportion of diagnosed female hypertensives taking medication was greater than that for diagnosed male hypertensives.

The proportion of diagnosed white adult hypertensives who were medicated was similar to the proportion of diagnosed black adult hypertensives who were medicated (75.1 versus 72.7 percent, respectively). Diagnosed female hypertensives of both races were more likely to be medicated than diagnosed male hypertensives of the same race (81.0 and 68.8 percent for white females and males, respectively, and 75.9 and 66.0 percent for black females and males, respectively). Black female hypertensives in the age group 65–74 years reported the highest rate of medication, 88.9 percent. Thus, for every 10 black women diagnosed as hypertensive, 9 reported taking medication. Once again, the relatively limited number of hypertensive black adults in the sample proscribed much age-specific statistical testing.

Joint distributions of SBP and DBP

The recently published report of the third Joint National Committee for the Detection, Evaluation, and Treatment of High Blood Pressure (JNC III), among other recommendations, defined new categories of elevated blood pressure to assist practitioners in classifying patients' degrees of cardiovascular risk.[7] Newly created categories include "high normal" for



NOTE: Based on the average of 3 blood pressure measurements. Definite hypertension is defined as systolic blood pressure ≥ 160 mmHg and/or diastolic blood pressure ≥ 95 mmHg and/or taking antihypertensive medication.

Figure 5. Number and percent of hypertensives who were diagnosed, by sex and age: United States, 1976–80

adults with a DBP between 85 and 89 mmHg, and other categories related to isolated systolic hypertension. (Table D presents a side-by-side comparison of the traditional and the JNC III definitions of hypertension categories.) To more fully meet the needs of those desiring to assess the implications of these new categorizations, tables 7–10 provide cumulative frequency distributions for demographic subgroups within commonly used SBP categories by DBP categories.

These distributions for age, race, and sex population subgroups allow the reader to determine what proportion of the subgroup falls below or above any of the commonly used univariate or bivariate definitions of elevated blood pressure. For instance, focusing on the definition of elevated blood pressure based on an SBP of 140 mmHg or more or a DBP of 90 mmHg or more (which includes all the JNC III hypertensive categories), it can be seen in figure 6 and table E that, for all four race-sex subgroups, the proportion with elevated blood pressure rose with age. Standard errors for these rates are not provided in tables 7–10 but can be obtained from Terence Drizd at the National Center for Health Statistics. Among white men the proportion increased significantly as age increased, from 16.0 percent for those ages 18–24 years to 53.0 percent for those ages 65–74 years. Among white women, the proportion with elevated blood pressure at ages 18–24 years was 2.0 percent, significantly lower than the rate for white men of the same age. However, the proportion of white women with elevated blood pressure rose rapidly after menopause (ages 45–54 years), resulting in 56.2 percent of white women 65–74 years of age having elevated blood pressure.

The increase across age was also evident for black men and women. For black men, the increase across the age span of 18–24 years to 65–74 years was from 10.8 to 58.5 percent. The comparable rise for black women was from 8.0 to 66.5 percent. Again, the rapid rise in the prevalence of elevated blood pressure among women after the menopause years can be seen. The data also show an earlier rise in the prevalence rates for elevated hypertension for black men and women than for white men and women. This phenomenon was noted above in the section on definite hypertension.

For every age and sex group except males ages 18–24 years, the prevalence rates for elevated blood pressure were higher for black adults than for white adults. The differences were particularly pronounced in the age range 35–64 years, where the rates for black adults exceeded those for white adults by 10–20 per 100. By ages 65–74 years, the rates for white adults approached the rates for black adults.

Similar analyses can be conducted for any of the hypertension categories defined by JNC III. As mentioned earlier, those definitions provide a more detailed or specific classification for assessing the degree of risk experienced by those persons with elevated blood pressure. Because the JNC III definitions establish lower values of DBP and SBP to be used as thresholds for a diagnosis of hypertension, table F shows a greater proportion of the population characterized as hypertensive when the JNC III definitions are used than when traditional definitions are used.

Based on the JNC III definitions, about one person in four (26.4 percent) was hypertensive (that is, not "normal" or "high normal") in the period spanned by the NHANES II survey. The proportion of women classified as "normal" (that is, DBP less than 85 mmHg and SBP less than 140 mmHg) was significantly higher than the proportion of men so classified (72.1 versus 60.0 percent, respectively), as was the proportion of white versus black adults (67.2 and 59.5 percent, respectively).

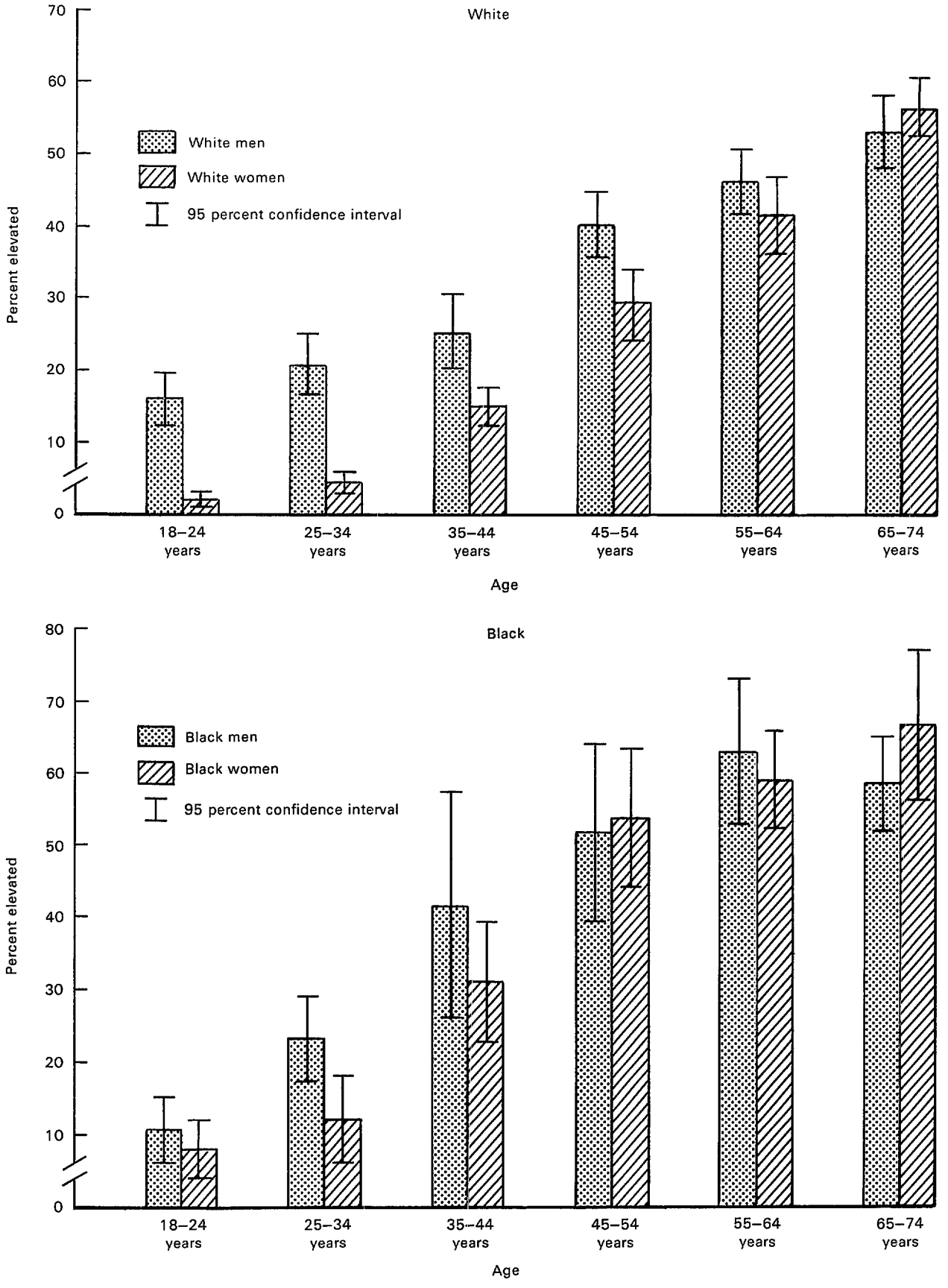
Approximately 37.4 million U.S. civilian noninstitutionalized adults between the ages of 18 and 74 years fell in one of the five hypertension categories at the estimated midpoint of the NHANES II survey. Hypertensive persons who have pharmacologically reduced their blood pressure to less than the threshold values would normally be added to this number in estimating the total hypertensive population of the United States, and the bottom line of table F shows the proportion of race and sex groups that are classified as hypertensive if those adults on antihypertensive medication are added to those adults whose blood pressures are elevated. Using this definition, 29.7 percent (about 42.1 million) adults ages 18–74 years were hypertensive.

Figure 7 shows the proportions of white and black men and women with hypertension, using the traditional (that is, WHO) and the JNC III definitions. The proportions of adults who were determined to be hypertensive using the expanded JNC III definition were between 30 and 95 percent higher (relatively) than the rates for hypertension using the traditional definition, depending on which race-sex group is considered. The excess prevalence among black adults of both sexes was maintained by the new definition. A slight excess of hypertension was found among white men compared with white women (32.5 versus 25.4 percent, respectively, using the 140 mmHg

Table D. Comparison of JNC III and traditional hypertension definitions

Hypertension category	*JNC III*	*Traditional*
DBP < 85 mmHg and SBP < 140 mmHg	Normal	Normal
DBP 85–89 mmHg and SBP < 140 mmHg	High normal	Normal
DBP 90–94 mmHg and SBP < 160 mmHg	Mild hypertension	Mild hypertension
DBP 90–94 mmHg and SBP ≥ 160 mmHg	Mild hypertension	Definite hypertension
DBP 95–104 mmHg	Mild hypertension	Definite hypertension
DBP 105–114 mmHg	Moderate hypertension	Definite hypertension
DBP ≥ 115 mmHg	Severe hypertension	Definite hypertension
DBP < 90 mmHg and SBP 140–159 mmHg	Borderline isolated systolic hypertension	Mild hypertension
DBP < 90 mmHg and SBP ≥ 160 mmHg	Isolated systolic hypertension	Isolated systolic hypertension

NOTE: JNC III = Third Joint National Committee for the Detection, Evaluation, and Treatment of High Blood Pressure; DBP = diastolic blood pressure; SBP = systolic blood pressure.



NOTE: Based on the average of 3 blood pressure measurements with systolic pressure ≥ 140 mmHg and/or diastolic pressure ≥ 90 mmHg.

Figure 6. Prevalence of elevated blood pressure among white and black men and women by age: United States, 1976–80

Table E. Prevalence rates for mild, moderate, and severe hypertension combined, based on JNC III definitions, by race, sex, and age: United States, 1976–80

[Rates are per 100]

Age	White men		White women		Black men		Black women	
	Rate	SE	Rate	SE	Rate	SE	Rate	SE
18–24 years	16.0	1.87	2.0	0.50	10.8	2.37	8.0	2.14
25–34 years	20.6	1.99	4.4	0.79	23.3	3.03	12.2	3.05
35–44 years	25.3	2.64	14.9	1.33	41.8	7.99	31.1	4.24
45–54 years	40.0	2.23	29.1	2.44	51.6	6.34	53.7	4.88
55–64 years	46.0	2.30	41.3	2.63	62.9	5.08	59.0	3.47
65–74 years	53.0	2.53	56.2	2.11	58.5	3.38	66.5	5.29

Table F. Distribution of U.S. population according to JNC III hypertension categories, by race, sex, and category: United States, 1976–80

High blood pressure category	All	White adults	Black adults	Men	Women	White men	White women	Black men	Black women
					Percent				
Normal	66.4	67.2	59.5	60.0	72.1	60.5	73.3	54.8	63.4
High normal	7.2	7.2	7.3	9.1	5.5	9.0	5.6	9.5	5.5
Elevated blood pressure:									
Total	26.4	25.6	33.2	30.9	22.3	30.5	21.1	35.8	31.1
Mild high blood pressure	14.9	14.4	19.1	18.6	11.6	18.4	10.7	20.8	17.8
Moderate high blood pressure	1.6	1.4	3.1	1.9	1.4	1.8	1.1	2.9	3.2
Severe high blood pressure	0.6	0.5	1.4	0.7	0.5	0.5	0.4	2.1	0.8
Borderline isolated systolic hypertension	7.7	7.8	7.7	8.4	7.1	8.4	7.2	8.7	6.9
Isolated systolic hypertension	1.5	1.5	1.9	1.3	1.8	1.3	1.7	1.2	2.3
Elevated blood pressure or medicated	29.7	28.8	38.2	32.9	26.8	32.5	25.4	38.0	38.4

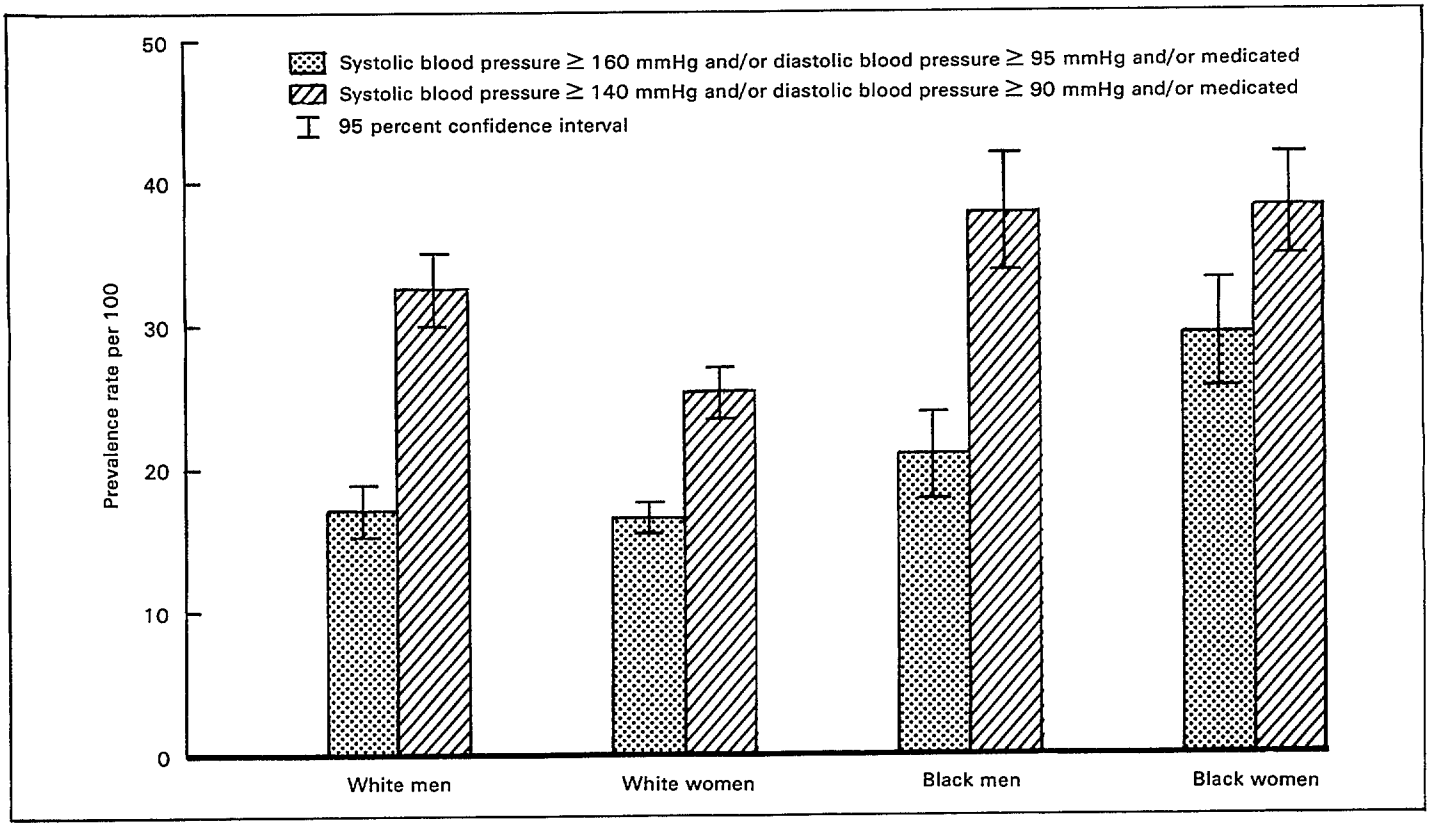


Figure 7. Prevalence of hypertension among white and black men and women 18–74 years of age using traditional definitions and definitions of the Third Joint National Committee for the Detection, Evaluation, and Treatment of High Blood Pressure: United States, 1976–80

and 90 mmHg definition), and the difference was statistically significant.

Of the 37.4 million adults with hypertension in the United States, over one-half fell in the category defined as mild hypertension, that is, with an average DBP of 90 to 104 mmHg and an SBP of less than 140 mmHg, regardless of medication status. Mild hypertension was significantly more prevalent among men than women (18.6 versus 11.6 percent, respectively) and among black adults than among white adults (19.1 versus 14.4 percent, respectively).

Secular trends, 1960–80

History

Until the 1950's, safe and effective medication for long-term outpatient treatment of hypertension was not available. Prior to that time, antihypertensive drugs were very potent, and their use often resulted in adverse side effects.[37] Consequently, only malignant hypertension was treated and such therapy was generally performed in emergency rooms or hospitals. Diuretics came into use in the late 1950's as the first effective hypertension treatment with an acceptably low incidence of adverse effects.

The advent of the modern period of hypertension treatment was signaled by a widespread recognition of hypertension as an important public health problem in the 1960's. The Framingham Heart Study and the Tecumseh Study demonstrated an increased risk of stroke and myocardial infarction associated with elevated blood pressure.[28,38–42] The Veterans Administration Cooperative Study showed that lowering blood pressure in persons with moderate or severe hypertension (diastolic blood pressure (DBP) of 105 mmHg or more) reduced the risks of stroke and congestive heart failure.[33,34,43] About 1968, the first long-term public programs were developed to begin screening and treatment of hypertension.

In 1972, the National High Blood Pressure Education Program (NHBPEP) was initiated.[44] This program was designed to develop national recognition of hypertension as a public health problem of major importance. The National High Blood Pressure Coordinating Council was formed by the National High Blood Pressure Education Program to help coordinate the efforts of the many groups that had become involved in hypertension control. Such groups included a wide variety of volunteer and professional organizations. The Coordinating Council functions today as a forum for consensus and action for these groups.

In 1975, the first Joint National Committee on the Detection, Evaluation, and Treatment of High Blood Pressure issued its report, distributing it to health care providers and organizations.[45] Its recommendations included treatment of all adults with DBP's of 105 mmHg or greater as well as those with DBP's of 90–104 mmHg if other risk factors were present, a formalized stepped care approach to treatment, and avoidance of ineffective or inappropriate drugs. These recommendations formed one of the first common treatment guidelines for hypertension.

In 1979 the results of the Hypertension Detection and Follow-Up Program (HDFP) were published.[36,46] This multicenter, community-based, randomized, controlled trial compared the effects of a systematic antihypertensive treatment program (Stepped Care) and referral to community-based medical therapy (Referred Care). Those persons with a DBP of 90 mmHg or more assigned to the Stepped Care group achieved consistently better control of their elevated blood pressure and experienced a 5-year, all-cause mortality 17 percent lower than those in the Referred Care group. Mortality was also significantly lower for the Stepped Care subgroup with mild hypertension (entry DBP of 90 to 104 mmHg) compared with the corresponding Referred Care subgroup. The results suggested that systematic effective management of hypertension has the potential to reduce mortality for the large numbers of persons with elevated blood pressure in the population, including those with mild hypertension.

In 1980, following a review of the results of the HDFP, the second JNC report was published.[47] It offered guidelines for the extent of evaluation of persons with elevated blood pressure, recommended treatment of persons with diastolic blood pressures of 90 mmHg or more, made guarded recommendations on isolated systolic hypertension, and updated the stepped care treatment guidelines to include the beta blockers. These updated guidelines also suggested weight reduction in obese patients and sodium control as adjunctive therapy for the management of hypertension.

Following the development of new antihypertensive agents and the publication of the results of new clinical trials in the early 1980's, the report of the JNC III was recently published.[7] It emphasized increased targeting for screening programs and increased use of nonpharmacologic methods initially and during long-term management of hypertension. As pointed out earlier, persons with diastolic blood pressure of 85 to 89 mmHg were newly categorized as having "high normal blood pressure." Other new categories were created related to isolated systolic hypertension. The stepped care recommendations were updated to include the beta blockers as acceptable Step 1 agents and the angiotensin-converting enzyme inhibitors and calcium channel blockers as acceptable agents in later steps. "Step-down" therapy was mentioned for use in selected patients.

Data from repeated cross-sectional blood pressure surveys have been published for Minnesota;[48,49] Baltimore, Md.;[50] the State of Maryland;[51] Chicago, Ill.;[52] Charleston, S.C.;[53] North Karelia, Finland;[54] and the State of Connecticut.[55] These studies appear to have demonstrated improvements in blood pressure control in a number of populations in recent years. The National Health Examination Survey (NHES) and the National Health and Nutrition Examination Survey (NHANES) results presented here strengthen these findings by documenting

blood pressure trends in a representative sample of the entire U.S. adult population ages 18–74 years over a 20-year period.

Comparisons of results among three National Health Surveys

As described in the introduction, during the period 1960–1980 the National Center for Health Statistics conducted three cross-sectional surveys designed to assess the health of the civilian noninstitutionalized adult population of the United States. The first National Health Examination Survey (NHES I) was conducted in 1960–62.[8] The first National Health and Nutrition Examination Survey (NHANES I) was conducted in 1971–74.[a] The second NHANES, conducted in 1976–80, was the subject of the first part of this report.[9,10] The three surveys differ in regard to subject matter covered but generally permit time-related comparisons of selected measures.

Differences among the three surveys dictated the choice of the first blood pressure determination for comparisons among surveys rather than the mean of three blood pressures, which was the source of the analyses in the first part of this report. Only the first blood pressure (BP) determination is available for all examinees for all surveys. In NHANES I only 33.3 percent of the adult examinees received the detailed examination in which three blood pressure measurements were made. Also, in all three surveys only the first blood pressure measurement was taken under the following identical circumstances:

- Only the first determination was always performed with the examinees in a seated position. In NHANES I and NHANES II the examinee was recumbent for the second determination.
- The first determination was always made by a physician. The second and third determinations in NHANES I were usually made by a nurse.
- In all three surveys the first determination was made at the start of the physician's examination.

Other factors were considered before accepting the premise that there were no survey-specific biases inherent in the first determination. Standard mercury sphygmomanometers were used in all three surveys. Regular size adult cuffs (12.5 cm long) were used on adults in all three surveys. Examination room temperatures did not differ substantially among the surveys. In all of the surveys the first measurement was taken while the examinee was seated on the examination table, without support for the back. The hours of examination were identical for all three surveys, so any diurnal variations were constant for all three surveys. The chronologic relationship between the physician's examination and other, possibly stressful, examination components was random in all three surveys. Observer differences were discounted because of survey design considerations or as a result of postsurvey analyses. The possibility of orthostatic hypotension was discounted, because the first determination was always made at the start of the physician's examination and was always done with the examinee seated, with no immediately previous recumbent period.

The possibility exists that the first blood pressure may have been slightly elevated because of examinee anxiety. (Comparing tables 1 and 11, for instance, which present means for the average of three blood pressure measurements and for the first blood pressure alone for NHANES II, suggests that the difference is about 3 mmHg. If all three pressures used in the average had been sitting measurements, and if the last measurement had not been subjected to bias due to orthostatic hypotension, this difference would have been less.) However, there was nothing to suggest that the degree of elevation was any greater or lesser for any one of the surveys. No sources of survey-specific bias in the first blood pressure measurement were found.

The systolic blood pressure (SBP) was chosen as the primary measure for comparison among the surveys. Numerous studies have found that the determination of SBP is more reliable than that of DBP. In one study comparing clinic and home blood pressure readings on hypertensive patients it was found that 69 percent of the variance in home SBP readings was predicted by clinic SBP readings, while only 30 percent of the variance in home DBP readings was predicted by clinic DBP readings.[56] Superior reliability of systolic readings was also found in the Framingham study.[57] A study by Wilcox on blood pressure variability using a sound motion picture device for testing also found a greater variability in the DBP readings.[58]

Reliance solely on an SBP determination detracts little from an evaluation of BP-associated morbidity and mortality. For instance, one prospective study, using a multiple logistic model to evaluate the relationship of various cardiovascular risk factors to total cardiovascular disease mortality in Evans County, Georgia, retained SBP pressure while dropping out DBP pressure.[59] This greater predictive ability, and the fact that most factors which confound blood pressure measurement seem to have greater impact on the DBP than on the SBP, recommends the SBP as the measure of choice in an analysis of trends.

The results of the three surveys showed significant improvement in mean SBP for white and black races and both sexes over the period covered by the three NCHS surveys (table 11).[b] The age-adjusted mean SBP for white men ages 18–74 years was 133 mmHg in 1960–62, 131 mmHg in 1971–74, and 129 mmHg in 1976–80. For white women ages 18–74 years, the age-adjusted mean SBP fell from 129 mmHg in 1960–62 to 128 mmHg in 1971–74 to 123 mmHg in 1976–80. For black men, these means were 138 mmHg, 136 mmHg, and 130 mmHg for the three surveys, respectively. The corresponding means for black women were 138 mmHg, 135 mmHg, and 126 mmHg. The differences between the earliest and latest means were significant in each of the four race-sex groups.

[a]NHANES I was augmented by a separate but similar subsample measured in 1974–75. The augmentation subsample consisted only of detailed examinees who were not weighted to be part of the numerically much larger 1971–74 sample. Consequently, the augmentation sample was omitted from further analysis.

[b]A more complete presentation of the basic data from NHES I and NHANES I, including sample sizes for specific age-race-sex subgroups, has been published.[11–13]

In general, the age-adjusted mean SBP declined more in black adults than in white adults and more in women than in men over the period. Specifically, the age-adjusted mean SBP declined 4 mmHg in white men, 6 mmHg in white women, 8 mmHg in black men, and 12 mmHg in black women. The amount of improvement in SBP was greater for the older age groups than it was for the younger age groups (for example, see figures 8 and 9). During the 20-year period, the mean SBP among white adults ages 18–24 years fell only 1 mmHg (from 118 to 117 mmHg), while for white adults ages 65–74 years it fell 12 mmHg (from 157 to 145 mmHg).

One of the original intentions of this report was to examine the proportion of the population with an SBP equal to or greater than 160 mmHg. Many individuals with an SBP in the range of

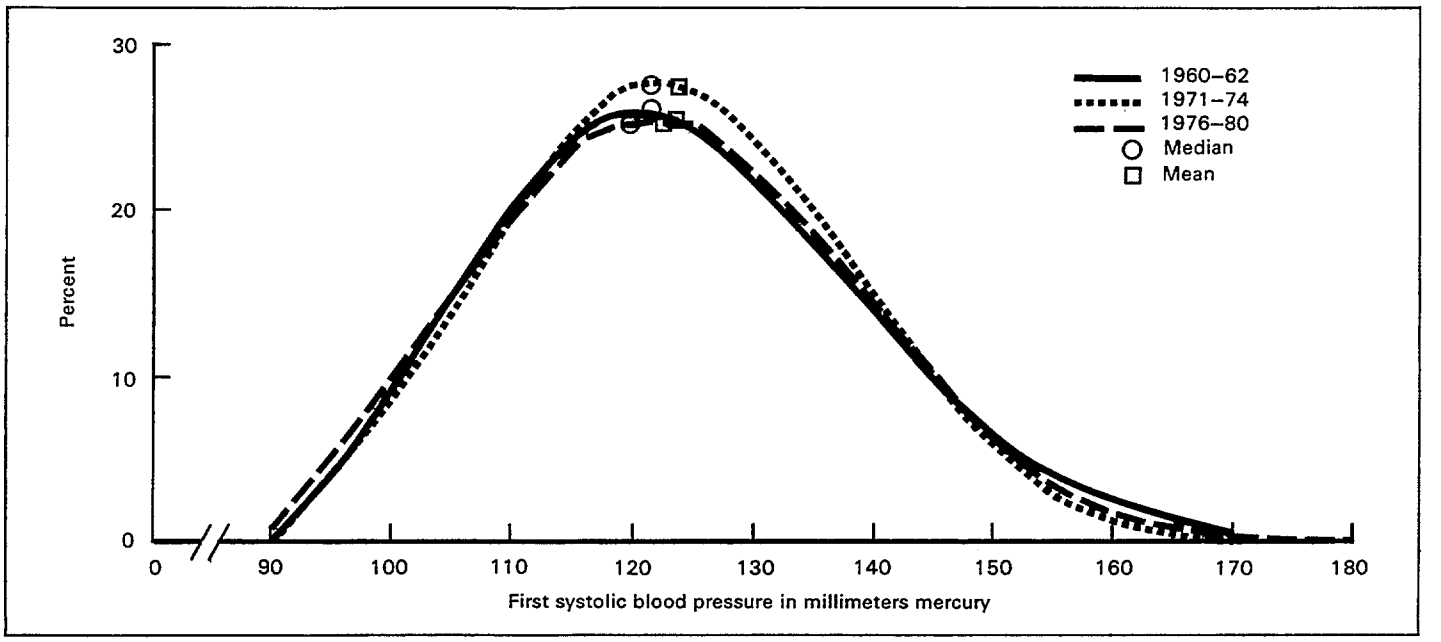


Figure 8. Smoothed weighted frequency distribution of the first systolic blood pressure for white men ages 18–24 years by survey: United States, NHES I (1960–62), NHANES I (1971–74), and NHANES II (1976–80)

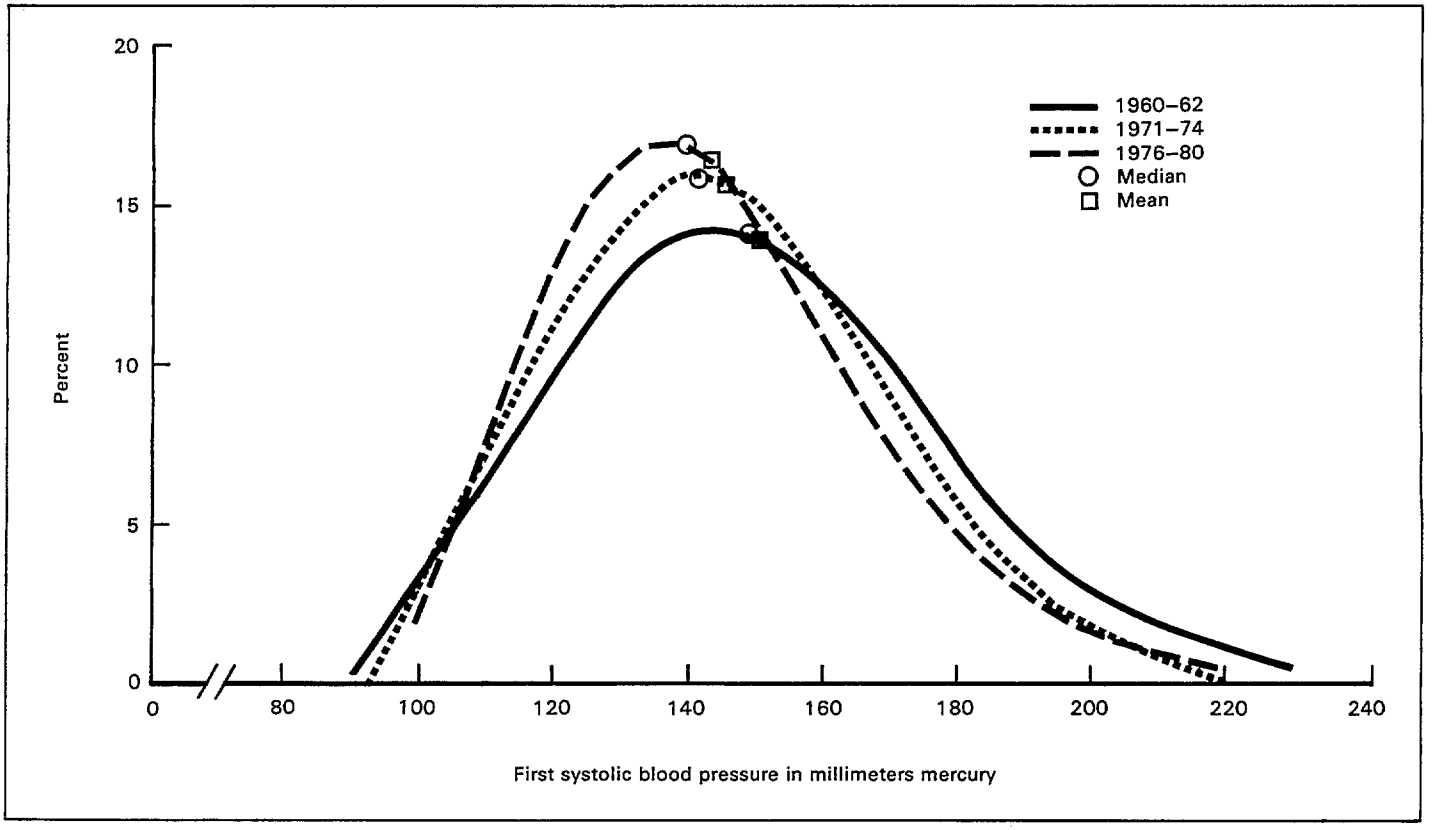


Figure 9. Smoothed weighted frequency distribution of the first systolic blood pressure for white men ages 65–74 years by survey: United States, NHES I (1960–62), NHANES I (1971–74), and NHANES II (1976–80)

140–159 mmHg will not be treated, while some individuals with an SBP initially in excess of 159 mmHg may have their pressures reduced to less than 160 mmHg after treatment is begun. However, the small number of sample persons in the race-sex-specific younger and middle age groups with SBP over 160 mmHg resulted in estimated proportions that did not reach minimum standards for reliability. Consequently, attention was redirected to the proportion of the population with an SBP of 140 mmHg or more.

The age-adjusted proportions of persons with SBP equal to or greater than 140 mmHg decreased across the three surveys for both races and both sexes (table 11). Specifically, the age-adjusted proportion of white men in that category decreased from 32.4 percent in 1960–62 to 27.0 percent in 1976–80. The proportion for white women declined from 26.1 to 21.1 percent, for black men from 41.2 to 28.3 percent, and for black women from 39.6 to 26.7 percent over the 20-year time period. Thus, the magnitude of the decline in the proportion of persons with SBP equal to or greater than 140 mmHg was similar among men and women of the same race, but substantially greater for black adults than for white adults. Given the higher proportion of persons with SBP equal to or greater than 140 mmHg among black adults in the 1960–62 survey, and given the larger decline in that proportion among black adults since that time, the proportion of such persons is similar among the four race-sex groups in the 1976–80 data: 27.0, 21.1, 28.3, and 26.7 percent for white men and women and black men and women, respectively.

The age-specific proportions of persons with SBP equal to or greater than 140 mmHg declined over the three surveys for both races and both sexes (table 11). The magnitude of the decline was greater among the older age groups than among the younger age groups for both races. In all three surveys the older age groups consistently had higher proportions of persons with SBP equal to or greater than 140 mmHg than the younger age groups. For example, this proportion exceeded one-half for most race-sex groups ages 55–74 years, while it was less than one-fifth for most race-sex groups ages 18–34 years.

In contrast to the significant improvements noted for SBP over the three surveys, the results for DBP do not demonstrate any consistent changes for any race-sex group (table 12). These results are somewhat contrary to what was expected and may have been the product of problems in the determination of DBP in the later two surveys. (This issue is explored further in the Discussion section.) Findings in regard to DBP are presented here as a preface to analyses of trends in hypertension.

Age-adjusted mean DBP levels showed variable fluctuations with no discernible trend over time for all race-sex groups except white males (table 12). Among white males, the age-adjusted mean DBP increased from 79 mmHg in NHES I to 83 mmHg in NHANES II, and the difference was statistically significant. For all three surveys, black adults had higher mean DBP levels than white adults, and males generally had higher DBP levels than females, consistent with similar race and sex relationships for mean SBP measurements. The age-specific DBP means also showed no consistent trends over the three surveys (table 12).

The proportion of the population with definite hypertension (SBP equal to or greater than 160 mmHg and/or DBP equal to or greater than 95 mmHg, and/or taking antihypertensive medication) by age, race, and sex is presented in table 13 for the three surveys. The age-adjusted proportion of white adults with definite hypertension rose from 18.0 percent in 1960–62 to 21.0 percent in 1976–80. Among black adults, the age-adjusted proportion fell from 33.6 percent in 1960–62 to 28.6 percent in 1976–80, but the decline was not statistically significant. The small increase among white adults was more evident in men than in women, while the larger decrease in black adults occurred for both sexes similarly (figure 10). The age-specific proportions of persons with definite hypertension generally reflected trends similar to their respective race-sex groups over time.

The proportion of the population with elevated blood pressure (SBP equal to or greater than 140 mmHg and/or DBP equal to or greater than 90 mmHg, regardless of medication status) is presented in table 14 by age, race, and sex for the three surveys. The age-adjusted proportion of adults with elevated blood pressure was essentially unchanged over the span of the three surveys, increasing by only 1.1 percent. The age-adjusted proportion for males rose by 2.9 percent and fell for females by 0.6 percent, but the differences did not reach statistical significance. Among white adults the age-adjusted proportion increased by 1.5 percent, and among black adults fell by 4.1 percent, but again the differences were not statistically significant. Observed age-specific rates tended to increase among those less than 55 years of age and decreased among those age 55 years and over.

The data presented in tables 15–17 and described below include the proportion of persons in each of the hypertension rubrics as a percent of the total U.S. adult population. This choice of presentation is intended to address the needs of those comparing chronic heart disease rates for the overall U.S. population, or demographically defined subgroups of that population. On the other hand, some users of these data may wish to study proportions for medically defined subgroups of that population (for example, persons taking antihypertensive medication as a proportion of all those with hypertension). These readers are referred to table 18, which presents much of the data from tables 15–17 with the proportions calculated by this alternate method.

As shown in table 15, the proportion of persons with undiagnosed hypertension has declined in the period covered by the three surveys. Although slight increases were noted for some race-sex groups between the 1960–62 and 1971–74 surveys, the downward trend between the 1960–62 and 1976–80 surveys was significant for each of the four race-sex groups except white males. Over the period from 1960–62 to 1976–80, the age-adjusted proportion of white adults with undiagnosed hypertension fell 1 or 2 percent (from 10.7 to 9.8 percent in men, and from 7.7 to 5.6 percent in women). In contrast, the rates among black adults of both sexes were more than halved, falling from 21.1 to 9.9 percent among black men and from 13.2 to 4.5 percent among black women.

The declines in age-specific proportions of persons with undiagnosed hypertension were substantially larger among black adults than white adults in most age groups. While some

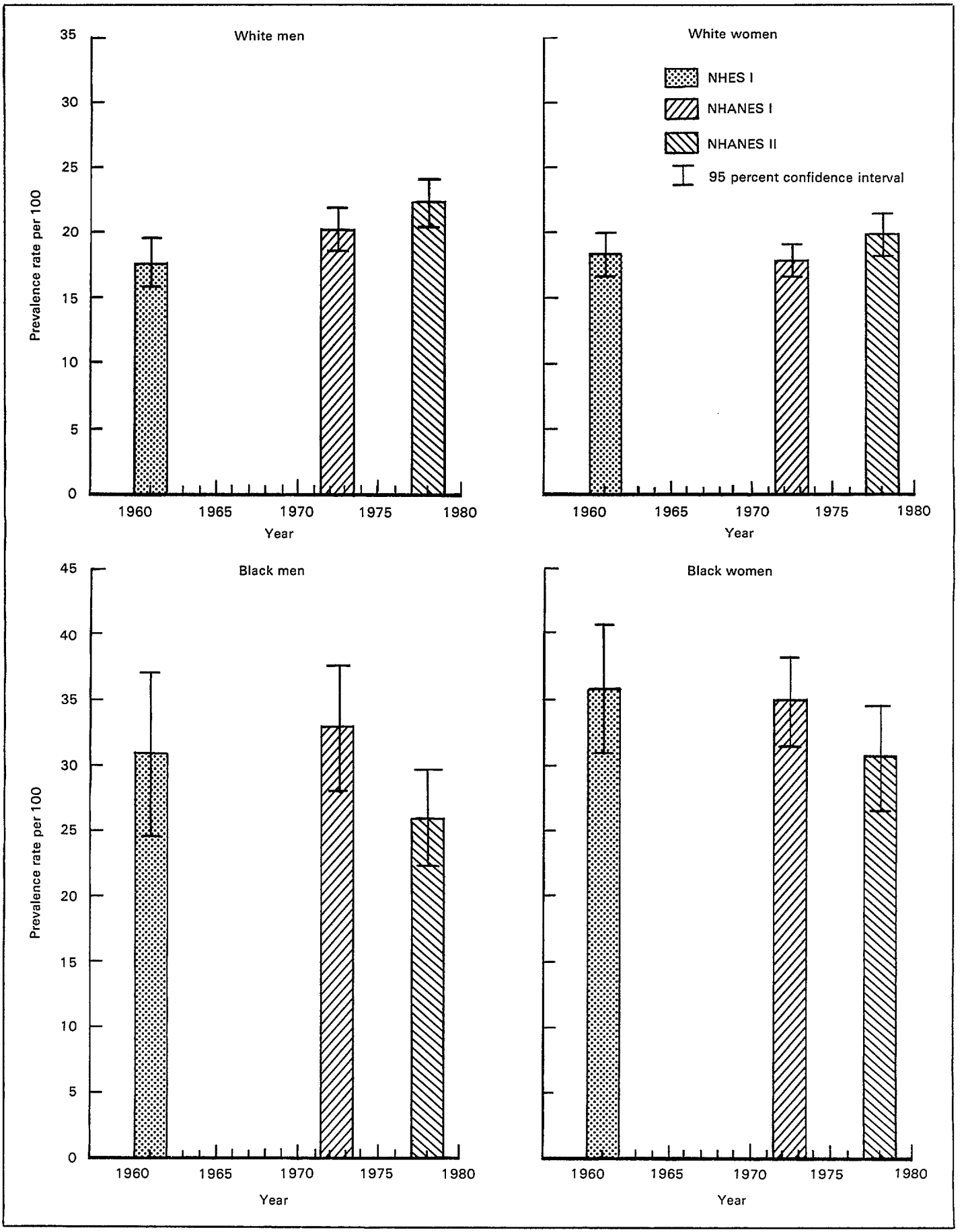


Figure 10. Age-adjusted prevalence of definite hypertension among white and black men and women by survey: United States, NHES I (1960–62), NHANES I (1971–74), and NHANES II (1976–80)

of the age-specific proportions for black adults were twice as high as those for white adults in the 1960–62 study, most of the age-specific proportions for black adults were very close to those of white adults in the 1976–80 survey. In fact, for black women ages 55–74 years in the 1976–80 survey, the proportions with undiagnosed hypertension were actually lower than for white women in the same age groups, although the differences did not reach statistical significance.

The proportions of persons taking antihypertensive medications are shown in table 16 for each of the three surveys. (The reader is cautioned that the question addressing medication use asked of the respondents in the 1971–74 survey was slightly different from those used in the 1960–62 and 1976–80 surveys. The questions used in those two surveys referred only to current medication use, while that used in NHANES I asked about use in the previous 6 months. This difference would be expected to result in a slight upward bias of the 1971–74 estimates, but the amount of that bias has not been quantified.) This proportion rose between 1960–62 and 1976–80 for each race-sex group. Most of the increase was noted between NHANES I and NHANES II, even though the period between NHES I and NHANES I was nearly twice the period between NHANES I and II. The age-adjusted proportion of persons taking antihypertensive medications rose from 3.8 percent in 1960–62 to 7.6 percent in 1976–80 for white men, from 7.0 to 11.1 percent for white women, from 6.0 to 9.2 percent for black men, and from 15.9 to 19.3 percent (not statistically significant) for black women. While the age-adjusted proportion of persons taking such medications was generally higher among black adults than among white adults and among women than men, the amount of increase from NHES I to NHANES II was similar for each of the four race-sex groups.

With regard to age-specific rates, the largest absolute increases in the proportion taking antihypertensive medications occurred generally among persons ages 45–64 years, while the smallest changes occurred among the age groups 18–34 years.

As shown in table 17, the proportion of persons with controlled hypertension markedly increased between NHES I and NHANES II. This proportion at least doubled for each race-sex group: From 1.5 to 3.4 percent for white men, from 2.9 to 6.3 percent for white women, from 0.6 to 3.3 percent for black men, and from 6.0 to 11.6 percent for black women. The increase was statistically significant for each race-sex group.

The absolute proportion of persons with controlled hypertension (that is, DBP less than 95 mmHg and SBP less than 160 mmHg) changed the least among those ages 18–34 years over the 20-year period. The age-specific proportions increased most among the older age groups; for example, the proportion more than doubled for white persons in each of the age groups between 45 and 74 years. For white adults ages 65–74 years, the proportion of the population subgroup with pharmacologically controlled blood pressure more than doubled, rising from 6.7 to 15.2 percent over the 20-year period. Comparable figures for black adults ages 65–74 years describe over a fivefold increase, from 5.2 percent in 1960–62 to 26.4 percent in 1976–80.

The data in tables 18–20 can be used to estimate the proportion of all hypertensives who were able to control their hypertension with medication. In particular, marked changes were observed for persons 45–74 years of age. During the period of the NHES I survey, 11.3 percent of hypertensives in this age range were controlled (1,859 out of 16,423 (in thousands)). This proportion increased to 16.0 percent (3,250 out of 20,318) in 1971–74 and then to 27.3 percent (6,203 out of 22,747) in 1976–80.

Tables 18–20 also present the number and proportion of medicated hypertensives who successfully controlled their hypertension. Among all medicated hypertensives ages 45–74 years, the proportion with blood pressures less than 140/90 mmHg was 33.8 percent in 1960–62, 42.7 percent in 1971–74, and 51.2 percent in 1976–80. The proportion rose within each of the four race-sex groups when only those ages 45–74 years were considered. The increase for white men in this age group, 7.4 percent, was the smallest observed, while that for black men, 39.5 percent, was the largest observed. These changes were not tested for statistical significance because of limited sample sizes in some cells.

Discussion

A number of previous studies have suggested that detection and control of hypertension have improved in some communities over the past decade. Surveys of blood pressure levels in Baltimore, Md.; Birmingham, Ala.; and Davis, Calif., were done in 1973–74 as part of the HDFP and again in 1977–78 to assess changes in these communities.[60] The surveys measured the blood pressures of nonoverlapping random samples of adults ages 30–69 years in the three cities. The mean DBP decreased from 83.2 mmHg in 1973–74 to 81.7 mmHg in 1977–78 when adjusted for age, race, sex, and center.[60] The prevalence of elevated DBP (≥95 mmHg) and elevated SBP (≥160 mmHg) decreased for almost every age, race, and sex subgroup studied. The proportion of persons aware of their elevated blood pressure status and receiving treatment also increased. The proportion of persons with actual hypertension who were on treatment and under control increased from 28 to 43 percent for black men, 47 to 61 percent for black women, 28 to 44 percent for white men, and 52 to 69 percent for white women over the 5 years studied.[60]

Blood pressure levels in the Minneapolis-St. Paul area were measured through surveys in 1973–74 and 1980–81.[48,49] In those surveys adults ages 25–59 years (about 95 percent of whom were white persons) had mean age-adjusted blood pressure decreases of 3 mmHg for men and 2 mmHg for women over the period examined. Mean blood pressure levels improved over time for both SBP and DBP. With regard to hypertension detection and control, the surveys found improvements in the proportion of hypertensive persons with adequately controlled blood pressures (from 40.4 to 76.1 percent), with inadequately controlled blood pressures (from 13.7 to 8.5 percent), with diagnosed but untreated hypertension (from 20.4 to 8.8 percent), and with undetected hypertension (from 25.5 to 6.6 percent).

The Connecticut High Blood Pressure Program has also recently reported general improvements (since 1978–79) in the proportion of that State's adult population who were aware,

treated, and controlled.[55] Their findings suggest that, at least in one State, the trends observed in the HDFP centers and in Minneapolis-St. Paul between 1973 and 1981 may well be continuing into the present.

These findings are reflected in the National Center for Health Statistics (NCHS) surveys reported here. A significant reduction was also found in mean SBP and in the proportion of persons within race-sex groups with elevated SBP. The proportion of persons with undiagnosed hypertension declined significantly in the period spanned by the three surveys. The proportion of persons taking antihypertensive medication increased, as did the proportion of the population whose hypertension was controlled. The findings of the surveys described in the first part of this discussion were consistently in agreement with the NCHS surveys conducted in the same period. The level of agreement between the proportions of controlled hypertensives observed in these nationally representative surveys (table 18) and those observed in the three HDFP centers discussed above[60] was remarkable.

The significant improvement in mean SBP for each race-sex group over the three surveys provides supportive evidence for the beneficial effects of efforts to identify and control elevated blood pressure in the U.S. population in recent years. The decline in the proportion of persons with SBP greater than or equal to 140 mmHg is consistent with the decline in mean SBP, and similarly suggests that improvement in the control of elevated blood pressure has occurred.

Previous reports have shown that the prevalence of elevated blood pressure in black adults is consistently higher than in white adults.[60] The results of these three surveys suggest that the difference in prevalence between the races has decreased, and that the decreases in mean SBP and proportion of persons with SBP equal to or greater than 140 mmHg have been larger in black adults than in white adults.

The mean SBP and proportion of persons with SBP greater than or equal to 140 mmHg was higher in persons in the older age groups in all three surveys, which is consistent with other studies. The extent to which this difference represents a natural aging process (such as progressive loss of arterial elasticity) or a widespread preventable form of pathology among the elderly is uncertain. However, the larger improvements in SBP among the older age groups compared with the younger age groups are encouraging.

It is important to determine whether the changes in blood pressure levels in the period spanned by the three surveys are caused by factors that affected only those persons at highest risk or by factors that affected the U.S. population as a whole. The substantial decline in the proportion of the population with SBP greater than 140 mmHg suggests that the major factor has been an increased identification and treatment of persons with elevated blood pressure. The decrease in the median SBP over the same time period is smaller but may be partly due to a number of society-wide changes in lifestyle patterns resulting from increased awareness of cardiovascular factors.

The absence of a clear decline in DBP levels over the time period is somewhat puzzling, given that SBP and DBP levels are highly correlated[39] and that most regimens for treating hypertension tend to focus on lowering the DBP to an acceptable level. A number of explanations are possible, but the most likely involve insufficient attention to the determination of the DBP by the examiners on the later two surveys, or environmental conditions in the examination centers which were more likely to interfere with an accurate determination of the DBP than of the SBP.

The issue of observer attention may be most productively addressed by comparisons among the three surveys of the 5th, 50th, and 95th percentiles of DBP (table 12). These show that there were almost no consistent differences among the three surveys in the 95th percentile, a modest and fairly consistent increase (2–4 mmHg) among the first and later two surveys in the 50th percentile, and a larger (2–8 mmHg) increase in the 5th percentile. Such a pattern is possible if the examiners in the later two surveys were inclined to release the pressure on the cuff faster than the recommended 2 mmHg per second. This practice would have the effect of raising the DBP, because the examiner would be apt to miss the last pulse before the actual cessation of Korotkoff sounds. It is also reasonable to suggest that this effect would be more pronounced at the lower end of the DBP distribution, where the examiners might be more likely to rush the determination. This phenomenon would not be expected to be present for the first survey, in which the examiners were required to record both the fourth and fifth Korotkoff sounds. The difference between the fourth and fifth sounds can be difficult to detect and requires close attention and adherence to recommended techniques.

Observer inattention could have consequences in other ways. In particular, because the examiners of the later two surveys were not required to record both the fourth and fifth sounds, it is possible that once the diastolic value was well within the normotensive range, the physician may have listened less meticulously for the disappearance of the Korotkoff sounds. In general, the written instructions given to the physicians for the reading and recording of blood pressures in the later two surveys were less detailed than in the first survey, and no blood pressure measurement retraining was provided for the physicians. As a consequence, the physicians may not have been aware of the need for an accurate determination of DBP from an epidemiological standpoint, regardless of the clinical significance of the value.

Some support for the hypothesis of observer inattention can be found in the distribution of end digits for DBP measurements (see appendix IV). That analysis shows that the physicians of the later two surveys were more likely than those of the first survey to report DBP values that ended in 0 or 5, when in fact all blood pressure measurements should have been even-numbered and equally likely, thus eliminating the possibility of an end digit of 5.

The difference in character between the physicians of the first survey and the physicians of the later surveys may have had consequences for the accurate determination of DBP in another way. It is possible that the older physicians of the later two surveys may have suffered more from some degree of hearing loss associated with aging than the younger physicians of the first survey, although it has not been possible to quantify this effect.

The trends in mean SBP, proportion of persons with SBP

greater than or equal to 140 mmHg, and proportion of persons taking antihypertensive medications are unaffected by any difficulties with diastolic readings. The general trends in proportion of persons with diagnosed, undiagnosed, and controlled hypertension rely on the accuracy of the diastolic reading only in the upper end of the blood pressure distribution (diastolic greater than or equal to 90 mmHg). Therefore, difficulties with diastolic readings primarily in the lower end of the distribution would have little or no effect on the analysis of these trends.

The proportion of black adults with definite hypertension decreased over the period covered by the three surveys (although not significantly), suggesting that some preventive measures may have had an impact on the prevalence of the disease in black adults. However, no similar decline is evident in the proportion of white adults with definite hypertension. One might speculate that the lack of a decline is a function of (*a*) the less-than-perfect DBP measurements, (*b*) declining cardiovascular disease mortality over the past two decades, keeping more hypertensive white males alive and contributing to the overall increase, (*c*) race-specific changes in lifestyle factors related to hypertension, and/or (*d*) more mild hypertensives being medicated, thus "promoting" them into the definite category. Further investigation is necessary before any conclusions can be drawn.

A significant decline in the proportion of persons with undiagnosed hypertension was noted for each of the four race-sex groups over the 20-year period. This improvement provides supportive evidence for the success of major public health campaigns to increase public awareness of hypertension, to increase physician interest in treating hypertension, and to create blood pressure screening programs over that time.

The proportion of persons taking antihypertensive medication has increased over the period spanned by the three surveys. The proportion of adults under age 35 years taking blood pressure medication is very low for several reasons. Such persons have a low prevalence of elevated blood pressure when compared with older adults. In addition, physicians may tend to treat elevated blood pressure in younger persons with nonpharmacologic means more readily than older persons. Finally, young men have fewer contacts with physicians and are, therefore, less likely to have their blood pressure taken.

Among adults age 35 years and older, the increasing proportion of blood pressure medication use with age is consistent with the increasing prevalence of elevated blood pressure with age. Persons ages 35–74 years were more likely to take blood pressure medications in 1976–80 than in 1960–62. This increase is consistent with the hypothesis of increasing awareness and diagnosis of hypertension over that time period. In addition, part of the increased use of blood pressure medications since 1960 may be a response to the recent interest in treating even mildly elevated blood pressure, and to the development of new antihypertensive drugs which are less toxic and more effective. The higher proportion of blood pressure medication use among black adults than among white adults was consistent with the higher prevalence of elevated blood pressure found in black adults in all three surveys.

Finally, the proportion of persons with controlled hypertension increased significantly for each of the four race-sex groups. Such results may have been expected, given the trends in increased awareness and treatment over the 20-year period.

In summary, the changes in blood pressure levels in the period spanned by the three surveys are in the anticipated directions. Overall, mean SBP has decreased, the prevalence of elevated blood pressure has decreased, the use of antihypertensive medications has increased, the proportion of persons with controlled hypertension has increased, and the improvements have been most marked in the population subgroups most at risk at the beginning of the period. The reasons for these changes are varied, but perhaps the three most significant are (*a*) the advent of more effective treatment regimens, (*b*) a greater awareness by physicians and the general public of the risks inherent in high blood pressure and of the lifestyle factors influencing blood pressure, and (*c*) a greater recognition by physicians of the desirability of treating even mildly elevated blood pressure. Although a direct causal relationship has not been demonstrated, these results do provide suggestive evidence that various private and public programs (such as the National High Blood Pressure Education Program) have had some beneficial effect.

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List of detailed tables

NHANES II, 1976–80

Trend tables

Table 1. Systolic blood pressure by race, sex, and age with weighted population estimates, means, standard deviations, standard errors, and selected percentiles: United States, 1976–80

Race, sex, and age	Population estimate	Mean systolic blood pressure	Standard deviation	Standard error	Percentiles			
					50th	75th	90th	95th
ALL RACES[1]								
Both sexes	Number in thousands	Millimeters mercury						
18–74 years	141,728	126	19.8	0.59	123	137	151	163
18–24 years	27,448	117	14.2	0.62	116	125	136	142
25–34 years	32,752	118	14.5	0.66	117	127	137	143
35–44 years	23,651	123	16.4	0.78	120	131	143	151
45–54 years	23,032	130	19.1	0.66	127	140	154	164
55–64 years	20,350	137	20.3	0.83	135	149	164	175
65–74 years	14,496	144	23.0	0.83	141	157	173	187
Men								
18–74 years	67,555	129	17.7	0.64	127	139	151	162
18–24 years	13,275	124	13.7	0.82	123	131	141	147
25–34 years	15,895	125	14.0	0.81	123	133	141	148
35–44 years	11,367	126	14.8	0.99	125	134	145	152
45–54 years	11,114	131	18.3	0.84	129	141	155	165
55–64 years	9,607	137	19.3	0.89	135	149	163	175
65–74 years	6,297	142	21.9	0.85	140	155	170	183
Women								
18–74 years	74,173	123	21.2	0.62	119	133	152	163
18–24 years	14,173	111	11.7	0.64	110	119	125	132
25–34 years	16,856	112	12.3	0.67	111	119	127	133
35–44 years	12,284	119	17.1	0.85	117	128	140	150
45–54 years	11,918	129	19.7	0.96	127	139	154	163
55–64 years	10,743	137	21.2	1.03	135	149	165	175
65–74 years	8,198	146	23.7	0.95	143	159	177	190
WHITE ADULTS								
Both sexes								
18–74 years	123,494	126	19.4	0.63	123	136	151	162
18–24 years	23,362	117	14.3	0.63	117	126	136	143
25–34 years	28,357	118	14.4	0.69	117	127	137	143
35–44 years	20,392	122	15.8	0.81	120	130	141	150
45–54 years	20,235	129	18.5	0.71	127	140	153	162
55–64 years	18,243	137	19.7	0.83	134	148	163	171
65–74 years	12,906	144	22.9	0.89	141	157	173	186
Men								
18–74 years	59,198	129	17.4	0.66	127	139	151	162
18–24 years	11,442	124	13.7	0.85	123	133	141	147
25–34 years	13,864	125	13.7	0.82	124	133	141	147
35–44 years	9,808	126	14.3	1.09	125	133	143	151
45–54 years	9,865	131	18.1	0.83	129	141	155	165
55–64 years	8,642	137	18.9	0.89	135	148	163	171
65–74 years	5,576	142	22.0	0.90	140	155	170	183
Women								
18–74 years	64,296	123	20.7	0.66	119	133	150	162
18–24 years	11,919	111	11.6	0.64	110	118	125	131
25–34 years	14,494	112	12.1	0.70	111	119	127	133
35–44 years	10,584	119	16.4	0.82	115	127	139	149
45–54 years	10,369	127	18.7	1.60	125	137	151	159
55–64 years	9,601	137	20.4	1.02	134	149	163	172
65–74 years	7,329	145	23.5	1.06	143	158	177	188

[1]Includes races other than white and black.

Table 1. Systolic blood pressure by race, sex, and age with weighted population estimates, means, standard deviations, standard errors, and selected percentiles: United States, 1976–80—Con.

Race, sex, and age	Population estimate	Mean systolic blood pressure	Standard deviation	Standard error	Percentiles			
					50th	75th	90th	95th
BLACK ADULTS	Number in thousands	Millimeters mercury						
Both sexes								
18–74 years	14,740	128	22.4	0.81	124	139	157	170
18–24 years	3,406	116	13.8	1.01	115	123	134	141
25–34 years	3,499	118	15.8	1.11	116	128	137	145
35–44 years	2,527	128	19.6	1.37	127	140	153	162
45–54 years	2,259	137	21.7	1.55	137	147	163	183
55–64 years	1,760	145	25.5	2.20	140	159	180	189
65–74 years	1,288	147	23.5	1.45	143	160	182	195
Men								
18–74 years	6,592	130	19.8	1.05	127	140	156	165
18–24 years	1,533	121	13.7	1.41	119	128	137	145
25–34 years	1,546	124	16.6	1.63	123	135	144	159
35–44 years	1,112	131	17.2	2.30	130	142	150	159
45–54 years	1,044	136	20.3	2.40	135	141	157	*173
55–64 years	801	144	23.3	2.63	140	157	180	*184
65–74 years	555	142	20.7	1.10	140	156	170	183
Women								
18–74 years	8,148	126	24.2	0.87	121	139	159	173
18–24 years	1,873	112	12.7	1.19	111	119	126	139
25–34 years	1,953	114	13.8	1.46	114	121	130	135
35–44 years	1,415	126	21.0	1.82	124	139	153	162
45–54 years	1,215	138	23.0	2.10	137	150	167	183
55–64 years	959	146	27.2	2.77	139	163	180	193
65–74 years	733	151	24.8	2.30	146	165	186	200

Table 2. Diastolic blood pressure by race, sex, and age with weighted population estimates, means, standard deviations, standard errors, and selected percentiles: United States, 1976–80

Race, sex, and age	Population estimate	Mean diastolic blood pressure	Standard deviation	Standard error	Percentiles			
					50th	75th	90th	95th
ALL RACES[1]								
Both sexes	Number in thousands	Millimeters mercury						
18–74 years	141,728	79	11.6	0.44	78	86	94	100
18–24 years	27,448	73	9.3	0.36	72	79	85	89
25–34 years	32,752	76	10.6	0.51	75	82	90	95
35–44 years	23,651	80	11.0	0.59	79	87	94	100
45–54 years	23,032	83	12.0	0.58	83	90	99	103
55–64 years	20,350	84	11.5	0.51	83	91	98	103
65–74 years	14,496	82	11.7	0.49	81	89	98	102
Men								
18–74 years	67,555	81	11.3	0.46	80	88	96	101
18–24 years	13,275	76	9.2	0.44	75	81	87	91
25–34 years	15,895	79	10.5	0.64	79	86	93	97
35–44 years	11,367	82	10.4	0.71	82	89	96	101
45–54 years	11,114	85	12.0	0.63	84	93	100	105
55–64 years	9,607	85	11.5	0.57	85	93	99	105
65–74 years	6,297	83	11.5	0.53	81	90	98	103
Women								
18–74 years	74,173	77	11.6	0.45	76	83	92	98
18–24 years	14,173	70	8.6	0.45	70	75	81	84
25–34 years	16,856	73	9.6	0.53	72	79	85	89
35–44 years	12,284	78	11.0	0.61	77	84	92	97
45–54 years	11,918	82	11.6	0.71	80	89	97	101
55–64 years	10,743	82	11.4	0.53	81	89	97	102
65–74 years	8,198	82	11.8	0.58	81	89	97	102
WHITE ADULTS								
Both sexes								
18–74 years	123,494	79	11.4	0.46	78	86	93	99
18–24 years	23,362	73	9.2	0.40	72	79	85	89
25–34 years	28,357	76	10.4	0.55	75	83	90	95
35–44 years	20,392	79	10.7	0.58	79	86	93	98
45–54 years	20,235	83	11.6	0.59	82	90	98	103
55–64 years	18,243	83	11.3	0.55	82	90	97	103
65–74 years	12,906	82	11.6	0.54	81	89	97	102
Men								
18–74 years	59,198	81	11.1	0.48	80	87	95	100
18–24 years	11,442	76	9.2	0.48	75	81	88	91
25–34 years	13,864	79	10.3	0.65	79	86	93	97
35–44 years	9,808	82	10.0	0.72	81	87	95	100
45–54 years	9,865	85	11.8	0.64	84	92	101	105
55–64 years	8,642	84	11.1	0.61	83	92	99	103
65–74 years	5,576	82	11.4	0.56	81	89	98	102
Women								
18–74 years	64,296	77	11.3	0.47	75	83	91	97
18–24 years	11,919	70	8.3	0.45	70	75	81	83
25–34 years	14,494	73	9.4	0.56	71	78	85	89
35–44 years	10,584	77	10.7	0.59	76	83	91	96
45–54 years	10,369	81	11.1	0.73	80	88	95	99
55–64 years	9,601	82	11.3	0.58	81	89	97	102
65–74 years	7,329	81	11.7	0.63	81	88	97	102

[1]Includes races other than white and black.

Table 2. Diastolic blood pressure by race, sex, and age with weighted population estimates, means, standard deviations, standard errors, and selected percentiles: United States, 1976–80—Con.

Race, sex, and age	Population estimate	Mean diastolic blood pressure	Standard deviation	Standard error	Percentiles			
					50th	75th	90th	95th
BLACK ADULTS								
Both sexes	Number in thousands	Millimeters mercury						
18–74 years	14,740	81	13.4	0.61	80	89	99	104
18–24 years	3,406	73	9.8	0.63	73	79	84	89
25–34 years	3,499	77	11.9	0.74	77	82	92	99
35–44 years	2,527	84	12.3	1.25	85	93	101	103
45–54 years	2,259	89	13.7	1.20	88	97	104	111
55–64 years	1,760	88	13.2	0.79	87	95	107	115
65–74 years	1,288	85	11.7	0.79	83	93	100	105
Men								
18–74 years	6,592	83	13.5	0.77	81	90	100	106
18–24 years	1,533	75	9.5	0.96	75	81	85	89
25–34 years	1,546	80	12.4	1.46	79	87	97	102
35–44 years	1,112	86	12.1	1.85	87	94	101	104
45–54 years	1,044	88	14.4	1.89	89	93	101	*111
55–64 years	801	90	14.9	1.23	88	98	115	*119
65–74 years	555	86	11.6	0.72	83	93	101	107
Women								
18–74 years	8,148	80	13.3	0.60	79	88	98	103
18–24 years	1,873	71	9.8	0.96	71	77	83	87
25–34 years	1,953	75	11.0	0.99	73	80	90	93
35–44 years	1,415	82	12.3	1.49	82	90	99	102
45–54 years	1,215	89	13.3	1.51	87	100	105	110
55–64 years	959	87	11.4	1.00	87	93	102	110
65–74 years	733	85	11.7	1.22	84	95	99	103

Table 3. Systolic blood pressure by race, sex, and educational level with weighted population estimates, standardized means, and standard errors: United States, 1976–80

Race and sex	Education								
	Less than 9 years			9–12 years			13 years or more		
	Population estimate	Mean[1]	Standard error	Population estimate	Mean[1]	Standard error	Population estimate	Mean[1]	Standard error
All races[2]	Number in thousands	Millimeters mercury		Number in thousands	Millimeters mercury		Number in thousands	Millimeters mercury	
Both sexes	18,997	129	0.74	69,901	126	0.56	48,126	124	0.66
Men	9,404	131	0.97	30,279	130	0.68	25,550	128	0.66
Women	9,593	127	0.81	39,621	123	0.58	22,576	120	0.75
White adults									
Both sexes	15,944	128	0.76	61,858	126	0.60	44,703	124	0.68
Men	7,962	131	1.05	26,862	130	0.73	23,945	128	0.67
Women	7,982	126	0.84	34,997	123	0.61	20,757	120	0.79
Black adults									
Both sexes	3,053	131	1.78	8,042	130	1.00	3,423	128	1.49
Men	1,442	131	2.28	3,418	131	1.10	1,605	132	2.04
Women	1,611	132	2.59	4,625	129	1.19	1,818	124	1.40

[1]Age standardized by the direct method to the overall U.S. population at the midpoint of the survey.
[2]Includes races other than white and black.

Table 4. Diastolic blood pressure by race, sex, and educational level with weighted population estimates, standardized means, and standard errors: United States, 1976–80

Race and sex	Education								
	Less than 9 years			*9–12 years*			*13 years or more*		
	Population estimate	*Mean*[1]	*Standard error*	*Population estimate*	*Mean*[1]	*Standard error*	*Population estimate*	*Mean*[1]	*Standard error*
All races[2]	Number in thousands	Millimeters mercury		Number in thousands	Millimeters mercury		Number in thousands	Millimeters mercury	
Both sexes	18,997	81	0.64	69,901	79	0.41	48,126	78	0.55
Men	9,404	82	0.73	30,279	82	0.47	25,550	80	0.56
Women	9,593	79	0.74	39,621	77	0.43	22,576	76	0.59
White adults									
Both sexes	15,944	80	0.68	61,858	79	0.43	44,703	78	0.55
Men	7,962	82	0.78	26,862	82	0.51	23,945	80	0.56
Women	7,982	79	0.77	34,997	77	0.44	20,757	75	0.61
Black adults									
Both sexes	3,053	82	1.16	8,042	82	0.59	3,423	80	1.12
Men	1,442	82	1.31	3,418	84	0.77	1,605	82	1.26
Women	1,611	83	1.76	4,625	81	0.70	1,818	77	1.03

[1]Age standardized by the direct method to the overall U.S. population at the midpoint of the survey.
[2]Includes races other than white and black.

Table 5. Number and percent of population in selected blood pressure categories, by race, sex, and age: United States, 1976–80

Race and age	Both sexes				Men				Women			
	N[2]	n[3]	P[4]	SE[5]	N[2]	n[3]	P[4]	SE[5]	N[2]	n[3]	P[4]	SE[5]
NORMOTENSIVE[1]												
All races[6]												
18–74 years[7]	99,601	7,923	70.3	0.96	45,330	3,634	67.1	1.26	54,270	4,289	73.2	0.80
18–24 years	24,953	1,864	90.9	0.95	11,278	835	85.0	1.67	13,675	1,029	96.5	0.67
25–34 years	28,284	1,919	86.4	1.06	12,601	844	79.3	1.83	15,683	1,075	93.0	0.87
35–44 years	18,047	1,196	76.3	1.67	8,150	522	71.7	2.55	9,897	674	80.6	1.51
45–54 years	13,524	848	58.7	1.48	6,244	395	56.2	2.20	7,280	453	61.1	2.01
55–64 years	9,624	1,179	47.3	1.59	4,559	570	47.5	2.03	5,065	609	47.1	2.10
65–74 years	5,169	917	35.7	1.39	2,449	468	39.7	1.97	2,670	449	32.6	1.82
White adults												
18–74 years[7]	87,933	6,991	71.2	1.03	39,948	3,194	67.5	1.38	47,985	3,797	74.6	0.86
18–24 years	21,260	1,577	91.0	1.03	9,611	708	84.0	1.87	11,649	869	97.7	0.56
25–34 years	24,614	1,643	86.8	1.18	10,967	710	79.1	1.97	13,647	933	94.2	0.87
35–44 years	16,307	1,069	78.6	1.65	7,226	469	73.7	2.58	8,811	600	83.2	1.41
45–54 years	12,286	766	60.7	1.56	5,662	359	57.4	2.09	6,624	407	63.9	2.29
55–64 years	8,986	1,095	49.3	1.67	4,216	525	48.8	2.05	4,769	570	49.7	2.30
65–74 years	4,751	841	36.8	1.52	2,265	423	40.6	2.17	2,485	418	33.9	1.80
Black adults												
18–74 years[7]	9,111	769	61.8	1.60	4,088	361	62.0	2.12	5,022	408	61.6	1.47
18–24 years	3,064	241	90.0	1.10	1,368	106	89.2	2.37	1,696	135	90.6	2.46
25–34 years	2,837	227	81.1	2.27	1,180	108	76.3	3.00	1,657	119	84.8	3.39
35–44 years	1,526	101	60.4	4.58	631	38	56.8	8.13	895	63	63.2	4.39
45–54 years	861	62	38.1	4.06	458	29	43.8	7.29	403	33	33.2	4.60
55–64 years	513	76	29.1	2.33	266	42	33.2	4.38	246	34	25.7	3.13
65–74 years	310	62	24.1	2.94	185	38	33.3	3.31	125	24	17.1	3.98
DEFINITE HYPERTENSIVE[8]												
All races[6]												
18–74 years[7]	25,065	2,901	17.7	0.58	11,748	1,292	17.4	0.82	13,317	1,609	18.0	0.53
18–24 years	562	46	2.0	0.41	369	32	*2.8	0.77	193	14	*1.4	0.43
25–34 years	2,155	150	6.6	0.79	1,472	95	9.3	1.33	683	55	4.1	0.67
35–44 years	2,891	205	12.2	1.12	1,520	108	13.4	1.62	1,371	97	11.2	1.13
45–54 years	5,861	380	25.4	1.36	2,856	176	25.7	1.78	3,005	204	25.2	1.63
55–64 years	7,065	919	34.7	1.18	3,128	410	32.6	1.71	3,936	509	36.6	1.32
65–74 years	6,531	1,201	45.1	1.23	2,402	471	38.1	1.55	4,129	730	50.4	1.73
White adults												
18–74 years[7]	20,805	2,371	16.8	0.62	10,135	1,086	17.1	0.90	10,670	1,285	16.6	0.55
18–24 years	443	37	1.9	0.42	332	28	*2.9	0.82	111	9	*0.9	0.37
25–34 years	1,768	117	6.2	0.87	1,236	77	8.9	1.43	532	40	3.7	0.73
35–44 years	2,126	152	10.4	1.09	1,184	86	12.1	1.59	942	66	8.9	0.97
45–54 years	4,820	300	23.8	1.48	2,584	157	26.2	1.93	2,235	143	21.6	1.82
55–64 years	6,013	763	33.0	1.24	2,707	343	31.3	1.79	3,306	420	34.4	1.46
65–74 years	5,636	1,002	43.7	1.33	2,092	395	37.5	1.60	3,544	607	48.3	1.80
Black adults												
18–74 years[7]	3,790	485	25.7	1.09	1,388	183	21.1	1.46	2,403	302	29.5	1.62
18–24 years	98	8	*2.9	1.15	37	4	*2.4	1.18	61	4	*3.2	1.82
25–34 years	348	31	10.0	1.43	205	17	*13.3	2.41	143	14	*7.3	1.81
35–44 years	645	48	25.5	3.15	264	19	*23.8	5.40	381	29	*26.9	5.07
45–54 years	980	78	43.4	4.09	272	19	*26.0	5.69	709	59	58.3	4.95
55–64 years	948	143	53.8	2.72	372	61	46.4	3.93	576	82	60.1	3.89
65–74 years	772	177	59.9	2.90	239	63	42.9	4.63	533	114	72.8	4.74

See footnotes at end of table.

Table 5. Number and percent of population in selected blood pressure categories, by race, sex, and age: United States, 1976–80—Con.

Race and age	Both sexes				Men				Women			
	N[2]	n[3]	P[4]	SE[5]	N[2]	n[3]	P[4]	SE[5]	N[2]	n[3]	P[4]	SE[5]
BORDERLINE HYPERTENSIVE[9]												
All races[6]												
18–74 years[7]	17,062	1,680	12.0	0.49	10,476	990	15.5	0.67	6,586	690	8.9	0.51
18–24 years	1,933	144	7.0	0.80	1,628	121	12.3	1.54	305	23	*2.2	0.52
25–34 years	2,312	168	7.1	0.70	1,822	128	11.5	1.15	490	40	2.9	0.57
35–44 years	2,713	188	11.5	0.88	1,697	115	14.9	1.57	1,016	73	8.3	1.04
45–54 years	3,647	225	15.8	1.02	2,014	119	18.1	1.34	1,633	106	13.7	1.48
55–64 years	3,661	458	18.0	1.21	1,919	247	20.0	1.78	1,742	211	16.2	1.61
65–74 years	2,796	497	19.3	1.03	1,396	260	22.2	1.81	1,400	237	17.1	1.11
White adults												
18–74 years[7]	14,757	1,472	11.9	0.54	9,115	868	15.4	0.76	5,641	604	8.8	0.54
18–24 years	1,659	124	7.1	0.88	1,499	110	13.1	1.71	160	14	*1.3	0.32
25–34 years	1,976	141	7.0	0.78	1,661	114	12.0	1.32	315	27	*2.2	0.52
35–44 years	2,230	158	10.9	0.82	1,399	98	14.3	1.56	831	60	7.9	1.02
45–54 years	3,129	198	15.5	1.20	1,619	101	16.4	1.47	1,510	97	14.6	1.72
55–64 years	3,244	404	17.8	1.21	1,719	218	19.9	1.72	1,525	186	15.9	1.70
65–74 years	2,519	447	19.5	1.12	1,219	227	21.9	2.00	1,300	220	17.7	1.24
Black adults												
18–74 years[7]	1,839	177	12.5	1.34	1,116	105	16.9	2.25	723	72	8.9	1.27
18–24 years	244	19	*7.2	1.62	128	11	*8.4	2.45	116	8	*6.2	2.31
25–34 years	315	26	*9.0	1.70	161	14	*10.4	2.93	154	12	*7.9	2.49
35–44 years	356	24	*14.1	3.64	217	13	*19.5	6.07	139	11	*9.9	3.79
45–54 years	418	22	*18.5	3.79	315	14	*30.1	6.69	103	8	*8.5	3.56
55–64 years	300	45	17.0	2.60	163	26	*20.4	4.68	137	19	*14.2	2.46
65–74 years	206	41	16.0	2.47	132	27	*23.7	4.23	74	14	*10.1	3.20
ISOLATED SYSTOLIC HYPERTENSIVE[10,11]												
All races[6]												
18–74 years[7]	2,172	338	11.5	0.11	857	126	1.3	0.13	1,315	212	1.8	0.15
18–34 years	96	8	*0.2	0.06	89	7	*0.3	0.12	7	1	*0.0	0.02
35–54 years	181	13	*0.4	0.12	60	4	*0.3	0.14	122	9	*0.5	0.21
55–74 years	1,895	317	5.4	0.36	708	115	4.5	0.44	1,186	202	6.3	0.48
White adults												
18–74 years[7]	1,872	287	1.5	0.12	759	112	1.3	0.14	1,113	175	1.7	0.17
18–34 years	70	6	*0.1	0.06	63	5	*0.2	0.13	7	1	*0.0	0.03
35–54 years	181	13	*0.4	0.14	60	4	*0.3	0.15	122	9	*0.6	0.24
55–74 years	1,620	268	5.2	0.37	637	103	4.5	0.47	984	165	5.8	0.51
Black adults												
18–74 years[7]	273	45	1.9	0.34	82	11	1.2	0.37	191	34	2.3	0.56
18–34 years	26	2	*0.4	0.15	26	2	*0.8	0.34	0	0	-	-
35–54 years	0	0	-	-	0	0	-	-	0	0	-	-
55–74 years	248	43	8.1	1.82	56	9	*4.2	1.72	191	34	11.3	2.68

[1]Systolic blood pressure (SBP) less than 140 mmHg and diastolic blood pressure (DBP) less than 90 mmHg and not taking antihypertensive medication.
[2]Population estimate in thousands.
[3]Sample size.
[4]Weighted percent of population subgroup in blood pressure category.
[5]Standard error of percent.
[6]Includes races other than white and black.
[7]Age adjusted by the direct method to the overall U.S. population at the midpoint of the survey.
[8]SBP equal to or greater than 160 mmHg and DBP equal to or greater than 95 mmHg, and/or taking antihypertensive medication.
[9]SBP equal to or greater than 140 mmHg but less than 160 mmHg and/or DBP equal to or greater than 90 mmHg but less than 95 mmHg, and not taking antihypertensive medication.
[10]SBP equal to or greater than 160 mmHg and DBP less than 90 mmHg.
[11]Adjacent age groups merged to enhance statistical reliability.

Table 6. Number and proportion of definite hypertensives diagnosed, medicated, and controlled, by race, sex, and age: United States, 1976–80

Race, sex, and age	Sample size	Definite hypertensives[1]	Definite hypertensives who were diagnosed[2]		Definite hypertensives who were medicated[3]		Definite hypertensives who were controlled[4]	Medicated definite hypertensives who were controlled
		Number in thousands		Percent	Number in thousands	Percent	Number in thousands	Percent
ALL RACES								
Both sexes								
18–74 years[5]	2,901	25,065	18,438	73.6	13,975	74.6	8,637	61.8
18–24 years	46	562	246	*43.8	101	*40.9	92	*91.2
25–34 years	150	2,155	1,139	52.8	655	57.5	458	69.8
35–44 years	205	2,891	1,807	62.5	1,111	61.5	656	59.1
45–54 years	380	5,861	4,518	77.1	3,289	72.8	1,908	58.0
55–64 years	919	7,065	5,517	78.1	4,370	79.2	2,800	64.1
65–74 years	1,201	6,531	5,211	79.8	4,450	85.4	2,724	61.2
Men								
18–74 years[5]	1,292	11,748	7,603	66.4	5,213	68.9	2,890	55.7
18–24 years	32	369	122	*33.0	46	*37.6	37	*80.6
25–34 years	95	1,472	689	46.8	331	48.1	184	*55.4
35–44 years	108	1,520	797	52.4	474	59.5	243	*51.2
45–54 years	176	2,856	2,017	70.6	1,249	61.9	596	47.7
55–64 years	410	3,128	2,237	71.5	1,687	75.4	961	57.0
65–74 years	471	2,402	1,743	72.5	1,426	81.8	870	61.0
Women								
18–74 years[5]	1,609	13,317	10,835	80.5	8,763	79.3	5,747	65.9
18–24 years	14	193	124	*64.4	55	*44.0	55	*100.0
25–34 years	55	683	450	66.0	324	71.9	274	*84.6
35–44 years	97	1,371	1,011	73.7	637	63.0	414	65.0
45–54 years	204	3,005	2,501	83.2	2,040	81.6	1,313	64.3
55–64 years	509	3,936	3,280	83.3	2,683	81.8	1,838	68.5
65–74 years	730	4,129	3,468	84.0	3,024	87.2	1,854	61.3
WHITE ADULTS								
Both sexes								
18–74 years[5]	2,371	20,805	15,105	72.3	11,610	75.1	7,331	63.2
18–24 years	37	443	186	*41.9	62	*33.2	53	*85.6
25–34 years	117	1,768	932	52.7	527	56.6	375	*71.2
35–44 years	152	2,126	1,274	60.0	786	61.7	483	61.5
45–54 years	300	4,820	3,638	75.5	2,700	74.2	1,576	58.4
55–64 years	763	6,013	4,616	76.8	3,728	80.8	2,464	66.1
65–74 years	1,002	5,636	4,460	79.1	3,807	85.4	2,380	62.5
Men								
18–74 years[5]	1,086	10,135	6,538	65.4	4,496	68.8	2,543	56.9
18–24 years	28	332	100	*30.0	34	*33.8	25	*73.7
25–34 years	77	1,236	587	47.5	283	48.3	160	*56.4
35–44 years	86	1,184	592	50.0	331	55.8	202	*61.0
45–54 years	157	2,584	1,819	70.4	1,140	62.6	538	47.2
55–64 years	343	2,707	1,917	70.8	1,460	76.2	866	59.3
65–74 years	395	2,092	1,524	72.8	1,248	81.9	753	60.3
Women								
18–74 years[5]	1,285	10,670	8,567	79.3	7,114	81.0	4,788	67.7
18–24 years	9	111	86	*77.5	28	*32.5	28	*100.0
25–34 years	40	532	345	64.8	244	*70.7	216	*88.4
35–44 years	66	942	682	72.5	456	66.8	282	*61.8
45–54 years	143	2,235	1,819	81.4	1,560	85.8	1,038	66.5
55–64 years	420	3,306	2,699	81.6	2,268	84.0	1,598	70.5
65–74 years	607	3,544	2,937	82.9	2,559	87.1	1,626	63.6

See footnotes at end of table.

Table 6. Number and proportion of definite hypertensives diagnosed, medicated, and controlled, by race, sex, and age: United States, 1976–80—Con.

Race, sex, and age	Sample size	Definite hypertensives[1]	Definite hypertensives who were diagnosed[2]		Definite hypertensives who were medicated[3]		Definite hypertensives who were controlled[4]	Medicated definite hypertensives who were controlled
		Number in thousands		Percent	Number in thousands	Percent	Number in thousands	Percent
BLACK ADULTS								
Both sexes								
18–74 years[5]	485	3,790	3,043	80.9	2,180	72.7	1,218	55.6
18–24 years	8	98	61	*62.1	39	*64.2	39	*100.0
25–34 years	31	348	200	*57.4	128	*64.1	82	*64.2
35–44 years	48	645	508	78.8	300	59.1	149	*49.5
45–54 years	78	980	819	83.6	589	71.9	332	*56.4
55–64 years	143	948	806	85.0	563	69.9	308	54.7
65–74 years	177	772	650	84.2	560	86.2	308	55.1
Men								
18–74 years[5]	183	1,388	938	69.1	607	66.0	280	51.8
18–24 years	4	37	22	*59.5	12	*54.7	12	*100.0
25–34 years	17	205	102	*49.6	48	*47.2	24	*49.6
35–44 years	19	264	180	*68.2	119	*66.2	17	*13.9
45–54 years	19	272	198	*72.8	109	*55.2	58	*53.1
55–64 years	61	372	270	72.7	189	69.8	81	*42.7
65–74 years	63	239	166	69.6	130	78.5	89	*68.5
Women								
18–74 years[5]	302	2,403	2,105	87.6	1,572	75.9	938	58.6
18–24 years	4	61	39	*63.6	27	*69.6	27	*100.0
25–34 years	14	143	98	*68.5	80	*81.6	58	*73.0
35–44 years	29	381	328	86.2	181	*55.2	132	*72.9
45–54 years	59	709	621	87.7	480	77.3	274	*57.2
55–64 years	82	576	536	93.0	375	69.9	227	60.7
65–74 years	114	533	483	90.7	430	88.9	219	51.0

[1]Based on average of 3 blood pressures. Systolic blood pressure (SBP) ≥160 mmHg, diastolic blood pressure (DBP) ≥95 mmHg, taking antihypertensive medication.
[2]Physician diagnosed high blood pressure or hypertension.
[3]Reported taking antihypertensive medication "always," "often," or "sometimes."
[4]SBP < 160 mmHg and DBP < 95 mmHg.
[5]Age-adjusted by the direct method to the combined population of hypertensives at the midpoint of the survey.

Table 7. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for white men by age: United States, 1976–80

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 18–24 years				Number in thousands			
Population estimate	11,442	10,004	10,971	11,287	11,381	11,411	11,442
	Number in thousands			Percent			
All levels	11,442	87.4	95.9	98.6	99.5	99.7	100.0
Less than 80 mmHg	7,754	64.2	67.0	67.7	67.8	67.8	67.8
Less than 85 mmHg	9,454	76.9	81.3	82.3	82.6	82.6	82.6
Less than 90 mmHg	10,600	84.0	90.3	92.2	92.5	92.6	92.6
Less than 95 mmHg	11,218	87.0	95.0	97.3	97.8	98.0	98.0
Less than 105 mmHg	11,413	87.3	95.8	98.5	99.3	99.5	99.7
Less than 115 mmHg	11,442	87.4	95.9	98.6	99.5	99.7	100.0
Ages 25–34 years				Number in thousands			
Population estimate	13,864	12,190	13,295	13,651	13,786	13,808	13,864
	Number in thousands			Percent			
All levels	13,864	87.9	95.9	98.5	99.4	99.6	100.0
Less than 80 mmHg	7,225	51.0	52.1	52.1	52.1	52.1	52.1
Less than 85 mmHg	10,124	70.4	72.7	73.0	73.0	73.0	73.0
Less than 90 mmHg	11,600	79.4	82.9	83.6	83.7	83.7	83.7
Less than 95 mmHg	12,844	85.7	91.2	92.2	92.4	92.5	92.6
Less than 105 mmHg	13,701	87.9	95.6	98.0	98.6	98.7	98.8
Less than 115 mmHg	13,831	87.9	95.9	98.5	99.4	99.5	99.8
Ages 35–44 years				Number in thousands			
Population estimate	9,808	8,418	9,222	9,612	9,712	9,721	9,808
	Number in thousands			Percent			
All levels	9,808	85.8	94.0	98.0	99.0	99.1	100.0
Less than 80 mmHg	4,057	40.4	41.4	41.4	41.4	41.4	41.4
Less than 85 mmHg	6,426	62.2	65.2	65.5	65.5	65.5	65.5
Less than 90 mmHg	7,867	74.7	79.1	80.1	80.2	80.2	80.2
Less than 95 mmHg	8,835	82.2	87.9	90.0	90.1	90.1	90.1
Less than 105 mmHg	9,613	85.8	93.6	97.0	97.7	97.8	98.0
Less than 115 mmHg	9,783	85.8	94.0	98.0	98.9	99.0	99.7
Ages 45–54 years				Number in thousands			
Population estimate	9,865	7,131	8,490	9,087	9,533	9,730	9,865
	Number in thousands			Percent			
All levels	9,865	72.3	86.1	92.1	96.6	98.6	100.0
Less than 80 mmHg	3,266	32.0	32.8	33.1	33.1	33.1	33.1
Less than 85 mmHg	5,264	50.0	52.1	53.1	53.4	53.4	53.4
Less than 90 mmHg	6,619	60.0	65.3	66.6	66.9	67.1	67.1
Less than 95 mmHg	7,992	68.7	77.0	79.3	80.5	80.9	81.0
Less than 105 mmHg	9,359	72.1	84.7	90.5	93.5	94.4	94.9
Less than 115 mmHg	9,696	72.3	86.1	92.1	96.1	97.8	98.3

Table 7. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for white men by age: United States, 1976–80—Con.

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 55–64 years				Number in thousands			
Population estimate	8,642	5,160	6,645	7,580	8,131	8,424	8,642
	Number in thousands			Percent			
All levels	8,642	59.7	76.9	87.7	94.1	97.5	100.0
Less than 80 mmHg	2,916	29.5	32.2	33.0	33.3	33.7	33.7
Less than 85 mmHg	4,612	44.7	50.1	52.0	52.9	53.4	53.4
Less than 90 mmHg	6,014	54.0	63.4	67.0	68.7	69.3	69.6
Less than 95 mmHg	7,203	57.9	71.9	78.7	81.7	82.6	83.3
Less than 105 mmHg	8,317	59.6	76.7	86.5	91.9	94.4	96.2
Less than 115 mmHg	8,601	59.7	76.9	87.7	94.1	97.3	99.5
Ages 65–74 years				Number in thousands			
Population estimate	5,576	2,783	3,796	4,462	4,990	5,257	5,576
	Number in thousands			Percent			
All levels	5,576	49.9	68.1	80.0	89.5	94.3	100.0
Less than 80 mmHg	2,308	30.7	36.7	38.8	40.2	41.1	41.4
Less than 85 mmHg	3,550	42.6	53.7	58.5	61.7	62.8	63.7
Less than 90 mmHg	4,197	47.0	60.9	67.9	72.1	74.2	75.3
Less than 95 mmHg	4,872	49.5	66.0	76.0	83.0	85.6	87.4
Less than 105 mmHg	5,395	49.8	67.9	79.6	88.4	93.0	96.8
Less than 115 mmHg	5,530	49.9	68.1	80.0	89.5	94.3	99.2

Table 8. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for white women by age: United States, 1976–80

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 18–24 years		Number in thousands					
Population estimate	11,919	11,769	11,866	11,902	11,919	11,919	11,919
	Number in thousands	Percent					
All levels	11,919	98.7	99.6	99.9	100.0	100.0	100.0
Less than 80 mmHg	10,381	86.7	87.0	87.1	87.1	87.1	87.1
Less than 85 mmHg	11,409	95.2	95.6	95.7	95.7	95.7	95.7
Less than 90 mmHg	11,768	98.0	98.5	98.7	98.7	98.7	98.7
Less than 95 mmHg	11,844	98.5	99.1	99.3	99.4	99.4	99.4
Less than 105 mmHg	11,909	98.7	99.6	99.9	99.9	99.9	99.9
Less than 115 mmHg	11,919	98.7	99.6	99.9	100.0	100.0	100.0
Ages 25–34 years		Number in thousands					
Population estimate	14,494	14,212	14,392	14,419	14,485	14,485	14,494
	Number in thousands	Percent					
All levels	14,494	98.1	99.3	99.5	99.9	99.9	100.0
Less than 80 mmHg	11,590	79.8	80.0	80.0	80.0	80.0	80.0
Less than 85 mmHg	13,149	90.6	90.7	90.7	90.7	90.7	90.7
Less than 90 mmHg	13,909	95.6	96.0	96.0	96.0	96.0	96.0
Less than 95 mmHg	14,194	97.2	97.8	97.8	97.9	97.9	97.9
Less than 105 mmHg	14,435	98.1	99.2	99.4	99.6	99.6	99.6
Less than 115 mmHg	14,485	98.1	99.3	99.5	99.9	99.9	99.9
Ages 35–44 years		Number in thousands					
Population estimate	10,584	9,587	10,113	10,261	10,479	10,550	10,584
	Number in thousands	Percent					
All levels	10,584	90.6	95.6	97.0	99.0	99.7	100.0
Less than 80 mmHg	6,647	62.4	62.8	62.8	62.8	62.8	62.8
Less than 85 mmHg	8,379	77.5	78.6	78.8	79.1	79.2	79.2
Less than 90 mmHg	9,294	85.1	86.7	87.1	87.7	87.8	87.8
Less than 95 mmHg	10,009	89.3	93.0	93.8	94.5	94.6	94.6
Less than 105 mmHg	10,389	90.3	95.1	96.4	97.9	98.1	98.2
Less than 115 mmHg	10,537	90.6	95.6	97.0	99.0	99.5	99.6
Ages 45–54 years		Number in thousands					
Population estimate	10,369	8,030	9,173	9,870	10,155	10,227	10,369
	Number in thousands	Percent					
All levels	10,369	77.4	88.5	95.2	97.9	98.6	100.0
Less than 80 mmHg	4,943	46.5	47.5	47.5	47.5	47.5	47.7
Less than 85 mmHg	6,834	61.9	64.8	65.8	65.8	65.8	65.9
Less than 90 mmHg	8,256	70.9	77.3	79.2	79.3	79.5	79.6
Less than 95 mmHg	9,288	75.6	84.4	88.5	88.9	89.3	89.6
Less than 105 mmHg	10,177	77.2	88.2	94.9	97.3	97.7	98.1
Less than 115 mmHg	10,294	77.4	88.5	95.2	97.9	98.4	99.3

Table 8. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for white women by age: United States, 1976–80—Con.

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 55–64 years				Number in thousands			
Population estimate	9,601	5,871	7,330	8,385	8,997	9,307	9,601
	Number in thousands			Percent			
All levels	9,601	61.2	76.4	87.3	93.7	96.9	100.0
Less than 80 mmHg	4,263	39.1	41.8	43.7	44.1	44.4	44.4
Less than 85 mmHg	6,175	52.7	59.3	62.8	63.9	64.2	64.3
Less than 90 mmHg	7,564	58.7	69.4	75.4	77.5	78.4	78.8
Less than 95 mmHg	8,467	60.7	73.8	82.2	86.0	87.6	88.2
Less than 105 mmHg	9,313	61.2	76.4	86.8	92.6	95.5	97.0
Less than 115 mmHg	9,512	61.2	76.4	87.1	93.5	96.6	99.1
Ages 65–74 years				Number in thousands			
Population estimate	7,329	3,298	4,567	5,623	6,308	6,748	7,329
	Number in thousands			Percent			
All levels	7,329	45.0	62.3	76.7	86.1	92.1	100.0
Less than 80 mmHg	3,315	32.7	38.9	42.6	44.6	45.0	45.2
Less than 85 mmHg	4,733	40.4	51.3	59.1	62.0	63.8	64.6
Less than 90 mmHg	5,676	43.8	57.9	68.4	73.4	75.8	77.4
Less than 95 mmHg	6,406	44.8	60.8	73.8	80.6	84.1	87.4
Less than 105 mmHg	7,098	45.0	62.3	76.6	85.4	91.0	96.8
Less than 115 mmHg	7,278	45.0	62.3	76.7	86.1	91.9	99.3

Table 9. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for black men by age: United States, 1976–80

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 18–24 years				Number in thousands			
Population estimate	1,533	1,413	1,479	1,508	1,527	1,527	1,533
	Number in thousands			Percent			
All levels	1,533	92.2	96.5	98.4	99.6	99.6	100.0
Less than 80 mmHg	1,040	64.4	67.3	67.3	67.8	67.8	67.8
Less than 85 mmHg	1,365	83.3	87.6	88.5	89.0	89.0	89.0
Less than 90 mmHg	1,465	89.2	93.5	95.0	95.5	95.5	95.5
Less than 95 mmHg	1,517	92.2	96.5	98.4	98.9	98.9	98.9
Less than 105 mmHg	1,527	92.2	96.5	98.4	99.6	99.6	99.6
Less than 115 mmHg	1,533	92.2	96.5	98.4	99.6	99.6	100.0
Ages 25–34 years				Number in thousands			
Population estimate	1,546	1,325	1,445	1,475	1,534	1,540	1,546
	Number in thousands			Percent			
All levels	1,546	85.7	93.5	95.4	99.2	99.6	100.0
Less than 80 mmHg	788	47.4	49.5	51.0	51.0	51.0	51.0
Less than 85 mmHg	1,100	66.0	68.6	70.1	71.2	71.2	71.2
Less than 90 mmHg	1,280	76.7	80.2	81.7	82.8	82.8	82.8
Less than 95 mmHg	1,382	83.3	86.8	88.3	89.4	89.4	89.4
Less than 105 mmHg	1,488	85.7	91.7	93.6	96.3	96.3	96.3
Less than 115 mmHg	1,534	85.7	93.5	95.4	99.2	99.2	99.2
Ages 35–44 years				Number in thousands			
Population estimate	1,112	790	980	1,059	1,069	1,088	1,112
	Number in thousands			Percent			
All levels	1,112	71.0	88.1	95.2	96.2	97.8	100.0
Less than 80 mmHg	333	29.9	29.9	29.9	29.9	29.9	29.9
Less than 85 mmHg	502	45.1	45.1	45.1	45.1	45.1	45.1
Less than 90 mmHg	689	58.2	62.0	62.0	62.0	62.0	62.0
Less than 95 mmHg	865	69.4	77.7	77.7	77.7	77.7	77.7
Less than 105 mmHg	1,072	71.0	88.1	93.7	94.7	96.4	96.4
Less than 115 mmHg	1,100	71.0	88.1	95.2	96.2	97.8	98.9
Ages 45–54 years				Number in thousands			
Population estimate	1,044	684	903	942	991	1,003	1,044
	Number in thousands			Percent			
All levels	1,044	65.5	86.5	90.2	95.0	96.1	100.0
Less than 80 mmHg	272	25.3	25.3	26.1	26.1	26.1	26.1
Less than 85 mmHg	434	34.6	40.8	41.6	41.6	41.6	41.6
Less than 90 mmHg	673	48.4	63.6	64.5	64.5	64.5	64.5
Less than 95 mmHg	830	60.2	78.7	79.5	79.5	79.5	79.5
Less than 105 mmHg	970	65.5	86.5	89.1	92.9	92.9	92.9
Less than 115 mmHg	1,003	65.5	86.5	90.2	95.0	96.1	96.1

Table 9. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for black men by age: United States, 1976–80—Con.

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 55–64 years				Number in thousands			
Population estimate	801	373	566	630	678	713	801
	Number in thousands			Percent			
All levels	801	46.6	70.6	78.6	84.6	89.0	100.0
Less than 80 mmHg	205	22.6	24.3	24.8	25.6	25.6	25.6
Less than 85 mmHg	300	28.8	33.8	36.1	36.9	37.4	37.4
Less than 90 mmHg	424	37.1	46.3	48.6	52.0	52.6	53.0
Less than 95 mmHg	558	44.2	58.1	63.7	68.0	68.9	69.6
Less than 105 mmHg	683	46.6	68.7	75.3	80.1	81.3	85.2
Less than 115 mmHg	734	46.6	70.6	78.6	83.4	85.8	91.5
Ages 65–74 years				Number in thousands			
Population estimate	555	267	369	459	498	516	555
	Number in thousands			Percent			
All levels	555	48.1	66.4	82.6	89.7	92.9	100.0
Less than 80 mmHg	167	23.0	27.6	30.1	30.1	30.1	30.1
Less than 85 mmHg	294	39.5	47.5	51.1	52.8	52.8	52.8
Less than 90 mmHg	359	41.5	52.5	60.9	63.4	63.4	64.7
Less than 95 mmHg	433	45.9	62.1	73.1	75.6	76.6	77.9
Less than 105 mmHg	521	48.1	66.4	81.4	87.1	89.5	93.8
Less than 115 mmHg	548	48.1	66.4	82.0	89.1	92.2	98.7

Table 10. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for black women by age: United States, 1976–80

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 18–24 years				Number in thousands			
Population estimate	1,873	1,782	1,861	1,873	1,873	1,873	1,873
	Number in thousands			Percent			
All levels	1,873	95.2	99.4	100.0	100.0	100.0	100.0
Less than 80 mmHg	1,556	81.7	83.1	83.1	83.1	83.1	83.1
Less than 85 mmHg	1,745	90.1	93.2	93.2	93.2	93.2	93.2
Less than 90 mmHg	1,793	92.0	95.8	95.8	95.8	95.8	95.8
Less than 95 mmHg	1,839	94.0	98.2	98.2	98.2	98.2	98.2
Less than 105 mmHg	1,873	95.2	99.4	100.0	100.0	100.0	100.0
Less than 115 mmHg	1,873	95.2	99.4	100.0	100.0	100.0	100.0
Ages 25–34 years				Number in thousands			
Population estimate	1,953	1,886	1,926	1,926	1,937	1,953	1,953
	Number in thousands			Percent			
All levels	1,953	96.5	98.6	98.6	99.2	100.0	100.0
Less than 80 mmHg	1,452	74.3	74.3	74.3	74.3	74.3	74.3
Less than 85 mmHg	1,677	85.8	85.8	85.8	85.8	85.8	85.8
Less than 90 mmHg	1,737	87.8	88.9	88.9	88.9	88.9	88.9
Less than 95 mmHg	1,869	94.1	95.7	95.7	95.7	95.7	95.7
Less than 105 mmHg	1,905	96.0	97.5	97.5	97.5	97.5	97.5
Less than 115 mmHg	1,953	96.5	98.6	98.6	99.2	100.0	100.0
Ages 35–44 years				Number in thousands			
Population estimate	1,415	1,103	1,231	1,324	1,374	1,382	1,415
	Number in thousands			Percent			
All levels	1,415	78.0	87.0	93.6	97.1	97.7	100.0
Less than 80 mmHg	630	43.0	43.0	44.6	44.6	44.6	44.6
Less than 85 mmHg	822	55.8	56.5	58.1	58.1	58.1	58.1
Less than 90 mmHg	1,053	68.9	72.0	74.4	74.4	74.4	74.4
Less than 95 mmHg	1,208	72.9	79.3	82.4	85.4	85.4	85.4
Less than 105 mmHg	1,374	77.3	85.6	92.3	95.8	96.3	97.1
Less than 115 mmHg	1,404	78.0	87.0	93.6	97.1	97.7	99.3
Ages 45–54 years				Number in thousands			
Population estimate	1,215	669	864	1,025	1,119	1,130	1,215
	Number in thousands			Percent			
All levels	1,215	55.0	71.1	84.3	92.1	93.0	100.0
Less than 80 mmHg	310	25.5	25.5	25.5	25.5	25.5	25.5
Less than 85 mmHg	507	40.2	41.7	41.7	41.7	41.7	41.7
Less than 90 mmHg	693	46.3	53.0	57.0	57.0	57.0	57.0
Less than 95 mmHg	817	49.9	59.2	64.3	64.8	64.8	67.3
Less than 105 mmHg	1,081	55.0	69.7	80.3	84.9	84.9	88.9
Less than 115 mmHg	1,177	55.0	71.1	83.5	90.5	90.5	96.8

Table 10. Joint cumulative frequency distributions of systolic blood pressure categories by diastolic blood pressure categories for black women by age: United States, 1976–80—Con.

Cumulative diastolic blood pressures	Population estimate	Cumulative systolic blood pressures: Less than 140 mmHg	Less than 150 mmHg	Less than 160 mmHg	Less than 170 mmHg	Less than 180 mmHg	All levels
Ages 55–64 years				Number in thousands			
Population estimate	959	485	635	698	814	863	959
	Number in thousands			Percent			
All levels	959	50.5	66.2	72.8	84.9	90.0	100.0
Less than 80 mmHg	248	22.0	25.1	25.5	25.9	25.9	25.9
Less than 85 mmHg	426	31.1	41.4	42.6	43.0	43.4	44.4
Less than 90 mmHg	627	41.0	53.4	55.0	61.8	63.2	65.4
Less than 95 mmHg	759	45.9	60.3	63.6	72.3	76.2	79.1
Less than 105 mmHg	880	50.5	66.2	71.5	83.2	87.5	91.7
Less than 115 mmHg	948	50.5	66.2	72.8	84.9	90.0	98.8
Ages 65–74 years				Number in thousands			
Population estimate	733	311	394	495	585	626	733
	Number in thousands			Percent			
All levels	733	42.5	53.7	67.6	79.8	85.4	100.0
Less than 80 mmHg	252	20.1	24.3	29.3	30.4	32.0	34.3
Less than 85 mmHg	377	30.5	37.2	43.8	45.3	47.8	51.4
Less than 90 mmHg	463	33.5	41.8	50.8	54.7	57.1	63.2
Less than 95 mmHg	551	35.6	45.9	57.1	64.3	66.8	75.2
Less than 105 mmHg	706	42.5	53.7	67.6	78.6	84.3	96.4
Less than 115 mmHg	725	42.5	53.7	67.6	79.8	85.4	98.9

Table 11. Systolic blood pressure by survey, race, sex, and age with weighted population estimates, means, standard errors, selected percentiles, and proportions at or above 140 mmHg: United States, 1960–62, 1971–74, and 1976–80

Survey, race, sex, and age	Population estimate	Mean systolic blood pressure	Standard error	Percentiles		Proportion ≥ 140 mmHg	Standard error
				50th	95th		
1960–62 (NHES I)							
White adults	Number in thousands	Millimeters mercury					
Both sexes:							
18–74 years[1]	93,856	131	0.53	128	180	29.2	0.81
18–24 years	13,311	118	0.85	118	144	7.7	1.34
25–34 years	18,530	121	0.43	120	146	11.1	1.03
35–44 years	20,446	127	0.54	124	160	22.2	0.98
45–54 years	17,682	135	0.75	132	176	36.2	1.83
55–64 years	13,865	146	1.22	142	194	57.2	1.74
65–74 years	10,022	157	1.64	156	210	71.7	1.95
Men:							
18–74 years[1]	44,808	133	0.65	130	170	32.4	1.44
18–24 years	6,199	124	1.28	122	152	14.3	2.68
25–34 years	8,960	126	0.58	126	150	18.0	1.82
35–44 years	9,858	130	0.37	128	162	29.6	1.51
45–54 years	8,621	135	0.71	134	170	38.1	2.60
55–64 years	6,629	143	1.60	140	182	54.9	2.93
65–74 years	4,541	151	1.80	150	204	63.5	3.37
Women:							
18–74 years[1]	49,048	129	0.59	124	184	26.1	0.63
18–24 years	7,112	113	0.81	112	132	1.9	0.71
25–34 years	9,570	116	0.70	116	138	4.7	1.04
35–44 years	10,587	123	0.91	120	156	15.3	1.39
45–54 years	9,061	134	1.26	130	180	34.4	2.49
55–64 years	7,236	148	1.89	142	204	59.4	2.27
65–74 years	5,481	162	2.02	160	212	78.6	2.95
Black adults							
Both sexes:							
18–74 years[1]	11,109	138	1.29	130	194	40.1	1.98
18–24 years	1,680	118	1.21	114	144	8.7	2.74
25–34 years	2,273	124	1.20	120	162	17.1	2.16
35–44 years	2,562	136	2.18	130	180	37.0	3.51
45–54 years	2,277	147	3.16	142	208	56.3	3.42
55–64 years	1,469	155	2.30	150	202	72.6	4.89
65–74 years	849	170	4.21	172	226	85.2	5.97
Men:							
18–74 years[1]	5,065	138	1.38	132	184	41.2	2.81
18–24 years	730	121	2.10	120	148	15.8	5.43
25–34 years	902	129	2.18	128	164	21.8	5.20
35–44 years	1,184	137	2.50	130	178	40.1	4.88
45–54 years	1,129	143	4.00	140	182	54.1	6.99
55–64 years	737	152	3.15	152	186	68.3	5.07
65–74 years	382	164	6.93	174	208	76.8	8.80
Women:							
18–74 years[1]	6,044	138	1.99	130	206	39.6	1.95
18–24 years	950	115	1.45	114	138	3.4	2.05
25–34 years	1,370	121	1.69	118	162	14.0	2.60
35–44 years	1,377	134	3.25	128	184	34.4	4.73
45–54 years	1,148	151	4.86	144	210	58.4	5.95
55–64 years	732	158	4.53	150	206	76.9	6.64
65–74 years	467	174	6.48	172	230	92.1	6.31
1971–74 (NHANES I)							
White adults							
Both sexes:							
18–74 years[1]	113,952	129	0.40	126	170	27.4	0.85
18–24 years	21,287	119	0.51	120	140	9.2	1.20
25–34 years	23,663	121	0.49	120	146	11.1	0.95
35–44 years	19,515	125	0.62	122	156	19.0	1.57
45–54 years	20,891	133	1.01	130	170	35.4	1.99
55–64 years	17,211	142	0.86	140	188	51.6	1.75
65–74 years	11,384	149	0.80	148	190	65.7	1.54

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 11. Systolic blood pressure by survey, race, sex, and age with weighted population estimates, means, standard errors, selected percentiles, and proportions at or above 140 mmHg: United States, 1960–62, 1971–74, and 1976–80—Con.

Survey, race, sex, and age	Population estimate	Mean systolic blood pressure	Standard error	Percentiles		Proportion ≥ 140 mmHg	Standard error
				50th	95th		
1971–74 (NHANES I)—Con.							
White adults—Con.	Number in thousands	Millimeters mercury					
Men:							
18–74 years[1]	54,377	131	0.47	130	166	29.7	1.12
18–24 years	10,207	124	0.71	122	144	14.7	2.09
25–34 years	11,559	125	0.69	124	150	16.3	1.58
35–44 years	9,441	127	0.81	126	154	21.2	2.34
45–54 years	10,073	135	1.10	132	172	38.6	2.54
55–64 years	8,166	140	1.10	138	180	49.7	2.67
65–74 years	4,931	146	0.94	142	190	59.6	1.81
Women:							
18–74 years[1]	59,575	128	0.49	122	170	25.2	0.89
18–24 years	11,080	115	0.60	114	136	4.2	0.78
25–34 years	12,104	116	0.48	115	140	6.1	0.74
35–44 years	10,074	123	0.71	120	160	16.9	1.35
45–54 years	10,818	131	1.29	130	170	32.4	2.58
55–64 years	9,045	143	1.24	140	190	53.3	2.10
65–74 years	6,454	152	1.04	150	195	70.3	1.95
Black adults							
Both sexes:							
18–74 years[1]	12,850	135	0.94	130	186	36.6	1.97
18–24 years	2,841	117	1.18	118	142	7.9	1.47
25–34 years	2,770	125	0.92	124	150	18.4	3.27
35–44 years	2,308	133	1.30	130	170	32.0	3.69
45–54 years	2,265	146	4.22	138	200	49.3	6.23
55–64 years	1,569	149	2.67	145	186	65.6	5.15
65–74 years	1,097	159	2.63	156	210	78.9	2.48
Men:							
18–74 years[1]	5,689	136	1.21	130	180	36.3	2.44
18–24 years	1,293	123	1.95	122	146	11.5	2.90
25–34 years	1,160	129	1.59	130	150	21.4	6.15
35–44 years	1,007	136	2.13	132	180	31.3	5.93
45–54 years	1,042	142	4.32	130	190	44.0	7.56
55–64 years	707	144	3.27	140	180	60.9	6.93
65–74 years	480	157	3.46	150	210	77.8	3.03
Women:							
18–74 years[1]	7,161	135	1.20	126	190	37.0	1.83
18–24 years	1,548	113	1.08	110	138	4.9	1.51
25–34 years	1,610	122	1.08	120	155	16.2	3.37
35–44 years	1,301	130	1.66	125	170	32.6	3.86
45–54 years	1,224	150	5.26	146	200	53.9	6.94
55–64 years	861	153	4.17	152	190	69.4	8.08
65–74 years	617	162	3.00	160	210	79.8	3.29
1976–80 (NHANES II)							
White adults							
Both sexes:							
18–74 years[1]	123,494	126	0.62	122	166	23.9	1.01
18–24 years	23,362	117	0.65	116	140	8.3	1.02
25–34 years	28,357	118	0.58	118	142	9.3	0.80
35–44 years	20,392	122	0.77	120	150	15.6	1.40
45–54 years	20,235	130	0.71	128	168	30.1	1.59
55–64 years	18,243	138	0.82	136	180	45.2	1.83
65–74 years	12,906	145	0.97	140	190	57.5	1.89
Men:							
18–74 years[1]	59,198	129	0.62	128	166	27.0	1.23
18–24 years	11,442	123	0.90	120	150	14.3	1.83
25–34 years	13,864	124	0.78	124	150	15.5	1.41
35–44 years	9,808	125	0.99	124	150	17.1	2.27
45–54 years	9,865	132	0.77	130	170	34.1	2.01
55–64 years	8,642	139	0.92	138	180	47.0	2.10
65–74 years	5,576	144	0.98	140	190	55.2	1.95

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 11. Systolic blood pressure by survey, race, sex, and age with weighted population estimates, means, standard errors, selected percentiles, and proportions at or above 140 mmHg: United States, 1960–62, 1971–74, and 1976–80—Con.

Survey, race, sex, and age	Population estimate	Mean systolic blood pressure	Standard error	Percentiles		Proportion ≥ 140 mmHg	Standard error
				50th	95th		
1976–80 (NHANES II)—Con.							
White adults—Con.	Number in thousands	Millimeters mercury					
Women:							
18–74 years[1]	64,296	123	0.73	120	168	21.1	1.05
18–24 years	11,919	110	0.57	110	130	2.6	0.60
25–34 years	14,494	112	0.65	110	136	3.3	0.74
35–44 years	10,584	120	0.85	118	150	14.2	1.16
45–54 years	10,369	128	1.10	126	166	26.3	2.00
55–64 years	9,601	138	1.02	135	180	43.6	2.40
65–74 years	7,329	146	1.20	142	190	59.2	2.61
Black adults							
Both sexes:							
18–74 years[1]	14,740	128	0.75	124	172	27.5	1.41
18–24 years	3,406	115	0.96	114	142	7.4	1.70
25–34 years	3,499	118	0.88	116	150	10.2	1.06
35–44 years	2,527	128	1.33	126	160	29.2	4.09
45–54 years	2,259	137	2.09	130	180	40.0	4.45
55–64 years	1,760	146	2.19	140	196	57.6	3.05
65–74 years	1,288	147	1.63	142	198	60.5	3.96
Men:							
18–74 years[1]	6,592	130	1.07	126	170	28.3	2.16
18–24 years	1,533	119	1.45	118	142	11.3	2.91
25–34 years	1,546	123	1.52	120	150	14.8	2.42
35–44 years	1,112	131	2.01	130	158	34.6	6.96
45–54 years	1,044	134	2.86	130	170	29.1	7.31
55–64 years	801	145	3.23	140	194	57.8	6.08
65–74 years	555	144	1.60	140	190	56.5	3.73
Women:							
18–74 years[1]	8,148	126	1.23	120	176	26.7	1.78
18–24 years	1,873	111	1.25	110	134	4.3	1.28
25–34 years	1,953	114	1.35	110	140	6.5	1.83
35–44 years	1,415	126	1.80	124	160	25.0	4.51
45–54 years	1,215	140	2.62	138	182	49.5	3.54
55–64 years	959	146	2.46	140	200	57.5	4.29
65–74 years	733	150	2.85	148	200	63.5	6.54

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 12. Diastolic blood pressure by survey, race, sex, and age with weighted population estimates, means, standard errors, selected percentiles, and proportions at or above 90 and 95 mmHg: United States, 1960–62, 1971–74, and 1976–80

Survey, race, sex, and age	Population estimate	Mean diastolic blood pressure	Standard error	Percentiles			Proportion ≥ 90 mmHg	Proportion ≥ 95 mmHg
				5th	50th	95th		
1960–62 (NHES I)	Number in thousands	Millimeters mercury						
White adults								
Both sexes:								
18–74 years[1]	93,856	78	0.42	60	78	100	17.6	8.9
18–24 years	13,311	71	0.67	50	70	90	5.5	2.8
25–34 years	18,530	74	0.39	58	74	92	8.0	3.5
35–44 years	20,446	79	0.67	60	78	100	18.0	9.1
45–54 years	17,682	82	0.89	64	80	102	24.5	13.7
55–64 years	13,865	84	0.64	66	82	106	32.9	14.8
65–74 years	10,022	82	0.76	62	80	108	27.9	15.8
Men:								
18–74 years[1]	44,808	79	0.53	60	80	100	19.4	9.5
18–24 years	6,199	72	1.23	48	72	92	9.1	4.4
25–34 years	8,960	76	0.57	60	76	94	10.8	4.9
35–44 years	9,858	80	0.89	60	80	100	23.5	11.8
45–54 years	8,621	83	0.74	64	82	102	26.3	14.8
55–64 years	6,629	83	0.74	64	82	102	30.2	12.3
65–74 years	4,541	81	0.97	64	80	106	25.7	13.7
Women:								
18–74 years[1]	49,048	78	0.43	60	78	100	16.1	8.4
18–24 years	7,112	69	0.68	50	70	86	2.3	1.4
25–34 years	9,570	73	0.43	58	72	90	5.5	2.1
35–44 years	10,587	77	0.65	60	76	96	12.9	6.5
45–54 years	9,061	81	0.76	62	80	102	22.8	12.6
55–64 years	7,236	84	0.77	66	82	110	35.4	17.2
65–74 years	5,481	84	1.01	62	80	110	29.7	17.5
Black adults								
Both sexes:								
18–74 years[1]	11,109	83	0.68	60	82	112	30.6	21.5
18–24 years	1,680	72	0.87	52	72	90	7.4	2.9
25–34 years	2,273	78	1.13	58	78	100	18.9	12.5
35–44 years	2,562	85	1.18	66	82	110	34.9	26.9
45–54 years	2,277	90	1.58	66	88	124	45.9	32.7
55–64 years	1,469	92	1.42	68	90	120	55.5	38.3
65–74 years	849	90	2.82	64	90	120	54.8	42.4
Men:								
18–74 years[1]	5,065	83	1.01	60	83	110	31.7	22.9
18–24 years	730	73	1.92	52	75	90	8.7	3.5
25–34 years	902	80	1.79	60	80	100	28.2	19.6
35–44 years	1,184	84	1.38	66	82	110	34.1	26.7
45–54 years	1,129	88	2.28	66	88	120	44.8	31.4
55–64 years	737	91	1.84	70	90	112	56.3	39.6
65–74 years	382	88	4.24	68	88	114	40.5	37.8
Women:								
18–74 years[1]	6,044	83	0.77	60	80	116	30.2	20.8
18–24 years	950	72	0.96	58	72	90	6.4	2.4
25–34 years	1,370	76	1.19	58	76	100	12.9	7.9
35–44 years	1,377	86	1.47	66	82	110	35.7	27.1
45–54 years	1,148	91	2.04	68	88	124	46.9	34.1
55–64 years	732	93	2.49	68	90	126	54.7	37.1
65–74 years	467	92	3.40	64	90	124	66.5	46.2
1971–74 (NHANES I)								
White adults								
Both sexes:								
18–74 years[1]	113,952	81	0.28	60	80	102	24.1	12.8
18–24 years	21,287	74	0.36	58	74	90	6.3	2.5
25–34 years	23,663	78	0.34	60	78	95	14.1	5.5
35–44 years	19,515	82	0.42	62	80	102	24.7	12.6
45–54 years	20,891	85	0.61	66	84	108	34.6	19.3
55–64 years	17,211	86	0.47	70	86	108	40.5	23.7
65–74 years	11,384	85	0.53	68	84	108	37.6	21.9

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 12. Diastolic blood pressure by survey, race, sex, and age with weighted population estimates, means, standard errors, selected percentiles, and proportions at or above 90 and 95 mmHg: United States, 1960–62, 1971–74, and 1976–80—Con.

Survey, race, sex, and age	Population estimate	Mean diastolic blood pressure	Standard error	Percentiles			Proportion ≥ 90 mmHg	Proportion ≥ 95 mmHg
				5th	50th	95th		
1971–74 (NHANES I)—Con.								
White adults—Con.	Number in thousands	Millimeters mercury						
Men:								
18–74 years[1]	54,377	83	0.31	64	82	104	28.6	14.7
18–24 years	10,207	76	0.49	60	78	90	9.2	4.0
25–34 years	11,559	81	0.51	66	80	96	19.9	7.7
35–44 years	9,441	84	0.62	68	84	105	30.9	16.4
45–54 years	10,073	87	0.67	70	86	110	43.1	23.2
55–64 years	8,166	86	0.66	68	86	108	42.8	24.4
65–74 years	4,931	85	0.55	66	84	108	37.9	20.7
Women:								
18–74 years[1]	59,575	79	0.33	60	80	100	20.0	11.0
18–24 years	11,080	71	0.46	56	70	88	3.6	1.2
25–34 years	12,104	75	0.32	60	74	90	8.5	3.3
35–44 years	10,074	79	0.51	60	80	100	18.9	9.0
45–54 years	10,818	83	0.70	64	80	105	26.7	15.7
55–64 years	9,045	86	0.57	70	84	108	38.5	23.1
65–74 years	6,454	86	0.63	68	84	108	37.3	22.8
Black adults								
Both sexes:								
18–74 years[1]	12,850	85	0.48	62	82	110	35.2	23.3
18–24 years	2,841	74	0.78	58	74	90	8.1	3.4
25–34 years	2,770	81	0.81	60	80	104	23.9	12.3
35–44 years	2,308	89	0.88	70	88	110	47.6	31.2
45–54 years	2,265	92	1.75	70	90	120	52.7	38.6
55–64 years	1,569	92	1.51	72	90	115	57.2	43.7
65–74 years	1,097	91	0.91	70	90	120	52.4	35.9
Men:								
18–74 years[1]	5,689	87	0.74	68	85	110	58.4	25.0
18–24 years	1,293	76	0.98	60	76	94	11.2	4.1
25–34 years	1,160	84	1.58	68	80	106	32.5	15.4
35–44 years	1,007	91	1.33	70	90	110	54.7	36.3
45–54 years	1,042	92	2.47	75	88	120	45.6	35.0
55–64 years	707	93	2.02	70	90	118	57.4	47.4
65–74 years	480	91	1.17	70	90	116	56.6	36.3
Women:								
18–74 years[1]	7,161	84	0.60	60	80	110	32.7	22.0
18–24 years	1,548	72	1.04	52	72	90	5.6	2.9
25–34 years	1,610	78	0.97	60	80	102	17.6	10.2
35–44 years	1,301	87	1.15	70	85	110	42.1	27.2
45–54 years	1,224	93	1.87	70	92	116	58.8	41.6
55–64 years	861	91	2.01	74	90	110	57.1	40.7
65–74 years	617	90	1.25	66	88	120	49.1	35.5
1976–80 (NHANES II)								
White adults								
Both sexes:								
18–74 years[1]	123,494	80	0.50	60	80	100	26.5	12.8
18–24 years	23,362	74	0.43	58	72	90	10.3	3.6
25–34 years	28,357	77	0.54	60	78	98	18.1	7.2
35–44 years	20,392	81	0.61	64	80	100	26.7	11.8
45–54 years	20,235	85	0.61	68	84	106	39.7	22.4
55–64 years	18,243	85	0.57	68	84	104	39.0	19.5
65–74 years	12,906	84	0.55	64	82	106	35.7	19.1
Men:								
18–74 years[1]	59,198	83	0.52	64	80	102	32.2	15.7
18–24 years	11,442	77	0.53	60	78	96	16.5	5.6
25–34 years	13,864	81	0.69	62	80	100	27.0	11.6
35–44 years	9,808	83	0.74	68	84	100	33.4	14.6
45–54 years	9,865	87	0.67	70	86	110	45.7	26.7
55–64 years	8,642	86	0.62	68	86	108	43.1	22.6
65–74 years	5,576	84	0.56	65	84	105	34.9	18.3

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 12. Diastolic blood pressure by survey, race, sex, and age with weighted population estimates, means, standard errors, selected percentiles, and proportions at or above 90 and 95 mmHg: United States, 1960–62, 1971–74, and 1976–80—Con.

Survey, race, sex, and age	Population estimate	Mean diastolic blood pressure	Standard error	Percentiles			Proportion ≥ 90 mmHg	Proportion ≥ 95 mmHg
				5th	50th	95th		
1976–80 (NHANES II)—Con.								
White adults—Con.	Number in thousands	Millimeters mercury						
Women:								
18–74 years[1]	64,296	78	0.51	60	78	100	21.2	10.2
18–24 years	11,919	71	0.46	58	70	88	4.4	1.7
25–34 years	14,494	74	0.57	60	72	90	9.5	3.0
35–44 years	10,584	79	0.61	60	78	100	20.5	9.1
45–54 years	10,369	83	0.79	65	80	102	34.1	18.4
55–64 years	9,601	84	0.63	65	82	104	35.2	16.8
65–74 years	7,329	84	0.69	62	82	108	36.2	19.6
Black adults								
Both sexes:								
18–74 years[1]	14,740	82	0.55	60	80	110	33.9	17.5
18–24 years	3,406	74	0.74	58	74	92	11.8	3.7
25–34 years	3,499	79	0.66	60	78	100	20.1	9.2
35–44 years	2,527	85	1.33	64	88	106	45.8	23.5
45–54 years	2,259	90	1.39	70	90	116	52.2	32.0
55–64 years	1,760	90	0.96	70	90	116	54.2	28.9
65–74 years	1,288	87	0.77	66	88	110	46.7	24.4
Men:								
18–74 years[1]	6,592	84	0.77	64	82	110	36.0	20.4
18–24 years	1,533	76	1.38	60	74	94	13.9	4.7
25–34 years	1,546	82	1.41	62	80	106	26.8	13.4
35–44 years	1,112	88	1.91	65	90	110	52.8	33.2
45–54 years	1,044	88	2.22	70	86	112	42.9	25.6
55–64 years	801	91	1.27	70	90	124	56.4	35.4
65–74 years	555	86	0.80	66	88	110	46.2	25.7
Women:								
18–74 years[1]	8,148	81	0.60	60	80	108	32.2	15.3
18–24 years	1,873	73	1.18	56	70	90	10.1	2.8
25–34 years	1,953	76	0.91	58	76	95	14.8	5.8
35–44 years	1,415	83	1.58	60	84	105	40.3	15.9
45–54 years	1,215	91	1.70	70	90	118	60.2	37.6
55–64 years	959	88	1.35	70	90	110	52.3	23.4
65–74 years	733	87	1.17	68	86	110	47.2	23.4

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 13. Proportion of adult population with definite hypertension by race, sex, age, and survey: United States, 1960–62, 1971–74, and 1976–80

Race, sex, and age	1960–62 (NHES I)		1971–74 (NHANES I)		1976–80 (NHANES II)	
	Definite hypertension	Standard error	Definite hypertension	Standard error	Definite hypertension	Standard error
WHITE ADULTS						
Both sexes			Percent of population			
18–74 years[1]	18.0	0.74	19.1	0.53	21.0	0.82
18–24 years	4.2	1.03	3.1	0.58	4.5	0.66
25–34 years	5.3	0.71	6.1	0.72	8.7	0.82
35–44 years	12.4	0.79	14.7	1.08	14.7	1.28
45–54 years	21.6	1.66	25.6	1.52	30.0	1.47
55–64 years	34.3	2.53	38.6	1.71	38.4	1.30
65–74 years	53.6	2.85	48.0	1.40	49.2	1.42
Men						
18–74 years[1]	17.6	0.99	20.2	0.84	22.3	0.97
18–24 years	6.2	1.94	4.9	1.16	6.9	1.08
25–34 years	6.8	0.90	8.4	1.37	12.9	1.47
35–44 years	15.3	1.59	18.1	1.93	17.2	2.08
45–54 years	20.9	2.12	28.2	2.02	32.4	1.85
55–64 years	30.5	3.33	38.1	2.54	38.0	1.82
65–74 years	44.0	3.77	41.3	1.62	43.6	1.91
Women						
18–74 years[1]	18.3	0.89	17.9	0.61	19.8	0.82
18–24 years	2.5	0.74	1.4	0.31	2.1	0.57
25–34 years	3.9	0.86	4.0	0.54	4.6	0.77
35–44 years	9.6	1.29	11.5	1.06	12.3	1.21
45–54 years	22.2	2.45	23.2	1.89	27.8	2.01
55–64 years	37.8	3.05	39.2	2.25	38.8	1.76
65–74 years	61.5	4.02	53.1	1.85	53.4	1.86
BLACK ADULTS						
Both sexes						
18–74 years[1]	33.6	2.21	33.9	1.48	28.6	1.53
18–24 years	6.1	1.97	3.8	0.99	4.5	1.38
25–34 years	17.8	3.75	16.0	2.72	11.3	2.21
35–44 years	32.1	3.58	36.6	4.43	29.0	3.44
45–54 years	43.5	4.18	50.8	5.69	48.7	5.00
55–64 years	53.8	5.35	59.3	4.63	58.1	3.33
65–74 years	77.2	7.64	64.2	3.44	63.0	3.87
Men						
18–74 years[1]	30.8	3.17	32.8	2.46	26.0	1.84
18–24 years	*6.3	3.66	*4.8	1.54	*4.7	2.32
25–34 years	21.8	6.99	16.1	5.52	14.4	3.76
35–44 years	30.9	5.86	42.3	6.66	34.7	6.82
45–54 years	34.6	5.86	45.3	7.88	33.6	8.80
55–64 years	50.8	7.97	54.0	6.42	53.9	5.33
65–74 years	63.3	14.32	58.6	3.97	45.2	4.45
Women						
18–74 years[1]	35.9	2.57	34.8	1.76	30.7	2.04
18–24 years	*5.9	2.57	*3.0	1.07	*4.2	2.05
25–34 years	15.2	4.12	16.0	2.39	8.8	2.64
35–44 years	33.2	3.84	32.3	4.72	24.6	4.53
45–54 years	52.3	6.34	55.4	6.04	61.7	4.38
55–64 years	56.9	9.06	63.6	6.67	61.7	4.49
65–74 years	88.5	5.09	68.5	4.60	76.5	4.93

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 14. Proportion of adult population with elevated blood pressure by sex, age, and race: United States, 1960–62, 1971–74, and 1976–80

Sex and age	Total[1]			White			Black		
	1960–62	1971–74	1976–80	1960–62	1971–74	1976–80	1960–62	1971–74	1976–80
	Percent of population								
Both sexes									
18–74 years[2]	34.3	35.6	35.4	33.2	34.6	34.7	44.9	45.6	40.8
18–24 years	10.6	12.3	14.7	10.4	12.6	14.6	13.5	11.3	15.5
25–34 years	15.6	19.6	20.8	14.7	18.8	20.7	22.4	28.2	22.4
35–44 years	29.8	32.2	33.0	28.1	29.6	30.8	43.5	54.5	47.9
45–54 years	44.4	46.9	47.1	42.4	45.8	45.9	60.6	57.4	58.9
55–64 years	62.3	59.4	56.7	60.9	58.4	55.2	78.8	71.8	70.5
65–74 years	73.8	70.3	63.1	73.1	69.3	61.9	85.2	80.0	71.7
Men									
18–74 years[2]	38.2	40.2	41.1	37.4	39.7	40.9	46.5	47.4	43.7
18–24 years	18.8	18.9	22.8	18.7	19.7	23.6	20.9	15.9	20.2
25–34 years	23.3	27.5	31.2	22.3	27.2	31.5	31.9	33.6	31.5
35–44 years	37.4	38.1	39.5	37.0	36.0	37.6	44.2	60.5	53.8
45–54 years	47.2	52.8	52.1	46.0	53.0	52.0	56.3	53.3	50.9
55–64 years	59.3	59.3	58.6	58.3	58.9	57.6	74.8	67.5	71.7
65–74 years	65.9	65.4	62.0	65.0	64.0	60.6	76.8	79.3	68.7
Women									
18–74 years[2]	30.8	31.4	30.2	29.3	29.8	29.1	44.3	44.3	38.4
18–24 years	3.5	6.3	7.1	3.1	6.1	6.0	7.9	7.5	11.5
25–34 years	8.6	12.3	11.0	7.6	10.8	10.4	16.1	24.2	15.1
35–44 years	22.7	26.7	27.0	19.8	23.6	24.6	43.0	49.9	43.4
45–54 years	41.8	41.5	42.3	39.1	39.1	40.1	64.8	61.0	65.8
55–64 years	65.0	59.5	55.0	63.3	57.9	53.1	82.8	75.3	69.4
65–74 years	80.3	74.1	63.9	79.8	73.4	63.0	92.1	80.6	74.0

[1] Includes all other races not shown separately.
[2] Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

NOTE: Elevated blood pressure includes readings of either systolic blood pressure of at least 140 mmHg or diastolic blood pressure of at least 90 mmHg or both.

Table 15. Proportion of adult population with undiagnosed hypertension by race, sex, age, and survey: United States, 1960–62, 1971–74, and 1976–80

Race, sex, and age	1960–62 (NHES I)		1971–74 (NHANES I)		1976–80 (NHANES II)	
	Undiagnosed hypertension	Standard error	Undiagnosed hypertension	Standard error	Undiagnosed hypertension	Standard error
			Percent of population			
WHITE ADULTS						
Both sexes						
18–74 years[1]	9.2	0.53	11.2	0.47	7.6	0.56
18–24 years	3.2	0.97	2.7	0.52	3.2	0.51
25–34 years	2.7	0.55	4.9	0.60	4.5	0.51
35–44 years	7.5	0.70	10.4	0.92	7.7	0.96
45–54 years	12.8	1.32	15.8	1.27	10.1	1.25
55–64 years	14.9	1.69	20.3	1.49	11.4	1.20
65–74 years	24.1	2.16	23.0	1.09	13.0	0.79
Men						
18–74 years[1]	10.7	0.73	13.4	0.70	9.8	0.68
18–24 years	5.5	1.92	4.4	1.08	5.2	0.86
25–34 years	4.6	1.04	6.5	1.12	7.2	0.92
35–44 years	9.6	1.32	14.1	1.50	10.5	1.50
45–54 years	13.6	1.71	18.6	1.69	12.2	1.57
55–64 years	16.0	2.09	22.2	2.22	13.4	1.38
65–74 years	24.6	3.48	24.1	1.32	15.0	1.58
Women						
18–74 years[1]	7.7	0.65	9.3	0.60	5.6	0.54
18–24 years	1.1	0.62	1.1	0.27	*1.3	0.44
25–34 years	0.9	0.40	3.4	0.51	1.9	0.53
35–44 years	5.6	0.84	7.0	0.96	5.1	0.75
45–54 years	12.0	1.48	13.1	1.63	8.0	1.60
55–64 years	13.8	2.19	18.6	2.19	9.5	1.43
65–74 years	23.6	2.41	22.2	1.58	11.6	0.83
BLACK ADULTS						
Both sexes						
18–74 years[1]	16.7	1.72	17.1	1.35	6.9	0.65
18–24 years	*3.2	1.58	3.5	0.98	2.4	0.83
25–34 years	11.6	3.32	10.5	2.23	4.3	1.30
35–44 years	20.0	3.62	18.4	3.85	8.0	2.33
45–54 years	23.9	4.14	26.2	5.34	10.3	2.17
55–64 years	25.8	4.68	22.9	4.11	11.2	1.87
65–74 years	24.0	5.78	32.6	3.06	11.6	1.83
Men						
18–74 years[1]	21.1	2.96	18.7	2.26	9.9	1.18
18–24 years	*6.3	3.66	*4.8	1.54	*3.3	1.99
25–34 years	20.8	6.57	*12.7	5.11	*6.2	2.59
35–44 years	26.6	6.33	19.3	6.04	14.5	4.66
45–54 years	22.5	7.22	29.0	7.53	11.0	4.31
55–64 years	33.1	5.69	24.9	6.87	17.2	3.52
65–74 years	22.7	8.96	32.7	3.97	16.8	2.20
Women						
18–74 years[1]	13.2	1.85	15.8	1.52	4.5	0.83
18–24 years	*0.8	0.77	*2.5	1.01	*1.7	1.15
25–34 years	*5.7	2.40	9.0	1.79	*2.9	1.70
35–44 years	14.3	2.89	17.7	4.05	*3.0	1.37
45–54 years	25.3	4.36	23.9	5.48	9.7	2.72
55–64 years	*18.6	6.94	21.3	4.96	6.2	1.99
65–74 years	25.0	7.84	32.4	3.58	7.7	2.10

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 16. Proportion of adult population taking antihypertensive medication by race, sex, age, and survey: United States, 1960–62, 1971–74, and 1976–80

Race, sex, and age	*1960–62 (NHES I)*		*1971–74 (NHANES I)*		*1976–80 (NHANES II)*	
	Medicated	*Standard error*	*Medicated*	*Standard error*	*Medicated*	*Standard error*
WHITE ADULTS						
Both sexes			Percent of population			
18–74 years[1]	5.5	0.39	6.1	0.24	9.4	0.30
18–24 years	*0.8	0.29	*0.0	0.05	*0.3	0.14
25–34 years	1.3	0.33	*0.5	0.20	1.9	0.37
35–44 years	1.9	0.34	2.7	0.46	3.9	0.51
45–54 years	5.0	0.70	6.9	0.81	13.3	1.08
55–64 years	12.8	1.59	15.6	1.24	20.4	1.09
65–74 years	19.8	1.82	20.9	0.97	29.5	0.93
Men						
18–74 years[1]	3.8	0.44	5.1	0.43	7.6	0.29
18–24 years	*0.5	0.33	*0.1	0.10	*0.3	0.23
25–34 years	*0.6	0.38	*0.6	0.39	2.0	0.50
35–44 years	*1.5	0.52	*2.2	0.76	3.4	0.59
45–54 years	3.5	0.99	5.9	1.11	11.6	0.99
55–64 years	9.1	1.95	14.4	2.15	16.9	1.42
65–74 years	13.5	2.65	14.7	1.14	22.4	1.32
Women						
18–74 years[1]	7.0	0.56	6.9	0.38	11.1	0.47
18–24 years	*1.0	0.46	-	-	*0.2	0.17
25–34 years	2.0	0.59	*0.4	0.14	1.7	0.54
35–44 years	2.3	0.65	3.2	0.50	4.3	0.85
45–54 years	6.5	1.07	7.8	1.32	15.0	1.68
55–64 years	16.1	2.27	16.6	1.67	23.6	1.50
65–74 years	25.0	2.38	25.7	1.40	34.9	1.26
BLACK ADULTS						
Both sexes						
18–74 years[1]	11.3	0.99	11.5	1.10	14.8	1.02
18–24 years	*2.0	1.18	*0.2	0.09	*1.1	0.90
25–34 years	6.3	1.94	*3.9	1.37	3.7	1.12
35–44 years	7.9	2.10	9.1	2.30	11.9	2.34
45–54 years	13.6	3.45	17.1	4.10	26.1	3.46
55–64 years	14.9	2.99	25.7	4.94	32.0	2.50
65–74 years	37.4	5.93	25.2	2.38	43.5	4.00
Men						
18–74 years[1]	6.0	0.91	8.1	1.50	9.2	1.10
18–24 years	-	-	-	-	*0.8	0.83
25–34 years	*1.3	1.35	*0.9	0.88	*3.1	1.38
35–44 years	*2.8	1.79	*8.6	4.54	*10.7	3.62
45–54 years	*5.7	3.84	*13.0	5.69	*10.5	5.38
55–64 years	*8.6	3.13	*14.5	5.58	23.5	3.33
65–74 years	29.9	7.32	22.2	2.73	23.5	3.76
Women						
18–74 years[1]	15.9	1.71	14.2	1.47	19.3	1.60
18–24 years	*3.5	2.09	*0.3	0.17	*1.4	1.45
25–34 years	9.6	3.03	*6.2	2.20	*4.1	1.68
35–44 years	12.2	2.76	9.5	2.35	12.8	3.41
45–54 years	21.4	5.02	20.6	5.51	39.5	4.51
55–64 years	21.2	5.59	34.8	6.86	39.1	4.74
65–74 years	43.5	8.66	27.6	3.70	58.6	5.13

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 17. Proportion of adult population with controlled hypertension by race, sex, age, and survey: United States, 1960–62, 1971–74, and 1976–80

Race, sex, and age	1960–62 (NHES I)		1971–74 (NHANES I)		1976–80 (NHANES II)	
	Controlled hypertension	Standard error	Controlled hypertension	Standard error	Controlled hypertension	Standard error
WHITE ADULTS						
Both sexes			Percent of population			
18–74 years[1]	2.2	0.32	2.7	0.21	4.9	0.26
18–24 years	*0.8	0.29	*0.0	0.05	*0.1	0.08
25–34 years	1.1	0.34	0.1	0.03	1.1	0.27
35–44 years	1.0	0.21	1.3	0.28	2.2	0.37
45–54 years	2.4	0.51	3.4	0.56	5.8	0.72
55–64 years	4.2	1.31	7.0	1.03	11.5	0.95
65–74 years	6.7	1.35	8.4	0.68	15.2	0.97
Men						
18–74 years[1]	1.5	0.39	2.2	0.28	3.4	0.25
18–24 years	*0.5	0.33	*0.1	0.10	-	-
25–34 years	*0.6	0.38	*0.1	0.09	*0.7	0.29
35–44 years	*0.4	0.27	*0.9	0.43	2.0	0.45
45–54 years	*1.3	0.70	2.4	0.60	3.8	0.81
55–64 years	3.0	1.79	6.9	1.58	8.2	0.96
65–74 years	5.4	1.59	6.2	0.70	10.9	1.08
Women						
18–74 years[1]	2.9	0.44	3.1	0.33	6.3	0.39
18–24 years	*1.0	0.46	-	-	*0.2	0.17
25–34 years	*1.6	0.54	*0.2	0.11	1.4	0.46
35–44 years	1.5	0.46	1.6	0.38	2.4	0.69
45–54 years	3.4	0.71	4.4	1.05	7.7	1.22
55–64 years	5.2	1.23	7.2	1.30	14.4	1.21
65–74 years	7.7	2.26	10.2	1.00	18.5	1.18
BLACK ADULTS						
Both sexes						
18–74 years[1]	3.6	0.87	4.6	0.67	7.9	0.96
18–24 years	*2.0	1.18	*0.0	0.05	*0.8	0.79
25–34 years	*3.8	1.69	*3.1	1.35	*2.1	0.75
35–44 years	*3.4	1.44	*4.7	2.01	4.7	1.79
45–54 years	*4.0	1.76	*7.0	2.82	12.1	2.79
55–64 years	*3.7	1.74	7.2	2.44	18.7	2.22
65–74 years	*5.2	3.79	8.5	1.61	26.4	4.68
Men						
18–74 years[1]	*0.6	0.43	*3.7	1.26	3.3	0.71
18–24 years	-	-	-	-	-	-
25–34 years	-	-	-	-	*1.0	0.69
35–44 years	*2.8	1.79	*5.4	3.72	*1.5	1.45
45–54 years	-	-	*8.3	5.48	*4.3	2.40
55–64 years	*1.1	1.15	*4.5	3.51	8.2	1.68
65–74 years	-	-	8.2	2.46	13.1	3.69
Women						
18–74 years[1]	6.0	1.41	5.1	0.78	11.6	1.44
18–24 years	*3.5	2.09	*0.1	0.09	*1.4	1.45
25–34 years	*6.4	2.76	*5.3	2.19	*3.0	1.27
35–44 years	*4.0	1.52	*4.1	1.85	*7.2	2.83
45–54 years	*8.0	3.04	*6.0	2.19	18.8	4.65
55–64 years	*6.4	3.33	*9.5	3.56	27.5	3.79
65–74 years	*9.5	6.91	8.7	1.80	36.5	6.75

[1]Age adjusted by the direct method to the overall U.S. population at the midpoint of the 1976–80 survey.

Table 18. Number and proportion of hypertensives diagnosed, medicated, and controlled, by survey and age: United States, 1960–62, 1971–74, 1976–80

Status	*1960–62 (NHES I)*			*1971–74 (NHANES I)*			*1976–80 (NHANES II)*		
	18–74 years	*18–44 years*	*45–74 years*	*18–74 years*	*18–44 years*	*45–74 years*	*18–74 years*	*18–44 years*	*45–74 years*
					Number in thousands				
Population estimate	106,852	60,258	46,594	128,147	73,404	54,743	141,728	83,851	57,877
Definite hypertensives	21,972	5,549	16,423	26,766	6,447	20,318	30,762	8,014	22,747
					Percent				
Adult population with definite hypertension	20.6	9.2	35.2	20.9	8.8	37.1	21.7	9.6	39.3
					Number in thousands				
Definite hypertensives who were diagnosed	10,549	2,098	8,451	10,826	1,800	9,026	21,786	4,738	17,049
					Percent				
Definite hypertensives who were diagnosed	48.0	37.8	51.5	40.4	27.9	44.4	70.8	59.1	74.9
					Number in thousands				
Definite hypertensives who were medicated	6,654	1,162	5,492	8,610	996	7,614	13,975	1,867	12,109
					Percent				
Definite hypertensives who were medicated	30.3	20.9	33.4	32.2	15.4	37.5	45.4	23.3	53.2
					Number in thousands				
Medicated hypertensives who were controlled	2,616	757	1,859	3,737	487	3,250	7,232	1,029	6,203
					Percent				
Medicated hypertensives who were controlled	39.3	65.2	33.8	43.4	48.9	42.7	51.7	55.1	51.2

Table 19. Proportions of hypertensives diagnosed, medicated, and controlled, by sex or race, survey, and age: United States, 1960–62, 1971–74, 1976–80

Sex, race, and status	1960–62 (NHES I)			1971–74 (NHANES I)			1976–80 (NHANES II)		
	18–74 years	18–44 years	45–74 years	18–74 years	18–44 years	45–74 years	18–74 years	18–44 years	45–74 years
Men				Number in thousands					
Definite hypertensives	10,050	3,184	6,865	13,037	3,886	9,151	15,201	5,066	10,135
				Percent					
Adult population with definite hypertension	19.8	11.1	30.8	21.4	11.0	35.8	22.5	12.5	37.5
Definite hypertensives who were diagnosed	37.3	27.0	42.0	32.8	23.8	36.6	61.5	49.1	67.6
Definite hypertensives who were medicated	20.3	8.8	25.7	24.8	9.9	31.1	34.3	16.8	43.0
Medicated hypertensives who were controlled	35.6	57.8	32.0	43.9	41.5	44.3	42.8	41.1	43.1
Women				Number in thousands					
Definite hypertensives	11,923	2,365	9,558	13,729	2,562	11,168	15,561	2,948	12,612
				Percent					
Adult population with definite hypertension	21.3	7.5	39.3	20.4	6.7	38.3	21.0	6.8	40.9
Definite hypertensives who were diagnosed	57.1	52.4	58.2	47.7	34.2	50.9	80.0	76.3	80.8
Definite hypertensives who were medicated	38.7	37.2	39.0	39.2	23.9	42.7	56.3	34.4	61.4
Medicated hypertensives who were controlled	41.0	67.5	34.7	43.1	53.5	41.7	57.1	66.9	55.8
White adults				Number in thousands					
Definite hypertensives	18,015	4,074	13,941	22,440	4,983	17,457	25,922	6,496	19,426
				Percent					
Adult population with definite hypertension	19.2	7.8	33.5	19.7	7.7	35.3	21.0	9.0	37.8
Definite hypertensives who were diagnosed	48.6	39.5	51.3	38.9	23.4	43.3	69.9	58.0	73.9
Definite hypertensives who were medicated	29.9	18.3	33.3	31.9	13.1	37.3	44.8	21.2	52.7
Medicated hypertensives who were controlled	40.4	68.5	35.9	44.4	44.7	44.3	51.7	57.1	51.0
Black adults				Number in thousands					
Definite hypertensives	3,768	1,331	2,438	4,182	1,398	2,784	4,216	1,280	2,936
				Percent					
Adult population with definite hypertension	33.9	20.4	53.0	32.5	17.7	56.5	28.6	13.6	55.3
Definite hypertensives who were diagnosed	46.5	33.9	53.5	47.8	41.4	51.1	78.6	73.1	80.9
Definite hypertensives who were medicated	32.5	28.5	34.7	33.2	23.1	38.3	51.7	36.5	58.3
Medicated hypertensives who were controlled	32.7	55.1	22.6	40.4	60.4	34.3	53.3	47.1	55.0

Table 20. Proportions of hypertensives diagnosed, medicated, and controlled, by race, sex, survey, and age: United States, 1960–62, 1971–74, 1976–80

Race, sex, and status	*1960–62 (NHES I)*			*1971–74 (NHANES I)*			*1976–80 (NHANES II)*		
	18–74 years	*18–44 years*	*45–74 years*	*18–74 years*	*18–44 years*	*45–74 years*	*18–74 years*	*18–44 years*	*45–74 years*
WHITE ADULTS									
Men				Number in thousands					
Definite hypertensives	8,322	2,496	5,826	11,161	3,179	7,982	13,177	4,270	8,907
				Percent					
Adult population with definite hypertension	18.6	10.0	29.4	20.5	10.2	34.4	22.3	12.2	37.0
Definite hypertensives who were diagnosed	39.2	32.2	42.3	31.2	19.5	35.8	61.1	47.5	67.7
Definite hypertensives who were medicated	21.1	9.4	26.1	24.9	8.9	31.3	34.1	15.2	43.2
Medicated hypertensives who were controlled	39.0	54.8	36.6	43.4	36.7	44.2	44.2	45.2	44.0
Women				Number in thousands					
Definite hypertensives	9,693	1,578	8,115	11,280	1,805	9,475	12,745	2,226	10,519
				Percent					
Adult population with definite hypertension	19.8	5.8	37.3	18.9	5.4	36.0	19.8	6.0	38.5
Definite hypertensives who were diagnosed	56.6	51.1	57.7	46.5	30.2	49.6	79.1	78.3	79.2
Definite hypertensives who were medicated	37.5	32.2	38.5	38.8	20.4	42.3	55.8	32.7	60.7
Medicated hypertensives who were controlled	41.1	74.9	35.6	45.0	50.8	44.4	56.5	67.6	55.3
BLACK ADULTS									
Men				Number in thousands					
Definite hypertensives	1,617	609	1,007	1,809	674	1,135	1,715	681	1,034
				Percent					
Adult population with definite hypertension	31.9	21.6	44.8	31.8	19.5	50.9	26.0	16.2	43.1
Definite hypertensives who were diagnosed	29.6	9.2	42.0	41.3	40.1	42.0	66.0	64.3	67.1
Definite hypertensives who were medicated	17.8	7.5	24.0	24.4	14.3	30.3	35.4	26.3	41.4
Medicated hypertensives who were controlled	14.6	73.5	3.4	48.2	56.8	45.8	35.6	18.1	42.9
Women				Number in thousands					
Definite hypertensives	2,152	721	1,430	2,373	725	1,649	2,501	599	1,901
				Percent					
Adult population with definite hypertension	35.6	19.5	60.9	33.1	16.2	61.0	30.7	11.4	65.4
Definite hypertensives who were diagnosed	59.2	54.7	61.5	52.8	42.6	57.3	87.2	83.1	88.5
Definite hypertensives who were medicated	43.6	46.3	42.2	40.0	31.3	43.8	62.9	48.1	67.5
Medicated hypertensives who were controlled	38.3	52.6	30.3	36.7	61.9	28.8	60.2	65.0	59.1

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Appendix I
Survey design and estimation procedures

Survey design

The sampling plans for the first National Health Examination Survey (NHES I) and the first and second National Health and Nutrition Examination Surveys (NHANES I and II) have been described at length in earlier publications.[8–10] Each of the surveys utilized a stratified multistage probability design in which a sample of the civilian noninstitutionalized population of the United States was selected. Excluded from the selection for all three surveys were persons residing on reservation lands of American Indians, and excluded from selection for NHES I and NHANES I were persons residing in Alaska or Hawaii.

Successive stages in the sampling process dealt with primary sampling units (PSU's—a standard metropolitan statistical area, a county, or a small group of contiguous counties), census enumeration districts (ED's), segments (clusters of households), households, eligible persons, and sample persons. In the first stage of sample selection for each survey, the approximately 1,900 PSU's into which the United States is subdivided were grouped into superstrata. There were 42 such superstrata for NHES I, 40 for NHANES I, and 64 for NHANES II. A modified Goodman-Kish controlled selection technique was used to select from each superstrata one or more PSU's (also called stands) to be included in the sample.[61] Forty-two PSU's were selected for inclusion in NHES I, 65 for inclusion in NHANES I, and 64 for inclusion in NHANES II.

ED's (within-PSU geographic areas with similar numbers of households) were then selected for subsequent sampling. For NHANES I and NHANES II, the ED's within each PSU were further grouped into "poverty" and "nonpoverty" strata to allow oversampling among the "poverty stratum" ED's. A systematic sample of segments (clusters of households) was selected from within the ED's.

At the third stage of sampling, lists of all eligible sample persons within each segment were made. From these lists systematic random samples in each age-sex group were selected to be examined, using the following sampling rates:

Survey and age/sex group	*Sampling rate*
NHES I	
18–74 years	1/2
Survey and age/sex group—Con.	*Sampling rate*—Con.
NHANES I	
18–19 years	1/4
20–44 years:	
Male	1/4
Female	1/2
45–64 years	1/4
65–74 years	1/1
NHANES II	
18–59 years	1/4
60–74 years	3/4

Of the 7,710 persons included in the NHES I sample, 6,672 (86.5 percent) were interviewed and examined. Comparable figures for NHANES I and II, ages 18–74 years, were 13,645 of 19,572 and 12,504 of 18,209 (69.7 and 68.7 percent, respectively).

Estimation procedures

All data presented in this report are based on "weighted" observations. That is, data recorded for each sample person are inflated to characterize the subuniverse from which that sample person was drawn. The weight for each examined person is a product of the reciprocal of the probability of selecting the person, an adjustment for nonresponse cases (that is, persons not examined), and a poststratified ratio adjustment. The latter increases precision by making the final sample estimates of the population agree approximately with independent controls prepared by the U.S. Bureau of the Census for the noninstitutionalized population of the United States as of the approximate survey midpoint, by age, sex, and race.

Nonresponse bias

In any health examination survey there exists the potential for three levels of nonresponse: Household interview nonresponse, examination nonresponse, and item nonresponse. Household interview nonresponse is defined as the proportion of those sample persons who do not complete the household medical history questionnaire. Examination nonresponse is the proportion of those sample persons who initially respond to the household demographic questions and some or all of the medical history questionnaire, but who subsequently do not come to the examination center for an examination. Item nonresponse re-

NOTE: A list of references follows the text.

sults from sample persons who do not complete some portion of either the household interview questionnaires or the examination protocol.

The response rates for all three surveys are presented in table I. The summary response rates varied from a high of 86.8 percent for NHES I down to 68.7 percent for NHANES II. In each of the surveys an inverse relationship between age and response rate was observed. That is, as age increased, the response rate decreased. The magnitude of the difference was similar among the surveys, with an approximate 10 percent decline in response rates between the youngest and oldest age groups observed for each of the three surveys.

Intense efforts were undertaken during each survey to develop and implement procedures and inducements that would reduce all types of nonresponse and thereby reduce the potential for bias in the survey estimates. Several studies have been conducted to evaluate the effectiveness of these procedures and to quantify any systematic bias that may have occurred. For instance, a comparison of the 1976 National Health Interview Survey (NHIS)[62] and NHANES II[63] suggests that there is not a large nonresponse bias in some health-related variables because of the close agreement on selected interview items in NHANES II data with comparable items in the 1976 NHIS data, for which there was a nonresponse rate of only 4 percent. An earlier analysis comparing examined and nonexamined (but interviewed) persons from the first 35 stands of NHANES I found the two groups quite similar with respect to health characteristics being compared.[64] A third study found no difference between examined and nonexamined persons selected for participation in NHANES I with respect to health-related variables.[65] A study of factors relating to response in NHES I found that 36 and 31 percent of the nonexamined and examined persons viewed themselves as being in excellent health, while 5 and 6 percent of the nonexamined and examined persons reported being in poor health.[66] Finally, a study of NHES I examinees involving comparisons between two extreme groups, those who participated in the survey with no persuasive effort and those who participated only after a great deal of persuasive effort, found that differences between the two groups generally had little effect on estimates, based on numerous selected examination and questionnaire items.[67]

These findings have been interpreted as evidence that no large bias exists between the two groups for the items investigated and provide support for the belief that there is little bias introduced to the findings because of differences in health characteristics between examined and nonexamined persons.

Table I. Sample sizes and response rates for NHES I (1960–62), NHANES I (1971–74), and NHANES II (1976–80), by age

Survey and age	Total sample size	Number examined	Percent examined
NHES I			
18–74 years	6,955	6,039	86.8
18–24 years	960	866	90.2
25–34 years	1,453	1,300	89.5
35–44 years	1,553	1,378	88.7
45–54 years	1,343	1,164	86.7
55–64 years	997	809	81.1
65–74 years	649	522	80.5
NHANES I			
18–74 years	19,572	13,645	69.7
18–24 years	3,131	2,297	73.4
25–34 years	3,682	2,694	73.2
35–44 years	3,184	2,327	73.1
45–54 years	2,292	1,599	69.8
55–64 years	1,891	1,262	66.7
65–74 years	5,392	3,466	64.3
NHANES II			
18–74 years	18,209	12,504	68.7
18–24 years	2,713	2,054	75.7
25–34 years	3,031	2,237	73.8
35–44 years	2,236	1,589	71.1
45–54 years	2,149	1,453	67.6
55–64 years	3,868	2,556	66.1
65–74 years	4,212	2,615	62.1

NOTE: A list of references follows the text.

Appendix II
Statistical methodology

Measures of variability

Because the statistics presented in this report are based on a sample, they may differ from the figures that would have been obtained if a complete census had been taken using the same survey instruments, instructions, interview and examination personnel, and procedures. The probability design of the sample permits the estimation of standard errors and standard deviations that are appropriate for the design and weighted estimates shown in this report.

The standard error is primarily a measure of the variation inherent in the process of estimating a population mean from a sample mean. As calculated for this report, the standard error also reflects part of the variation that arises in the measurement process. It does not include estimates of any bias that might be contained in the data.

The estimation of sampling errors for a sample of the type of the National Health and Nutrition Examination Survey is difficult for at least two reasons: (*a*) measurement error and "pure" sampling error are confounded in the data because it is difficult to find a procedure that will either completely include both or treat one or the other separately, and (*b*) the survey design and estimation procedure are complex and, accordingly, require computationally involved techniques for the calculation of variances. The estimates of standard errors are themselves subject to errors that may be large if the number of cases or the number of primary sampling units involved in the calculation of variances is small.

Estimates of the standard errors for selected statistics used in this report are presented in most of the tables in this report. These estimates have been calculated by a replication technique that yields overall variability through observation of variability among random subsamples of the total sample.[15,16] These estimated sampling errors do not reflect any residual bias that might still be present after attempted correction for nonresponse.

The standard deviation is a measure of the dispersion of the observations in a sample, and is useful in describing how an individual observation compares with the mean of the sample. As calculated for this report it also reflects part of the variation that arises in the measurement process. The estimates of standard deviations presented in the detailed tables were calculated using the pseudoreplication method.[15,16]

NOTE: A list of references follows the text.

Data reliability

The criteria for reliability of estimates shown in this report consisted of the following: (*a*) that the sample size on which the estimate is based be at least 25 persons, and (*b*) that the estimated coefficient of variation (that is, the standard error of the mean divided by the mean) be less than 30 percent. Thus, if the sample size was too small or if the variation regarding the mean was too large, an asterisk was placed next to the value on the table. This estimate is considered neither precise nor stable enough to meet reliability standards. However, the values are shown to give an impression of the observed distribution and to permit users to combine data into useful categories.

The following sample sizes were required for the presentation of percentile estimators given in this report:

Percentile	*Sample size*
50th	10
25th and 75th	20
10th and 90th	50
5th and 95th	100

If these minimum sample sizes were not met, there is an asterisk in the cell.

Appendix III
Demographic and socioeconomic terms

Age—In the first National Health Examination Survey, age at last birthday prior to the census interview was used as the criterion for inclusion in the sample. Data in the detailed tables and text of the report are shown by age at the time of the census interview, regardless of age at examination.

In the first and second National Health and Nutrition Examination Surveys, two ages were recorded for each examinee: The age at last birthday at the time of examination and at the time of the census interview. The age criterion for inclusion in the sample used in these two surveys was defined as age at the time of the census interview. The adjustment and weighting procedures used to produce national estimates were based on the age at interview. Data in the detailed tables and text of the report are shown by age at the time of the examination, except that those few who became 75 years of age by the time of the examination are included in the 65–74 year age group.

Race—For all three surveys, race was recorded as "white," "Negro," or "other." "Other" included Japanese, Chinese, American Indian, Korean, Eskimo, and all races other than white and black. Mexicans were included with "white" unless definitely known to be American Indian or other nonwhite race. Black persons and those of mixed black and other parentage were recorded as "Negro." When a person of mixed racial background was uncertain about his race, the race of his father was recorded.

Education—In all three surveys each person was classified by education according to the highest grade of school completed. The only grades counted were those attended in a regular graded public or private school where persons were given formal education, whether during the day or at night, on a full-time or part-time attendance basis. A "regular" school is one that advances a person toward an elementary or high school diploma, or a college, university, or professional degree. Education received in vocational, trade, or business schools outside the regular school system was not counted in determining the highest grade of school completed. If a person attended school in a foreign country, at an ungraded school, with a tutor, or under other special circumstances, the nearest equivalent of his highest grade attended was given.

Appendix IV
Limitations of data

The comparability of the blood pressure measurement procedures of the first National Health Examination Survey and the first and second National Health and Nutrition Examination Surveys may be indirectly evaluated by measuring shifts in the frequency distributions of systolic and diastolic blood pressure measurements (SBP's and DBP's, respectively) in an age-race-sex group in which no shifts would be expected. White males ages 18–24 years are an example of such a group. This demographic subgroup has little hypertension and is, therefore, not a target group for any significant blood pressure control measures. Also, males would not have taken any contraceptive medication. Such contraceptive medication may result in a rise of as much as 5–6 mmHg SBP.[68]

As can be seen from figure 8 in the text, the curves for SBP's for the three surveys practically coincide, as expected. The curves for the DBP's (see figure I), however, are separated, with succeeding surveys reflecting sequentially higher DBP's. Of considerable interest is the wide separation between the later surveys and the initial 1960–62 survey, a difference that is more marked in the lower part of the distribution.

The consistency of the rightward shift throughout the distribution between the diastolic curves of 1960–62 and 1976–80 may be due to a deficiency in the training of the physicians taking the readings. Extra attention was paid to blood pressure measurement in the 1960–62 survey. For example, "the nurse raised the manometer to the physician's eye level."[6] During the blood pressure determination, the physician obtained separate readings for both the fourth and fifth phases. Both numbers were recorded on the form in addition to the systolic level. It is highly likely that, because of the necessity of recording numbers for both the fourth and fifth phases, the physician was forced to concentrate his attention on the diastolic determinations. However, in the 1971–80 surveys physicians received no instructions on taking blood pressures. The physicians were instructed to read the manual for an overall description of how to conduct the examination. Additional evidence supporting the contention that more attention was paid to taking the blood pressures in 1960–62 than in 1971–80 is provided by the data for end-digit preference. The percent of persons with an end digit of 0 is

NOTE: A list of references follows the text.

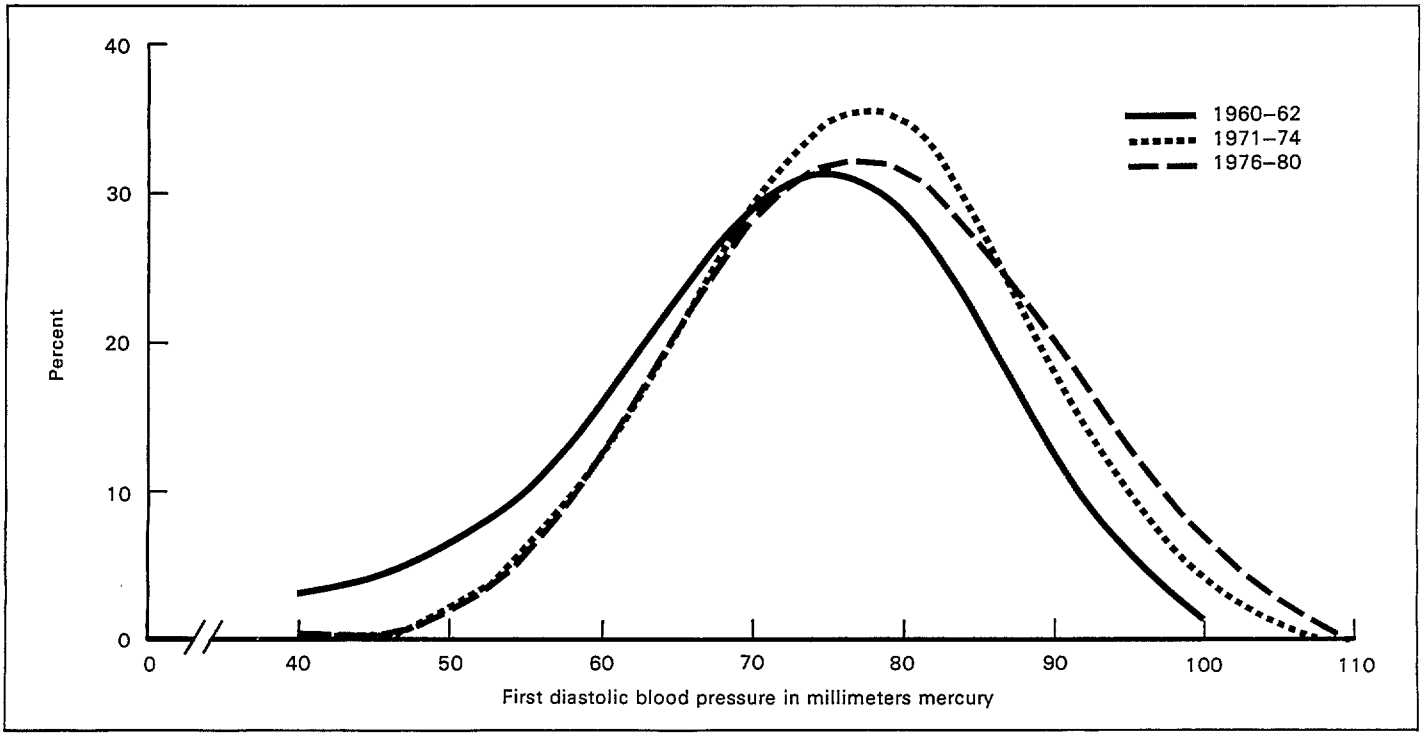

Figure I. Smoothed weighted frequency distribution of the first diastolic blood pressure for white men ages 18–24 years by survey: United States, NHES I (1960–62), NHANES I (1971–74), and NHANES II (1976–80)

shown in table II. As can be seen, preference for the zero end digit is markedly greater in the two later surveys than in the 1960–62 survey. Suppression of the end-digit preference is commonly regarded as an indication that more conscious attention is being paid in taking blood pressure readings. It is possible that the bias in DBP's might be somewhat less of a factor when taking the blood pressures of persons in the older age groups because the observer would be more attentive to the possibility of elevated blood pressures. However, differential analysis of these groups would be difficult because of the admixture of high numbers of medicated people in these groups.

Another possible explanation for the shift in DBP distributions is a possible reduction in hearing acuity among the physicians of the 1976–80 survey. All of the physicians involved in the 1960–62 survey were young (internal medicine residents), as were most of the physicians used in the 1971–74 survey. However, nearly all the physicians used in the 1976–80 survey were retired practitioners. An approximate 40-year examiner's age differential existed between the 1960–62 and 1976–80 surveys. No hearing tests were taken on any of the physicians involved. Assuming their hearing approximated that of the U.S. male population, and that the fundamental frequency of a "typical" heartbeat is 500 hertz or lower, one would expect the percent of persons responding to a 500-hertz tone at a threshold level of 20 decibels or better to fall from 96.7 percent at ages 25–34 years, and 80.5 percent at ages 55–64 years, to 77.7 percent at ages 65–74 years.[69] It should be noted that the blood pressure determinations did not take place in a soundproof room, so the hearing thresholds could be considerably higher. A deterioration in average hearing levels for the physicians employed in the 1976–80 survey may be postulated, but it is not possible to quantify this effect with these data.

The increased lability of the DBP compared with the SBP reflects the more difficult task presented to the auditory system (peripheral and central) by the diastolic end point. This is caused by the following:

1. The amplitude of the Korotkoff sounds following the onset of the first phase increases rapidly in volume, whereas sounds following the commencement of the muffling associated with the fourth phase take a relatively longer time to die out.[70,71]
2. The fourth phase involving muffling abruptly changes the quality of the sound to a soft blowing nature. This results from a marked diminution or disappearance of sound frequencies above 60 hertz.[70,72] The curtailing of the frequency spectrum above 60 hertz results in a loss of audibility because hearing sensitivity is greater at higher frequencies. The American Heart Association committee report on recommendations for human blood pressure determination notes that the determination of the fifth phase (diastolic pressure) depends on the position of the stethoscope over the artery, the efficiency of the stethoscope in transmitting sounds of low intensity, and the sensitivity of the observer's hearing.[72] An effect of hearing acuity on the fifth sound level was noted in a Scandinavian study with the remark that observer *L* seemed to have very high readings for the diastolic fifth sound, which may have been associated with her slightly deficient hearing.[73]

Thus, a deficiency in the training of the observer would probably result in diastolic readings biased upward, because the observer might not attempt to find the difficult end point of the fifth phase but instead cut it off at a somewhat higher level. This would be especially notable for a low diastolic reading (below 70 in the case of white men average age 18–24 years) as it makes no clinical difference whether a person has diastolic pressure of 65 or 55 mmHg. The upward bias due to inattention would be expected to be less frequent at higher diastolic readings, which might appear more unusual for a particular age-sex group and consequently might assume more clinical significance.

NOTE: A list of references follows the text.

Table II. Percent of persons with blood pressure reading ending in zero

Survey	*Systolic blood pressure*	*Diastolic blood pressure*
NHES I	32.4	34.7
NHANES I	47.3	42.9
NHANES II	51.3	51.5

NOTE: Ages 18–74 years.

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