

Total Serum Cholesterol Levels of Children 4-17 Years

United States, 1971-74

Total serum cholesterol values of children 4-17 years of age, are presented and discussed by age, sex, and race. Data are from the Health and Nutrition Examination Survey, United States, 1971-74.

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TOTAL SERUM CHOLESTEROL LEVELS OF CHILDREN 4-17 YEARS

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INTRODUCTION

Serum cholesterol levels of children 4-17 years of age in this report were obtained as part of the Health and Nutrition Examination Survey (HANES). HANES is a program of the National Center for Health Statistics in which measures of nutritional status are collected for a scientifically designed sample representative of the civilian noninstitutionalized population of the United States in the broad range of ages 1-74 years.¹

This Health Examination Survey, by means of which these data were obtained, is one of the major programs of the National Center for Health Statistics authorized under the National Health Survey Act of 1956 by the 84th Congress as a continuing Public Health Service activity to determine the health status of the population.

The Health and Nutrition Examination Survey was also used to obtain some limited information on the general health status of the entire age group as well as further information on the health status and medical care needs of those aged 25-74 years in the civilian noninstitutionalized population. A detailed description of the specific content and plan of operation, including the sample design, has been published.¹

As in previous Health Examination Surveys, the U.S. Bureau of the Census cooperated in the sample design and in the initial visits and interviewing at selected eligible households in the 65 primary sampling units throughout the United

States. Additional household visiting, interviewing, history taking, and an explanation of the examination procedures were undertaken by members of the field staff of the mobile examination center. The selected sample persons for whom an appointment could be made were brought into the specially constructed mobile examination centers which were centrally located in each of the primary sampling units. The teams which traveled to the various survey locations throughout the country included professional and paraprofessional medical and dental examiners along with technicians, interviewers, and other staff.

Field data collection operations for the first HANES survey were started in April 1971 and completed in June 1974. Of the 28,043 persons aged 1-74 years who were selected in the national probability sample to represent the 194 million persons in those age groups in the civilian noninstitutionalized population, 20,749, or 74.0 percent, were examined. When adjustments were made for the differential sampling ratios used for the effect of oversampling among the poor, preschool children, women of childbearing age, and the elderly, this corresponds to an effective response rate of 75 percent. Among children 4-17 years of age at interview for whom serum cholesterol determinations were made, there were 5,334 examined out of the probability sample of 6,356 selected to represent the 56 million of these ages in the population. This is an unadjusted response rate and an effective adjusted response rate of 84 percent. However,

interview data relating to the demographic, socioeconomic, and medical characteristics were collected on more than 99 percent of the 6,356 children in the probability sample.

SERUM CHOLESTEROL

Serum Collection and Storage

A nonfasting blood specimen was collected from examinees and stored in three 15-cm³ vacutainers. The tubes were kept at room temperature for clotting for 20-30 minutes following venipuncture. The blood clot was gently rimmed from the tube and the tubes were then centrifuged for 10 minutes at 2400 r/min. The serum from the three vials was pooled, mixed thoroughly, and distributed in 3-cm³ aliquots to prenumbered vials. Within 1 hour of venipuncture, these serum vials were placed in the freezer. Packed with ample carbon dioxide, styrofoam shippers containing the daily accumulation of vials were sent to the Center for Disease Control (CDC) laboratory in Atlanta; no thawing occurred in transit. The vials were stored in freezers at -20° C until ready for analysis. Multiple assessments were performed on each 3-cm³ vial of serum. The serum to be used eventually for the cholesterol assessment was thawed at CDC for iron, iron binding capacity, and magnesium determinations. The remaining serum in the 3-cm³ vial was then refrigerated until packed in dry ice for shipment to the CDC Lipid Laboratory at Chamblee, Georgia. The serum remained frozen at -20° C until analyzed for cholesterol content. Thawing and freezing the serum do not affect the determination of cholesterol content by competent extraction methods.²

Cholesterol Determinations

All serum cholesterol determinations were made in the Lipid Standardization Laboratory of the Center for Disease Control, U.S. Public Health Service, Atlanta, Georgia. The analytical method was based on that of Abell, et al.³ but was modified for a semiautomated production line. The method, described in detail by Eavenson, et al.,⁴ was made possible by the de-

velopment of a relatively stable Liebermann color reagent, and was designed for automatic pipetting units.

The Lipid Laboratory at CDC compared the results obtained with this semiautomated Abell method and those from the reference method of Abell, et al.³ For examining the bias of the semiautomated method, data were obtained from pools of sera analyzed by the reference method and the semiautomated method. For pools ranging from 134 to 343 mg per 100 ml, there was in 1972 an average positive bias of 4.07 percent for the semiautomated method as compared to the standard method; for the 1971-74 period the corresponding figure was a positive bias of 4.9 percent. The weighted average bias was 4.5 percent. In this report, the 1971-74 data are presented without correction for bias so that they provide population reference standards for determinations made by the semiautomated methodology now in use.

Definition of Variables

In this report, data on the distribution of serum cholesterol levels of children in the U.S. population aged 4-17 years are analyzed and discussed by age, sex, and race. The unweighted sample data of ages 1-3 years are only shown, but are not analyzed, because of possible bias due to missing values (see appendix I). The analyses of serum cholesterol levels with variables other than age, sex, and race will be presented in future reports.

Age.—The age is the year attained at the last birthday. The mean age of each category approximates the midpoint of the whole year, e.g., the 5-year-old male group consists of a 1 year cohort whose mean age is 5.51 years, while the corresponding female sample averages 5.52 years. The age criterion for inclusion in the HANES sample was defined as age at time of census interview. The adjustment and weighting procedures used to produce national estimates were based on the age at interview.

Race.—Race was recorded as white, black, and other races (appendix II). White children were 74.54 percent of the total children (5,355) examined of ages 4-17 years; blacks were 24.69 percent, which reflected the sampling design to

overrepresent the poor in HANES. Other races are included only when the total subjects are used but are not included in the white-black breakdown.

The estimated populations shown in each table, along with the numbers of sample persons, are presented only to give a general indication of the size of the population which the data do characterize. These are produced from the sample weighting process and so will vary somewhat from census figures. The final sampling estimates of the population size were brought into closer alignment with the independent U.S. Bureau of the Census estimates for the civilian noninstitutionalized population of the United States as of November 1, 1972, by race, sex, and age.

RESULTS

Age and Sex

Percent distributions of boys and girls by age, according to their serum cholesterol levels, are presented in tables 1 and 2. Tables 3 and 4 present basic statistics of serum cholesterol distributions for these children by age and sex. In addition to listing the number of children examined, their mean age, and the estimated number in the population, the tables include the mean, standard deviation, standard error of the mean as defined through replication (discussed in variance estimations in appendix I), and the values for seven percentiles from the 5th through the 95th. All were derived from the weighted sample sizes.

The mean serum cholesterol levels of boys in the younger ages 4-11 years tend to increase with age to a high average value of 181.8 mg per 100 ml at ages 9-11 years. Another pattern in mean values is observed from 12 through 17 years, when the mean values consistently declined to a low mean value of 167.5 mg per 100 ml at age 17 years (table 3, figure 1). Table 4 and figure 1 also show that the mean values of girls were relatively stable at ages 4-7 years, 174.7 to 177.1 mg per 100 ml, with the mean values increasing abruptly to 186.5 mg per 100 ml at age 8. From age 8 through age 13 the mean levels consistently decreased from the

peak at age 8 to 170.4 mg per 100 ml at age 13 years, a decrease in mean level of 16.1 mg per 100 ml. This direction is not evident at ages 14 through 17 years, when the mean levels increased irregularly each year from 172.8 mg per 100 ml at age 14 to 180.6 mg per 100 ml at age 17 years.

Overall, the mean serum cholesterol levels for girls increased from 174.7 mg per 100 ml at age 4 years to 180.6 mg per 100 ml at age 17 years, an increase of 5.9 mg per 100 ml. The decrease in mean levels between similar ages for boys is slightly less, 3.8 mg per 100 ml.

Girls had higher observed mean serum cholesterol levels than boys of the same age for 10 of the 14 age groups considered. The exceptions were for those ages 7, 11, 12, and 13 years. However, the differences in mean serum cholesterol levels between girls and boys, by age, were not significant at the .05 level using the sign test.

Percentiles of the serum cholesterol distributions are shown by age for boys and girls (tables 3 and 4). For each age-sex group the mean serum cholesterol level was always greater than the median, which indicates that the serum cholesterol distribution was skewed to the right, positive skewness. This skewness was more evident for boys than for girls.

The differences in age patterns between boys and girls described previously for the mean were also apparent when the percentile at the upper 90th, lower 10th, and middle 50th ends of the distribution were examined (figure 2).

In general, sex differences were greater at the upper end of the distribution than at the lower end (figure 2).

Race, Age, and Sex

Percent distribution of serum cholesterol levels is given for white and black children by age and sex in tables 5-8. Tables 9-12 present the basic statistics for these distributions by age, sex, and race.

The main serum cholesterol patterns observed previously for the total male population aged 4-17 years were similar to those observed for white boys separately (table 9, figure 3). Mean cholesterol levels of white boys were highest at ages 9-11 years and decreased

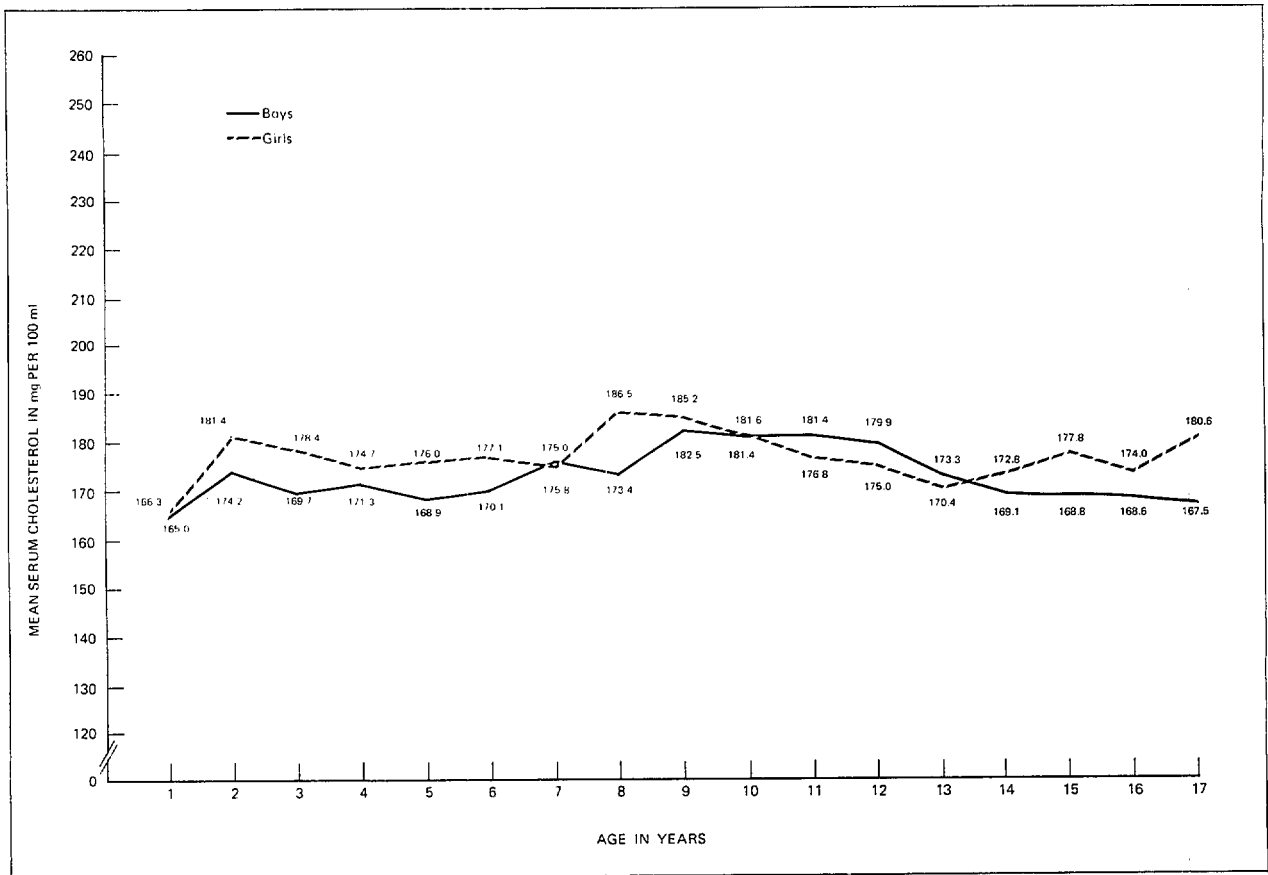


Figure 1. Mean serum cholesterol levels of children, by sex and age: United States, 1971-74

with age to a low value of 166.9 mg per 100 ml at age 17 years. For black boys, the peak in values was at ages 7-12 years, with the exception of a drop in mean value at age 10 years and then a decline in mean value from 184.1 mg per 100 ml at age 12 years to a low of 161.8 mg per 100 ml at age 14 years. From 14 years on, the mean levels increased rapidly to 178.7 mg per 100 ml at age 16 and then declined (table 10 and figure 3).

At every age except ages 10, 13, and 14 years, black boys had higher mean serum cholesterol values than white boys. However, the differences in mean serum cholesterol levels

between black and white boys were not significant at the .05 level using the sign test.

The age-cholesterol pattern for girls in the total population was generally found for white and black girls separately. The mean serum cholesterol values of white girls increased irregularly from an average value of 173.5 mg per 100 ml at ages 4-5 years to the highest mean value of 183.6 mg per 100 ml at ages 8-9 years and then declined to 168.3 mg per 100 ml at age 13 years. Thereafter with age, there was a general increase in mean level to 180.3 mg per 100 ml at age 17 years (table 11 and figure 4).

The mean levels of black girls also increased

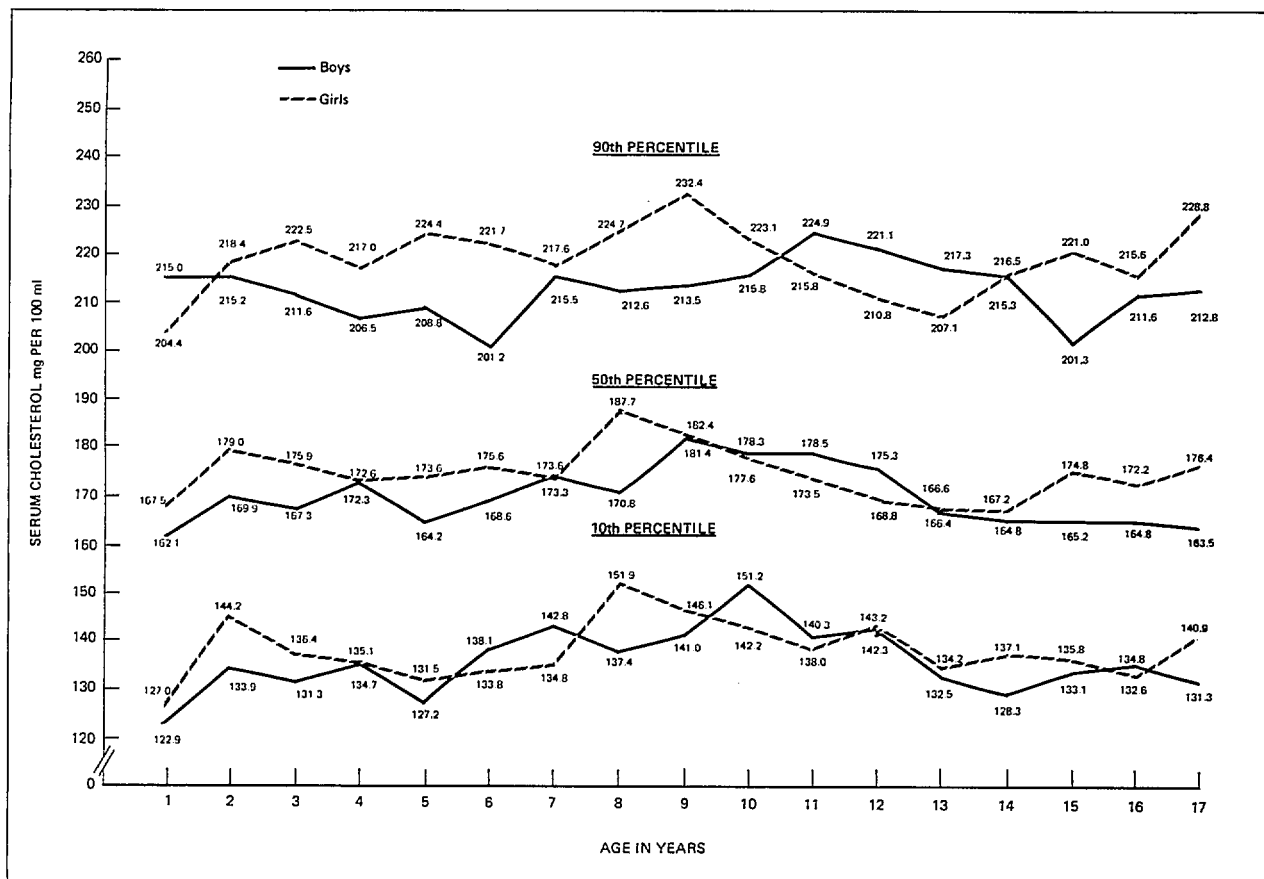


Figure 2. Selected estimated percentiles of the serum cholesterol distribution in children, by sex and age: United States, 1971-74

irregularly each year from 177.1 mg per 100 ml at age 4 to a peak of 202.8 mg per 100 ml at age 8. From this highest mean level at age 8, there is a decrease in mean values through age 12 and then a general increase to 194.5 mg per 100 ml at age 15. At ages 16 and 17 years, the mean cholesterol levels declined from those at age 15 (table 12 and figure 4).

At each age, with the exception of ages 6, 11, and 12 years, black girls had higher mean serum cholesterol levels than white girls. These results were not significant using the sign test, at the .05 level.

White and black girls generally had higher mean cholesterol levels than their male counter-

parts. However only the differences in mean serum cholesterol levels between white girls and white boys were significant at the .05 level using the sign test. With the exception of those at ages 7 and 12 years white girls had higher mean serum cholesterol levels than white boys of the same age group. The differences in mean levels between white and black children were greater for girls than for boys. The average differences between the mean levels of white and black children over age 14 was 7.1 mg per 100 ml for girls and 3.8 mg per 100 ml for boys.

In general, interracial differences for boys were greater at the upper end of the distribution (90th percentile) than at the lower end (10th

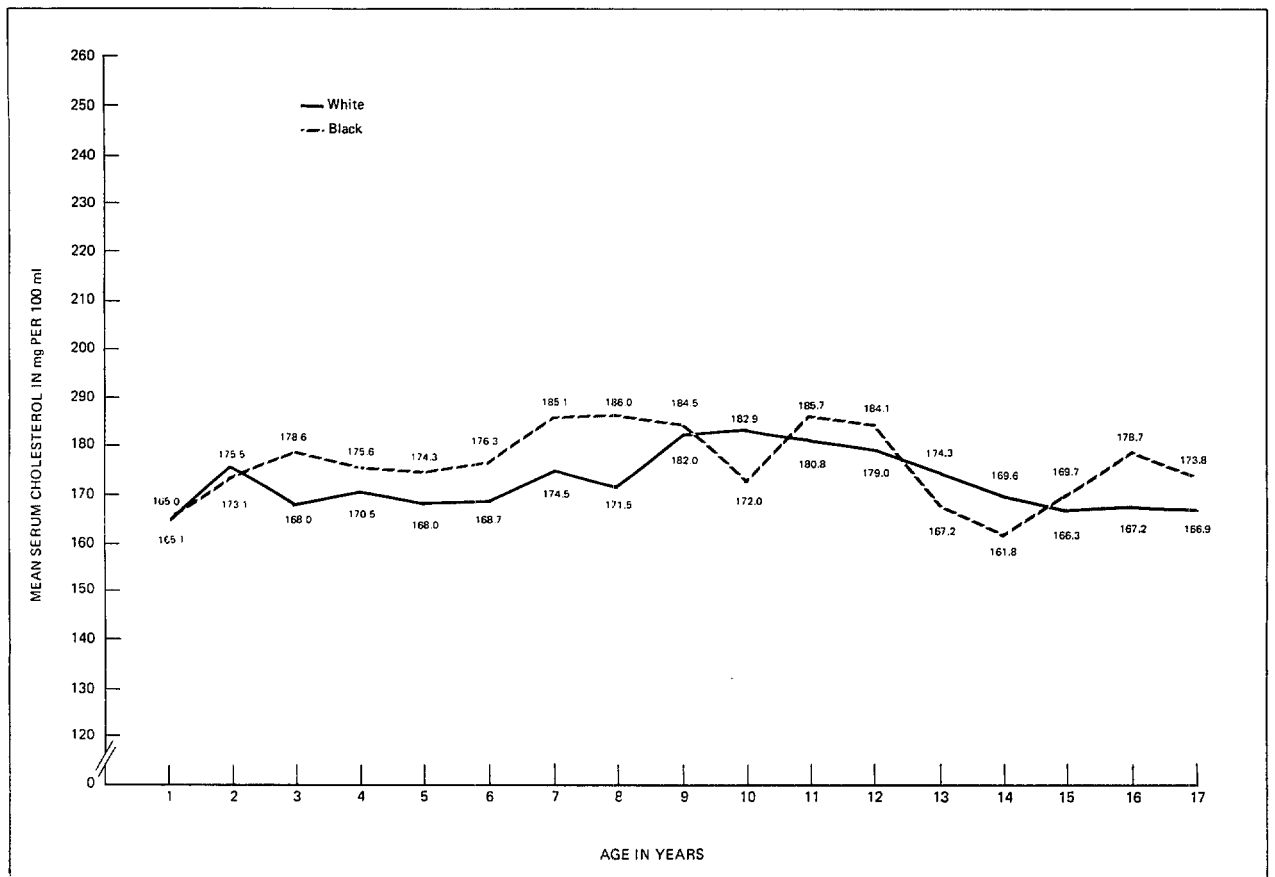


Figure 3. Mean serum cholesterol levels of boys, by race and age: United States, 1971-74

percentile) (figure 5). The pattern was reversed for girls (figure 6).

DISCUSSION

The level of serum cholesterol has been identified as one of the multiple risk factors in the development of coronary heart disease. The results of epidemiological studies based on adult data from longitudinal studies such as the Framingham Heart Study⁵ have demonstrated that persons with elevated serum cholesterol values developed coronary heart disease with great frequency. Similar longitudinal data obtained from adolescents that relate serum

cholesterol levels in younger ages to future morbidity or mortality are not available. There is some evidence, however, that atherosclerosis frequently manifested by coronary heart disease may originate in childhood. Holman and others reported finding evidence of atherosclerosis in post mortem examinations of children.⁶ Enos and others reported gross evidence of coronary atherosclerosis in 77 percent of American soldiers, with an average age of 22 years, killed in the Korean War.⁷

Reference data of levels of children 4-17 years of age have been presented and analyzed by age, sex, and race because of the medical interest in such data. There are no such previous data for the general population of ages 4-17

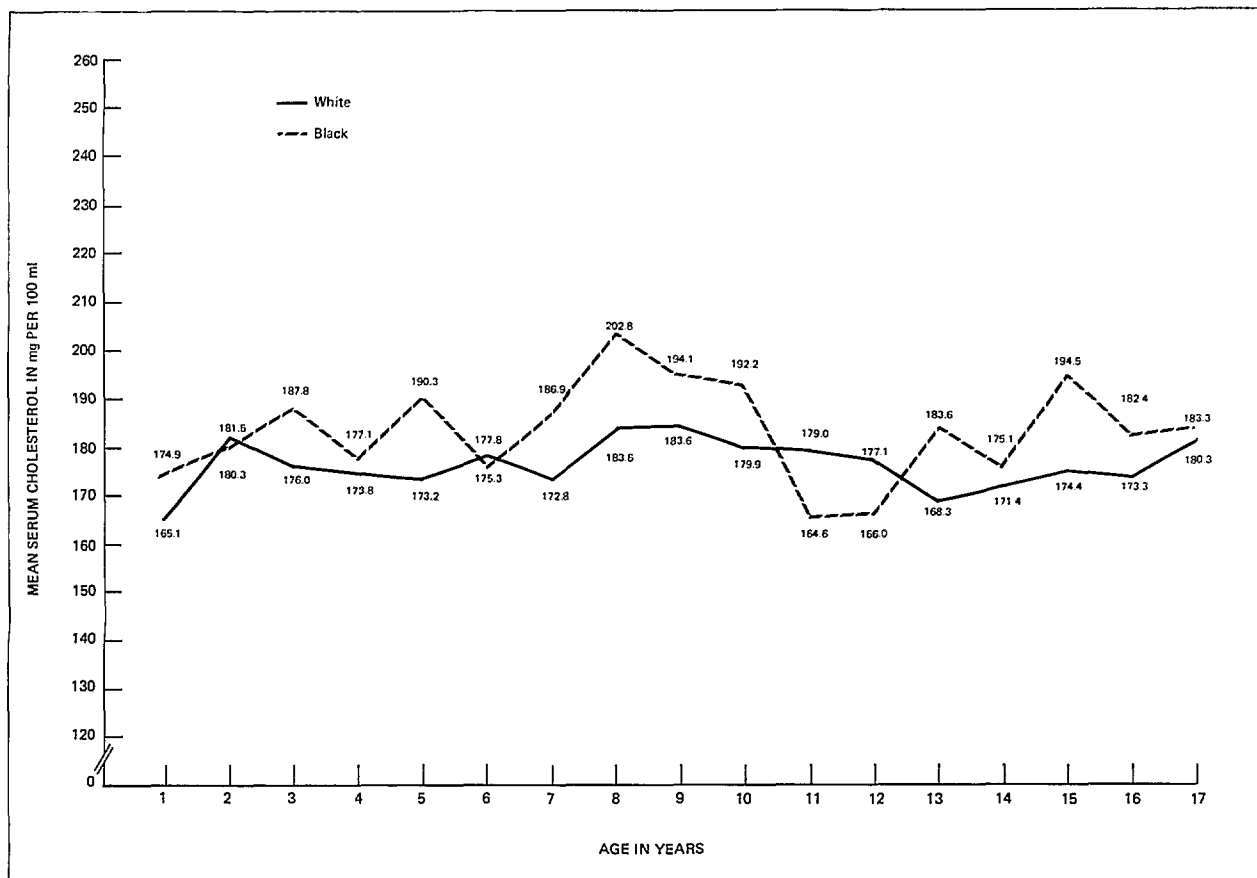


Figure 4. Mean serum cholesterol levels of girls, by race and age: United States, 1971-74

years. Such data as are available are taken from selected segments of the population and special study groups. These estimates could not be generalized to the U.S. population. HANES, on the other hand, provided cross-sectional data of serum cholesterol levels obtained on different age cohorts representative of the U.S. population. The age trends represented mean levels for successive cohorts of persons of different age groups. The limitations of cross-sectional data are recognized in considering group age changes because they reflect effects of environmental as well as developmental and hereditary influences.

Age and Sex

Mean serum cholesterol levels of girls and boys were stable in the younger years, within

the range of 174.7-177.1 and 168.9-175.8 mg per 100 ml at ages 4-7 years. The mean levels of girls of ages 8-17 years showed two distinct patterns in contrast to those for boys in the older ages. Mean levels of girls decreased from 186.5 mg per 100 ml at age 8 years to 170.4 mg per 100 ml at age 13 years and then increased to 180.6 mg per 100 ml at age 17 years. Boys show a consistent decrease in mean levels with age at ages 9 through 17 years. The mean levels of girls at all ages, with the exception of ages 7, 11, 12, and 13, had higher values than those of boys. The difference in mean values between girls and boys in the 4-17 age group averaged 3.7 mg per 100 ml, and ranged from 0.2 to 13.1 mg per 100 ml.

The estimates from HANES with respect to sex and age can be compared with other studies

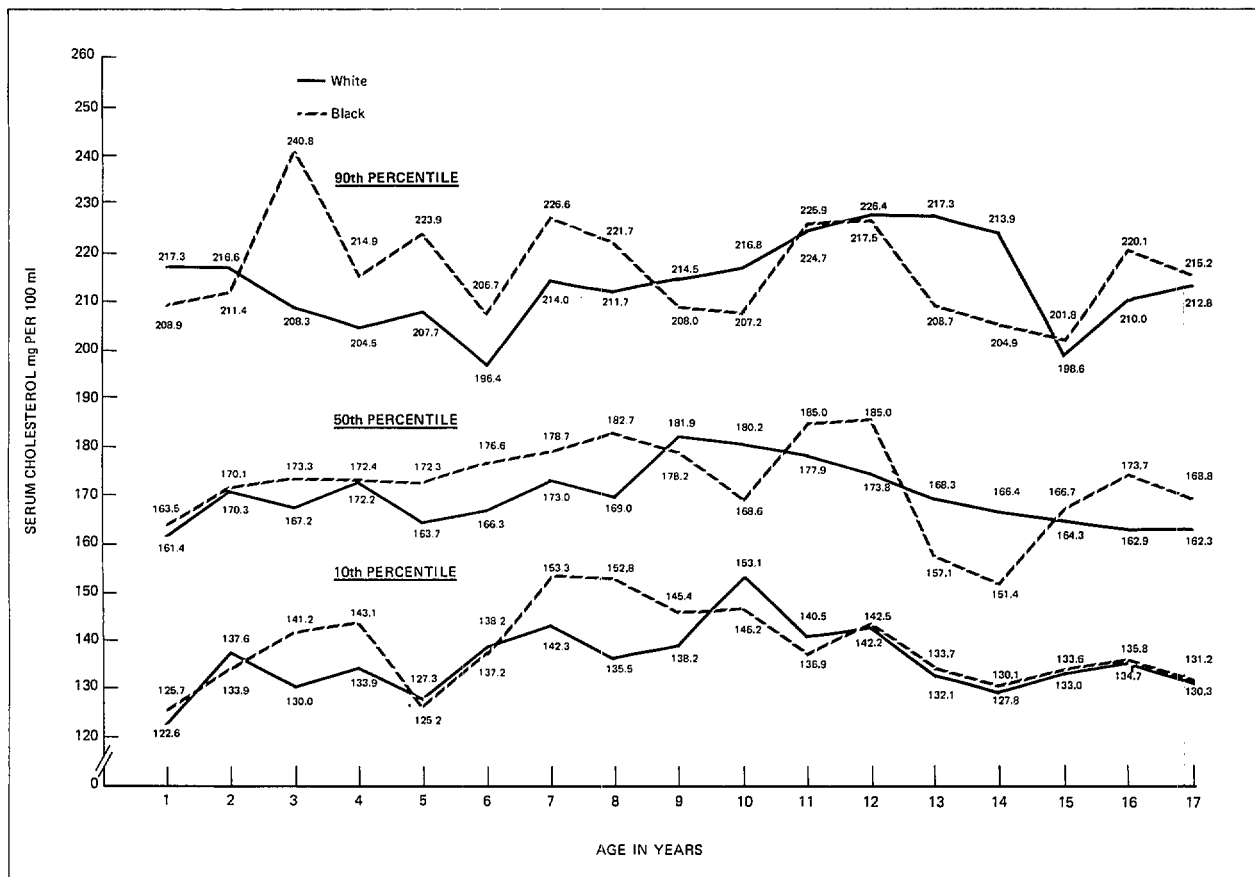


Figure 5. Selected estimated percentiles of the serum cholesterol distribution in white and black boys, by race and age: United States, 1971-74

of cholesterol in children and youths. In the Tecumseh Community Health study (Michigan), which was conducted in 1959 and 1960, serum cholesterol determinations were made on 6,788 children and adults;⁸ no blood specimens were obtained from persons under 4 years of age. Unfortunately for our purposes, the study findings were presented for the combined age groups 4-9, 10-14, and 15-19, which precludes a more detailed comparison. In each of these age groups, females had consistently though slightly higher serum cholesterol levels than males. The findings were consistent with HANES data with the exception of ages 11-13, in which ages the HANES data showed that boys had higher levels than girls had.

Other studies on children and youths in the United States have also found that girls have higher serum cholesterol levels than boys. In survey data on 1,000 healthy boys and girls in New York City, girls of ages 3-17 have higher serum cholesterol levels than boys of comparable ages.⁹

In a longitudinal study of 152 girls and 169 boys in Utah of single years of age 7 through 17, girls had higher mean serum cholesterol levels than boys.¹⁰

Clarke and others reported serum cholesterol levels on male and female volunteer and non-volunteer subjects of 12-18 years of age who were students attending public and parochial schools in Burlington, Vermont.¹¹ The analysis

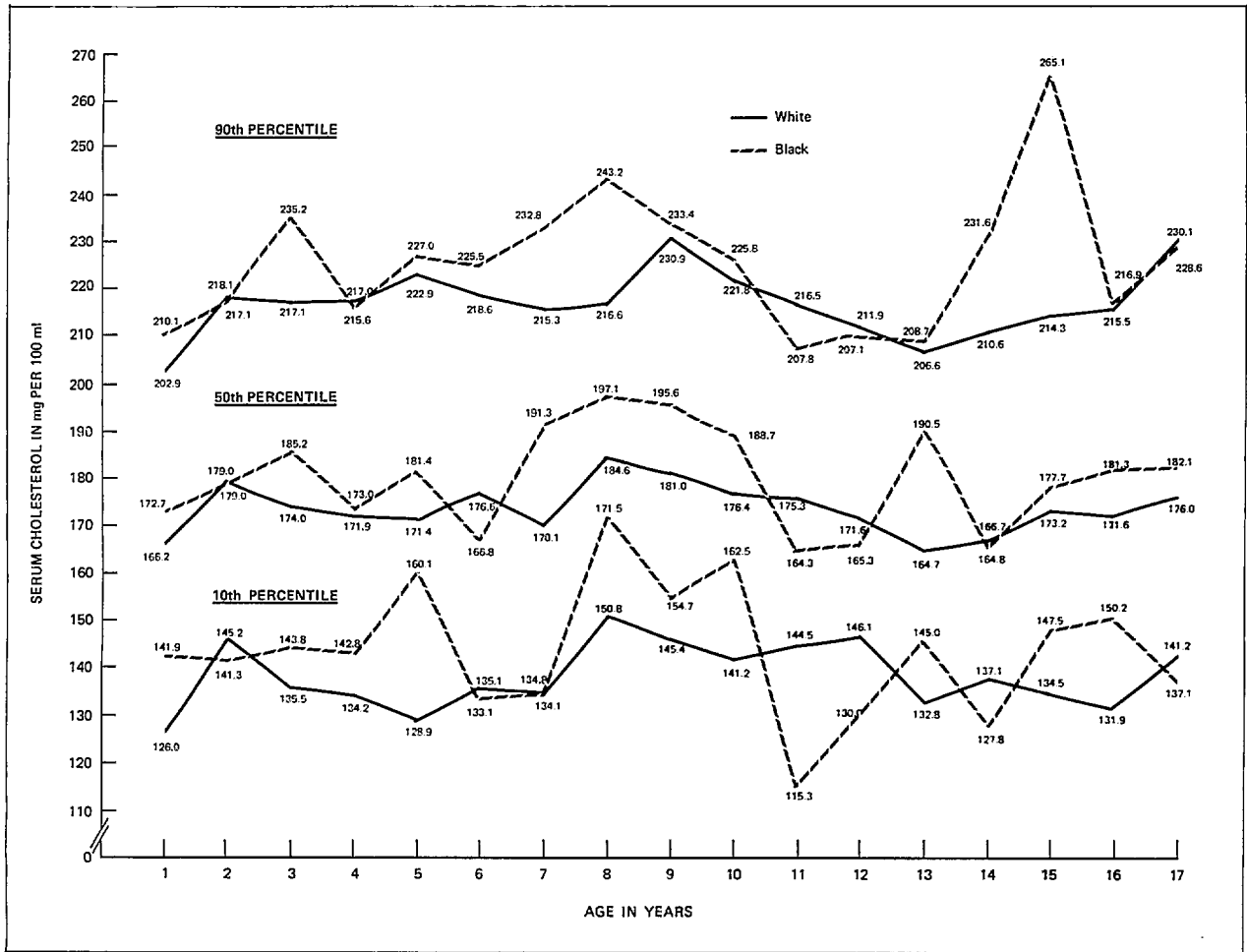


Figure 6. Selected estimated percentiles of the serum cholesterol distribution in white and black girls, by race and age: United States, 1971-74

by single years of age showed that females from age 14 to 18 years had higher mean levels than males of comparable ages. At age 12 males had higher mean levels than females, while at age 13 the corresponding levels were about equal.

The report of serum cholesterol values of youths aged 12-17 years obtained from findings of Cycle III of the Health Examination Survey (HES) showed that except for age 12, female youths in each age group had higher mean serum cholesterol levels than males of comparable ages.¹² However, in studies conducted in Claxton, Georgia, of schoolchildren of single years of age from 6 to 18 years, no consistent

difference in mean serum cholesterol levels between males and females was found.¹³ Similarly in the Muscatine Study conducted in Iowa of children and youths of single years of age from 6 to 18 years, there was little difference between the mean levels of serum cholesterol in males and females.¹⁴

The relationship between serum cholesterol level and age in various children study groups has been reported in the literature, and there appears to be no consistent pattern regarding the relationship in reported studies. The Health Examination Survey¹² showed a decrease in mean serum cholesterol levels among adolescent

males of ages 12-16. This relationship of serum cholesterol levels and age was also observed in a survey among boys of ages 11-18 years conducted in Sydney, Australia.¹⁵ In the New York City survey,⁹ mean serum cholesterol levels among girls did not change significantly from ages 2 through 17, though there appeared to be a slight decrease in the mean level by age. Mean serum cholesterol levels among boys remained relatively constant during comparable ages. The Muscatine, Iowa, Study¹⁴ reported similar mean serum cholesterol levels among children of both sexes of ages 6 through 18. Female adolescents in the Health Examination Survey¹² showed little if any change in mean serum cholesterol levels from ages 12-16. At age 17 there was an increase of 6.4 mg per 100 ml from that observed among females at age 16. In the Utah Study¹⁰ age did not affect mean serum cholesterol levels among both boys and girls of ages 7-17. In the Burlington, Vermont Study¹¹ mean serum cholesterol levels among males decreased

from ages 12 to 14 years and then increased to age 17, while those among females increased from ages 13 to 17.

In the Claxton, Georgia,¹³ and Busselton, Australia,¹⁶ studies among boys and girls of ages 6-17, serum cholesterol levels increased with age.

The U.S. estimates of serum cholesterol levels of children ages 4-17 years can be compared with those reported in HANES for adults of ages 18-74. Table 13 shows the mean serum cholesterol levels of children and adults, obtained in HANES for 1971-74, by age and sex with the standard deviations of the population distribution. Figure 7 shows the adult mean levels as a continuation of the mean levels of those presented for children of individual ages of 4-17 years from HANES.

Males show a mean serum level of 167.5 mg per 100 ml at age 17 after a consistent decline from a mean level of 182.5 mg per 100 ml at age 9. The mean levels for adults in age group 18-24 is 186.9 mg per 100 ml, an increase of 19.4 mg

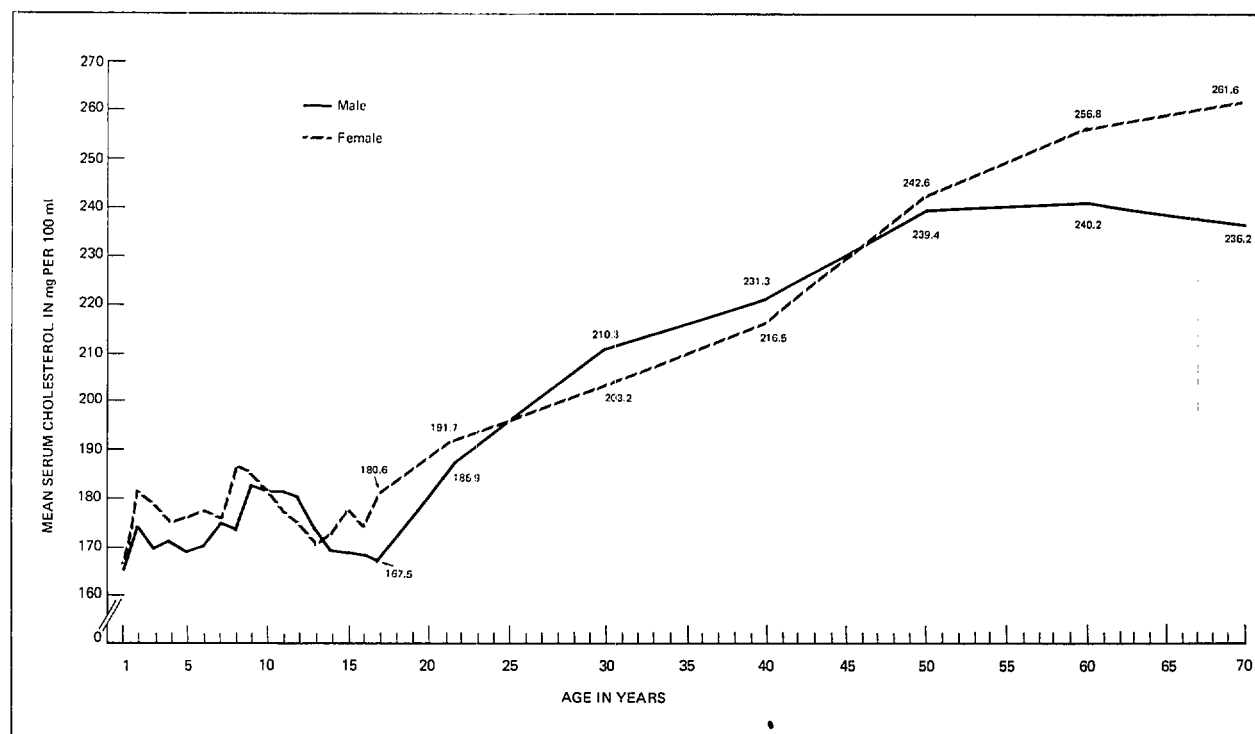


Figure 7. Mean serum cholesterol levels of children aged 1-17 years and adults 18-74 years, by age and sex: United States, 1971-74

per 100 ml, or 11.6 percent from the mean level at age 17. The mean levels for male adults increase rapidly to age group 35-44 years, and then increase less rapidly in the age groups 45-54 and 55-64 years. A slight decline occurs in the age group 65-74 years.

A similar analysis of the mean level at age 17 for girls with that at ages 18-24 years for females also shows a rise in mean levels. The mean level increases to the age group 45-54 years and then increases less rapidly in the later age groups. The rise in mean level among men does not start until the early adult ages, 18-24 years, whereas in women the rise begins earlier.

The mean levels for women are higher than those for men in the youngest age group, 18-24 years. The mean levels for women increase less rapidly than those for men in the age groups 25-34 and 35-44 years but increase much more rapidly than men's levels after age 55. The mean levels for women are about the same as those for men in the age group 45-54 years. The mean levels for men peak at the age group 55-64 years and then decline, while the mean levels for women continue to rise.

The mean levels in adults are consistently higher than those in children of ages 4-17 years. Table 13 also shows that the distributions have greater variability in adults than in children of ages 4-17 years.

Race

Black children of both sexes showed higher mean serum cholesterol levels than white children of comparable age and sex. The differences in mean levels between white and black children are greater for females than for males. The average differences between the mean levels of white and black children over the 14 ages was 7.1 mg per 100 ml for females and 3.8 mg per 100 ml for males.

In the HANES survey of U.S. adults, black females had a slightly but generally higher mean level than white females of comparable age. The average difference over all six age groups in mean levels between white and black females was 2.2 mg per 100 ml. This pattern is not observed between white and black males. Mean

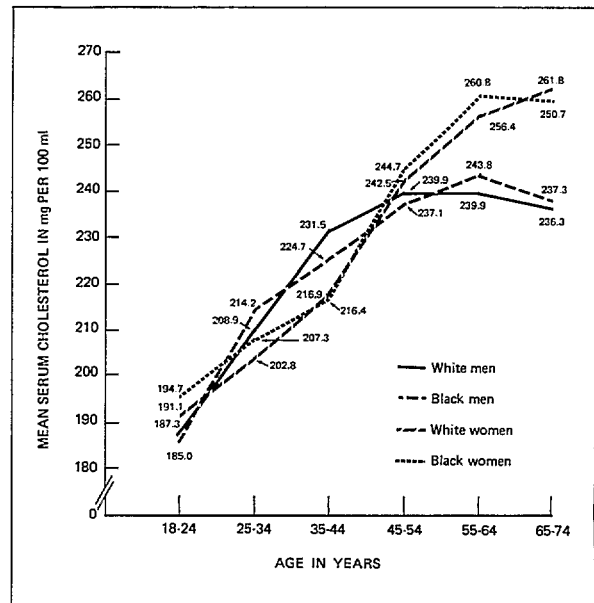


Figure 8. Mean serum cholesterol levels of adults aged 18-74 years, by age and race: United States, 1971-74

serum levels for white males are higher than those for black males in the age groups 18-24, 35-44, 45-54 years. The differences in mean levels range from 2.3 to 6.8 mg per 100 ml. At ages 25-34 and ages 55 years and over, black males have higher mean levels than white males; the differences in mean levels are small and range from 1.0 to 4.3 mg per 100 ml (figure 8).

Other studies have shown racial differences in mean cholesterol levels. A study of serum cholesterol levels in Southwestern and Midwestern American Indians and white persons showed lower cholesterol levels among the Indians.^{17,18} Surveys of children and adolescents among white, Bantu, and Cape colored populations showed findings of higher cholesterol levels in the white children than in either the Bantu or Cape colored children.¹⁹

Prevalence of High Cholesterol Levels

No effort was made to classify serum cholesterol values according to standards. This involves looking at the reference distributions of serum cholesterol levels and considering the proportion of children in any age-sex group which exceeds

some specified level. At present, there is no generally agreed upon point at which levels should be considered "high."

Frederick and associates set the upper limit of normal at the 95th percentile; a serum cholesterol level over 230 mg per 100 ml in children would be abnormal.²⁰ There are others who prefer normal levels based on epidemiological studies rather than on statistical cutoff points. They indicate that the U.S. population generally tend to have elevated serum cholesterol levels and would not use the upper 5 percent of the serum cholesterol distribution. They suggest that the risk of premature coronary artery disease is not likely below the level of 180 and 200 mg per 100 ml in childhood.^{21,22} Kannel and Dawber²³ advocate that infants and children whose plasma cholesterol levels exceed 160 mg per 100 ml should be periodically monitored for blood cholesterol and for diet and weight control.

SUMMARY

Total serum cholesterol findings among children 4-17 years of age in the civilian noninstitutionalized population of the United States as obtained in the Health and Nutrition Examination Survey, 1971-74, are presented and analyzed in this report. Age, sex, and race differences in total serum cholesterol determinations are included.

For HANES, a national probability sample of 6,356 persons was selected to represent 56 million persons in the population aged 4-17 years. Of these 5,355, or 84 percent, were examined.

The present report provides basic data on the distribution of children of ages 4-17 years with respect to total serum cholesterol determinations. These distributions should aid in identifying the proportions of children in any age-sex-race group which exceeds some specified level. Some of these principal findings are summarized below.

For boys of ages 4-8 years, the mean values varied only slightly among the five age groups

within the range of 168.9-175.8 mg per 100 ml. A similar pattern was evident for girls of ages 4 through 7 years; however, the mean values were higher among girls than among boys. After age 9 there was a difference between sexes in regard to the variation of mean levels with age.

Among older boys, mean serum cholesterol levels decreased with age from 182.5 mg per 100 ml at age 9 to 167.5 mg per 100 ml at age 17, a decrease of 8.2 percent.

Among older girls, mean serum cholesterol levels decreased with age from 186.5 mg per 100 ml at age 8 to 170.4 mg per 100 ml at age 13, a decline of 8.6 percent and then increased to 180.6 mg per 100 ml at age 17, an increase of 6.0 percent.

Girls in the U.S. population had higher mean serum cholesterol levels than boys in 10 of the 14 age comparisons. The differences in mean levels between sexes in these ages averaged 4.7 mg per 100 ml and ranged from 0.2 mg per 100 ml to 13.1 mg per 100 ml.

Black boys and girls in the U.S. population had higher mean serum cholesterol levels than their white counterparts. The differences in mean levels between white and black children were greater for girls (7.1 mg per 100 ml) than for boys (3.8 mg per 100 ml).

The mean serum cholesterol level obtained for males of age 17 years is consistent with the finding that serum cholesterol levels rise sharply with age for young men. Similar analysis of the mean cholesterol level for females of age 17 years with those of females aged 18-24 years shows that the mean values rise less rapidly than those of males. The increase in mean cholesterol levels observed in the data for females between the ages of 16 and 17 years is followed by an increase during the age group 18-24 years and a continued rise in serum cholesterol level among females in the age groups 25-34 and 35-44 years. In adult males the rise is not only more rapid but it begins earlier. Not only are the mean serum cholesterol levels higher in adults than in children, but also the distributions have greater variability in adults than in children aged 4-17 years.

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Table 1. Percent distribution of serum cholesterol levels of boys by age: United States, 1971-74

Serum cholesterol level (Mg per 100 ml)	1 year	2 years	3 years	4 years	5 years	6 years	7 years
	Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 100	3.0	1.8	-	1.6	0.4	-	-
100-109	0.8	0.6	0.4	0.7	0.7	-	0.1
110-119	3.8	2.4	2.7	1.1	1.8	0.7	1.3
120-129	5.3	1.8	4.0	3.6	9.0	2.6	1.7
130-139	11.3	5.4	7.6	6.0	6.6	7.5	2.4
140-149	11.3	10.1	10.3	8.7	10.2	9.1	14.0
150-159	12.0	12.5	14.7	10.3	14.9	18.8	8.9
160-169	15.0	14.9	13.8	13.4	13.8	11.8	14.0
170-179	9.0	14.9	12.9	18.4	9.4	21.4	19.2
180-189	8.3	11.3	10.7	15.6	7.7	9.7	9.8
190-199	3.8	7.7	7.6	6.3	6.7	7.5	10.6
200-209	6.8	3.6	4.9	6.3	9.2	7.1	5.1
210-219	1.5	4.8	3.6	3.7	3.5	1.5	4.9
220-229	3.0	2.4	1.8	1.3	2.0	0.6	4.3
230-239	2.3	1.8	2.2	0.9	1.0	0.4	3.5
240-249	0.8	0.6	2.2	2.2	0.9	0.2	-
250-259	1.5	-	0.4	0.1	1.3	-	-
260-269	-	0.6	-	-	0.7	-	0.1
270-279	-	1.2	-	-	-	-	-
280-289	-	-	-	-	-	-	-
290-299	-	-	-	-	-	-	-
300 or more	0.8	1.8	-	-	0.5	1.2	0.2
	Number						
Number of boys examined	133	168	224	304	273	179	164
Estimated boys in population in thousands	(¹)	(¹)	(¹)	1,815	1,563	1,673	1,979

¹U.S. population estimates not included because of possible bias due to missing values.

NOTE: Percents may not add to 100.0 due to rounding.

Table 1. Percent distribution of serum cholesterol levels of boys by age: United States, 1971-74—Con.

8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
Percent distribution—Con.									
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-	-	-	-	0.2	0.2	0.3	0.3	-	-
1.8	0.6	-	-	1.9	1.0	3.0	0.2	-	0.1
1.4	-	0.5	0.5	-	0.3	1.9	2.7	0.2	2.3
3.0	2.3	2.1	1.9	1.0	6.1	5.3	3.9	2.8	5.1
4.8	6.4	1.4	7.3	4.4	9.2	12.2	8.5	13.2	10.9
5.4	7.1	4.8	9.4	9.5	11.3	9.3	9.1	17.3	15.9
12.4	10.8	9.7	8.8	10.1	14.8	11.5	15.5	9.9	10.0
20.3	8.1	14.0	8.6	16.9	10.3	12.4	17.2	12.4	12.3
13.3	12.4	19.2	14.2	10.1	10.5	8.3	11.7	17.4	9.5
12.5	14.6	12.8	11.2	13.3	10.7	13.3	13.4	5.1	9.9
10.1	12.5	13.9	8.2	11.4	3.4	5.1	6.9	9.8	4.4
3.3	13.8	7.7	8.7	5.9	7.6	5.6	4.4	1.6	6.3
7.0	3.9	6.2	6.3	4.7	6.0	3.2	1.0	2.1	7.6
2.3	2.2	3.0	8.7	4.8	3.4	2.6	0.7	3.3	0.7
2.2	0.2	2.9	2.8	1.6	1.1	1.5	0.4	0.7	3.1
0.3	0.1	1.8	1.0	0.4	2.0	1.7	1.8	3.3	0.9
-	-	-	0.9	1.8	0.2	1.3	0.8	0.7	-
0.4	1.5	0.1	-	0.1	-	0.1	-	-	-
-	0.1	-	0.7	0.4	-	0.2	0.6	0.3	-
-	0.7	-	0.7	-	-	-	-	-	-
-	1.4	-	-	-	-	0.7	-	-	-
-	1.3	-	-	1.3	2.2	0.6	1.0	-	-
Number—Con.									
152	169	184	178	200	174	174	171	169	176
1,861	2,019	2,205	2,177	2,304	1,978	2,030	2,093	2,019	2,094

Table 2. Percent distribution of serum cholesterol levels of girls by age: United States, 1971-74

Serum cholesterol level (Mg per 100 ml)	1	2	3	4	5	6	7
	year	years	years	years	years	years	years
	Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 100.....	1.8	-	0.5	1.3	-	2.0	0.3
100-109.....	0.9	0.6	0.5	0.4	1.1	-	0.2
110-119.....	1.8	0.6	1.0	0.3	3.0	0.8	-
120-129.....	6.4	3.8	2.9	1.8	4.9	4.0	3.8
130-139.....	8.3	0.6	6.4	11.2	6.4	7.4	10.9
140-149.....	11.0	6.3	7.8	7.2	7.5	7.0	9.8
150-159.....	9.2	13.3	8.3	7.1	9.0	9.4	8.9
160-169.....	9.2	10.8	14.7	18.0	12.6	8.2	10.9
170-179.....	17.4	13.9	12.3	9.8	14.2	17.8	14.3
180-189.....	11.0	16.5	13.2	12.8	14.4	10.1	10.9
190-199.....	11.0	7.6	10.8	7.7	6.4	5.4	9.1
200-209.....	5.5	12.0	6.4	9.5	4.2	11.3	6.1
210-219.....	2.8	4.4	4.4	3.9	2.8	5.3	5.8
220-229.....	1.8	4.4	4.4	5.9	7.5	7.0	0.9
230-239.....	1.8	1.9	1.5	1.0	0.6	3.4	3.8
240-249.....	-	-	2.0	1.9	1.0	0.9	2.1
250-259.....	-	0.6	1.5	0.1	0.5	-	-
260-269.....	-	1.3	-	-	2.1	-	1.4
270-279.....	-	0.6	-	0.3	0.7	-	0.3
280-289.....	-	-	0.5	-	0.6	-	0.3
290-299.....	-	-	0.5	-	0.6	-	-
300 or more	-	0.6	0.5	-	0.1	-	0.2
	Number						
Number of examined girls	109	158	204	281	314	176	169
Estimated number of girls in population in thousands	(1)	(1)	(1)	1,599	1,695	1,787	1,754

¹U.S. population estimates not included because of possible bias due to missing values.

NOTE: Percents may not add to 100.0 due to rounding.

Table 2. Percent distribution of serum cholesterol levels of girls by age: United States, 1971-74—Con.

8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
Percent distribution—Con.									
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-	-	2.8	1.5	0.1	-	-	-	-	-
1.4	-	-	-	-	1.4	0.6	-	0.8	-
1.0	2.7	0.8	3.1	2.1	3.3	3.0	0.9	5.9	1.8
1.8	0.9	2.0	1.4	1.0	2.1	3.5	3.6	2.5	0.8
1.9	1.2	2.0	4.6	3.0	6.7	3.7	8.6	2.9	6.4
2.0	7.6	9.8	5.7	10.5	13.0	10.8	10.3	13.6	9.8
9.0	10.3	5.3	12.4	10.4	13.4	18.6	6.6	5.0	12.4
11.5	10.4	10.6	17.1	23.4	13.8	12.4	12.4	16.2	11.1
15.1	13.5	19.7	10.9	10.5	12.3	11.4	14.5	13.1	11.0
7.4	12.5	12.3	10.0	9.3	10.6	6.5	16.3	11.5	13.9
18.7	9.2	10.0	9.6	8.5	9.2	11.5	4.8	8.7	8.8
9.9	12.5	6.7	11.4	10.6	5.3	6.0	4.8	6.0	6.0
8.9	3.3	6.0	3.7	5.6	3.5	3.0	6.7	6.3	4.9
2.7	4.5	6.1	1.3	2.3	2.6	4.0	4.4	2.1	3.3
4.1	5.0	1.8	2.5	0.2	0.3	2.4	1.4	0.3	1.3
1.6	3.0	1.1	2.8	-	0.2	1.2	-	2.0	3.9
1.6	1.0	0.2	-	2.3	0.4	-	-	2.4	0.2
-	0.2	-	1.4	-	0.6	0.8	1.5	0.6	2.5
0.4	0.9	0.9	0.4	0.2	0.1	0.2	0.1	-	0.2
1.1	-	0.8	0.1	-	-	-	-	-	1.1
-	1.2	-	0.2	-	0.5	0.7	3.0	-	-
-	-	1.3	-	-	0.7	-	-	0.2	0.7
Number—Con.									
152	171	197	166	177	198	184	171	175	157
1,799	2,017	2,173	1,911	1,812	2,175	2,036	2,163	2,144	1,804

Table 3. Serum cholesterol levels of boys 1-17 years of age, mean age, number examined, estimated number in the population, mean, standard deviation, standard error of the mean, and selected percentiles, by age: United States, 1971-74

Age	Mean age	n	N	Mean	Standard deviation	Standard error of the mean	Percentile						
							5	10	25	50	75	90	95
1 year.....	1.56	133	(¹)	165.0	37.8	(¹)	108.4	122.9	140.8	162.1	185.8	215.0	231.8
2 years	2.47	168	(¹)	174.2	38.9	(¹)	120.6	133.9	151.0	169.9	190.7	216.2	235.2
3 years	3.49	224	(¹)	169.7	29.9	(¹)	123.1	131.3	147.8	167.3	188.8	211.6	228.0
4 years	4.52	304	1,815	171.3	28.7	1.97	124.3	134.7	153.0	172.3	186.6	206.5	217.8
5 years	5.51	273	1,563	168.9	35.8	2.66	122.1	127.2	145.8	164.2	190.9	208.8	225.8
6 years	6.48	179	1,673	170.1	26.8	2.07	132.1	138.1	152.5	168.6	182.9	201.2	207.6
7 years	7.47	164	1,979	175.8	28.1	4.45	136.7	142.8	155.5	173.6	193.1	215.5	226.5
8 years	8.44	152	1,861	173.4	27.6	2.63	125.7	137.4	156.4	170.8	190.4	212.6	220.2
9 years	9.48	169	2,019	182.5	36.6	3.43	133.0	141.0	157.2	181.4	200.2	213.5	260.8
10 years	10.48	184	2,205	181.4	25.4	2.43	142.0	151.2	164.2	178.3	196.8	215.8	228.5
11 years	11.46	178	2,177	181.4	32.4	3.16	133.2	140.3	156.0	178.5	205.0	224.9	223.4
12 years	12.54	200	2,304	179.9	37.0	3.95	133.8	142.3	157.1	175.3	196.0	221.1	234.1
13 years	13.49	174	1,978	173.3	40.4	4.45	125.3	132.5	146.7	166.4	192.3	217.3	233.6
14 years	14.47	174	2,030	169.1	36.8	2.80	118.3	128.3	142.4	164.8	187.4	215.3	236.7
15 years	15.46	171	2,093	168.8	33.9	3.08	124.0	133.1	150.2	165.2	184.0	201.3	223.7
16 years	16.49	169	2,019	168.6	29.3	2.89	132.0	134.8	144.6	164.8	183.3	211.6	228.9
17 years	17.48	176	2,094	167.5	30.9	3.18	123.0	131.3	143.2	163.5	187.2	212.8	218.8

¹Variances for means and U.S. population estimates not included because of possible bias due to missing values.

NOTE: n = examined boys; N = estimated population in thousands.

Table 4. Serum cholesterol levels of girls 1-17 years of age, mean age, number examined, estimated number in the population, mean, standard deviation, standard error of the mean, and selected percentiles, by age: United States, 1971-74

Age	Mean age	n	N	Mean	Standard deviation	Standard error of the mean	Percentile						
							5	10	25	50	75	90	95
1 year.....	1.54	109	(¹)	166.3	29.5	(¹)	120.5	127.0	145.4	167.5	187.7	204.4	215.9
2 years.....	2.45	158	(¹)	181.4	33.9	(¹)	136.0	144.2	158.7	179.0	201.1	218.4	233.5
3 years.....	3.51	204	(¹)	178.4	35.2	(¹)	126.2	136.4	156.1	175.9	196.3	222.5	238.7
4 years.....	4.53	281	1,599	174.7	31.7	3.52	131.1	135.1	153.7	172.6	196.1	217.0	226.3
5 years.....	5.52	314	1,695	176.0	36.1	2.80	121.7	131.5	152.2	173.6	192.9	224.4	245.1
6 years.....	6.50	176	1,787	177.1	32.5	3.93	124.9	133.8	153.6	175.6	202.3	221.7	228.1
7 years.....	7.55	169	1,754	175.0	33.4	2.95	130.6	134.8	150.1	173.3	195.0	217.6	237.5
8 years.....	8.47	152	1,799	186.5	31.2	3.14	133.7	151.9	166.2	187.7	204.7	224.7	238.3
9 years.....	9.49	171	2,017	185.2	33.8	3.00	140.2	146.1	161.9	182.4	204.8	232.4	243.9
10 years.....	10.47	197	2,173	181.6	38.2	4.24	126.3	142.2	162.0	177.6	198.8	223.1	235.2
11 years.....	11.55	166	1,911	176.8	33.0	3.49	122.9	138.0	156.4	173.5	197.9	215.8	238.7
12 years.....	12.50	177	1,812	175.0	27.9	3.51	135.3	143.2	157.2	168.8	194.9	210.8	218.9
13 years.....	13.51	198	2,175	170.4	35.2	3.16	121.2	134.2	147.9	166.6	187.7	207.1	221.2
14 years.....	14.47	184	2,036	172.8	32.4	2.82	123.6	137.1	151.7	167.2	193.6	216.5	230.7
15 years.....	15.47	171	2,163	177.8	35.9	4.12	130.5	135.8	152.2	174.8	193.4	221.0	236.9
16 years.....	16.55	175	2,144	174.0	34.3	3.04	116.5	132.6	148.6	172.2	193.7	215.6	241.0
17 years.....	17.47	157	1,804	180.6	35.7	3.44	133.4	140.9	154.5	176.4	198.1	228.8	248.4

¹Variances for means and U.S. population estimates not included because of possible bias due to missing values.

NOTE: n = examined girls; N = estimated population in thousands.

Table 5. Percent distribution of serum cholesterol levels of white boys by age: United States, 1971-74

Serum cholesterol level (Mg per 100 ml)	1 year	2 years	3 years	4 years	5 years	6 years	7 years
	Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 100.....	4.1	1.6	-	1.8	0.5	-	-
100-109.....	1.0	-	0.6	0.8	0.8	-	-
110-119.....	2.1	2.4	2.9	1.1	1.2	0.7	1.5
120-129.....	5.2	2.4	4.1	3.5	9.4	2.9	1.8
130-139.....	15.5	4.0	8.2	7.0	6.8	7.1	2.8
140-149.....	11.3	9.7	10.0	8.4	10.3	9.2	14.9
150-159.....	9.3	14.5	12.9	8.4	14.9	21.2	9.2
160-169.....	11.3	15.3	16.5	14.3	15.2	13.0	13.3
170-179.....	10.3	12.9	12.9	20.2	8.9	21.7	19.5
180-189.....	8.2	12.9	10.6	15.4	8.3	8.6	9.2
190-199.....	4.1	6.5	7.1	6.4	6.9	8.0	9.9
200-209.....	7.2	4.0	5.3	6.0	8.1	4.1	5.4
210-219.....	1.0	4.8	4.1	2.4	3.4	0.9	5.4
220-229.....	3.1	2.4	1.8	1.5	1.6	0.8	3.9
230-239.....	3.1	2.4	2.4	0.8	0.7	0.4	3.1
240-249.....	1.0	0.8	-	2.3	0.4	-	-
250-259.....	1.0	-	0.6	-	1.5	-	-
260-269.....	-	-	-	-	0.8	-	0.1
270-279.....	-	0.8	-	-	-	-	-
280-289.....	-	-	-	-	-	-	-
290-299.....	-	-	-	-	-	-	-
300 or more	1.0	2.4	-	-	0.6	1.5	-
	Number						
Number of examined white boys	97	124	170	229	207	126	125
Estimated number of white boys in population in thousands	(¹)	(¹)	(1)	1,547	1,319	1,343	1,718

¹U.S. population estimates not included because of possible bias due to missing values.

NOTE: Percents may not add to 100.0 due to rounding.

Table 5. Percent distribution of serum cholesterol levels of white boys by age: United States, 1971-74—Con.

8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
Percent distribution—Con.									
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-	-	-	-	0.2	-	-	0.2	-	-
2.0	0.8	-	-	1.6	0.9	3.5	-	-	1.1
1.3	-	0.2	0.6	-	0.3	2.2	2.8	0.2	2.7
3.4	2.5	2.2	1.9	0.8	6.9	5.0	3.7	3.0	4.6
5.5	7.4	1.6	7.2	5.0	8.2	9.6	10.0	13.1	11.7
5.9	6.1	3.5	9.1	9.4	10.5	9.3	9.4	19.2	16.5
11.5	10.7	7.4	9.5	10.0	14.0	11.3	16.6	10.9	10.7
20.7	9.0	14.4	9.2	18.1	9.9	12.7	15.3	11.0	10.5
14.0	10.0	20.5	14.4	11.5	10.5	9.3	11.5	17.7	10.1
13.2	16.0	14.3	10.5	13.0	11.6	15.2	15.4	4.9	9.6
11.2	12.5	13.5	7.7	11.2	3.5	4.3	5.3	9.9	4.6
-	12.5	7.4	8.9	5.2	8.0	6.0	4.9	-	5.5
7.5	4.8	6.7	7.2	4.8	7.0	3.6	1.0	2.0	7.9
2.4	2.3	2.9	7.5	3.4	3.8	1.7	0.7	3.0	0.4
1.2	0.3	3.3	3.3	1.6	1.2	1.8	0.5	0.5	3.4
0.3	-	2.1	1.2	0.5	1.3	2.0	1.2	3.8	0.7
-	-	-	1.1	2.1	0.3	1.4	0.9	0.8	-
-	1.9	0.1	-	-	-	0.1	-	-	-
-	0.2	-	0.8	-	-	-	0.7	-	-
-	0.9	-	-	-	-	-	-	-	-
-	1.8	-	-	-	-	0.8	-	-	-
-	0.3	-	-	1.6	2.0	0.2	-	-	-
Number—Con.									
116	117	148	132	152	129	134	124	128	139
1,644	1,636	1,909	1,823	1,970	1,697	1,730	1,728	1,752	1,831

Table 6. Percent distribution of serum cholesterol levels of black boys by age: United States, 1971-74

Serum cholesterol level (Mg per 100 ml)	1 year	2 years	3 years	4 years	5 years	6 years	7 years
	Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 100	-	-	-	-	-	-	-
100-109	-	2.4	-	1.5	-	-	0.9
110-119	8.3	2.4	2.1	0.7	5.7	0.7	-
120-129	5.6	-	2.1	4.1	7.1	1.7	1.4
130-139	-	7.1	4.2	-	6.1	9.6	-
140-149	11.1	11.9	10.4	11.0	5.8	8.9	5.1
150-159	19.4	7.1	16.7	23.3	16.1	6.4	7.0
160-169	25.0	14.3	6.3	7.5	5.7	7.3	18.7
170-179	5.6	21.4	14.6	7.2	13.1	21.1	17.6
180-189	8.3	7.1	12.5	14.1	3.8	14.1	13.9
190-199	2.8	11.9	10.4	5.2	6.0	5.4	15.6
200-209	5.6	2.4	4.2	8.7	17.5	19.8	2.9
210-219	2.8	4.8	2.1	12.5	0.8	4.2	1.9
220-229	2.8	2.4	2.1	-	4.6	-	7.0
230-239	-	-	2.1	2.0	3.2	-	6.7
240-249	-	-	10.4	1.7	4.2	0.8	-
250-259	2.8	-	-	0.5	-	-	-
260-269	-	2.4	-	-	-	-	-
270-279	-	2.4	-	-	-	-	-
280-289	-	-	-	-	-	-	-
290-299	-	-	-	-	-	-	-
300 or more	-	-	-	-	-	-	1.4
	Number						
Number of examined black boys	36	42	48	74	64	52	38
Estimated number of black boys in population in thousands	(1)	(1)	(1)	260	226	321	253

¹U.S. population estimates not included because of possible bias due to missing values.

NOTE: Percents may not add to 100.0 due to rounding.

Table 6. Percent distribution of serum cholesterol levels of black boys by age: United States, 1971-74—Con.

8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
Percent distribution—Con.									
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-	-	-	-	-	1.1	1.9	1.1	-	-
-	-	-	-	4.1	1.1	-	1.5	-	-
2.1	-	2.7	-	-	-	-	2.7	-	-
-	1.4	1.8	2.3	2.2	1.5	7.6	4.4	1.4	9.8
-	2.1	-	9.1	0.9	15.3	29.0	0.9	13.4	5.9
1.9	10.9	8.1	13.0	10.3	15.5	9.3	4.5	4.5	12.1
19.0	11.2	29.7	0.8	11.7	19.5	13.7	11.6	2.5	5.3
16.0	4.4	8.1	6.0	10.3	12.7	11.1	31.6	22.1	17.3
8.5	21.8	12.5	8.6	1.8	10.4	2.6	15.4	15.0	6.3
8.1	10.2	3.8	17.5	16.0	4.7	2.5	3.7	6.3	13.5
2.2	12.3	14.5	12.5	7.9	2.8	10.3	12.2	8.9	3.3
28.3	18.9	11.2	8.5	10.6	5.4	3.4	2.1	13.0	13.2
3.7	-	3.5	1.9	4.5	-	1.1	0.9	2.9	5.6
1.1	1.7	4.2	15.0	13.8	0.9	1.5	1.1	5.6	3.4
6.1	-	-	-	2.0	-	-	-	2.2	1.3
-	0.6	-	-	-	6.1	-	5.5	-	2.9
-	-	-	-	-	-	1.1	0.8	-	-
3.0	-	-	-	1.0	-	-	-	-	-
-	-	-	-	3.0	-	1.6	-	2.3	-
-	-	-	4.9	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	5.5	-	-	-	2.9	3.1	-	-	-
Number—Con.									
33	52	33	43	47	45	39	43	41	35
203	383	251	313	316	281	282	310	267	235

Table 7. Percent distribution of serum cholesterol levels of white girls by age: United States, 1971-74

Serum cholesterol level (Mg per 100 ml)	1 year	2 years	3 years	4 years	5 years	6 years	7 years
	Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 100.....	2.5	-	0.6	1.5	-	2.5	-
100-109.....	-	-	0.6	0.4	1.4	-	0.3
110-119.....	2.5	0.8	1.3	0.3	2.9	0.8	-
120-129.....	7.4	4.2	3.2	2.1	5.8	4.5	3.4
130-139.....	8.6	-	5.8	12.2	7.4	3.9	11.9
140-149.....	11.1	4.2	9.1	7.0	8.1	5.5	11.4
150-159.....	9.9	14.2	9.1	8.2	10.5	9.7	10.0
160-169.....	9.9	10.0	16.2	16.4	12.2	8.2	13.0
170-179.....	14.8	16.7	11.0	9.1	12.2	20.5	15.0
180-189.....	12.3	16.7	12.3	12.3	14.5	12.2	9.3
190-199.....	9.9	7.5	12.3	8.9	6.9	4.3	6.0
200-209.....	3.7	12.5	5.2	10.1	3.6	11.5	6.0
210-219.....	3.7	4.2	3.9	2.1	2.8	6.7	6.4
220-229.....	1.2	3.3	3.2	5.9	5.7	5.6	-
230-239.....	2.5	2.5	1.9	1.2	0.4	4.1	2.9
240-249.....	-	-	1.9	2.0	1.2	-	2.5
250-259.....	-	0.8	0.6	0.1	0.6	-	-
260-269.....	-	1.7	-	-	2.6	-	1.1
270-279.....	-	0.8	-	0.3	0.6	-	0.3
280-289.....	-	-	-	-	0.7	-	0.4
290-299.....	-	-	0.6	-	-	-	-
300 or more	-	-	0.6	-	-	-	0.2
	Number						
Number of examined white girls	81	120	154	204	224	125	122
Estimated number of white girls in population in thousands	(1)	(1)	(1)	1,339	1,416	1,445	1,507

¹U.S. population estimates not included because of possible bias due to missing values.

NOTE: Percents may not add to 100.0 due to rounding.

Table 7. Percent distribution of serum cholesterol levels of white girls by age: United States, 1971-74—Con.

8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
Percent distribution—Con.									
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-	-	3.3	1.8	-	-	-	-	-	-
1.7	-	-	-	-	1.6	0.7	-	0.6	-
1.1	3.1	1.0	0.4	1.0	3.8	2.4	1.1	6.2	1.8
2.1	1.0	2.3	0.3	1.0	2.2	3.7	3.9	2.5	0.9
1.8	0.9	2.1	4.2	1.5	7.4	4.1	10.2	3.2	5.9
2.3	8.4	11.1	6.6	9.6	13.1	11.3	10.7	14.7	10.9
10.3	10.9	5.6	13.5	10.6	14.7	18.3	7.5	5.1	13.0
13.2	11.3	10.9	16.4	24.7	13.7	12.7	12.6	15.4	9.9
13.8	13.0	19.7	11.7	9.4	13.3	11.8	11.4	13.2	11.5
7.2	13.6	11.5	9.8	10.1	11.2	6.4	19.3	11.1	13.8
19.2	8.7	9.2	10.8	10.2	5.5	12.6	5.1	9.1	8.1
10.9	11.2	5.7	11.3	10.6	4.8	5.8	4.7	5.3	6.4
8.8	3.1	6.9	4.5	5.9	4.1	3.5	7.5	6.1	4.5
1.5	4.6	4.5	1.5	2.6	2.1	3.9	1.8	2.3	3.4
3.1	4.1	2.1	2.9	-	0.3	0.7	1.7	0.3	1.5
-	2.8	0.9	1.9	-	0.2	1.4	-	1.7	4.0
1.3	1.0	-	-	2.8	-	-	-	2.4	-
-	-	-	1.7	-	0.4	-	-	0.7	2.7
0.4	1.0	1.1	0.5	-	0.1	-	-	-	-
1.3	-	0.9	-	-	-	-	-	-	1.0
-	1.4	-	0.3	-	0.6	0.8	2.6	-	-
-	-	1.5	-	-	0.8	-	-	0.2	0.8
Number—Con.									
117	129	148	122	128	153	132	125	141	116
1,507	1,751	1,855	1,569	1,506	1,886	1,731	1,752	1,933	1,524

Table 8. Percent distribution of serum cholesterol levels of black girls by age: United States, 1971-74

Serum cholesterol level (Mg per 100 ml)	1 year	2 years	3 years	4 years	5 years	6 years	7 years
	Percent distribution						
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 100	-	-	-	-	-	-	1.7
100-109.....	-	2.8	-	-	-	-	-
110-119.....	-	-	-	-	3.5	1.0	-
120-129.....	4.2	2.8	-	7.3	0.4	2.5	5.8
130-139.....	4.2	2.8	8.3	8.7	1.7	19.0	5.5
140-149.....	8.3	13.9	2.1	2.1	1.9	12.9	1.6
150-159.....	8.3	11.1	6.3	27.3	2.3	8.4	3.7
160-169.....	8.3	11.1	10.4	14.3	13.5	8.4	-
170-179.....	29.2	5.6	16.7	13.7	24.5	7.8	11.0
180-189.....	4.2	16.7	16.7	1.5	14.9	2.2	17.1
190-199.....	16.7	8.3	6.3	6.7	4.2	9.7	26.0
200-209.....	12.5	11.1	10.4	13.6	7.1	10.9	6.9
210-219.....	-	5.6	6.3	4.9	3.2	-	2.3
220-229.....	4.2	5.6	8.3	-	16.5	12.0	5.8
230-239.....	-	-	-	-	1.4	1.1	9.0
240-249.....	-	-	2.1	-	-	4.3	0.8
250-259.....	-	-	4.2	-	-	-	-
260-269.....	-	-	-	-	-	-	3.0
270-279.....	-	-	-	-	1.0	-	-
280-289.....	-	-	2.1	-	-	-	-
290-299.....	-	-	-	-	3.7	-	-
300 or more	-	2.8	-	-	0.3	-	-
	Number						
Number of examined black girls	24	36	48	73	88	50	46
Estimated number of black girls in population in thousands	(¹)	(¹)	(¹)	246	265	336	241

¹U.S. population estimates not included because of possible bias due to missing values.

NOTE: Percents may not add to 100.0 due to rounding.

Table 8. Percent distribution of serum cholesterol levels of black girls by age: United States, 1971-74—Con.

8 years	9 years	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
Percent distribution—Con.									
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-	-	-	-	0.9	-	-	-	-	-
-	-	-	-	-	-	-	-	2.5	-
-	-	-	17.1	7.6	-	7.5	-	2.7	2.0
-	-	-	7.3	1.5	1.4	2.9	2.4	2.6	-
2.6	3.8	1.7	6.8	10.5	2.1	1.7	0.1	-	10.1
-	2.6	1.9	1.4	8.3	11.9	8.9	8.0	2.2	3.1
1.7	6.9	3.9	8.2	10.2	5.6	22.7	2.3	3.3	9.3
1.9	4.6	9.2	19.7	18.9	14.6	12.1	11.1	22.7	19.9
22.6	18.8	16.1	7.6	16.8	6.0	10.8	29.6	11.7	2.0
8.5	5.1	17.9	11.8	6.2	6.8	2.7	1.8	16.8	15.6
16.0	13.3	15.2	4.2	-	33.1	6.4	3.6	3.8	13.8
4.7	24.4	13.5	7.0	11.8	8.9	7.9	5.4	14.3	3.9
9.6	4.9	-	-	4.4	-	0.8	3.0	9.7	7.3
9.2	3.8	16.8	-	1.0	5.3	5.2	17.0	-	3.3
9.5	4.9	-	0.7	1.2	-	3.5	-	-	-
10.4	4.4	2.6	7.6	-	-	-	-	5.8	3.3
3.3	1.0	1.4	-	-	2.6	-	-	2.0	1.7
-	1.6	-	-	-	1.9	6.0	8.8	-	1.4
-	-	-	-	1.0	-	1.2	0.8	-	1.7
-	-	-	0.8	-	-	-	-	-	1.7
-	-	-	-	-	-	-	5.3	-	-
-	-	-	-	-	-	-	-	-	-
Number—Con.									
35	41	48	42	47	44	50	46	33	40
293	247	303	315	284	287	265	411	203	263

Table 9. Serum cholesterol levels of white boys 1-17 years of age, mean age, number examined, estimated number in the population, mean, standard deviation, standard error of the mean, and selected percentiles, by age: United States, 1971-74

Age	Mean age	n	N	Mean	Standard deviation	Standard error of the mean	Percentile						
							5	10	25	50	75	90	95
1 year.....	1.57	97	(¹)	165.0	40.3	(¹)	105.4	122.6	136.4	161.4	187.5	217.3	233.1
2 years.....	2.48	124	(¹)	175.5	40.3	(¹)	122.9	137.6	151.4	170.3	191.9	215.6	235.2
3 years.....	3.49	170	(¹)	168.0	28.6	(¹)	122.3	130.0	147.6	167.2	187.3	208.3	218.4
4 years.....	4.52	229	1,547	170.5	28.4	2.27	123.9	133.9	152.9	172.2	185.7	204.5	217.4
5 years.....	5.52	207	1,319	168.0	35.7	2.69	122.5	127.3	145.6	163.7	187.7	207.7	222.7
6 years.....	6.46	126	1,343	168.7	26.9	2.41	131.9	138.2	152.2	166.3	178.7	196.4	206.0
7 years.....	7.48	125	1,718	174.5	27.6	4.64	135.3	142.3	153.8	173.0	192.5	214.0	224.7
8 years.....	8.45	116	1,644	171.5	26.8	3.15	124.5	135.5	155.5	169.0	187.4	211.7	217.7
9 years.....	9.46	117	1,636	182.0	35.9	4.07	132.1	138.2	156.9	181.9	199.0	214.5	260.2
10 years.....	10.47	148	1,909	182.9	25.1	2.57	142.7	153.1	166.3	180.2	197.3	216.8	231.4
11 years.....	11.45	132	1,823	180.8	31.7	3.49	133.2	140.5	156.1	177.9	205.1	224.7	233.8
12 years.....	12.54	152	1,970	179.0	37.2	4.34	134.2	142.2	157.1	173.8	194.3	217.5	234.3
13 years.....	13.50	129	1,697	174.3	40.2	5.14	124.9	132.1	147.4	168.3	195.5	217.3	228.7
14 years.....	14.48	134	1,730	169.6	35.8	3.17	116.1	127.8	144.6	166.4	187.2	213.9	236.3
15 years.....	15.46	124	1,728	166.3	28.1	2.70	124.4	133.0	148.0	164.3	183.2	198.6	208.8
16 years.....	16.48	128	1,752	167.2	28.8	3.28	131.2	134.7	144.1	162.9	178.9	210.0	230.9
17 years.....	17.47	139	1,831	166.9	30.8	3.61	122.4	131.2	142.7	162.3	186.7	212.8	218.5

¹Variances for means and U.S. population estimates not included because of possible bias due to missing values.

NOTE: n = examined white boys; N = estimated population in thousands.

Table 10. Serum cholesterol levels of black boys 1-17 years of age, mean age, number examined, estimated number in the population, mean, standard deviation, standard error of the mean, and selected percentiles, by age: United States, 1971-74

Age	Mean age	n	N	Mean	Standard deviation	Standard error of the mean	Percentile						
							5	10	25	50	75	90	95
1 year.....	1.54	36	(¹)	165.1	30.5	(¹)	111.4	125.7	146.9	163.5	179.0	208.9	223.8
2 years.....	2.41	42	(¹)	173.1	33.4	(¹)	120.6	133.9	153.1	170.1	188.3	211.4	237.1
3 years.....	3.49	48	(¹)	178.6	33.1	(¹)	128.9	141.2	151.7	173.3	195.6	240.8	249.9
4 years.....	4.50	74	260	175.6	30.5	5.50	126.3	143.1	153.0	172.4	200.5	214.9	218.5
5 years.....	5.49	64	226	174.3	36.2	8.84	117.6	125.2	150.1	172.3	202.7	223.9	236.6
6 years.....	6.54	52	321	176.3	25.7	5.15	132.5	137.2	155.9	176.6	198.7	206.7	210.0
7 years.....	7.39	38	253	185.1	29.9	6.21	144.8	153.3	165.1	178.7	196.0	226.6	234.2
8 years.....	8.42	33	203	186.0	28.5	4.97	150.5	152.8	161.1	182.7	205.8	221.7	236.1
9 years.....	9.53	52	383	184.5	39.1	6.89	141.2	145.4	158.5	178.2	200.8	208.0	354.9
10 years.....	10.60	33	251	172.0	25.2	5.59	140.6	146.2	153.8	168.6	195.2	207.2	217.1
11 years.....	11.53	43	313	185.7	36.9	8.04	132.4	136.9	148.9	185.0	205.3	225.9	228.9
12 years.....	12.58	47	316	184.1	36.1	6.61	123.9	142.5	155.8	185.0	208.5	226.4	234.6
13 years.....	13.41	45	281	167.2	41.1	7.90	130.7	133.7	143.4	157.1	177.1	208.7	245.8
14 years.....	14.45	39	282	161.8	40.7	8.66	123.6	130.1	134.8	151.4	178.0	204.9	256.4
15 years.....	15.50	43	310	169.7	29.4	3.49	118.2	133.6	157.7	166.7	183.3	201.8	242.1
16 years.....	16.55	41	267	178.7	30.7	5.62	132.5	135.8	161.3	173.7	200.7	220.1	228.2
17 years.....	17.56	35	235	173.8	32.2	7.92	124.6	130.3	146.9	168.8	201.0	215.2	226.9

¹Variances for means and U.S. population estimates not included because of possible bias due to missing values.

NOTE: n = examined black boys; N = estimated population in thousands.

Table 11. Serum cholesterol levels of white girls 1-17 years of age, mean age, number examined, estimated number in the population, mean, standard deviation, standard error of the mean, and selected percentiles, by age: United States, 1971-74

Age	Mean age	n	N	Mean	Standard deviation	Standard error of the mean	Percentile						
							5	10	25	50	75	90	95
1 year.....	1.54	81	(¹)	165.1	30.3	(¹)	120.1	126.0	143.6	166.2	187.1	202.9	215.7
2 years.....	2.46	120	(¹)	181.5	29.0	(¹)	139.0	145.2	161.2	179.0	201.0	218.1	233.6
3 years.....	3.51	154	(¹)	176.0	35.4	(¹)	125.0	135.5	153.9	174.0	193.8	217.1	235.0
4 years.....	4.54	204	1,339	173.8	32.6	3.93	130.4	134.2	151.6	171.9	195.7	217.0	226.9
5 years.....	5.51	224	1,416	173.2	35.6	3.35	121.2	128.9	148.4	171.4	190.2	222.9	245.5
6 years.....	6.49	125	1,446	177.8	31.7	3.96	123.4	135.1	157.3	176.6	202.3	218.6	227.5
7 years.....	7.55	122	1,507	172.8	32.8	3.44	131.0	134.8	147.5	170.1	191.3	215.3	237.4
8 years.....	8.48	117	1,507	183.6	30.5	3.35	130.2	150.8	163.8	184.6	201.9	216.6	233.4
9 years.....	9.49	129	1,751	183.6	33.9	3.46	140.0	145.4	160.6	181.0	203.5	230.9	244.1
10 years.....	10.47	148	1,855	179.9	39.8	4.83	123.1	141.2	158.6	176.4	197.5	221.8	236.0
11 years.....	11.52	122	1,569	179.0	31.3	3.34	135.4	144.5	157.8	175.3	198.7	216.5	236.9
12 years.....	12.49	128	1,506	177.1	26.9	4.19	141.4	146.1	160.5	171.6	196.2	211.9	221.3
13 years.....	13.51	153	1,886	168.3	35.7	3.52	117.9	132.8	146.8	164.7	184.2	206.6	218.2
14 years.....	14.45	132	1,731	171.4	30.8	3.03	124.7	137.1	151.4	166.7	192.6	210.6	224.1
15 years.....	15.47	125	1,752	174.4	33.6	3.55	130.1	134.5	148.3	173.2	188.2	214.3	225.4
16 years.....	16.56	141	1,933	173.3	34.4	3.50	116.4	131.9	147.7	171.6	193.0	215.5	240.1
17 years.....	17.47	116	1,524	180.3	35.8	3.93	133.5	141.2	153.8	176.0	198.2	230.1	247.9

¹Variances for means and U.S. population estimates not included because of possible bias due to missing values.

NOTE: n = examined white girls; N = estimated population in thousands.

Table 12. Serum cholesterol levels of black girls 1-17 years of age, mean age, number examined, estimated number in the population, mean, standard deviation, standard error of the mean, and selected percentiles, by age: United States, 1971-74

Age	Mean age	n	N	Mean	Standard deviation	Standard error of the mean	Percentile						
							5	10	25	50	75	90	95
1 year.....	1.54	24	(¹)	174.9	23.7	(¹)	131.4	141.9	159.0	172.7	191.4	210.1	217.7
2 years.....	2.46	36	(¹)	180.3	47.1	(¹)	127.6	141.3	152.7	179.0	199.0	217.1	231.4
3 years.....	3.51	48	(¹)	187.8	33.0	(¹)	131.4	143.8	165.9	185.2	209.5	235.2	250.1
4 years.....	4.53	73	246	177.1	25.4	5.03	136.2	142.8	162.3	173.0	200.3	215.6	218.9
5 years.....	5.56	88	265	190.3	35.9	6.46	135.8	160.1	170.6	181.4	212.9	227.0	270.2
6 years.....	6.53	50	336	175.3	35.2	6.60	130.8	133.1	141.9	166.8	202.7	225.5	233.8
7 years.....	7.51	46	241	186.9	34.5	6.82	125.1	134.1	175.5	191.3	203.6	232.8	237.8
8 years.....	8.43	35	293	202.8	29.7	7.52	163.5	171.5	177.5	197.1	227.3	243.2	247.6
9 years.....	9.52	41	247	194.1	29.5	5.71	144.2	154.7	173.4	195.6	207.4	233.4	244.0
10 years.....	10.51	48	303	192.2	25.0	5.18	153.4	162.5	174.7	188.7	206.2	225.8	228.5
11 years.....	11.65	42	315	164.6	38.7	10.29	112.6	115.3	130.9	164.3	185.4	207.8	244.0
12 years.....	12.56	47	284	166.0	31.1	7.50	114.9	130.0	144.9	165.3	180.6	207.1	215.1
13 years.....	13.46	44	287	183.6	28.9	5.98	141.2	145.0	162.6	190.5	197.3	208.7	228.1
14 years.....	14.50	50	265	175.1	38.0	7.58	116.0	127.8	151.6	164.8	198.2	231.6	263.3
15 years.....	15.44	46	411	194.5	41.5	12.36	141.9	147.5	170.1	177.7	223.7	265.1	290.5
16 years.....	16.47	33	203	182.4	31.7	8.44	118.4	150.2	164.7	181.3	204.3	216.9	244.3
17 years.....	17.44	40	263	183.3	36.3	7.10	132.7	137.1	160.3	182.1	198.6	228.6	258.0

¹Variances for means and U.S. population estimates not included because of possible bias due to missing values.

NOTE: n = examined black girls; N = estimated population in thousands.

Table 13. Serum cholesterol levels of males and females 15-74 years of age, number examined, mean, and standard deviation, by age: United States, 1971-74

Age	Males			Females		
	n	Mean	Standard deviation	n	Mean	Standard deviation
15 years.....	171	168.8	33.9	171	177.8	35.9
16 years.....	169	168.6	29.3	175	174.0	34.3
17 years.....	176	167.5	30.9	157	180.6	35.7
18-24 years.....	772	186.9	36.7	1,524	191.7	41.0
18 years.....	124	178.6	29.2	144	175.4	34.1
19 years.....	135	174.4	36.4	137	186.3	36.9
20 years.....	104	183.1	35.7	236	188.6	38.2
21 years.....	112	186.2	34.4	257	198.1	45.8
22 years.....	107	190.7	38.3	249	197.9	40.1
23 years.....	94	200.5	34.1	253	198.0	44.3
24 years.....	96	195.4	39.6	248	196.7	39.6
25-34 years.....	804	210.3	44.0	1,896	203.2	42.2
35-44 years.....	665	231.3	45.9	1,663	216.5	43.5
45-54 years.....	765	239.4	47.0	836	242.6	52.0
55-64 years.....	597	240.2	51.2	670	256.8	48.2
65-74 years.....	1,657	236.2	53.8	1,822	261.6	51.9

NOTE: n = examined persons.

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Appendix I

STATISTICAL NOTES

The sampling plan of the Health and Nutrition Examination Survey (HANES) followed a highly stratified multistage probability design in which a sample of the civilian noninstitutionalized population of the coterminous United States, 1-74 years of age, was selected. Excluded from the selection process were those persons confined to institutions or residing upon any of the reservation lands set aside for use of American Indians. Successive elements dealt with in the process of sampling were the primary sampling unit (PSU), census enumeration district (ED), segment (a cluster of households), household, eligible person, and, finally, sample person.

The starting points in the first stage of this design were the 1960 decennial census lists of addresses and the nearly 1,900 primary sampling units into which the coterminous United States was divided. Each PSU is either a standard metropolitan statistical area, a single county, or two or three contiguous counties. The PSU's were grouped into 357 strata for use in the Health Interview Survey and subsequently collapsed into 40 super strata for HANES.

Fifteen of the 40 super strata contained a single large metropolitan area of more than 2,000,000 population. These 15 large metropolitan areas were chosen into the sample with certainty. The remaining 25 super strata were formed by classifying the noncertainty strata into four population density groups within each of four geographic regions. Then, using a modified Goodman-Kish controlled selection technique to assure proportionate representation of specified State groups and rate of population change classes, two PSU's were chosen from each of the 25 noncertainty super strata with the probability of selection of a PSU propor-

tionate to its 1960 population. In this manner a total first stage sample of 65 PSU's or "stands" are the areas within which a sample of persons would be selected for examination. The PSU's are scheduled to be sampled over a 3-year period with 300-600 persons to be examined per stand.

Although the 1970 census data were used as the frame for selecting the sample within PSU when they became available, the calendar of operations required that the 1960 census data be used for the first 44 locations in the HANES sample. The 1970 census data were used for the last 21 stands of the sample.

Beginning with the use of the 1970 census data, the segment size was changed from an expected 6 households selected from compact clusters of 18 households to an expected compact cluster of 8 households. The change was made because of operational advantages, and research by the U.S. Bureau of the Census indicated that precision of estimates would not be appreciably affected by the change from noncompact clusters to compact clusters.

For ED's not having usable addresses (generally located in rural areas), area sampling was employed, and consequently some variation in the segment size occurred. To make the sample representative of the current population of the United States the address or ED segments were supplemented by a sample of housing units that had been constructed since the 1960 and 1970 decennial censuses.

Within each PSU a systematic sample of segments was selected. The enumeration districts which fell into the sample were coded into one of two economic classes. The first class, identified as the "poverty stratum," was composed of "Current Poverty Areas" that had been identi-

fied by the U.S. Bureau of the Census in 1970 (pre-1970 census), plus other ED's in the PSU with a mean family income of less than \$3,000 in 1959 (based on 1960 census). The second economic class, the "nonpoverty stratum," included all ED's not designated as belonging to the "poverty stratum."

All sample segments classified as being in the "poverty stratum" were retained in the sample. For the first 42 stands sample segments in "nonpoverty stratum" ED's were divided into eight random subgroups and one of the subgroups was chosen to remain in the HANES sample. Research indicated that efficiency of estimates could be increased by changing the ratio of poverty to nonpoverty segments from 8 to 1 to 2 to 1. Therefore in the later stands, the selected segments in the "nonpoverty stratum" ED's were divided into two random subgroups, and one of the subgroups was chosen to remain in the HANES sample. The differential sampling permits a separate analysis with adequate reliability of those classified as being below the poverty level and those classified as being above the poverty level.

After identification of the sample segments, a list of all current addresses within the segment boundaries was made, and the households were interviewed to determine the age and sex of each household member as well as other demographic and socioeconomic information required for the survey. If no one was at home after repeated calls or if the household members refused to be interviewed, the interviewer tried to determine the household composition from neighbors.

To select the persons in the sample segments to be examined in HANES and at the same time to oversample certain groups at high risk of malnutrition, all household members aged 1-74 years in each segment were first listed on a sample selection worksheet with each household in the segment listed serially. The number of household members in each of the six age-sex groups shown below were then listed on the worksheet under the appropriate age-sex group column. The sample selection worksheets were next put in segment number order and a systematic random sample of persons in each age-sex group was selected to be examined using the following sampling rates.

<i>Age</i>	<i>Rate</i>
1-5 years.....	1/2
6-19 years.....	1/4
20-44 years (male).....	1/4
20-44 years (female).....	1/2
45-64 years.....	1/4
65-74 years.....	1

The persons selected in the 65-stand sample of HANES comprised a representative sample of the target population and included 28,043 sample persons 1-74 years of age, of whom 20,749, or 74.0 percent, were examined. When adjustments are made for differential sampling for high risk groups, the response rate becomes 75.0 percent.

Among those 4-17 years of age at interview for whom serum cholesterol determinations were made, there were 5,334 examined out of the probability sample of 6,356 selected to represent the 56 million of that age in the population. This is an unadjusted response rate and an effective adjusted response rate of 84 percent.

Data of children of ages 4-17 years 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 non-response cases (i.e., persons not examined), and a poststratified ratio adjustment which increases precision by bringing survey results into closer alignment with known U.S. population figures for 20 age, race, and sex groups as of November 1, 1972, the approximate midpoint of HANES.

A more detailed description of the survey design and selection technique can be found in "Plan and Operation of the Health and Nutrition Examination Survey, United States, 1971-73," *Vital and Health Statistics*, Series 1, No. 10a.¹

Nonresponse

In any Health Examination Survey, after the sample is identified and the sample persons are

NOTE: The list of references follows the text.

requested to participate in the examination, the survey meets one of its severe problems, namely, that of nonresponse. Usually a sizable number of sample persons will not participate in the examination. A further potential for bias results if the sample persons who do not participate differ from the sample persons examined with respect to the characteristics under examination. Intensive efforts were made in HANES to develop and implement procedures and inducements that would reduce the number of nonrespondents and thereby reduce the potential of bias due to nonresponse. These procedures and inducements are discussed in Series 1, No. 10a.¹

Despite these intensive efforts, 16.0 percent of the sample persons from 65 stands were not examined; previous surveys had response rates of 96 percent of children 6-11 and 90 percent of youth 12-17 years of age.^{24,25} Consequently, the potential for a sizable bias does exist in the 1971-74 estimates in this publication.

Because more than 99 percent of the sample persons responded to a medical and demographic questionnaire in 1971-74, one could examine the characteristics of the nonrespondents and the nature of nonresponse. This examination indicated that the likelihood of sizable bias is small.

As was mentioned earlier, the data in this report are based on weighted observations, and one of the components of the weight assigned to an examined person was an adjustment for nonresponse. A procedure was adopted which multiplies the reciprocal of the probability of selection of sample persons who were examined by a factor which brings estimates based on examined persons up to a level which would have been achieved if all sample persons had been examined. The nonresponse adjustment factor is calculated by dividing the sum of the reciprocals of the probability of selection for all sample persons in each of five income groups within each stand by the sum of the reciprocals of the probability of selection for examined sample persons in the same stand and income group. The five income groups are: less than \$3,000, \$3,000-\$6,999, \$7,000-\$9,999, \$10,000-\$14,999,

Table I. Percent distribution of nonresponse adjustments factors, stands 1-65, 1971-74 HANES

Size of factor	Percent distribution
Total	100.0
1.00-1.24.....	32.6
1.25-1.49.....	38.5
1.50-1.74.....	18.2
1.75-1.99.....	7.4
2.00-2.49.....	2.8
2.50-2.99.....	0.3
3.00.....	0.3

¹A size of 3.0 was assigned for all factors greater than 3.0. The final poststratified ratio adjustment corrects for this truncation.

and \$15,000 or more. For sample weighting purposes, income group was imputed for 5.6 percent of the sample persons using educational level of the head of the household. To the extent that the income-within-stand classes are homogeneous with respect to the health characteristics under study, the adjustment procedure is effective in reducing the potential of bias due to nonresponse. The percent distribution of the nonresponse adjustment factors computed for the 65-stand sample of HANES is shown in table I.

Missing Data

Examination surveys are subject to the loss of information not only through the failure to examine all sample persons but also from the failure to obtain complete examination for examined persons. More than 80 percent of the children 1-17 years old selected for examination were examined (table II). For ages 1-3 years, however, the percentages of sample children with serum cholesterol values were 37, 48, and 61 percent, respectively. The missing serum cholesterol values for children who were examined were due primarily to difficulties in obtaining blood samples, with pin-prick rather than venipuncture methods providing an inadequate quantity of blood.

Estimates in this report include imputed values for all examined children 4-17 years old

NOTE: The list of references follows the text.

Table II. Number of children selected for examination, percent examined, and percent with serum cholesterol measurements

Age	Number of children selected for examination	Percent examined	Percent with serum cholesterol measurement
Ages 1-17 years	8,471	83.9	69.8
1 year	711	84.1	36.9
2 years	704	82.7	48.4
3 years	700	84.3	61.2
Ages 4-17 years	6,356	83.9	76.7
4 years	703	84.2	67.4
5 years	712	83.0	71.2
6 years	404	80.7	72.0
7 years	394	85.8	78.9
8 years	360	83.9	75.3
9 years	414	84.6	78.5
10 years	447	83.0	78.1
11 years	396	83.8	78.0
12 years	439	86.8	82.9
13 years	444	84.7	81.5
14 years	436	83.7	78.7
15 years	399	85.0	81.2
16 years	416	82.9	80.5
17 years	392	83.2	79.6

with missing cholesterol values. This was done by randomly assigning a value for the missing item from among similar children with that item of information recorded. Results shown in this report for ages 1-3 years are based on weighted sample values but do not include imputed values for missing measurements. United States population estimates and variances for means have not been included in the text tables for these ages because of possible bias due to missing values. Special caution should be exercised when interpreting estimates for these ages.

Standard Errors

The probability design of the survey makes possible the estimation of standard errors corresponding to the weighted estimates presented. The standard error is primarily a measure of

sampling variability, that is, the variations that might occur by chance because only a sample of the population is surveyed. As calculated for this report, the standard error also reflects part of the variation which arises in the measurement process. It does not include estimates of any biases which might lie in the data. The chances are about 68 out of 100 that an estimate from the sample would differ from a complete census by less than the standard error. The chances are about 95 out of 100 that the difference would be less than twice the standard error and about 99 out of 100 that it would be less than 2½ times as large.

Estimates of standard errors are obtained from the sample data and are themselves subject to sampling error when the number of cases in a cell is small or even, occasionally, when the number of cases is substantial.

Estimates of the standard errors for selected statistics used in this report are presented in tables 3-4 and 9-12. These estimates have been prepared by a replication technique which yields overall variability through observation of variability among random subsamples of the total sample. Again readers are reminded that these estimated standard errors do not reflect any residual bias which might still be present after the attempted correction for nonresponse.

Standards of Reliability and Precision

All means and variances appearing in this report met defined standards before they were considered acceptably precise and reliable.

The rule for reporting means and percentiles consisted of the following two basic consecutive criteria: that a sample size be at least five, and that the estimated coefficient of variation [i.e., the standard error of the mean divided by the mean, or (s_x/X) , be less than 25 percent]. Thus if the sample size was too small, or if, given adequate sample size, the variation with respect to the mean was too large, then the estimate was considered neither precise nor reliable enough to meet the standards established for publication.



Appendix II

DEMOGRAPHIC AND SOCIOECONOMIC TERMS

The demographic and socioeconomic characteristics of the population sampled are defined as follows:

Age.—The age recorded for each examinee was the age at his last birthday on the date of examination. The age criterion for inclusion in the sample used in this survey was defined in terms of his age at time of census interview. Some of those who were 74 years old at the time of interview became 75 years old by the time of the examination. There were 20 such cases. In the adjustment and weighting proce-

dures used to produce national estimates, these persons were included in the group 74 years old.

Race.—For each individual, race was recorded by observation as “white,” “black,” or “other races.” The last category included American Indians, Chinese, Japanese, and all races other than white or black. Mexican persons were included with “white” unless definitely known to be American Indian or of another race other than white. Black persons and persons of mixed black and other parentage were recorded as “black.”



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