VITAL and HEALTH STATISTICS

DATA FROM THE NATIONAL HEALTH SURVEY

Mean Blood Hematocrit

of Adults

United States - 1960 - 1962

A discussion of the uses and the present norms of hematocrit values with data on the distribution of hematocrit values by age, race, and sex as well as estimates of mean blood hematocrit and its relationship to the demographic variables of age, race, sex, family income, education, residence, marital status, usual activity, occupation, and industry.

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NATIONAL CENTER FOR HEALTH STATISTICS

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DIVISION OF HEALTH EXAMINATION STATISTICS

ARTHUR J. McDOWELL, *Director*

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

CONTENTS

IN THIS REPORT findings are presented on hematocrit values obtained from Cycle I of the Health Examination Survey (HES). Cycle I consisted of examinations of a nationwide probability sample of persons 18-79 years of age selected from the U.S. civilian, noninstitutional population.

This report discusses the uses and the present norms of hematocrit values, presents the data collected by HES, and compares the information obtained in this survey with that obtained in other surveys. The relationship of mean blood hematocrit to the demographic variables of age, race, sex, family income, education, residence, marital status, usual activity, occupation, and industry are examined.

In every age group the mean hematocrit for men was higher than that for women. For every age group save 18-24-year-old men, white men and women had a higher mean hematocrit than Negroes of the same sex. The mean hematocrit also varied by residence, usual activity, and occupation. There was no clear pattern of prevalence associated with education, but there was an apparent trend for the Negro population to a higher mean hematocrit with increasing family income.

SYMBOLS

Data not available----------------------------   ---

Category not applicable-------------------   ...

Quantity zero---------------------------   -

Quantity more than 0 but less than 0.05----   0.0

Figure does not meet standards of
    reliability or precision------------------   *

MEAN BLOOD HEMATOCRIT OF ADULTS

Brian Devine, *Division of Health Examination Statistics*

INTRODUCTION

This report presents hematocrit values determined by the micromethod for the adult population of the United States and compares the values obtained with the norms currently in use. The distribution of hematocrit values by age, race, and sex is given, as well as estimates of mean blood hematocrit and its relationship to the demographic variables of age, race, sex, family income, education, residence, marital status, usual activity, occupation, and industry.

This is one of a series of reports describing and evaluating the plan, conduct, and findings of the first cycle of the Health Examination Survey. The survey was organized in order to obtain health information on the population of the United States by use of direct examination. Between October 1959 and December 1962 a series of examinations were conducted by the survey using a probability sample of noninstitutionalized U.S. adults aged 18-79 years. The purpose of this cycle of the examinations was to obtain information on the prevalence of cardiovascular diseases and certain other chronic diseases, dental health, and the distribution of a number of anthropometric and sensory characteristics. Altogether, 6,672 of a sample of 7,710 persons were examined. These sample persons were given a standard examination, which lasted about 2 hours, by medical and other staff members of the survey in specially designed mobile clinics.

The description of the general plan and of the sample population and response have been published.[1,2] These provide the general background for all the reports of findings. This report deals with findings of the microhematocrit test, in particular the distribution of hematocrit values and the mean hematocrit.

HEMATOCRIT

The hematocrit value or corpuscular volume can be defined as the volume occupied by the red cells (erythrocytes) contained in 100 ml. of blood. The value is altered by changes in the red cell count, as well as changes in red cell size.[3]

The hematocrit is used in determining erythrocyte indices, calculating blood volume and total erythrocyte mass, and establishing whether or not the patient is anemic. The latter is largely a rough indication, inasmuch as a low hematocrit indicates that the concentration of erythrocytes is reduced.[4]

THE MICROHEMATOCRIT TEST

A venous blood specimen of 15 cc. was taken from each examinee. Two microhematocrit capillary tubes were inserted into each blood specimen and filled to within 1/4 inch of the upper end of the tubes. They were then sealed with plasticene, and centrifuged (International Model MB) for 5 minutes. Both specimens were read to the nearest percent directly from an International Micri-capillary Reader, Model CR. The two values obtained for each examinee were averaged and the average recorded as the individual's hematocrit.

HEMATOCRIT AS AN ESTIMATOR OF ANEMIA

The answer to the question "Does the patient have anemia?" often cannot be gained from the history or the physical examination of the examinee. Anemia of moderate severity may not be detected even by careful inspection of the skin and mucous membranes. In another circumstance a neurasthenic individual with pallor of the skin and mucous membranes may report all the symptoms of anemia even though the blood is entirely normal. The presence of anemia can be established only by laboratory procedures, and the simplest and the most reliable screening procedure is the hematocrit determination.[5] Wintrobe judged the normal range (mean ± 2 S.D.) for adult males to be 40 to 54 ml. percent and for adult females 37 to 47 ml. percent, with means of 47.0 and 42.0 ml. percent respectively.[6] It has been suggested that the lower bounds of these normal ranges be used as cutting points, under which one would be considered anemic, since such an hematocrit would be significantly lower than the mean hematocrit. Although HES means were quite similar to Wintrobe's, HES normal ranges were different, especially for women. HES normal ranges were 38.8-54.2 ml. percent for men and 34.2-50.4 ml. percent for women. Indeed the use of 40.0 ml. percent for men and 37.0 ml. percent for women as cutting points would result in the inclusion of 3.6 percent of the men and 7.0 percent of the women rather than the 2.5 percent expected using Wintrobe's standards for each group. However, the differences shown by the use of either Wintrobe's cutting points or the lower 2.5 percent of the distribution in the analysis by demographic variables are largely the same as those seen by analysis of the means.

Other screening procedures, the hemoglobin determination for example, are also advocated by some authors,[7] but due to the ease and great accuracy of the hematocrit, it is considered the most useful single criterion of the degree of anemia available at present.[6] Occasionally values in the normal range may be obtained in patients with either macrocytic anemia or iron deficiency anemia of mild degree. Such unusual occurrences do not, however, seriously detract from the usefulness of the hematocrit test, since other procedures are subject to the same limitations.[5]
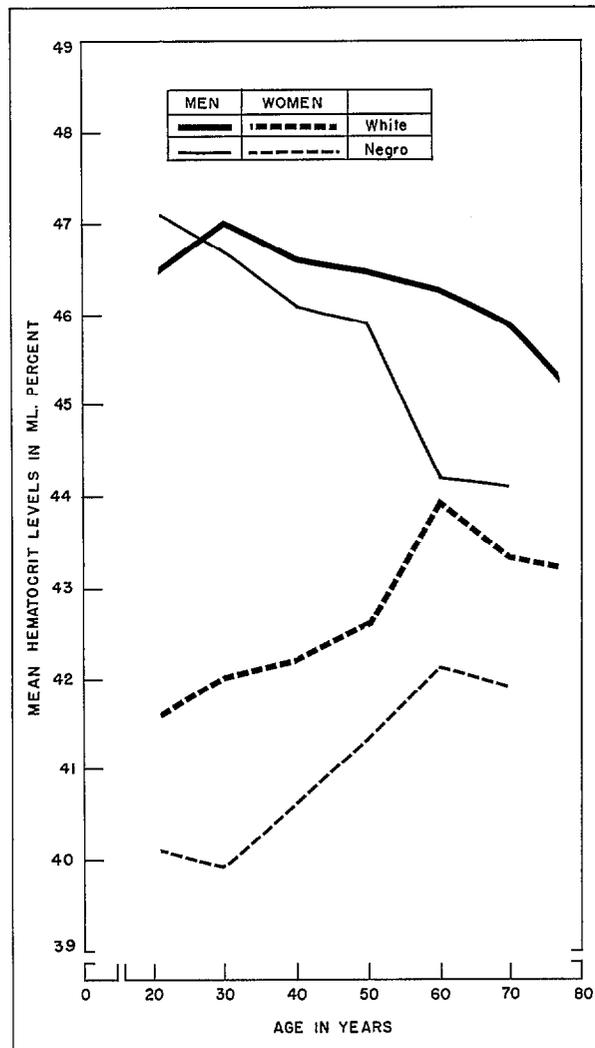

Figure 1. Mean hematocrit in adults, by age, race, and sex: United States, 1960-62

MEAN HEMATOCRIT

Age and Sex

The mean hematocrit for men aged 18-79 years was 46.5 ml. percent, while that for women aged 18-79 years was 42.4 ml. percent. With the exception of the first age group (18-24 years), mean hematocrits for men decreased with increasing age. Mean hematocrit for women rose with age until ages 55-64, after which it fell. In every age group the mean hematocrit for men was higher than that for women, with the difference between the rates declining from 5.3 ml. percent for ages 18-24 to 2.0 ml. percent for ages 75-79 years (table 1).

Race

There was a significant difference by race in mean hematocrit. Both white men and women had a higher mean hematocrit for every age group than Negroes of the same sex with one exception—the exception being 18-24-year-old men, where Negro men had a higher mean than white men. A largely similar age and sex pattern existed for both white and Negro adults (fig. 1 and table 2). The decline by age was, however, more pronounced for Negro men than white men.

PERCENTAGE DISTRIBUTION
OF HEMATOCRITS

Age and Sex

There is an implied inverse relationship between mean hematocrit levels and the rate of anemia. In general, when the mean hematocrit level for a particular group is higher or lower than expected the percentage of persons with low hematocrit values would be lower or higher, respectively.

The shifts in mean hematocrit levels by age and sex correspond to shifts in the hematocrit distributions (fig. 2, tables 3 and 4). As the distribution shifts to the left or toward lower values with increasing age as it does for men, the mean hematocrit decreases. As the distribution shifts to the right or toward higher values with age, as it does for women until ages 55-64 years, the mean increases.

Race and Sex

Similarly the distributions display the differences in mean hematocrits and also by inference the rates of anemia by race and sex (fig. 3, tables 5 and 6). The distribution curves for both white and Negro women were constantly to the left of those for white and Negro men, thus exhibiting that the lower mean hematocrit for women was not due to a different skewness of values but instead to a constant difference in the entire distribution. The distribution for Negro women was consistently to the left of that for white women reflecting a lower mean hematocrit. It was also skewed somewhat more to the left at the beginning of the curve which probably reflects a substantial racial difference in their rates of anemia. The distribution for Negro men, however, was to the left of that for white men only during the first half of the curve after which it was similar. Thus despite a fairly small difference in the means there was a moderate difference in anemia rates, as judged by the percentage with low hematocrit values. The differences in the spread of the distributions are apparent in this summary table of hematocrit percentiles by race and sex:

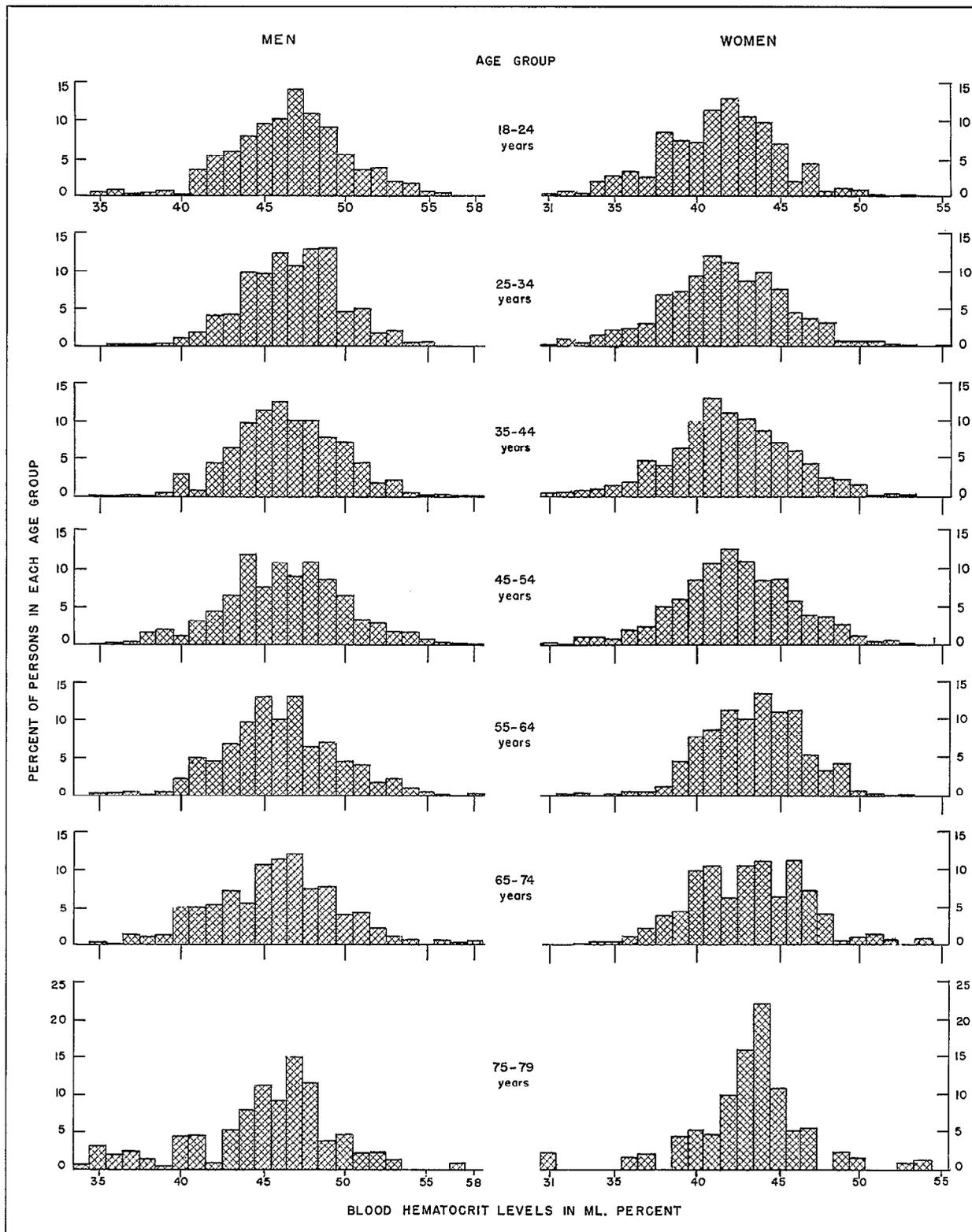| Sex and race	2.5	5.0	50.0	95.0	97.5
Men	Ml. percent				
Total--	38.5	40.5	46.5	52.5	54.0
White------	39.0	40.5	46.5	52.5	53.5
Negro------	37.5	39.5	46.0	52.0	53.5
Women					
Total--	34.0	36.0	42.5	48.5	50.0
White------	34.5	36.0	42.5	48.5	50.0
Negro------	30.0	32.0	41.5	47.0	48.5

Figure 2.   Percent distribution of hematocrit in adults, by age and sex: United States, 1960-62.
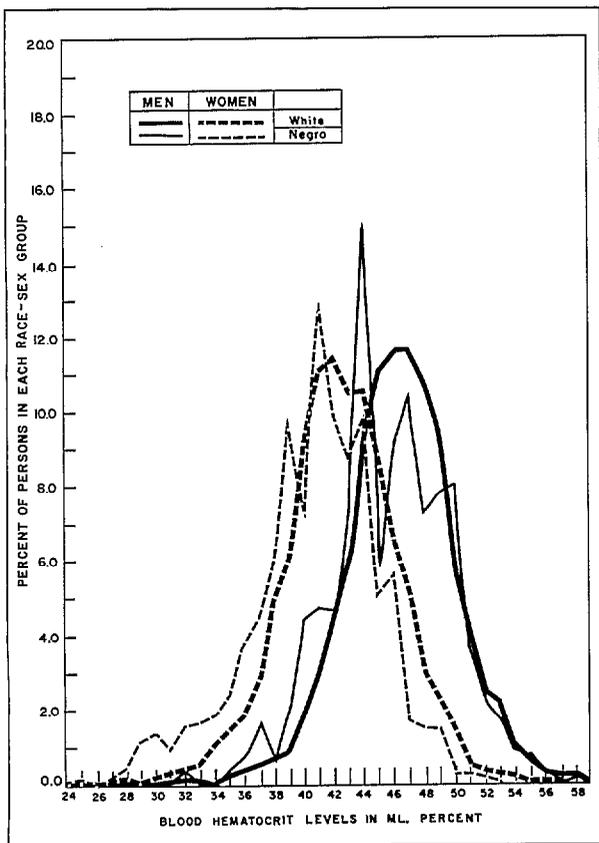
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Figure 3. Percent distribution of hematocrit in adults, by race and sex: United States, 1960-62.

OTHER DEMOGRAPHIC VARIABLES

In the following discussion, the population is classified in a variety of ways—by family income, education, etc.—and the mean level of blood hematocrit is compared in these different demographic groups. The demographic groups used in this report are defined in Appendix I. If the population is classified by family income, for example, the level of blood hematocrit in different income groups is examined to determine whether or not mean levels vary from one income group to another. These data are summarized in tables 7-10.

In evaluating these findings allowance must be made for the fact that there are differences from one group to another in the distribution of people by age, race, and sex, and that the level of blood hematocrit varies by age, race, and sex. Because the sampling variability of age-race-sex-specific values for any group is usually very large, a summary comparison was thought preferable to the presentation of levels specific by age.

For this reason, the actual hematocrit level for each race-sex group is compared with an expected value. The expected value of a particular group is obtained by weighting age-specific means for the total United States by the age distribution for the race-sex groups. The obvious meaning can be attached to differences between actual and expected means with the understanding that differences may arise by chance. A positive difference, for example, indicates that the hematocrit value for that group is higher than expected. In general, where there is no statistically significant difference between the actual and expected values for a group, differences for individual age-race-sex groups exhibit only random fluctuations.

Residence

White men in the South had a significantly higher mean hematocrit than expected. This was the only significant regional difference for either race (table 11). There was, however, a greatly narrowed gap in mean hematocrit between white and Negro men in the Northeast and West. This finding will be elaborated on in the "Discussion" section.

In terms of residence classifications and population density (tables 12-14), there were only small differentials evident for the white population. White men in urban areas outside of standard metropolitan statistical areas (SMSA's) had significantly higher mean hematocrits than expected, but no other significant differences were found in the white population.

There were a number of residence differentials evident for Negro men. They had higher than expected means in giant metropolitan areas and in the central city of standard metropolitan statistical areas. In addition there was a similarity between means in SMSA's for white and Negro men which will also be examined in the "Discussion" section.

Income and Education

In the white population there was no clear pattern of prevalence associated with either family income or education (tables 15 and 16).

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In the Negro population, however, there was a trend to higher mean hematocrit with increasing family income, but no such trend manifested itself with increasing education. An individual differential was seen as Negro women with family incomes of less than $2,000 had significantly lower than expected mean hematocrits.

Marital Status

The actual means by marital status were essentially the same as the expected means (table 17). There may be differences but they were either small or exhibited too great a variance to be deemed statistically significant.

Usual Activity Status

The actual means by usual activity status were essentially the same as the expected for all race-sex groups with one exception—white women (table 18). White women who worked had a significantly low mean blood hematocrit level, while white women who were classified as "other" had a significantly high mean hematocrit level. These "other" women are those not classified as working, keeping house, or retired, and refer mainly to those who are students.

Occupation and Industry

There were a number of differentials by occupation and industry for white men (tables 19 and 20). Farmers and farm managers had a significantly lower than expected mean hematocrit, while clerical and sales workers and those employed in finance, insurance, and real estate had a significantly higher than expected mean hematocrit.

DISCUSSION

There are few published studies on hematocrit levels which deal with a well-defined population group using techniques comparable with those of the Health Examination Survey. In one of these R. M. Greendyke presents a mean hematocrit level and a percent distribution of hematocrit values for a sample of normal adult males aged 17-29 years.[8] His findings for this somewhat limited group correspond fairly closely with the values found by the HES for the nearest comparable group of men, those aged 18-24 years.

A study by A. R. McDonough and his associates presents hematocrit data by age, sex, and race obtained from the population of Evans County, Georgia.[9] A remarkable similarity to HES data exists in the pattern of mean hematocrit for white and Negro men by age. Their findings parallel those of HES since they also found that Negro men at ages below 24 years have a higher mean hematocrit than white men at the same age, while at ages above 24 years, they have a lower mean hematocrit. They also found a rise in the mean for white men after the first age group and then a constant decrease with increasing age. On the basis of HES data these two relationships were not statistically significant, but the corroboration of these findings by McDonough leads one to believe that indeed they may exist in the population as a whole. The means by race-sex groups found by McDonough were all somewhat lower than those found by the HES in the South: 0.8 ml. percent lower for both white men and Negro men, and 0.9 ml. percent lower and 0.3 ml. percent lower for white and Negro women, respectively. The racial difference for men was 1.7 ml. percent in the HES and 1.8 ml. percent in Evans County. For women the difference was 2.0 ml. percent in the HES and 1.4 ml. percent in Evans County.

The racial difference shown by McDonough was found by the HES in all regions for women but only in the South for men:

	Outside South		South	
	White	Negro	White	Negro
Men---------	46.4	46.4	47.0	45.3
Women-------	42.3	40.8	42.7	40.7

(These rates and the rates below for white persons are adjusted to the age distribution of the parallel Negro group.)

The racial difference for men also disappears when means for standard metropolitan statistical areas only are considered:

	SMSA		Outside SMSA	
	White	Negro	White	Negro
Men-----------	46.4	46.5	46.6	45.2
Women--------	42.4	40.8	42.5	40.7

These relationships are not entirely independent as the Negro outside the South tends to live in SMSA's. The sample size of the HES, however, is too small to allow for disentanglement of these two variables. The above mean hematocrit values are clear indicators that hematocrit levels (and in turn anemia rates) for Negro men are related to environment. The reasons for Negro men having significantly lower mean hematocrits than white men in the South and outside SMSA's, but not elsewhere, cannot be determined exactly. Two factors, diet and availability and utilization of medical care, have been cited as possible explanations for differences in anemia rates. Diet, then, might be thought here to play a major role, but the lack of a similar relationship for women would seemingly tend to largely discount this as the major cause. Similarly the amount and kind of medical care available and the level of use of such also might be considered a determining factor.[10] Indeed the availability and utilization of medical care outside SMSA's and in the South are probably most limited for Negroes, and in particular for Negro males. This sex difference was reflected in the answer to a question asked each examinee concerning when he had last seen a doctor. A shorter time span was noted for those in SMSA's versus those outside SMSA's for Negro males, but not for Negro females as the time span since they had last seen a doctor was approximately the same regardless of the area in which they lived. Undoubtedly, however, there are also other factors which helped to bring about this relationship.

SUMMARY

The mean hematocrit level for men was 46.5 ml. percent, while that for women was 42.4 ml. percent. The normal range $\pm$ 2 S.D. from the mean) was 38.8-54.2 ml. percent for men and 34.2-50.4 ml. percent for women. In every age group the mean hematocrit for men was higher than that for women. For every age group save 18-24-year-old men, white men and women had a higher mean hematocrit than Negroes of the same sex.

Various other demographic variations were noted. The mean hematocrit was higher than expected for white men in the South. Negro men living outside the South had a mean hematocrit as high as white men. Residential differentials were especially evident for Negro men. In giant metropolitan areas and in the central city of standard metropolitan statistical areas, the means for Negro men were higher than expected. Negro men living in metropolitan areas also had mean hematocrits as high as white men.

There was no clear pattern of prevalence associated with education, but there was an apparent trend for the Negro population to higher hematocrits with increasing family income.

White women who work had a significantly low mean blood hematocrit, while white women who are classified as "other" had a significantly high mean hematocrit level.

White men who were farmers or farm managers had lower than expected mean hematocrits, while those who were clerical and sales workers and those employed in finance, insurance, and real estate had higher than expected mean hematocrits.

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REFERENCES

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DETAILED TABLES

Table 1. Mean hematocrit in adults, by sex and age: United States, 1960-62

Age	Men	Women
	Ml. percent	
Total, 18-79 years---	46.5	42.4
18-24 years---	46.7	41.4
25-34 years---	47.0	41.8
35-44 years---	46.6	42.0
45-54 years---	46.5	42.5
55-64 years---	46.1	43.7
65-74 years---	45.8	43.2
75-79 years---	45.1	43.1

Table 2. Mean hematocrit in adults, by sex, race, and age: United States, 1960-62

Age	Men		Women	
	White	Negro	White	Negro
	Ml. percent			
Total, 18-79 years---	46.5	45.8	42.5	40.8
18-24 years---	46.5	47.1	41.6	40.1
25-34 years---	47.0	46.7	42.0	39.9
35-44 years---	46.6	46.1	42.2	40.6
45-54 years---	46.5	45.9	42.6	41.3
55-64 years---	46.3	44.2	43.9	42.1
65-74 years---	45.9	44.1	43.3	41.9
75-79 years---	45.3	*	43.2	*

Table 3. Hematocrit by age, sex, and selected percentiles: United States, 1960-62

Sex and percentile	Total, 18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
Men				Ml. percent				
97.5	54.0	54.0	53.5	53.5	54.5	54.0	54.0	53.0
95.0	52.5	53.0	52.5	52.5	53.0	53.0	52.5	51.5
90.0	51.0	51.5	51.0	51.0	51.5	51.0	51.0	50.0
80.0	49.5	49.5	49.5	49.5	49.5	49.0	49.0	48.5
70.0	48.5	48.5	48.5	48.5	48.5	48.0	48.0	47.5
60.0	47.5	47.5	48.0	47.5	47.5	47.0	47.0	47.0
50.0	46.5	47.0	47.0	46.5	46.5	46.0	46.0	46.0
40.0	45.5	46.0	46.5	46.0	45.5	45.5	45.0	45.0
30.0	45.0	45.0	45.0	45.0	44.5	44.5	44.0	44.0
20.0	44.0	44.0	44.0	44.0	43.5	43.5	42.5	41.5
10.0	42.0	42.5	43.0	42.5	42.0	41.5	40.0	38.0
5.0	40.5	41.0	42.0	40.5	39.5	40.5	39.0	35.5
2.5	38.5	39.0	40.5	40.0	38.5	37.5	37.5	35.0
Women								
97.5	50.0	49.0	49.5	49.5	50.0	49.5	51.5	53.0
95.0	48.5	47.5	48.0	48.5	49.0	49.0	50.0	49.5
90.0	47.0	46.0	46.0	47.0	47.5	48.0	48.0	47.0
80.0	45.5	44.5	45.0	45.5	45.5	46.5	46.5	45.5
70.0	44.5	43.5	44.0	44.0	44.5	45.5	45.5	44.5
60.0	43.5	42.5	43.0	43.0	43.5	44.5	44.5	44.0
50.0	42.5	42.0	42.0	42.0	42.5	44.0	43.5	44.0
40.0	41.5	41.0	41.0	41.5	42.0	43.0	42.5	43.0
30.0	40.5	39.5	40.0	40.5	41.0	42.0	41.0	42.5
20.0	39.5	38.5	39.0	39.5	39.5	41.0	40.0	41.0
10.0	38.0	36.5	37.0	37.0	38.0	40.0	38.5	39.0
5.0	36.0	34.5	35.0	35.5	36.0	39.0	37.0	36.0
2.5	34.0	33.0	33.5	33.0	33.5	37.5	36.0	31.0

Table 4. Cumulative percent hematocrit distribution, by age and sex: United States, 1960-62

Sex and hematocrit level	Total, 18-79 years	18-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	75-79 years
Men								
Under 35.0	0.6	0.4	0.0	0.9	0.4	0.8	1.0	1.9
35.0-36.9	1.3	1.7	0.3	1.1	0.7	1.8	1.6	7.3
37.0-38.9	2.5	2.4	0.8	1.6	2.9	2.8	4.6	11.3
39.0-40.9	5.8	3.4	2.6	5.6	6.4	6.3	11.2	16.7
41.0-42.9	13.6	12.6	9.1	11.3	14.5	16.2	21.9	22.7
43.0-44.9	29.6	27.0	23.5	27.8	33.6	33.3	34.8	36.3
45.0-46.9	51.7	47.1	46.2	52.6	52.3	56.6	57.0	56.9
47.0-48.9	73.4	72.5	70.2	72.7	72.5	76.6	77.1	83.6
49.0-50.9	88.5	87.3	88.5	88.4	88.2	88.6	89.1	92.8
51.0-52.9	95.3	94.8	95.9	95.2	94.6	94.9	95.9	97.5
53.0-54.9	98.5	98.8	98.7	98.3	98.2	98.7	97.9	99.0
55.0-56.9	99.4	99.8	99.6	99.3	99.4	99.4	98.6	99.0
57.0 and over	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Women								
Under 31.0	0.9	1.0	0.9	1.1	1.1	-	1.1	2.2
31.0-32.9	1.8	2.2	2.1	2.1	2.0	0.2	1.1	4.5
33.0-34.9	3.5	5.0	4.3	4.1	3.6	0.7	1.9	4.5
35.0-36.9	7.0	11.3	9.0	7.8	6.2	2.0	3.8	6.2
37.0-38.9	14.9	22.5	19.3	16.4	13.7	4.3	10.3	8.6
39.0-40.9	30.0	37.5	36.1	32.7	28.7	17.1	25.1	18.7
41.0-42.9	52.6	62.0	59.7	56.9	52.3	37.5	42.4	33.5
43.0-44.9	73.2	82.5	78.3	75.6	72.0	61.2	64.2	71.7
45.0-46.9	87.9	92.4	90.7	88.6	86.9	84.2	82.4	87.6
47.0-48.9	95.4	97.2	97.5	95.4	94.7	93.3	94.0	93.1
49.0-50.9	98.7	99.5	98.7	99.4	98.9	98.6	96.3	97.5
51.0-52.9	99.5	99.7	99.6	99.8	99.8	99.2	98.8	97.5
53.0 and over	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5. Hematocrit by sex, race, and selected percentiles: United States, 1960-62

Percentile	Men		Women	
	White	Negro	White	Negro
	Ml. percent			
97.5	53.5	53.5	50.0	48.5
95.0	52.5	52.0	48.5	47.0
90.0	51.0	50.5	47.5	46.0
80.0	49.5	49.5	45.5	44.5
70.0	48.5	48.0	44.5	43.5
60.0	47.5	47.0	43.5	42.0
50.0	46.5	46.0	42.5	41.5
40.0	46.0	44.5	42.0	40.5
30.0	45.0	44.0	41.0	39.0
20.0	44.0	43.0	40.0	38.0
10.0	42.0	40.5	38.0	35.0
5.0	40.5	39.5	36.0	32.0
2.5	39.0	37.5	34.5	30.0

Table 6. Cumulative percent hematocrit distribution, by sex and race: United States, 1960-62

Hematocrit level	Men		Women	
	White	Negro	White	Negro
Under 29.0	0.1	-	0.4	0.8
29.0-30.9	0.1	-	0.6	3.3
31.0-32.9	0.5	0.5	1.3	5.8
33.0-34.9	0.6	0.5	2.7	9.4
35.0-36.9	1.3	1.6	6.0	15.5
37.0-38.9	2.4	3.8	13.6	25.8
39.0-40.9	5.4	10.3	28.8	42.8
41.0-42.9	13.1	19.6	51.0	65.6
43.0-44.9	28.3	42.0	72.1	84.0
45.0-46.9	51.1	57.0	87.3	94.5
47.0-48.9	73.6	74.5	95.1	97.7
49.0-50.9	88.6	90.4	98.6	99.3
51.0-52.9	95.3	96.2	99.4	99.7
53.0-54.9	98.5	98.7	99.8	99.8
55.0-56.9	99.3	99.8	99.9	99.8
57.0 and over	100.0	99.9	99.9	99.9

Table 7. Mean hematocrit in adults, by sex and specified residence categories: United States, 1960-62

Residence categories	Men	Women
Region	Ml. percent	
Northeast	46.5	42.3
South	46.7	42.4
West	46.3	42.4
Population-size group		
Giant metropolitan areas	46.3	42.2
Other very large metropolitan areas	46.9	42.9
Other standard metropolitan statistical areas	46.2	42.1
Other urban areas	46.6	42.3
Rural areas	46.5	42.5
Place description		
SMSA-in central city	46.6	42.2
SMSA-outside central city	46.3	42.5
Urban, not SMSA	47.0	42.4
Rural, farm	46.5	42.4
Rural, nonfarm	46.1	42.5
Place		
Urban	46.6	42.3
Rural	46.2	42.4

NOTE: See tables 11-14 for effect of age and racial differences among these various groups.

Table 8. Mean hematocrit in adults, by sex, family income, and education: United States, 1960-62

Income and education	Men	Women
Income	Ml, percent	
Under $2,000	46.1	42.2
$2,000-$3,999	46.4	42.4
$4,000-$6,999	46.6	42.2
$7,000-$9,999	46.5	42.3
$10,000 and over	46.7	42.7
Unknown	46.3	42.9
Education		
Under 5 years	46.6	42.5
5-8 years	46.4	42.4
9-12 years	46.6	42.2
13 years and over	46.5	42.6

NOTE: See tables 15 and 16 for effect of age and racial differences among these various groups.

Table 9. Mean hematocrit in adults, by sex and marital status: United States, 1960-62

Marital status	Men	Women
	Ml. percent	
Married	46.5	42.3
Widowed	46.1	43.3
Divorced	46.2	42.0
Separated	46.0	42.5
Never married	46.5	42.0

NOTE: See table 17 for effect of age and racial differences among these various groups.

Table 10. Mean hematocrit in adults, by sex, usual activity status, occupation, and industry: United States, 1960-62

Usual activity status, occupation, and industry	Men	Women
Usual activity status	Ml.	percent
Usually working--	46.6	42.0
Keeping house--	*	42.6
Retired--	45.4	*
Other or unknown--	46.6	42.4
Occupation		
Professional, technical, and managerial--	46.6	42.1
Farmers and farm managers--	45.8	*
Clerical and sales workers--	47.2	42.2
Craftsmen, foremen, and kindred workers--	46.3	*
Operatives and kindred workers---	46.5	41.9
Private household and service workers---	47.1	41.6
Farm and other laborers (except mine)--	46.5	42.0
Industry		
Agriculture, forestry, and fisheries--	46.1	42.7
Mining and construction--	46.4	*
Manufacturing--	46.3	41.7
Transportation, communication, and other public utilities-----------------------	46.6	41.9
Wholesale and retail trade---	46.8	42.3
Finance, insurance, and real estate--	47.5	42.3
Service and miscellaneous--	46.6	41.8
Government--	47.1	42.4

NOTE: See tables 18-20 for effect of age and racial differences among the various groups.

Table 11. Actual and expected mean hematocrit in adults, by sex, race, and geographic region: United States, 1960-62

Sex, race, and region	Actual	Expected	Difference
MEN			
White		Ml. percent	
Northeast	46.5	46.5	0.0
South	47.1	46.5	0.6
West	46.2	46.5	-0.3
Negro			
Northeast	46.2	45.9	0.3
South	45.3	45.7	-0.4
West	46.5	45.9	0.6
WOMEN			
White			
Northeast	42.4	42.5	-0.1
South	42.7	42.5	0.2
West	42.5	42.6	-0.1
Negro			
Northeast	40.8	40.7	0.1
South	40.7	40.8	-0.1
West	40.9	40.7	0.2

Table 12. Actual and expected mean hematocrit in adults, by sex, race, and population-size group: United States, 1960-62

Sex, race, and population-size group	Actual	Expected	Difference
MEN			
White		Ml. percent	
Giant metropolitan areas	46.2	46.5	-0.3
Other very large metropolitan areas	47.0	46.5	0.5
Other standard metropolitan statistical areas	46.2	46.5	-0.3
Other urban areas	46.9	46.5	0.4
Rural areas	46.5	46.5	0.0
Negro			
Giant metropolitan areas	47.0	46.0	1.0
Other very large metropolitan areas	45.9	46.1	-0.2
Other standard metropolitan statistical areas	46.2	45.6	0.6
Other urban areas	44.6	45.6	-1.0
Rural areas	45.7	45.8	-0.1
WOMEN			
White			
Giant metropolitan areas	42.4	42.6	-0.2
Other very large metropolitan areas	43.0	42.5	0.5
Other standard metropolitan statistical areas	42.2	42.5	-0.3
Other urban areas	42.4	42.4	0.0
Rural areas	42.8	42.6	0.2
Negro			
Giant metropolitan areas	40.6	40.7	-0.1
Other very large metropolitan areas	41.7	40.8	0.9
Other standard metropolitan statistical areas	40.3	40.9	-0.6
Other urban areas	41.1	40.8	0.3
Rural areas	40.4	40.9	-0.5

Table 13. Actual and expected mean hematocrit in adults, by sex, race, and place description: United States, 1960-62

Sex, race, and place description	Actual	Expected	Difference
MEN			
White		Ml. percent	
SMSA-in central city---	46.5	46.5	0.0
SMSA-outside central city--	46.3	46.5	-0.2
Urban, not SMSA--	47.3	46.5	0.8
Rural, farm---	46.5	46.4	0.1
Rural, nonfarm--	46.0	46.5	-0.5
Negro			
SMSA-in central city---	46.7	45.8	0.9
SMSA-outside central city--	45.3	46.1	-0.8
Urban, not SMSA--	43.9	45.4	-1.5
Rural, farm---	45.9	45.9	0.0
Rural, nonfarm--	45.5	45.8	-0.3
WOMEN			
White			
SMSA-in central city---	42.4	42.6	-0.2
SMSA-outside central city--	42.5	42.5	0.0
Urban, not SMSA--	42.5	42.5	0.0
Rural, farm---	42.9	42.7	0.2
Rural, nonfarm--	42.7	42.5	0.2
Negro			
SMSA-in central city---	40.8	40.8	0.0
SMSA-outside central city--	40.9	40.7	0.2
Urban, not SMSA--	41.2	40.8	0.4
Rural, farm---	40.3	40.7	-0.4
Rural, nonfarm--	40.5	41.0	-0.5

Table 14. Actual and expected mean hematocrit in adults, by sex, race, and residence: United States, 1960-62

Sex, race, and residence	Actual	Expected	Difference
MEN			
White		Ml. percent	
Urban--	46.7	46.5	0.2
Rural--	46.2	46.5	-0.3
Negro			
Urban--	45.7	45.7	0.0
Rural--	45.6	45.9	-0.3
WOMEN			
White			
Urban--	42.5	42.5	0.0
Rural--	42.6	42.5	0.1
Negro			
Urban--	40.9	40.7	0.2
Rural--	40.5	40.8	-0.3

Table 15. Actual and expected mean hematocrit in adults, by sex, race, and family income: United States, 1960-62

Sex, race, and family income	Actual	Expected	Difference
MEN			
White	Ml. percent		
Under $2,000	46.1	46.2	-0.1
$2,000-$3,999	46.5	46.4	0.1
$4,000-$6,999	46.6	46.6	0.0
$7,000-$9,999	46.4	46.6	-0.2
$10,000 and over	46.7	46.5	0.2
Unknown	46.4	46.5	-0.1
Negro			
Under $2,000	45.5	45.5	0.0
$2,000-$3,999	45.7	45.8	-0.1
$4,000-$6,999	46.3	46.0	0.3
WOMEN			
White			
Under $2,000	42.9	42.8	0.1
$2,000-$3,999	42.6	42.6	0.0
$4,000-$6,999	42.2	42.4	-0.2
$7,000-$9,999	42.3	42.4	-0.1
$10,000 and over	42.6	42.5	0.1
Unknown	43.0	42.7	0.3
Negro			
Under $2,000	40.2	41.0	-0.8
$2,000-$3,999	40.8	40.6	0.2
$4,000-$6,999	41.0	40.7	0.3

NOTE: Where categories are not listed for a specific race-sex group, the sample size was too small for reliable estimates to be presented.

Table 16. Actual and expected mean hematocrit in adults, by sex, race, and education: United States, 1960-62

Sex, race, and education	Actual	Expected	Difference
MEN			
White		Ml. percent	
Under 5 years	46.7	46.2	0.5
5-8 years	46.4	46.4	0.0
9-12 years	46.6	46.6	0.0
13 years and over	46.5	46.6	-0.1
Negro			
Under 5 years	45.7	45.3	0.4
5-8 years	45.7	45.8	-0.1
9-12 years	46.4	46.5	-0.1
WOMEN			
White			
Under 5 years	42.8	43.0	-0.2
5-8 years	42.7	42.9	-0.2
9-12 years	42.4	42.4	0.0
13 years and over	42.6	42.4	0.2
Negro			
Under 5 years	41.5	41.4	0.1
5-8 years	40.6	41.1	-0.5
9-12 years	40.5	40.4	0.1

NOTE: Where categories are not listed for a specific race-sex group, the sample size was too small for reliable estimates to be presented.

Table 17. Actual and expected mean hematocrit in adults, by sex, race, and marital status: United States, 1960-62

Sex, race, and marital status	Actual	Expected	Difference
MEN			
White		Ml. percent	
Married	46.5	46.5	0.0
Widowed	46.7	45.9	0.8
Divorced	45.8	46.4	-0.6
Never married	46.4	46.6	-0.2
Negro			
Married	45.6	45.7	-0.1
Never married	46.6	46.7	-0.1
WOMEN			
White			
Married	42.4	42.5	-0.1
Widowed	43.4	43.3	0.1
Divorced	42.1	42.7	-0.6
Separated	43.3	42.5	0.8
Never married	42.2	42.1	0.1
Negro			
Married	40.4	40.7	-0.3
Widowed	42.0	41.6	0.4
Never married	40.6	40.3	0.3

NOTE: Where categories are not listed for a specific race-sex group, the sample size was too small for reliable estimates to be presented.

Table 18. Actual and expected mean hematocrit in adults, by sex, race, and usual activity status: United States, 1960-62

Sex, race, and usual activity status	Actual	Expected	Difference
MEN			
White		Ml. percent	
Usually working---	46.6	46.6	0.0
Retired--	45.5	45.8	-0.3
Other or unknown---	46.6	46.5	0.1
Negro			
Usually working--	45.9	45.9	0.0
Other or unknown---	46.5	46.1	0.4
WOMEN			
White			
Usually working--	42.2	42.5	-0.3
Keeping house--	42.7	42.6	0.1
Other or unknown---	42.5	41.9	0.6
Negro			
Usually working--	40.6	40.7	-0.1
Keeping house--	40.9	40.9	0.0

NOTE: Where categories are not listed for a specific race-sex group, the sample size was too small for reliable estimates to be presented.

Table 19. Actual and expected mean hematocrit in adults, by sex, race, and occupation: United States, 1960-62

Sex, race, and occupation	Actual	Expected	Difference
MEN			
White	Ml. percent		
Professional, technical, and managerial	46.6	46.6	0.0
Farmers and farm managers	45.8	46.4	-0.6
Clerical and sales workers	47.2	46.6	0.6
Craftsmen, foremen, and kindred workers	46.3	46.6	-0.3
Operatives and kindred workers	46.5	46.6	-0.1
Private household and service workers	47.4	46.6	0.8
Farm and other laborers (except mine)	46.6	46.5	0.1
Negro			
Operatives and kindred workers	46.3	46.1	0.2
Farm and other laborers (except mine)	46.0	46.0	0.0
WOMEN			
White			
Professional, technical, and managerial	42.1	42.3	-0.2
Clerical and sales workers	42.3	42.1	0.2
Operatives and kindred workers	42.1	42.2	-0.1
Private household and service workers	42.2	42.3	-0.1
Negro			
Private household and service workers	40.3	40.7	-0.4

NOTE: Where categories are not listed for a specific race-sex group, the sample size was too small for reliable estimates to be presented.

Table 20. Actual and expected mean hematocrit in adults, by sex, race, and industry: United States, 1960-62

Sex, race, and industry	Actual	Expected	Difference
MEN			
White		Ml. percent	
Agriculture, forestry, and fisheries	46.1	46.5	-0.4
Mining and construction	46.4	46.6	-0.2
Manufacturing	46.4	46.6	-0.2
Transportation, communication, and other public utilities	46.6	46.6	0.0
Wholesale and retail trade	46.7	46.6	0.1
Finance, insurance, and real estate	47.6	46.5	1.1
Service and miscellaneous	46.7	46.6	0.1
Government	47.3	46.6	0.7
Negro			
Agriculture, forestry, and fisheries	45.6	45.6	0.0
Manufacturing	46.1	46.0	0.1
WOMEN			
White			
Manufacturing	41.8	42.2	-0.4
Wholesale and retail trade	42.5	42.3	0.2
Finance, insurance, and real estate	42.2	42.2	0.0
Service and miscellaneous	42.2	42.2	0.0
Government	42.6	42.1	0.5
Negro			
Service and miscellaneous	40.5	40.7	-0.2

NOTE: Where categories are not listed for a specific race-sex group, the sample size was too small for reliable estimates to be presented.

APPENDIX I

DEMOGRAPHIC TERMS

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

Race.—Race is recorded as "White," "Negro," or "Other." "Other" includes American Indian, Chinese, Japanese, and so forth. Mexican persons are included with "White" unless definitely known to be Indian or of another nonwhite race.

Population size.—The five classes comprising this characteristic were derived from the design of the sample which accomplished a stratification of the primary sampling units by population size in each of three broad geographic locations. Because the survey was started in 1960, the primary sampling units within each of the five population-size classes were necessarily based on populations and definitions of the 1950 census. The name of each selected primary sampling unit within each population-size class and geographic location, along with other selected sample data, are presented in an earlier report. [2]

The definitions for each of the five population-size classes are as follows:

Giant metropolitan areas.—This class includes primary sampling units defined in the census as standard metropolitan statistical areas (SMSA's) and having populations of 3 million persons or more.

Other very large metropolitan areas.—Included in this class are standard metropolitan statistical areas with populations of 500,000 to 3,000,000 as defined by the 1950 census.

Other standard metropolitan statistical areas.—This class includes other SMSA's.

Other urban.—This includes primary sampling units which were highly urban in composition but were not defined as SMSA's.

Rural.—This includes primary sampling units which were primarily rural in composition according to census definitions.

Region.—For the purpose of classifying the population by geographic area, the United States was divided into three major regions. This division was especially made for the design of the HES sample. The regions and the States included are as follows:

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

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

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

According to the 1960 definition, the urban population comprises all persons living in (a) places of 2,500 inhabitants or more incorporated as cities, boroughs, villages, and towns (except towns in New England, New York, and Wisconsin); (b) the densely settled urban fringe, whether incorporated or unincorporated, of

urbanized areas; (c) towns in New England and townships in New Jersey and Pennsylvania which contain no incorporated municipalities as subdivisions and have either 25,000 inhabitants or more or a population of 2,500-25,000 and a density of 1,500 persons or more per square mile; (d) counties in States other than the New England States, New Jersey, and Pennsylvania that have no incorporated municipalities within their boundaries and have a density of 1,500 persons or more per square mile; and (e) unincorporated places of 2,500 inhabitants or more not included in any urban fringe. The remaining population is classified as rural.

Place description.—In this survey the urban population is classified as living "in the central city" or "outside the central city" of an SMSA. The remaining urban population is classified as "not in SMSA."

The definitions and titles of standard metropolitan statistical areas are established by the U.S. Bureau of the Budget with the advice of the Federal Committee on Standard Metropolitan Statistical Areas.

The definition of an individual standard metropolitan statistical area involves two considerations: first, a city or cities of specified population to constitute the central city and to identify the county in which it is located as the central county; and, second, economic and social relationships with contiguous counties which are metropolitan in character so that the periphery of the specific metropolitan area may be determined.

Persons "in the central city" of an SMSA are therefore defined as those whose residency is in the city appearing in the stand and metropolitan statistical area title. Persons residing in an SMSA but not in the city appearing in the SMSA title are considered to reside "outside the central city."

The remaining population is allocated into rural-farm and rural-nonfarm groups. The farm population includes all persons living in rural territory on places of 10 or more acres from which sales of farm products amounted to $50 or more during the previous 12 months or on places of less than 10 acres from which sales of farm products amounted to $250 or more during the preceding 12 months. Other persons living in rural territory were classified as nonfarm. Persons were also classified as nonfarm if their household paid rent for the house but their rent did not include any land used for farming.

Employment status.—This term applies to the employment status of persons during the 2-week period prior to the week of interview. It is not intended that this term define the labor force or provide estimates of the employed or unemployed population at the time of the survey.

Persons who reported that they either worked at or had a job or business at any time during the 2-week period prior to the week of interview were considered employed. This includes paid work as an employee of someone else, self-employment in business, farming, or

professional practice, and unpaid work in a family business or farm. Persons on layoff from a job and those who were absent from their job or business because of temporary illness, vacation, strike, or bad weather are considered as employed if they expected to work as soon as the particular event causing their absence no longer existed. Freelance workers are considered as currently employed if they had a definite arrangement with one or more employers to work for pay according to a weekly or monthly schedule either full time or part time. Excluded are such persons who have no definite employment schedule but work only when their services are needed. Also excluded are (1) persons receiving revenue from an enterprise in whose operation they do not participate, (2) persons doing housework or charity work for which they receive no pay, and (3) seasonal workers during the portion of the year they were not working. (It should be noted that these data were not collected for Philadelphia.)

Occupation.—A person's occupation may be defined as his principal job or business. For the purposes of this survey the principal job or business of a respondent is defined in one of the following ways. If the person worked during the 2-week-reference period of the interview or had a job or business, the question concerning his occupation (or what kind of work he was doing) applies to his job during that period. If the respondent held more than one job, the question is directed to the one at which he spent the most time. It refers to the one he considers most important when equal time is spent at each job. A person who has not begun work at a new job, is looking for work, or is on layoff from work is questioned about his last full-time civilian job. A full-time job is defined as one at which the person spent 35 or more hours per week and which lasted 2 consecutive weeks or more. A person who has a job to which he has not yet reported and has never had a previous job or business is classified as a "new worker."

The occupational groups are shown below with the appropriate census code categories.

Occupational title	*Census code*
Professional, technical, and managerial ------------------	R,000-195, 250-285
Farmers and farm managers---	N, 222
Clerical and sales workers --	S, Y, Z, 301-395
Craftsmen, foremen, and kindred workers-------------	Q, 401-545
Operatives and kindred workers --------------------	T, W, 601-721

(U.S. Bureau of Census, 1960 Census of Population, Classified Index of Occupations and Industries, U.S. Government Printing Office, Washington, D.C., 1960.) This information was not collected for Philadelphia and Valdosta.

Private household and service
  workers -------------------- P, 801-803, 810-890

Farm and other laborers
  (except mine)--------------- U, V, X, 901, 905,
                              960-973

Unknown (including new
  workers) ------------------- 995 and all other
                              codes

Industry.—The industry in which a person was reportedly working was classified by the major activity of the establishment in which he worked.

The only exceptions to the above are those few establishments classified according to the major activity of the parent organization, and they are as follows: laboratories, warehouses, repair shops, and places for storage.

The industry groupings are shown below. (Data on industry were not collected for Valdosta and Philadelphia.) The census code (the Classified Index of Occupation and Industries) and the Standard Industrial Classification (SIC) code components are also listed.

Industry title	Census code	SIC code
Agriculture, forestry, and fisheries	A, 017, 018	01, 02, 07 (exc. 0713), 08, 09
Mining and construction	C, 126-156	10-14, 15-17
Manufacturing	B, M, 206-459	19-39, 0713
Transportation, communication, and other public utilities	L, 507-579	40-49
Wholesale and retail trade	D, F, G, 606-696	50, 52-59
Finance, insurance, and real estate	706-736	60-67
Service and miscellaneous	E, H, K, 806-898	70, 72, 73, 75, 76, 78, 82, 84, 86, 88, 89
Government	J, 906-936	91-94
Unknown (including new workers)	999	99

The industry title "government" differs somewhat from the usual industrial classification of government, since it is limited to the postal service and Federal, State, and local public administrations. This category includes only uniquely governmental functions and excludes those activities which may also be carried out by private enterprise. For example, teachers in public educational facilities and nurses engaged in medical services of governmental agencies are included with the "service and miscellaneous" group.

Usual activity status.—All persons are classified according to their usual activity status during the 12-month period prior to the week of interview. The "usual" activity status, in case more than one is reported, is the one at which the person spent the most time during the 12-month period.

The categories of usual activity status used are usually working, usually keeping house, retired, and other. For several reasons these categories are not comparable with somewhat similarly named categories in official Federal labor force statistics. First, the responses concerning usual activity status are accepted without detailed questioning, since the objective of the question is not to estimate the numbers of persons in labor force categories but to identify crudely certain population groups which may have differing health problems. Second, the figures represent the usual activity status over the period of an entire year, whereas official labor force statistics relate to a much shorter period, usually 1 week. Finally in the definitions of specific categories which follow, certain marginal groups are classified differently to simplify procedures.

Usually working includes persons who are paid employees; self-employed in their own business, profession, or in farming; or unpaid employees in a family business or farm. Work around the house or volunteer or unpaid work, such as for a church, etc., is not counted as working.

Usually keeping house includes women whose major activity is described as "keeping house" and who cannot be classified as "working."

Retired includes persons 45 years of age and older who consider themselves to be retired. In case of doubt a person 45 years of age or older is counted as retired if he or she has either voluntarily or involuntarily stopped working, is not looking for work, and is not described as "keeping house." A retired person may or may not be unable to work.

Other in this report includes men not classified as "working" or "retired" and women not classified as "working," "keeping house," or "retired." Persons who are going to school are included in this group.

Education.—Each person is classified by education in terms of the highest grade of school completed. Only grades completed in regular schools, where persons are given a formal education, are included. A "regular" school is one which advances a person toward an elementary or high school diploma or a college, university, or professional school degree. Thus, education in vocational, trade, or business schools outside the regular school system is not counted in determining the highest grade of school completed.

Income of family or unrelated individuals.—Each member of a family is classified according to the total income of the family of which he is a member. Within the household all persons related to each other by blood, marriage, or adoption constitute a family. Unrelated individuals are classified according to their own income.

The income recorded is the total of all income received by members of the family in the 12-month period preceding the week of interview. Income from all sources is included, e.g., wages, salaries, rents from properties, pensions, help from relatives, and so forth.

Marital status.—The categories of marital status are *married, widowed, divorced, separated,* and *never married.* Persons with common-law marriages are considered to be married. Separated refers to married persons who have a legal separation, those living apart with intentions of obtaining a divorce, and other persons permanently or temporarily estranged from their spouse because of marital discord.

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APPENDIX II

STATISTICAL NOTES

The Survey Design

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

Reliability

The methodological strength of the survey derives especially from its use of scientific probability sampling techniques and highly standardized and closely controlled measurement processes. This does not imply that statistics from the survey are exact or

Table I. Examinees with missing hematocrit results, by race, sex, and age: United States, 1960-62

Sex and age	All races	White	Negro
Both sexes	119	99	18
Men			
Total, 18-79 years	48	45	3
18-24 years	5	5	-
25-34 years	8	8	-
35-44 years	10	8	2
45-54 years	13	13	-
55-64 years	6	6	-
65-74 years	6	5	1
75-79 years	-	-	-
Women			
Total, 18-79 years	71	54	15
18-24 years	17	13	3
25-34 years	7	5	2
35-44 years	9	8	1
45-54 years	15	10	5
55-64 years	15	13	2
65-74 years	4	3	1
75-79 years	4	2	1

without error. Data from the survey are imperfect for three major reasons: (1) results are subject to sampling error, (2) the actual conduct of a survey never agrees perfectly with the design, and (3) the measurement processes themselves are inexact even though standardized and controlled.

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

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

Sampling and Measurement Error

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

The probability design of the survey makes possible the calculation of sampling errors. Traditionally the role of the sampling error has been the determination of how imprecise the survey results may be because they come from a sample rather than from the measurement of all elements in the universe.

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

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

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

Expected Values

In tables 11-20 the actual mean hematocrit for the various demographic variables is compared with the expected. The computation of expected rates was done as follows:

Suppose that in an area (say, the Northeast) the Health Examination Survey estimates that there are N_i persons in the ith age-sex-race group ($i = 1, 2, \ldots, 42$; sum of $N_i = N$).

Suppose the Health Examination Survey estimates that the mean hematocrit for the United States in the ith age-sex-race group is X_i.

Then the expected mean hematocrit for the area is

$$\frac{1}{N}\Sigma_i N_i X_i$$

Comparison of an actual value for, say, a region with the expected value for that region is undertaken on the assumption that a meaningful statement can be made which holds, in some average way, for all persons in the region. This may or may not be true. The specified region may have higher values for young persons and lower values for old persons than are found in other regions. In that case an average comparison will obliterate one or both of these differentials. A similar remark may be made with respect to values computed for all races together, since relationships found in one race may not be found in another. Some instances will be noted in the detailed tables where the white and Negro differentials are not the same. In arriving at the general conclusions expressed in the text, an effort was made to consider all the specific data, including data not presented in this report, but it must be recognized that balancing such evidence is a qualitative rather than quantitative exercise. The standard error of the difference between an actual and expected value may be approximated by the standard error of the actual value (table III).

Table II. Standard error of mean hematocrit in adults, by race, sex, and age: United States, 1960-62

Sex and age	Mean hematocrit		
	All races	White	Negro
Men	Percent of specified population group		
Total, 18-79 years---	0.15	0.15	0.29
18-24 years---	0.26	0.21	0.76
25-34 years---	0.21	0.21	0.42
35-44 years---	0.21	0.21	0.29
45-54 years---	0.21	0.21	0.65
55-64 years---	0.21	0.21	0.75
65-74 years---	0.29	0.32	0.82
75-79 years---	0.51	0.54	*
Women			
Total, 18-79 years---	0.13	0.13	0.26
18-24 years---	0.19	0.19	0.69
25-34 years---	0.19	0.19	0.58
35-44 years---	0.19	0.13	0.50
45-54 years---	0.19	0.19	0.65
55-64 years---	0.20	0.20	0.73
65-74 years---	0.31	0.34	0.81
75-79 years---	0.73	0.75	*

Small Numbers

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

Tests of Significance

Tests of significance for the demographic variables were performed in two ways. The first was to divide the difference between the actual and expected values by the standard error of the actual value. For example, for Negro men who were living in giant metropolitan areas the mean hematocrit was 0.92 ml. percent lower than expected, and the standard error was 0.30 percent. Since the difference was more than three times its standard error, it may be deemed statistically significant.

The second method was to examine the age-specific differences (not published) between the prevalence for the specified group and the prevalence for all persons. Thus, for white men living in the South the mean hematocrit was less than the overall mean hematocrit for all seven age groups. The probability of such an occurrence is .0.008, and the difference is considered statistically significant. In this instance the difference between the actual and expected values (which is really a weighted average of the age-specific differences) is 1.4 its standard error which (using tables of the normal distribution) has a probability of 0.16 and is not statistically significant.

Table III. Standard errors of the mean hematocrit in adults, by race, sex, and selected characteristics: United States, 1960-62

Characteristic	Mean hematocrit			
	White		Negro	
	Men	Women	Men	Women
Region	Standard error per 100 adults			
Northeast--	0.25	0.13	0.65	0.36
South---	0.39	0.30	0.38	0.39
West--	0.21	0.19	0.47	0.71
Population-size group				
Giant metropolitan areas--	0.15	0.13	0.30	0.36
Other very large metropolitan areas---------------------------------------	0.47	0.49	1.29	1.05
Other standard metropolitan statistical areas-----------------------------	0.29	0.13	0.73	1.27
Other urban areas---	0.30	0.38	0.69	0.52
Rural areas---	0.42	0.33	0.54	0.54
Place description				
SMSA-in central city--	0.25	0.23	0.44	0.32
SMSA-outside central city---	0.21	0.13	0.92	0.71
Urban, not SMSA---	0.30	0.30	0.69	0.69
Rural, farm---	0.36	0.41	0.67	0.75
Rural, nonfarm--	0.25	0.27	0.61	0.71
Usual activity status				
Usually working---	0.15	0.19	0.25	0.31
Keeping house---	*	0.13	*	0.26
Retired---	0.29	*	*	*
Other---	0.36	0.81	0.92	*
Industry				
Agriculture, forestry, and fisheries--------------------------------------	0.33	*	0.91	*
Mining and construction---	0.29	*	*	*
Manufacturing---	0.29	0.32	0.55	*
Transportation, communication, and other public utilities-----------------	0.25	*	*	*
Wholesale and retail trade--	0.26	0.30	*	*
Finance, insurance, and real estate---------------------------------------	0.50	0.60	*	*
Service and miscellaneous--	0.26	0.27	*	0.41
Government--	0.33	0.49	*	*

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Table III. Standard errors of the mean hematocrit in adults, by race, sex, and selected characteristics: United States, 1960-62—Con.

Characteristic	Mean hematocrit			
	White		Negro	
	Men	Women	Men	Women
Occupation	Standard error per 100 adults			
Professional, technical, and managerial	0.29	0.27	*	*
Farmers and farm managers	0.71	*	*	*
Clerical and sales workers	0.30	0.27	*	*
Craftsmen, foremen, and kindred workers	0.29	*	*	*
Operatives and kindred workers	0.29	0.35	0.36	*
Private household and service workers	0.47	0.27	*	0.44
Farm and other laborers (except mine)	0.42	*	0.56	*
Education				
Under 5 years	0.47	0.51	0.60	0.72
5-8 years	0.21	0.19	0.52	0.41
9-12 years	0.21	0.13	0.53	0.38
13 years and over	0.33	0.30	*	*
Family income				
Under $2,000	0.33	0.23	0.56	0.31
$2,000-$3,999	0.21	0.19	0.35	0.50
$4,000-$6,999	0.21	0.13	0.51	0.55
$7,000-$9,999	0.25	0.27	*	*
$10,000 and over	0.26	0.23	*	*
Unknown	0.36	0.27	*	*
Marital status				
Married	0.15	0.13	0.35	0.31
Widowed	0.55	0.19	*	0.69
Divorced	0.58	0.38	*	*
Separated	*	0.64	*	*
Never married	0.15	0.19	0.74	0.68

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