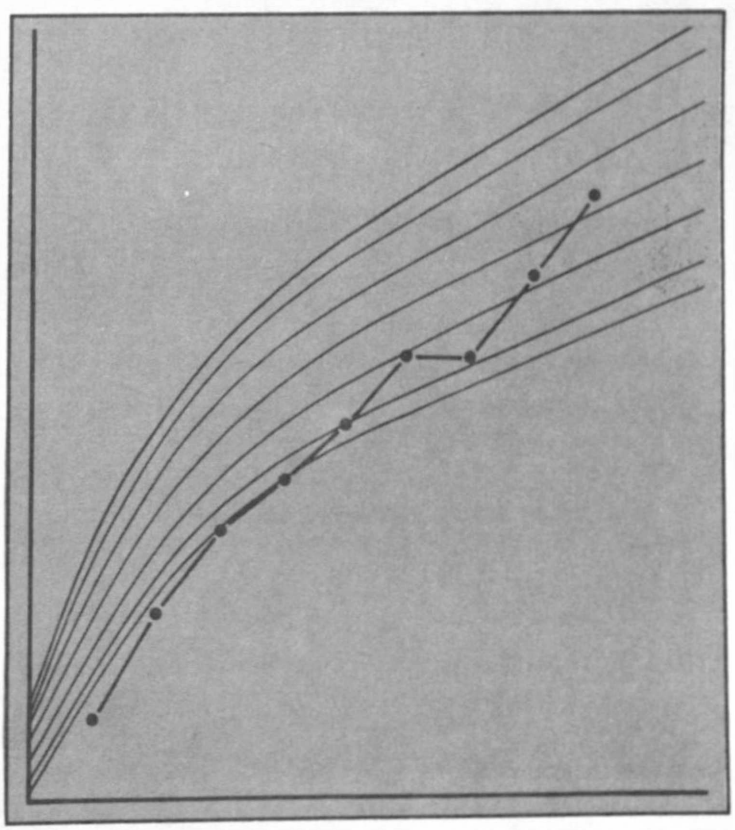
ANNUAL SUMMARY 1980
ISSUED NOVEMBER 1982

CENTERS FOR DISEASE CONTROL

NUTRITION SURVEILLANCE



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service

PREFACE

This report summarizes information, including selected indices of nutritional status, received from 22 States which comprise a group of contributors to a developing program of nutrition surveillance in the United States. We will consider adding other indices as their utility and availability become evident. As much as possible, tabulations in subsequent issues will be presented in the same format unless a change is appropriate.

The data presented in these tabulations come from a variety of sources, including health department clinics and other health care situations. Because of the lack of uniformity of data sources, as well as methodology, direct comparisons among States should be made with caution.

SUGGESTED CITATION:
Centers for Disease Control: Nutrition Surveillance 1980
Issued November 1982

Library of Congress Catalog Card No. 79-644825

Centers for Disease Control. . . . . William H. Foege, M.D., Directo

Center for Health Promotion and Education. . . . . .Carl W. Tyler, Jr., M.D., Acting Directo

Division of Nutrition. . . . . .Frederick L. Trowbridge, M.D., Directo
James W. Hicks, Deputy Directo

Field Services Branch. . . . . Gordon E. Robbins, M.P.H., Chie
Richard E. Peck, M.S., Public Health Adviso
David L. Pitts, Public Health Adviso

Epidemiology Branch. . . . . .James S. Marks, M.D., M.P.H., Chie
Phillip I. Nieburg, M.D., M.P.H., Medical Epidemiologis

Statistics Branch. . . . . James B. Goldsby, M.S., Acting Chie
Ellen W. Borland, Statistical Assistan
Mary R. Fuller, Computer Programme
Jimmy C. Simmons, Computer Systems Analys
Sharron M. Thomas, Statistical Assistan

Office of Educational Resources. . . . . Priscilla B. Holman, M.S.Ed., Directo
Laura W. Leathers, Writer-Edito

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Centers for Disease Control
Center for Health Promotion and Education
Division of Nutrition
Atlanta, Georgia 30333

TABLE OF CONTENTS

	Page
SUMMARY OF FINDINGS	1
CRITERIA FOR ABNORMAL VALUES	2
PEDIATRIC NUTRITION SURVEILLANCE SYSTEM	2
o History	
o Methods and Procedures	
o Surveillance Population	
o Quality Control	
PEDIATRIC SURVEILLANCE RESULTS	11
o Anthropometry	
o Hematology	
SPECIAL ANALYSES	26
o Southeast Asian Refugee Children	
o Native American Children	
o Multiple Abnormalities	
PREGNANCY NUTRITION SURVEILLANCE	35
o Background	
o Breast Feeding	
o Birth Weight	
REFERENCES	43
APPENDIX	44

HHS Publication No. (CDC) 83-8295

SUMMARY OF FINDINGS

In 1980 data from over 400,000 screening visits for children through 9 years of age from 22 States were submitted to the Pediatric Nutrition Surveillance System coordinated by the Centers for Disease Control (CDC). Almost 90% of these children were initially screened as part of the Special Supplemental Food Program for Women, Infants, and Children (WIC) or the Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program. Nutrition-related anthropometric or hematologic abnormalities were identified in 24.1% to 42.1% of screened children of different ethnic origins. Multiple abnormal indices, potentially related to nutrition, were found for 2.3% to 5.1% of the children. Children of Asian origin (including Southeast Asian refugees) had the highest prevalence of nutrition-related abnormalities, followed, in descending order of prevalence, by Native American, Hispanic, black, and white children.

As in previous years, the most prevalent nutrition-related problems defined by anthropometry were short stature (height-for-age <5th percentile) and overweight (weight-for-height >95th percentile). For most ethnic groups the prevalence of short stature peaked in the 12- through 23-month age group, with some 10.5% to 13.9% of children so classified (excluding Asian and Southeast Asian refugee children). The prevalence of overweight tended to be highest in the first 2 years of life, with 9.3% to 13.7% of children in the 12- through 23-month age group so classified (again excluding Asian and Southeast Asian refugee children). For Hispanic and Native American children, a high prevalence of overweight was observed through the preschool years; but for all ethnic groups, short stature and overweight were less prevalent in the limited number of school age children examined.

The prevalence of underweight (weight-for-height <5th percentile) was similar to that projected by the National Center for Health Statistics (NCHS) reference curves, indicating that underweight was not a major problem in the population under surveillance. The high prevalence of short stature and overweight among preschool Hispanic and Native American children was a consistent finding that should be further investigated.

The prevalence of low hemoglobin and hematocrit values varied widely by ethnic group, with Native American children generally showing the lowest prevalence and black children the highest prevalence of low values. Examination of hematologic data for the 5-year period from 1976 through 1980 showed no consistent change in the prevalence of low hemoglobin values, although a downward trend was observed in the prevalence of low hematocrit values among black children.

Proper interpretation of the nutritional significance of hematologic surveillance data is a continuing concern. Major issues include the reconciliation of differing prevalence estimates obtained from hemoglobin versus hematocrit measurements, and the development of reference standards which properly adjust for normal changes in hematologic values with age. The advantages of utilizing the smoothed 5th percentile of the NCHS/CDC reference curves as a definition of "low" hemoglobin or hematocrit values are discussed.

An important new development in 1980 has been the tabulation of pregnancy nutrition surveillance data based on approximately 16,000 records from 13 States. Nutrition-related and risk behavior indices which may affect pregnancy outcome are reported, including data on smoking, hypertension, and anemia. Data on birth weight and breast feeding in the post partum period are also presented.

CRITERIA FOR ABNORMAL VALUES

1. Low Hemoglobin and Low Hematocrit: Hemoglobin or hematocrit below the level specified in the following tables for appropriate age and sex.

Age	Hemoglobin	Hematocrit
6-23 months	10 grams	31%
2-5 years	11 grams	34%
6-14 years	12 grams	37%
15 or more years (females)	12 grams	37%
15 or more years (males)	13 grams	40%

2. Low Height-for-Age: Height-for-age less than the 5th percentile for children of the same sex and age in the reference population.

3. Low Weight-for-Age: Weight-for-age less than the 5th percentile for children of the same sex and age in the reference population.

4. Low Weight-for-Height: Weight-for-height less than the 5th percentile for children of the same sex and height in the reference population.

5. High Weight-for-Height: Weight-for-height greater than the 95th percentile for children of the same sex and height in the reference population.

Reference Population: Smoothed distribution of percentiles for the following populations:

Age	Reference Population Data
Birth - 24 months	Fels Research Institute Growth Study
25 - 59 months	First Health and Nutrition Examination Survey (HANES)
60 - 143 months	National Health Examination Survey, Cycle II; HANES
144 - 215 months	National Health Examination Survey, Cycle III; HANES

Note: Growth percentiles represent heights and weights which have been standardized for sex and age, and sex and height (for weight-for-height). Therefore, percentiles may be used to make height and weight comparisons between groups of individuals without concern for the age and sex distributions of groups being compared. However, comparisons of height and weight among groups with persons of diverse ethnic origins should be made with care because of possible genetic differences in growth potential.

PEDIATRIC NUTRITION SURVEILLANCE SYSTEM

History

In 1973 the CDC began working with five States (Arizona, Kentucky, Louisiana, Tennessee, and Washington) to develop a system for continuously monitoring the

nutritional status of specific, high-risk population groups. These five States recognized the need for timely nutrition-related data on populations served by them for use in program planning and evaluation. The system is based upon utilization of readily available data from selected health service delivery programs. Once this nucleus of States demonstrated that the surveillance mechanism was practical and workable, a gradual expansion into other States occurred.

During 1980 the CDC worked with 22 States in an expanding nutritional status surveillance program aimed primarily at selected high-risk pediatric populations (figure 1).

Methods and Procedures

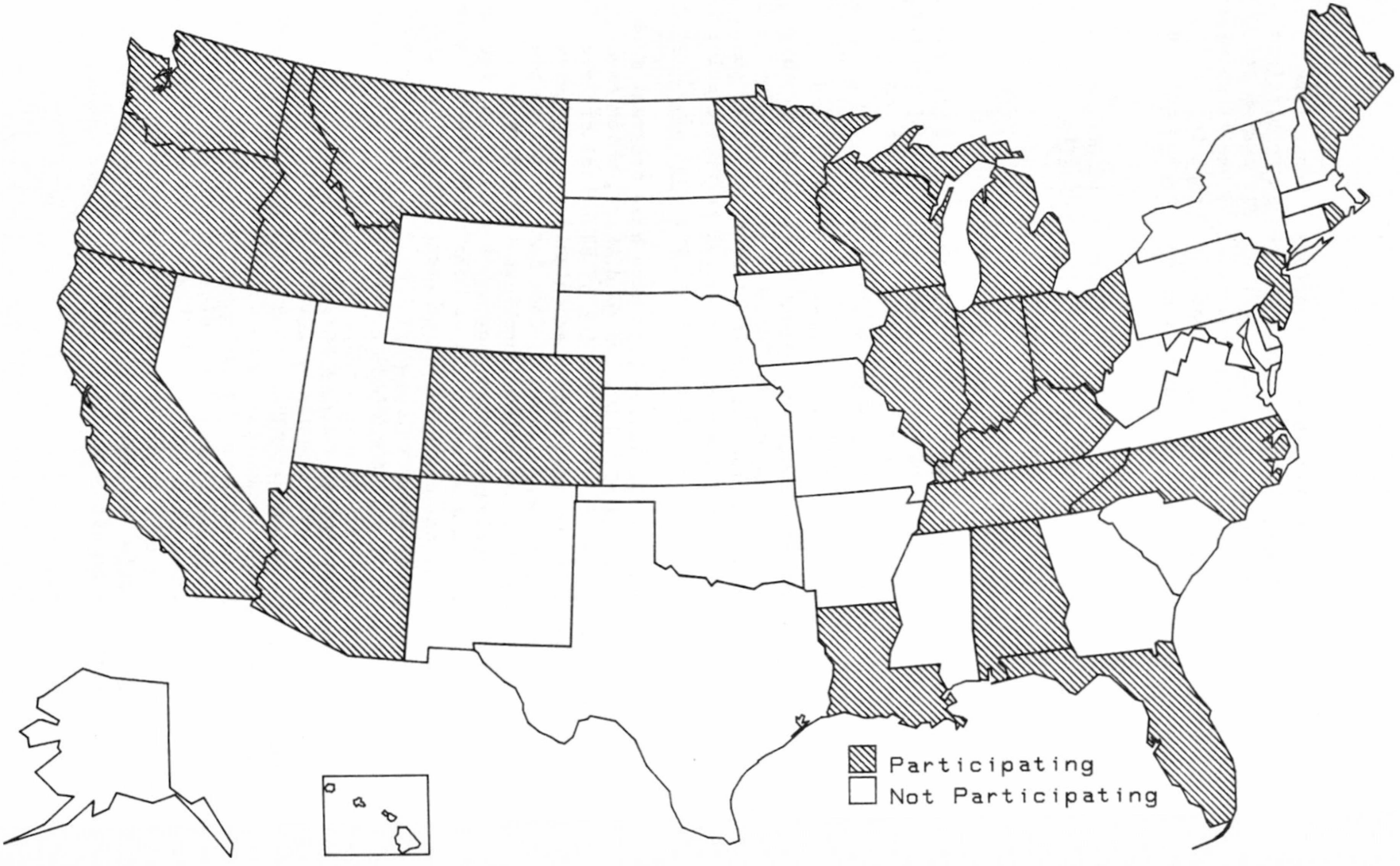
Nutritional status indicators for use in surveillance were selected from those indicators utilized in nutritional status surveys. The indices utilized were those which relate to the most widely prevalent nutritional problems and which are inexpensively and routinely obtained by local clinic staff.

Reference standards for the evaluation of surveillance data are derived principally from the national surveys conducted by the NCHS. Although data obtained from surveillance activities may not reflect the same ethnic and geographic composition as the sample drawn for national-level surveys, the data obtained from national samples still serve as a useful reference point in evaluating surveillance findings.

The principal sources of nutrition surveillance data have been programs such as Maternal and Child Health (MCH), EPSDT, WIC, and Head Start, which have been implemented to improve the health and well-being of high-risk children, particularly minority preschoolers, disadvantaged schoolchildren, and pregnant adolescents. Program administrators require up-to-date information on the prevalence and distribution of nutrition-related problems for effective program management. Nearly all health-oriented programs for children require that they be weighed and measured and a hemoglobin or hematocrit done. These simple and inexpensive determinations are relevant to assessment of the three most common nutrition-related problems documented by the major U.S. nutrition surveys: retardation of linear growth, overweight, and anemia.

Data on other important characteristics, such as age, sex, and ethnic background, are also readily available and can be incorporated into the surveillance mechanism with minimal additional cost and effort. In addition, some health agencies are engaged in measuring serum cholesterol and free erythrocyte protoporphyrin (FEP) levels in the pediatric population, so that these indicators can be used in surveillance. Additional items can be added to nutrition surveillance provided they meet the following criteria: 1) there is general agreement that the item is indicative of or related to poor nutritional status or is predictive of changes in nutritional status, and 2) the data items are amenable to quality control.

Figure 1. State participation in pediatric nutrition surveillance — 1980
CDC Pediatric Nutrition Surveillance System



The Nutrition Surveillance System functions as follows:

At the local level, clinic personnel record identifying and administrative information and the height, weight, hemoglobin or hematocrit, or other pertinent variables for each child screened in a service delivery program. These data are sent to the State health department, where they are edited for obvious measurement errors or inconsistent recording of data and keyed onto computer tapes. These tapes are either processed within the State or sent to CDC, where the data are analyzed.

The basic analyses are conceptually simple. Each child's height and weight values are compared with the NCHS reference-population values and with a set of age and sex-specific cutoff values for hemoglobin and hematocrit. These comparisons form the basis for the determination of prevalence estimates for anemia, growth retardation, or overweight. The data are then sent back to the States for use at the State, district, and local levels.

Monthly printouts, which list all children who were screened and found to have one or more potentially abnormal values, are provided to each clinic.

On a quarterly basis, tables are produced for each reporting clinic. These tables give the numbers and percents of children screened; age, ethnic group, and program distributions; percent and duration of breast feeding; prevalence of abnormal conditions as well as an estimate of the level of probable measurement error. In addition, each State nutrition director receives tables which rank reporting clinics by prevalence of shortness, overweight, thinness, anemia, and probable errors. Similar tabulations are provided annually. As needed, tabulations can be produced showing the proportions of children found to have highly prevalent nutritional abnormalities by the type of program, e.g., EPSDT, WIC, MCH clinics.

Surveillance Population

During 1980, data were submitted to the Pediatric Nutrition Surveillance System for more than 400,000 children from birth through 9 years of age who were screened in various service delivery programs. Table 1 shows the percentage distribution of screened children by State and service delivery program composition. According to the data submitted, 57.1% of the children were initially seen and certified to receive benefits in the WIC program, while 30.8% were initially seen in the EPSDT program. The remainder of the data came from children receiving routine MCH, Head Start, general medical, and school entrance examinations. Although almost 90% of the children seen in these clinics are identified as participants in one of two large Federally supported programs, a large percentage of these children are also receiving a number of other public health services, such as immunizations, lead screening, health education, etc.

Table 2 describes the ethnic distribution of screened children by State. The majority of children screened were white (55.4%), followed by blacks (29.8%) and Hispanics (8.7%).

Table 3 shows the composition of programs by the ethnic origin of screened children. The differences, as seen among the various programs, reflect the voluntary nature of the surveillance system and may not be related to any inherent program differences.

Table 4 shows that, among children through 9 years of age reported to the Nutrition Surveillance System, nearly 90% were children through 5 years of age. Of the total shown, 50.8% were males and 49.2% were females.

Quality Control

In 1980 over a million records for both screening and followup visits were submitted to the Nutrition Surveillance System. Of these, approximately 5% contained errors which caused the records to be rejected by the system. The most common causes of rejection included invalid clinic or county codes, birth dates later than the date of visit, and invalid ethnic or sex codes. The most common error, invalid clinic codes, was caused primarily by delay in receiving the appropriate codes of new reporting clinics.

The 947,000 records accepted by the system were submitted from 22 States, 847 counties, and 1,987 clinics. The quality of height* and weight measurements varies from clinic to clinic. Some sites have no adequate measuring boards; others have them, but they are used irregularly. Although the accuracy of measurements is often less than desirable, it appears to typify the quality of data obtained in public health clinics throughout the United States. However, it is believed that widespread improvements have been made in many clinics in the quality of measuring equipment as well as in the use of appropriate measurement techniques.

Concurrently, improved computer-editing procedures have been developed and implemented in the surveillance system which identify those measurements most likely to be in error. These procedures are based on the statistical probability of occurrence in a normalized reference population. Measurements whose probability of occurrence is less than 0.1% are called highly probable errors, and those whose probability of occurrence is between 1% and 0.1% are called probable errors. Measurements labeled as probable or highly probable errors are identified as extremely abnormal values in the clinic edit listings for verification and correction. To avoid including values which are highly likely to be in error, measurements whose probability of occurrence is less than 0.1% are excluded from tabulation and analysis.

*In the present report the term "height" refers to measurements of recumbent length in children through 24 months of age and upright stature in children over 24 months of age.

Table 1. Percentage distribution of screened children through 9 years of age by State and program composition — 1980
CDC Pediatric Nutrition Surveillance System

State	Program Composition							Total	
	EPSDT[1]	Medical Attention	MCH[2]	Head Start	School Entrance Exam	WIC[3]	Combination & Other	No.	%
Alabama	-	-	57.7	-	-	-	42.2	3,032	100.0
Arizona	-	-	10.6	2.8	0.1	65.5	20.9	23,357	100.0
California	72.9	-	-	3.5	9.7	-	14.0	12,258	100.0
Colorado	-	-	-	-	-	100.0	-	12,027	100.0
Florida	0.8	0.2	11.8	-	1.5	82.1	3.5	37,108	100.0
Idaho	80.4	-	18.9	-	-	-	0.8	265	100.0
Illinois	-	-	-	-	-	100.0	-	31,448	100.0
Indiana	-	-	11.1	-	-	88.9	-	19,933	100.0
Kentucky	4.4	-	1.2	-	2.0	92.4	-	35,279	100.0
Louisiana	100.0	-	-	-	-	-	-	14,496	100.0
Maine	-	-	-	-	-	100.0	-	2,887	100.0
Michigan	86.8	1.1	7.3	0.1	0.2	1.9	2.6	82,510	100.0
Minnesota	1.2	-	-	-	-	34.8	63.7	4,629	100.0
Montana	-	-	-	-	-	99.9	0.1	6,310	100.0
North Carolina	6.9	1.9	9.6	-	-	70.3	11.4	16,693	100.0
New Jersey	-	-	-	-	-	100.0	-	10,117	100.0
Ohio	77.3	13.9	-	-	-	8.6	0.2	18,786	100.0
Oregon	-	-	0.1	0.2	1.5	98.1	-	14,471	100.0
Rhode Island	2.5	5.6	5.6	-	-	82.0	4.3	284	100.0
Tennessee	14.2	1.2	8.2	0.2	0.2	70.7	5.1	26,773	100.0
Washington	3.0	-	17.4	0.8	0.1	78.5	-	7,205	100.0
Wisconsin	31.9	-	-	-	-	68.1	-	22,021	100.0
TOTAL	30.8	1.1	5.6	0.3	0.7	57.1	4.4	401,889	100.0

[1]EPSDT = Early and Periodic Screening, Diagnosis, and Treatment program.
[2]MCH = Maternal and Child Health.
[3]WIC = Special Supplemental Food Program for Women, Infants, and Children.

Table 2. Percentage distribution of screened children through 9 years of age by reporting State and ethnic origin -- 1980 CDC Pediatric Nutrition Surveillance System

State	Ethnic Origin						Total	
	White	Black	Hispanic	Native American	Asian*	Other & Unknown	No.	%
Alabama	22.2	77.6	-	-	-	0.2	3,032	100.0
Arizona	27.7	4.7	34.4	32.9	0.2	0.1	23,357	100.0
California	30.7	5.4	37.3	1.2	14.2	11.3	12,258	100.0
Colorado	57.5	4.4	35.1	0.5	2.5	-	12,027	100.0
Florida	32.4	54.5	10.4	0.1	0.5	2.0	37,108	100.0
Idaho	81.9	0.4	13.6	0.8	1.9	1.5	265	100.0
Illinois	39.0	45.1	13.1	0.1	1.5	1.3	31,448	100.0
Indiana	62.5	32.2	4.0	0.1	0.8	0.4	19,933	100.0
Kentucky	86.8	12.0	0.2	-	0.4	0.6	35,279	100.0
Louisiana	21.1	78.3	-	-	-	0.7	14,496	100.0
Maine	94.2	0.6	0.1	0.6	0.4	4.0	2,887	100.0
Michigan	54.8	38.9	1.6	0.4	0.1	4.2	82,510	100.0
Minnesota	65.4	5.5	3.5	1.0	23.7	0.8	4,629	100.0
Montana	87.4	0.5	2.8	7.5	1.5	0.2	6,310	100.0
North Carolina	34.1	63.6	0.4	1.1	0.8	-	16,693	100.0
New Jersey	26.3	46.1	25.5	0.1	0.7	1.2	10,117	100.0
Ohio	87.8	9.0	2.2	-	0.7	0.2	18,786	100.0
Oregon	79.9	3.1	10.1	2.9	3.8	0.1	14,471	100.0
Rhode Island	69.4	19.7	4.6	0.4	0.7	5.3	284	100.0
Tennessee	77.5	21.9	-	-	-	0.5	26,773	100.0
Washington	59.8	3.5	25.4	6.2	2.1	2.9	7,205	100.0
Wisconsin	72.5	12.6	6.1	5.9	2.7	0.2	22,021	100.0
TOTAL	55.4	29.8	8.7	2.8	1.5	1.8	401,889	100.0

*Includes Southeast Asian Refugees

Table 3. Percentage distribution of screened children through 9 years of age by program composition and ethnic origin — 1980
CDC Pediatric Nutrition Surveillance System

Program	Ethnic Origin						Total	
	White	Black	Hispanic	Native American	Asian*	Other & Unknown	No.	%
EPSDT	57.9	33.1	3.2	0.6	1.6	3.6	123,899	100.0
Medical Attention	66.0	29.9	2.8	0.2	0.4	0.6	4,273	100.0
MCH	41.8	46.5	8.9	0.7	0.6	1.4	22,389	100.0
Head Start	31.0	8.9	46.6	8.5	1.2	3.9	1,282	100.0
School Entrance Exam	58.9	8.6	25.9	0.6	1.6	4.4	2,902	100.0
WIC	56.4	26.9	10.5	4.2	1.3	0.6	229,401	100.0
Combination	31.8	40.3	23.5	2.6	0.3	1.6	7,728	100.0
Other	47.9	19.4	15.9	2.6	7.5	6.6	9,894	100.0
Unknown	43.8	38.8	14.9	-	1.7	0.8	121	100.0
TOTAL	55.4	29.8	8.7	2.8	1.5	1.8	401,889	100.0

*Includes Southeast Asian Refugees.

NOTE: See table 1 for explanation of acronyms.

Table 4. Percentage distribution of screened children through 9 years of age by program composition and age group — 1980 CDC Pediatric Nutrition Surveillance System

Program	Age						Total	
	< 3 Months	3-5 Months	6-11 Months	1 Year	2-5 Years	6-9 Years	No.	%
EPSDT	4.8	4.7	7.7	12.0	42.0	28.7	123,899	100.0
Medical Attention	10.4	6.8	11.1	16.5	35.4	19.9	4,273	100.0
MCH	17.9	8.4	11.6	14.3	33.4	14.5	22,389	100.0
Head Start	0.9	0.4	0.7	0.9	96.3	0.9	1,282	100.0
School Entrance Exam	0.4	0.2	0.1	0.5	66.8	32.0	2,902	100.0
WIC	30.4	8.9	13.8	17.0	29.9	-	229,401	100.0
Combination	44.0	7.6	12.1	12.7	23.6	-	7,728	100.0
Other	8.1	4.4	6.4	13.0	46.6	21.5	9,894	100.0
Unknown	22.3	5.0	9.1	14.0	44.6	5.0	121	100.0
TOTAL	21.0	7.3	11.4	15.0	34.7	10.6	401,889	100.0

NOTE: See table 1 for explanation of acronyms.

Table 5 summarizes the prevalence of highly probable errors by State for screened children through 9 years of age. It shows that the percent of records without highly probable errors ranged from 93.6% to 98.9%.

Height and weight errors were the most common errors, accounting for 1.7% and 1.6%, respectively, with age errors accounting for 1.1%. Exclusions because of hematology errors were relatively few.

Of the more than 385,000 records accepted for tabulation and analysis, 4.2% were found to have probable errors as defined previously (table 6). Individual States had between 93.9% and 97.6% of their records with all values within an acceptable range. This table also shows that the most common errors related to anthropometric measures were undermeasuring height and overmeasuring weight.

Although height and weight are the most useful anthropometric measurements for evaluating the nutritional status of children, care must be taken to maintain accuracy and precision.* An earlier study determined that the principal causes of measurement inaccuracies are inadequate equipment, improper techniques, and insufficient personal motivation (1).

The CDC continues to consult with States participating in the Nutrition Surveillance System to help improve data quality by identifying potential sources of data errors and providing training assistance in weighing and measuring techniques for State-level consultants.

PEDIATRIC SURVEILLANCE RESULTS

Anthropometry

Data on height, weight, age, and sex are converted to percentiles for height-for-age and weight-for-height; the NCHS reference population data base is used. Although cutoff points for abnormal values can be adjusted to meet specific local needs, it is advantageous to have generally agreed upon cutoff points so that meaningful comparisons can be made. Levels less than the 5th percentile height-for-age and weight-for-height and greater than the 95th percentile weight-for-height are used to report potentially abnormal values. Results based on these cutoff points are shown in table 7.

Among children 3 months through 5 years of age, the percentage of children whose height-for-age was less than the 5th percentile was greater than the 5% that would be expected if the population under surveillance was similar to

*Accuracy is the degree to which a measurement corresponds to the true value. Precision is the degree to which successive measurements of the same individual agree within specified limits.

Table 5. Prevalence of highly probable measurement, recording and/or keying errors in records for screened children through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

State	Number Reported	Percent With Highly Probable Error					Percent Without Highly Probable Error
		Ht	Wt	Age	Hgb	Hct	
Alabama	3,032	1.8	1.5	1.1	0.1	0.4	96.3
Arizona	23,357	2.3	1.4	1.3	0.1	0.2	96.0
California	12,258	1.6	1.9	1.2	0.4	0.6	95.2
Colorado	12,027	3.6	2.8	2.3	0.2	0.3	93.8
Florida	37,108	1.8	1.6	1.3	0.6	1.1	94.8
Idaho	265	0.8	–	0.4	–	–	98.9
Illinois	31,448	2.9	2.3	1.7	0.1	1.0	94.3
Indiana	19,933	2.3	1.1	1.4	0.4	0.3	95.7
Kentucky	35,279	2.2	1.4	1.2	0.2	0.5	95.8
Louisiana	14,496	1.9	1.8	0.8	0.4	0.2	95.6
Maine	2,887	2.0	1.7	1.2	0.3	0.3	95.6
Michigan	82,510	0.7	1.2	0.5	–	0.5	97.4
Minnesota	4,629	1.3	1.2	1.4	0.5	0.3	96.5
Montana	6,310	0.7	0.7	0.7	–	0.3	98.0
North Carolina	16,693	1.4	1.7	0.8	0.1	0.6	96.4
New Jersey	10,117	3.7	1.7	1.2	0.6	0.6	93.6
Ohio	18,786	1.6	1.8	1.3	0.3	0.4	95.8
Oregon	14,471	1.8	3.1	1.7	0.2	0.3	94.5
Rhode Island	284	2.8	1.8	2.5	–	0.4	94.0
Tennessee	26,773	1.1	1.2	0.9	–	0.4	97.0
Washington	7,205	3.0	3.2	2.4	0.2	0.4	94.1
Wisconsin	22,021	1.0	1.1	0.8	–	0.3	97.5
TOTAL	401,889	1.7	1.6	1.1	0.2	0.5	96.0

NOTE: Since a record may have more than one error, the sum of a line may not equal 100%.

Table 6. Prevalence of probable measurement, recording and/or keying errors in records for screened children through 9 years of age reported in nutrition surveillance in 1980
CDC Pediatric Nutrition Surveillance System

State	Number Reported*	Percent With Probable Error										Percent Without Probable Error
		Low					High					
		Ht	Wt	Age	Hgb	Hct	Ht	Wt	Age	Hgb	Hct	
Alabama	2,920	1.1	0.2	0.2	0.0	0.4	0.2	0.8	0.4	0.0	0.6	96.3
Arizona	22,430	1.1	0.6	0.5	0.1	0.3	0.2	0.8	0.8	0.1	0.1	96.0
California	11,667	0.3	0.2	0.4	0.2	0.5	0.1	1.1	1.0	0.2	0.2	95.9
Colorado	11,284	1.2	0.8	0.4	0.0	0.7	0.1	0.4	0.9	0.3	0.2	95.5
Florida	35,164	0.7	0.4	0.5	0.9	2.0	0.2	1.1	0.7	0.1	0.1	93.9
Idaho	262	0.4	0.8	–	–	–	–	0.4	1.5	–	0.4	96.6
Illinois	29,642	1.1	0.3	0.4	0.2	1.7	0.1	0.8	1.1	–	0.2	94.6
Indiana	19,067	1.1	0.4	0.6	1.0	0.9	0.3	0.7	0.9	0.1	0.1	94.7
Kentucky	33,786	1.0	0.4	0.7	0.3	0.9	0.2	0.8	0.7	0.1	0.1	95.3
Louisiana	13,864	0.7	0.3	0.3	0.8	0.2	0.2	0.9	0.6	0.1	0.1	96.1
Maine	2,761	0.6	0.3	0.7	0.1	0.4	0.2	0.6	0.5	0.1	0.1	96.7
Michigan	80,400	0.2	0.1	0.3	–	0.7	0.2	1.1	0.4	–	0.7	96.5
Minnesota	4,466	0.6	0.2	0.2	0.4	0.2	0.1	0.8	2.5	0.3	0.2	95.0
Montana	6,183	0.4	0.3	0.3	–	0.4	–	0.4	0.6	–	0.3	97.6
North Carolina	16,090	0.2	0.4	0.5	0.2	0.9	0.2	1.0	0.4	–	0.1	96.3
New Jersey	9,471	1.4	0.7	0.5	0.3	0.7	0.2	0.7	1.2	0.3	0.1	94.6
Ohio	17,996	0.3	0.2	0.3	0.1	0.6	0.1	0.9	0.5	0.2	0.2	96.7
Oregon	13,676	0.6	0.4	0.4	–	0.3	0.1	0.5	1.0	–	0.1	97.0
Rhode Island	267	0.4	1.5	0.7	–	0.7	–	0.4	1.1	0.4	–	95.1
Tennessee	25,961	0.4	0.2	0.3	–	1.2	0.1	0.9	0.6	–	0.2	96.4
Washington	6,777	0.6	0.2	0.4	–	1.1	0.1	0.9	0.7	–	0.1	96.0
Wisconsin	21,481	0.3	0.2	0.3	–	0.5	0.1	0.7	0.4	–	0.2	97.4
TOTAL	385,615	0.6	0.3	0.4	0.2	0.9	0.2	0.9	0.7	0.7	0.3	95.8

*Records with highly probable errors were excluded from this tabulation.

Table 7. Prevalence of abnormal anthropometric indices among screened children through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

Age Group & Ethnic Origin	No. Exam.	Height-for-Age % Below 5th Percentile	Weight-for-Height % Below 5th Percentile	Weight-for-Height % Above 95th Percentile
< 3 Months				
White	32,191	4.2	3.7	4.8
Black	15,124	7.4	3.6	8.8
Hispanic	6,858	4.2	5.3	5.1
Nat. Amer.[1]	3,271	3.5	4.4	5.4
Asian[2]	539	5.0	3.3	5.9
3-5 Months				
White	15,247	9.2	2.8	9.8
Black	7,272	14.4	2.4	13.6
Hispanic	2,150	11.6	2.6	11.4
Nat. Amer.[1]	914	8.3	3.2	14.6
Asian[2]	239	11.3	3.3	15.5
6-11 Months				
White	23,421	9.2	4.1	7.6
Black	13,064	11.9	4.6	10.3
Hispanic	3,540	10.5	4.6	9.9
Nat. Amer.[1]	1,092	8.9	3.1	13.4
Asian[2]	395	19.0	4.3	5.3
12-23 Months				
White	30,844	10.5	4.8	9.3
Black	16,501	11.2	5.1	11.4
Hispanic	4,910	12.5	4.9	12.3
Nat. Amer.[1]	1,171	13.9	5.3	13.7
Asian[2]	825	27.4	11.8	3.8
2-5 Years				
White	75,168	9.1	2.3	7.4
Black	38,300	6.4	3.8	7.1
Hispanic	10,914	11.9	2.2	12.0
Nat. Amer.[1]	2,590	10.5	2.0	16.3
Asian[2]	2,015	33.4	4.2	4.6
6-9 Years				
White	21,106	6.4	2.3	5.0
Black	12,259	3.1	3.8	3.6
Hispanic	1,394	8.8	1.6	7.5
Nat. Amer.[1]	226	2.7	0.9	5.3
Asian[2]	815	35.3	4.9	1.2

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees.

the reference population. This percentage was highest among black children less than 6 months of age and among Asian children in all age groups, rising from 11.3% among 3- through 5-month-olds to 35.3% among 6- through 9-year-olds. Among other ethnic groups, there was an increase in the prevalence of low height-for-age through 23 months of age, a slight decrease among 2- through 5-year-olds, and a marked decrease among 6- through 9-year-olds.

Although it is likely that these changes represent, in part, the more accurate measurements that are possible with older children, some of the decreasing prevalence with increasing age may represent secular differences among age cohorts or may be the result of catchup growth. Using cross-sectional data alone, it is impossible to differentiate among these possibilities. Data from previous analyses of surveillance information, comparing the same age group in different years, do not suggest that secular change is a major determinant of this shift.

Weight-for-height is the anthropometric index best related to caloric under- or overnutrition. The prevalence of low weight-for-height levels (less than the 5th percentile) is consistently at or below 5% for all age or ethnic groups except Asians 12 through 23 months of age. The data confirm that undernutrition is not a major public health problem in children reported in nutrition surveillance and, in fact, the prevalence of low weight-for-height in these groups is similar to that for a representative group of U.S. children.

However, overweight children (weight-for-height greater than the 95th percentile of the reference population) constitute more than 5% of the population that would be expected if the distribution of anthropometric values was similar to that in the reference population. Overweight is generally more prevalent among Hispanics and American Indians than among other ethnic groups. For all ethnic groups, the prevalence of overweight decreases for children aged 6 through 9 years old.

Table 8 shows the prevalence of these anthropometric indices among different ethnic groups for 1976-80 by year. Except for a sharp increase in the prevalence of low height-for-age among Asian children in 1978 (with further increases in 1979 and 1980), the prevalences of low or high anthropometric indices for all ethnic groups does not appear to show any marked trends over time. The data from table 8 are illustrated in figure 2.

An influx of Southeast Asian refugee children to the United States began in late 1977, and many were treated at clinics submitting data to the Nutrition Surveillance System. Southeast Asian refugee children are included with the other Asian children, so the high percentage of low height-for-age values seen in the total Asian population may result in part from the inclusion of refugee children.

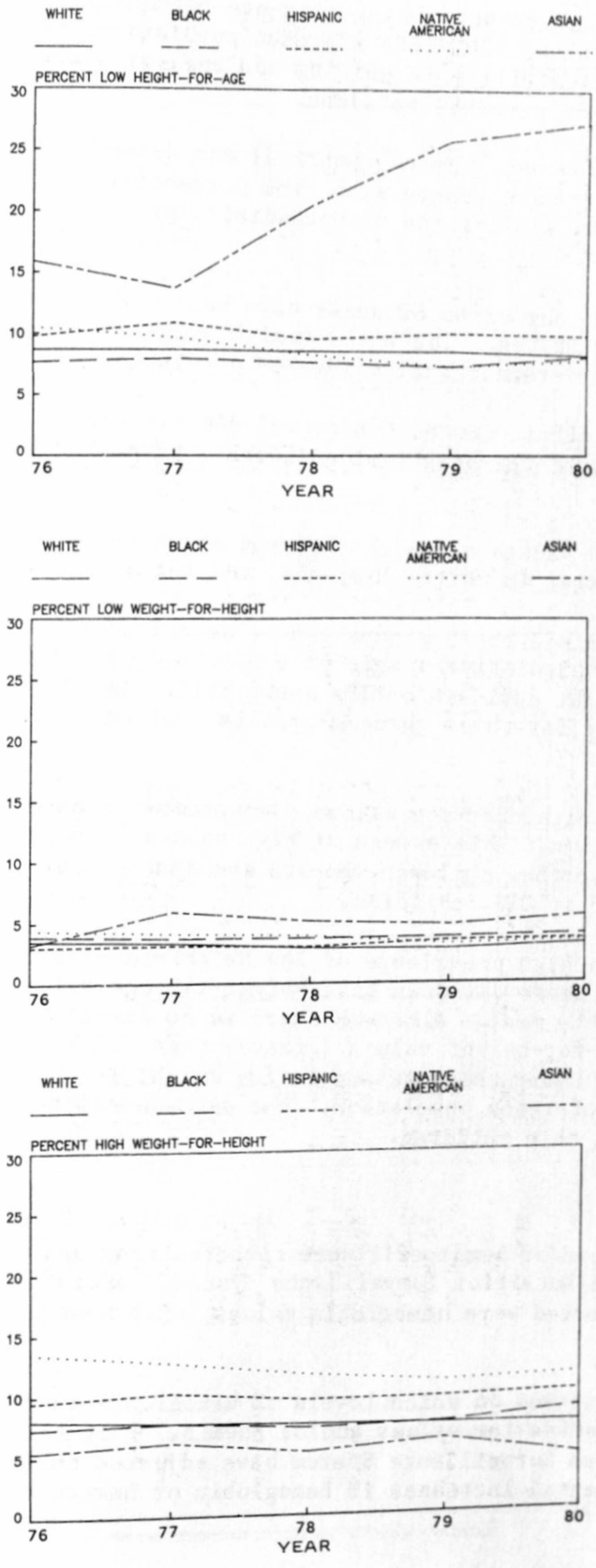
Many biological variables, including height-for-age, are normally distributed in most well-nourished healthy populations. Consequently, only fairly simple

Table 8. Prevalence of abnormal anthropometric indices among screened children through 9 years of age, 1976–1980 CDC Pediatric Nutrition Surveillance System

Ethnic Origin	Abnormal Index	Year 1976 No. Exam.	1976 %	1977 No. Exam.	1977 %	1978 No. Exam.	1978 %	1979 No. Exam.	1979 %	1980 No. Exam.	1980 %	5-Year Total No. Exam.	5-Year Total %
White	Low Ht-Age	52,158	8.7	114,276	8.7	117,683	8.6	139,165	8.6	197,977	8.3	621,259	8.5
	Low Wt-Ht	52,158	3.5	114,276	3.3	117,683	2.9	139,165	2.8	197,977	3.2	621,259	3.1
	High Wt-Ht	52,158	8.0	114,276	7.7	117,683	7.5	139,165	7.4	197,977	7.3	621,259	7.5
Black	Low Ht-Age	26,489	7.7	57,395	8.0	54,265	7.7	62,900	7.4	102,520	8.2	303,569	7.9
	Low Wt-Ht	26,489	3.9	57,395	3.7	54,265	3.7	62,900	3.8	102,520	4.0	303,569	3.8
	High Wt-Ht	26,489	7.3	57,395	7.7	54,265	7.2	62,900	7.5	102,520	8.5	303,569	7.8
Hispanic	Low Ht-Age	8,122	9.8	11,514	10.9	13,021	9.6	15,967	10.1	29,766	9.9	78,390	10.0
	Low Wt-Ht	8,122	3.0	11,514	3.1	13,021	3.0	15,967	3.5	29,766	3.6	78,390	3.3
	High Wt-Ht	8,122	9.5	11,514	10.2	13,021	9.5	15,967	9.6	29,766	9.9	78,390	9.8
Native American	Low Ht-Age	6,651	10.5	7,181	9.7	6,754	8.3	6,588	7.4	9,264	7.9	36,438	8.7
	Low Wt-Ht	6,651	4.4	7,181	4.1	6,754	3.9	6,588	3.2	9,264	3.5	36,438	3.8
	High Wt-Ht	6,651	13.5	7,181	12.7	6,754	11.6	6,588	10.9	9,264	11.3	36,438	12.0
Asian*	Low Ht-Age	371	15.9	459	13.7	769	20.5	1,490	25.8	4,828	27.3	7,917	25.0
	Low Wt-Ht	371	3.2	459	5.9	769	5.1	1,490	4.8	4,828	5.5	7,917	5.2
	High Wt-Ht	371	5.4	459	6.1	769	5.2	1,490	6.1	4,828	4.6	7,917	5.1

*Includes Southeast Asian Refugees

Figure 2. Prevalence of abnormal anthropometric indices among screened children through 9 years of age, 1976–1980
CDC Pediatric Nutrition Surveillance System



procedures are required to convert height-for-age percentiles to standard deviation (SD) scores in the NCHS/CDC reference population. The use of these SD scores allows more flexibility in editing and analyzing nutrition surveillance data than do percentiles alone.

Weight distributions, however, are asymmetrical and extend further above the median than below. This makes conversion from percentiles to SD scores more complex and requires the application of normalizing procedures described elsewhere (2).

The resulting reference curves in SD units have been widely used both within and outside the United States. The World Health Organization selected this data set for use as an international reference population (3).

Figure 3 presents, by ethnic group, the normal distribution of SD scores for height-for-age and weight-for-height of children 2 through 5 years of age who were screened in 1980.

It is evident that low values of height-for-age and high values of weight-for-height coexist in white, Hispanic, and Native American children.

Although children from all three groups can be described as shorter and more overweight than a representative sample of U.S. children, the highest prevalence of overweight children occurs among Native Americans, while the prevalence of stunting for these three groups is greatest among Hispanic children.

For black children, height-for-age values are somewhat greater than those for the reference population. This excess of high values of height-for-age in this ethnic group describes children who are somewhat taller than a representative sample of U.S. children.

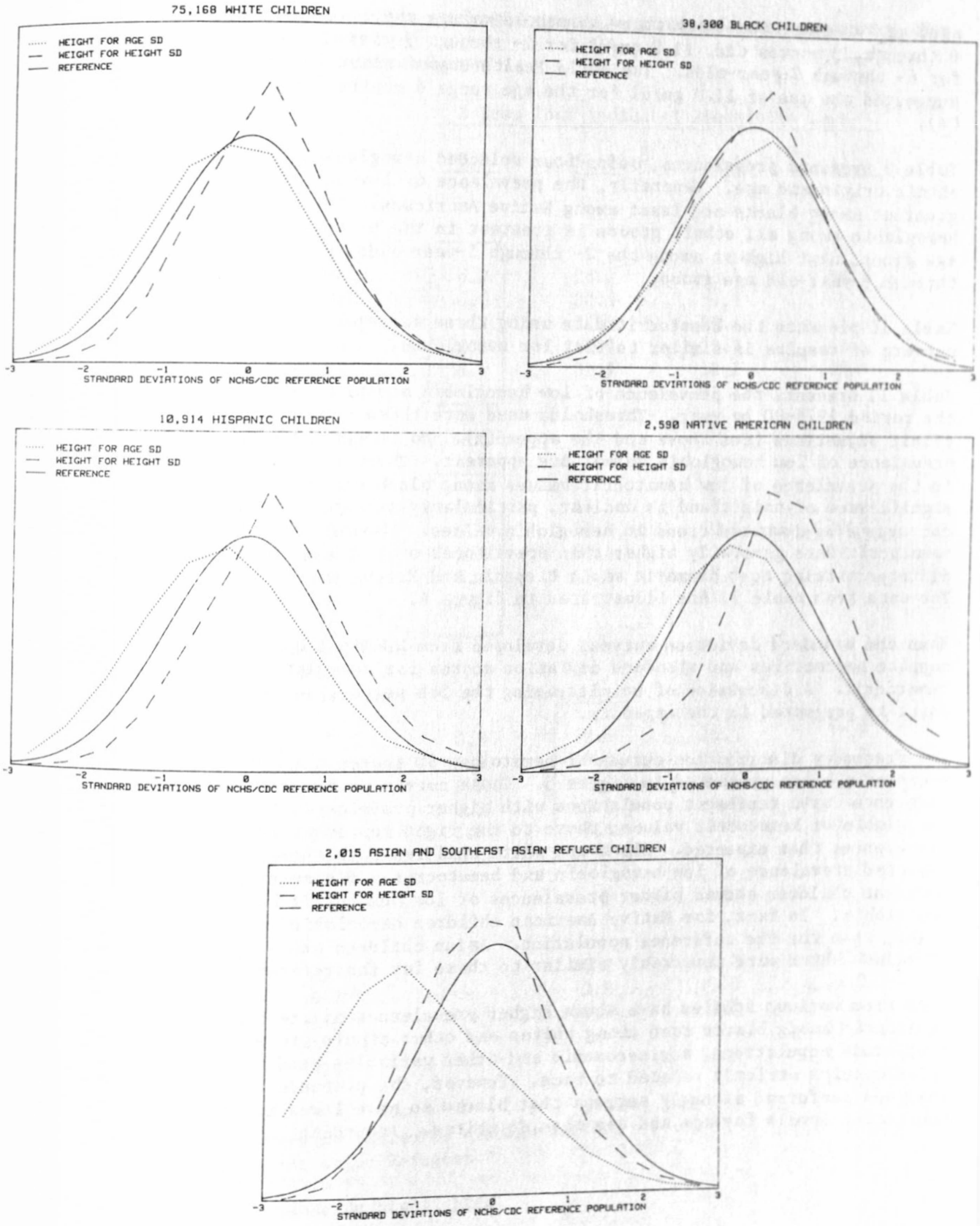
Asian children have a high prevalence of low height-for-age values. Approximately 20% of these children have height-for-age values that are more than two SD's below the mean. Although there is no excess of children with extremely low weight-for-height values (greater than 1.5 SD below the mean), the overall tendency among these Asians is for weight-for-height values to be below those of the reference population. The data describe a population of very short, somewhat thin children.

Hematology

Data on hemoglobin and/or hematocrit were reported from most of the States participating in the Nutrition Surveillance System. Approximately 20% of the hematology data reported were hemoglobin values, with hematocrits accounting for the balance.

There is little consensus on which levels of hemoglobin and/or hematocrit should be used to define low values and/or anemia. Most clinics providing data to the Nutrition Surveillance System have adjusted their screening levels to reflect developmental increases in hemoglobin or hematocrit that occur with

Figure 3. Distributions of anthropometric standard deviation scores for screened children 2-5 years of age — 1980
CDC Pediatric Nutriton Surveillance System



age. At present, these arbitrary threshold values are 10.0 gm/dl for children 6 through 23 months old, 11.0 gm/dl for 2- through 5-year-olds, and 12.0 gm/dl for 6- through 9-year-olds. The World Health Organization and others have suggested the use of 11.0 gm/dl for the age range 6 months through 5 years old (4).

Table 9 presents prevalences, using four selected hemoglobin thresholds by ethnic origin and age. Generally, the prevalence of low hemoglobin is greatest among blacks and least among Native Americans. The prevalence of low hemoglobin among all ethnic groups is greatest in the 6- through 23-month-old age group, next highest among the 2- through 5-year-olds, and lowest in the 6- through 9-year-old age group.

Table 10 presents the hematocrit data using three selected thresholds. The pattern of results is similar to that for hemoglobin.

Table 11 presents the prevalence of low hemoglobin and hematocrit values over the period 1976-80 by year. Thresholds used were those commonly applied in clinic situations (see above and the appendix). No changes over time in the prevalence of low hemoglobin values are apparent. There is a downward trend in the prevalence of low hematocrit values among black children, but the significance of this trend is unclear, particularly since there is no corresponding downward trend in hemoglobin values. Prevalences of low hematocrit were generally higher than prevalences of low hemoglobin, with the difference being most dramatic among Hispanic and Native American children. The data from table 11 are illustrated in figure 4.

Mean and standard deviation curves, developed from NHANES I data, were used to compute percentiles and standard deviation scores for hemoglobin and hematocrit. A discussion of results using the 5th percentile as a threshold point is presented in the appendix.

The frequency distribution curves of hematology SD scores for children 2-5 years of age are presented in figure 5. Those curves to the left of the reference curve represent populations with higher prevalences of low hemoglobin or hematocrit values; those to the right represent lower prevalences than expected. Black and white children both showed higher than expected prevalence of low hemoglobin and hematocrit. Hispanic and Native American children showed higher prevalences of low hematocrit but not low hemoglobin. In fact, for Native American children hemoglobin values were higher than for the reference population. Asian children showed distributions of values which were remarkably similar to those for the reference population.

Data from various studies have shown higher prevalences of low hemoglobin and hematocrit among blacks than among whites and other ethnic groups (5). In most study populations, socioeconomic and other variables tend to obscure relationships strictly related to race. However, the preponderance of analyses performed strongly suggest that blacks do have lower hemoglobin and hematocrit levels for age and sex than do whites. According to Owen and

Table 9. Prevalence of hemoglobin (gm/dl) values belowselected thresholds among screened children through 9 years of age — 1980
CDC Pediatric Nutrition Surveillance System

Age Group & Ethnic Origin	Number Examined	% Less Than Indicated Hemoglobin Level			
		10.0	11.0	11.5	12.0
6-11 Months					
White	4,893	6.0	25.7	43.6	58.2
Black	4,043	6.6	30.9	51.3	67.2
Hispanic	1,458	4.9	22.3	38.6	55.8
Nat. Amer.[1]	156	2.6	12.2	23.7	43.6
Asian[2]	119	8.4	31.1	52.1	65.5
12-23 Months					
White	7,156	5.5	23.7	39.5	53.8
Black	6,176	6.5	31.2	50.8	66.5
Hispanic	1,854	5.2	20.6	35.9	50.9
Nat. Amer.[1]	123	6.5	13.8	28.5	45.5
Asian[2]	248	12.1	27.8	37.9	54.4
2-5 Years					
White	13,703	0.8	12.8	25.6	38.9
Black	10,210	1.6	20.5	39.6	54.8
Hispanic	4,063	0.7	9.0	20.1	32.6
Nat. Amer.[1]	286	0.3	3.8	7.7	15.7
Asian[2]	635	0.3	7.4	15.6	31.2
6-9 Years					
White	1,877	-	0.2	4.7	14.8
Black	1,464	-	0.8	13.0	28.3
Hispanic	446	-	0.2	2.7	7.6
Nat. Amer.[1]	19	-	-	-	21.1
Asian[2]	328	-	-	4.0	13.1

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees.

NOTE: Current standards highlighted.

Table 10. Prevalence of hematocrit values below selected threshold among screened children through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

Age Group & Ethnic Origin	Number Examined	% Less Than Indicated Hematocrit Level		
		31	34	37
6-11 Months				
White	17,667	5.8	29.6	71.8
Black	9,934	6.4	31.2	72.8
Hispanic	2,345	7.4	35.2	75.8
Nat. Amer.[1]	884	2.8	18.2	56.0
Asian[2]	274	6.9	31.8	67.2
12-23 Months				
White	23,543	3.6	22.2	64.7
Black	12,099	5.5	28.0	68.7
Hispanic	3,204	4.5	27.3	67.9
Nat. Amer.[1]	1,052	1.2	17.4	56.1
Asian[2]	521	4.0	18.8	51.8
2-5 Years				
White	58,482	0.5	12.5	52.5
Black	29,225	0.8	17.0	56.5
Hispanic	7,373	0.5	15.7	56.0
Nat. Amer.[1]	2,283	0.1	7.6	42.3
Asian[2]	1,315	0.8	8.0	40.0
6-9 Years				
White	20,149	-	1.6	22.7
Black	12,002	-	2.3	29.2
Hispanic	1,053	-	1.8	26.7
Nat. Amer.[1]	236	-	1.7	19.1
Asian[2]	465	-	0.2	17.2

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees.

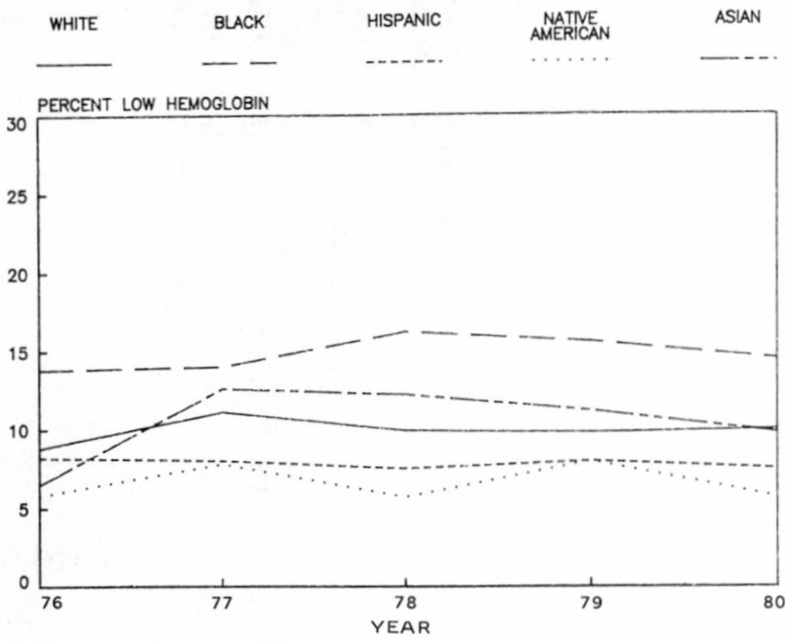
NOTE: Current standards highlighted.

Table 11. Prevalence of low hemoglobin and hematocrit values among screened children through 9 years of age, 1976–1980
CDC Pediatric Nutrition Surveillance System

Ethnic Origin	Hematology	Year 1976 No. Exam.	1976 % Low[1]	1977 No. Exam.	1977 % Low[1]	1978 No. Exam.	1978 % Low[1]	1979 No. Exam.	1979 % Low[1]	1980 No. Exam.	1980 % Low[1]	5-Year Total No. Exam.	5-Year Total % Low[1]
White	Hemoglobin	8,876	8.8	14,518	11.1	13,824	9.9	16,164	9.8	27,629	10.0	81,011	10.0
	Hematocrit	29,957	13.8	41,211	15.4	39,377	14.3	72,719	11.8	119,841	12.0	303,105	12.9
Black	Hemoglobin	7,887	13.8	10,241	14.0	8,814	16.2	11,737	15.6	21,893	14.5	60,572	14.8
	Hematocrit	11,024	23.2	16,510	17.3	12,531	17.8	28,538	15.8	63,260	15.5	131,863	16.7
Hispanic	Hemoglobin	3,760	8.2	3,650	8.0	3,051	7.5	3,353	8.0	7,821	7.5	21,635	7.8
	Hematocrit	4,173	13.5	5,554	13.8	5,727	15.4	6,978	17.1	13,975	14.1	36,407	14.8
Native American[2]	Hemoglobin	507	5.9	451	7.8	283	5.7	287	8.0	584	5.7	2,112	6.5
	Hematocrit	4,353	12.5	3,997	12.9	3,158	15.0	3,372	12.0	4,455	10.8	19,335	12.5
Asian[3]	Hemoglobin	46	6.5	103	12.6	131	12.2	411	11.2	1,330	9.8	2,021	10.3
	Hematocrit	259	12.7	274	9.9	406	9.9	749	10.8	2,575	9.1	4,263	9.7

[1]Low defined by age-specific thresholds as described on page 2.
[2]Native American = American Indian or Alaskan Native.
[3]Includes Southeast Asian Refugees.

Figure 4. Prevalence of abnormal hematologic indices among screened children through 9 years of age, 1976–1980
CDC Pediatric Nutrition Surveillance System



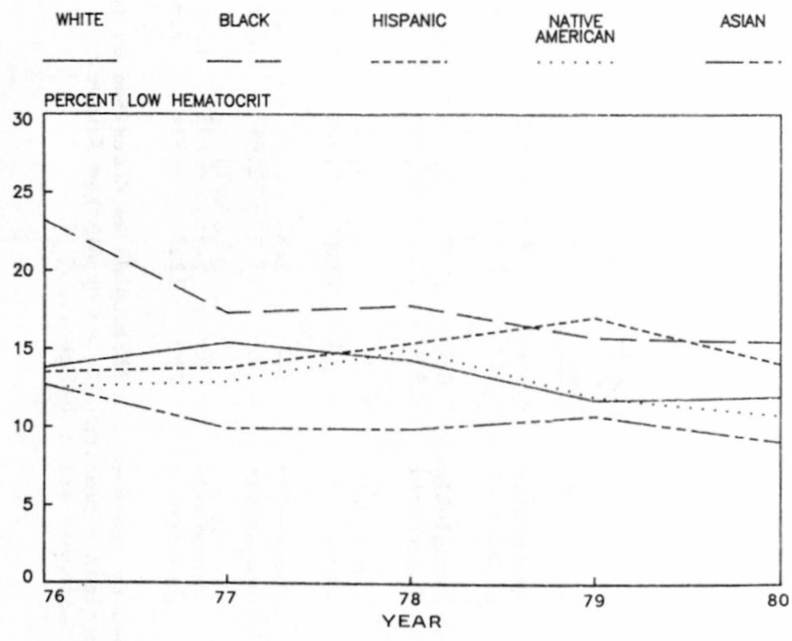
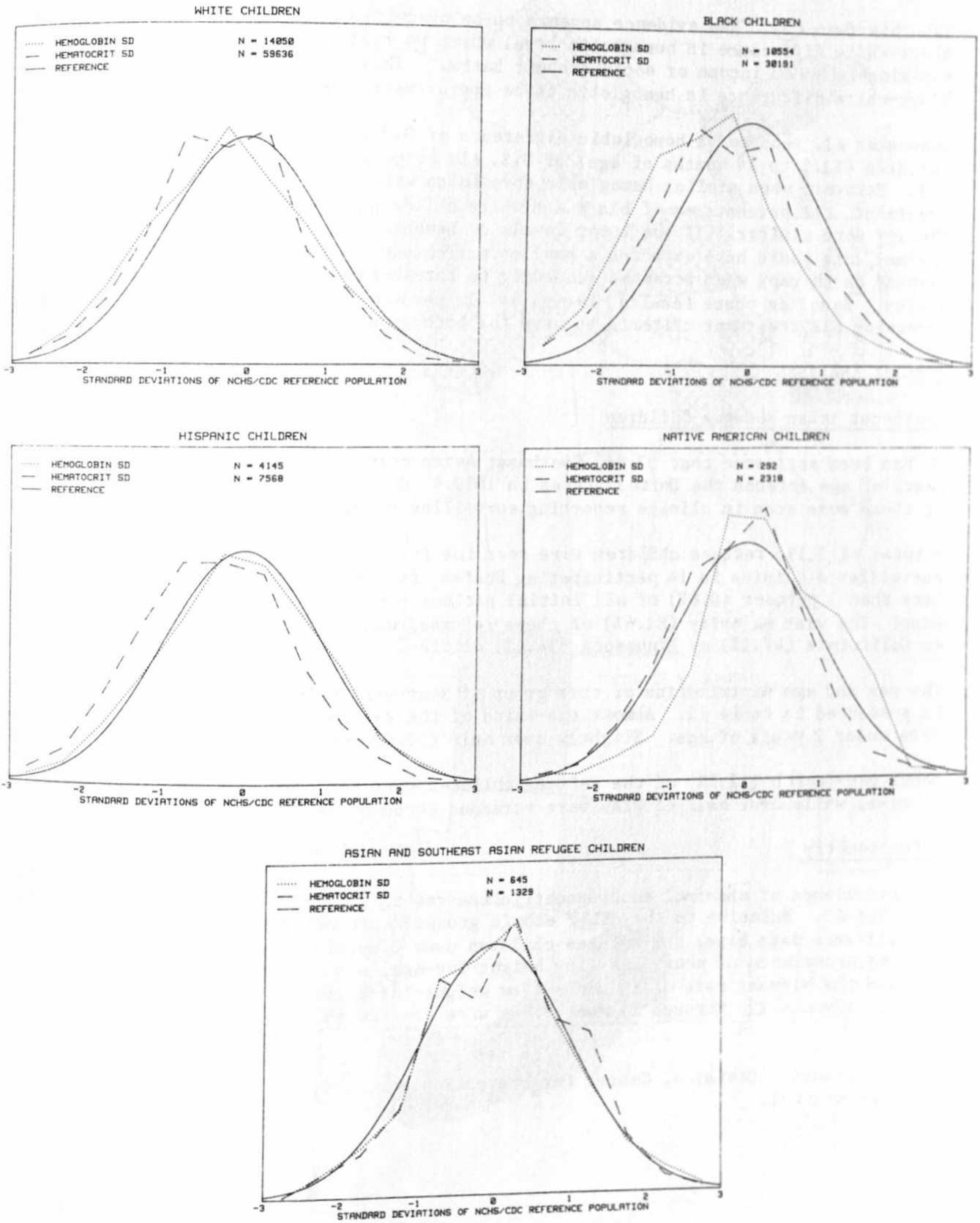


Figure 5. Distributions of hematologic standard deviation scores for screened children 2-5 years of age — 1980
CDC Pediatric Nutrition Surveillance System



Yanochik-Owen (5), "The evidence appears to be overwhelming that there is Black-White difference in hemoglobin level which is real and is not explainable on an income or socioeconomic basis." They have determined the black-white difference in hemoglobin to be approximately 0.5 gm/dl.

Reeves et al. reported a hemoglobin difference of 0.3 gm/dl in a study of children (11.5 to 14 months of age) of U.S. Air Force personnel in California (6). However, when similar hemoglobin thresholds were used to determine treatment, the percentages of black and white children responding to oral iron therapy were similar. If the lower levels of hemoglobin in blacks were "normal," one would have expected a smaller percentage of black infants to respond to therapy when screened according to thresholds similar to those for whites. Based on these results, Reeves et al. recommended that similar screening and treatment criteria be used for both groups.

SPECIAL ANALYSES

Southeast Asian Refugee Children

It has been estimated that 37,943 Southeast Asian refugee children through 9 years of age entered the United States in 1980.* Only a small fraction (8.4%) of these were seen in clinics reporting surveillance data.

A total of 3,195 refugee children were seen for initial examination in 229 surveillance clinics in 14 participating States (figure 6). This represents less than 1 percent (0.8%) of all initial patient visits made during the year. The vast majority (81.6%) of these refugees were initially seen either in California (47.2%) or Minnesota (34.4%) clinics.

The sex and age distribution of this group of Southeast Asian refugee children is presented in table 12. Almost one-third of the refugees screened (29.8%) were under 2 years of age. Slightly over half (52.6%) were boys.

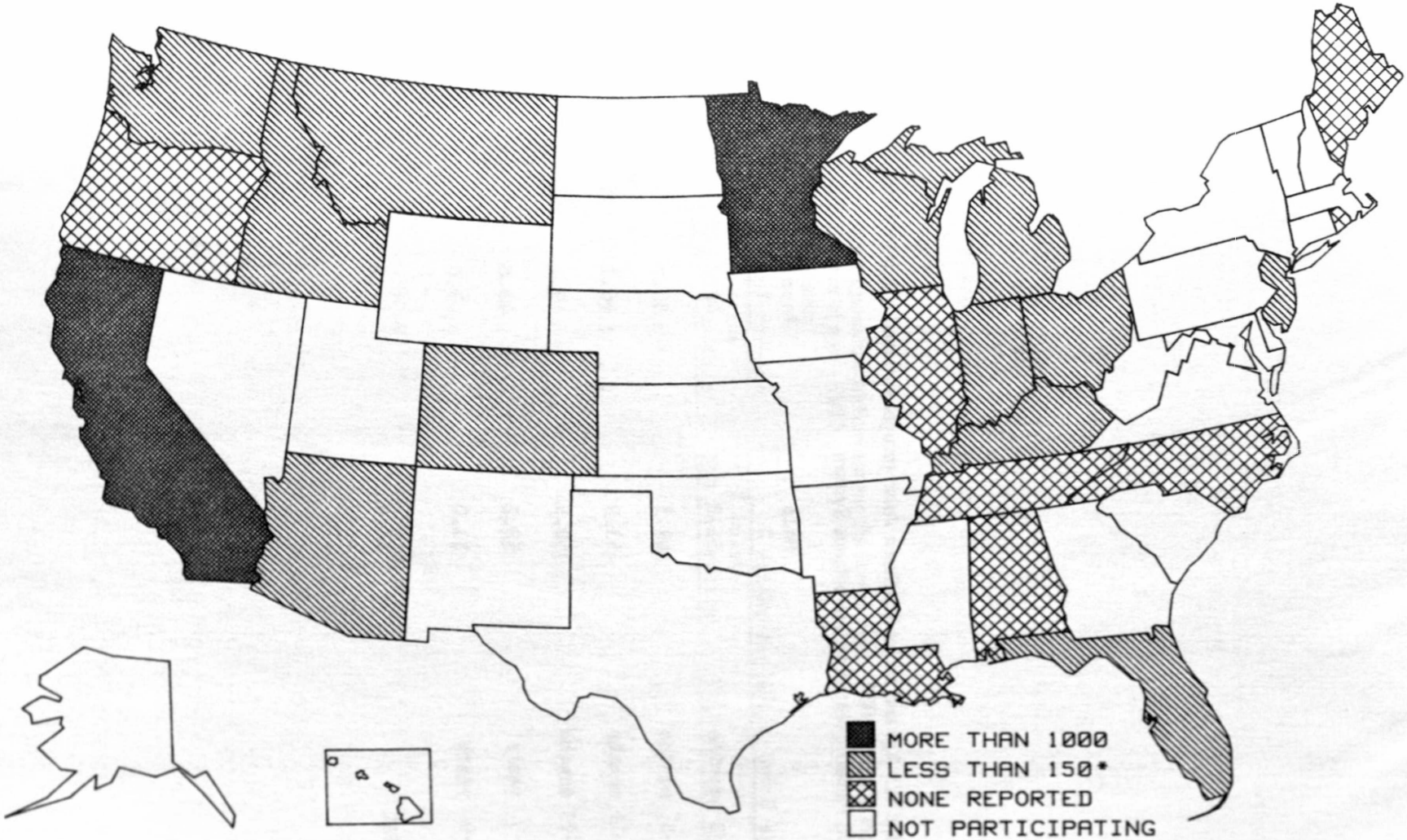
About one-fourth (22.5%) of the refugee children were screened through the WIC program, while over half (53.1%) were screened through the EPSDT program.

Anthropometry

The prevalence of abnormal anthropometric indices in this population is shown in table 13. Relative to the other ethnic groups represented in the surveillance data base, the refugee children over 3 months of age had the highest prevalence of shortness (low height-for-age) and those over 1 year of age had the highest rate of thinness (low weight-for-height). In absolute terms, only the 12- through 23-month-olds were considerably thinner (13.1%)

*From Quarantine Division, Center for Prevention Services, Centers for Disease Control.

Figure 6. States screening southeast Asian refugee children through 9 years of age — 1980
CDC Pediatric Nutrition Surveillance System



*No State Reported Between 150 and 1000

Table 12. Age and sex of Southeast Asian refugee screened children through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

Age Group	Male %	Female %	Total No.	Total %
< 3 months	51.2	48.8	254	100.0
3-5 months	49.3	50.7	71	100.0
6-11 months	53.9	46.1	152	100.0
12-23 months	50.9	49.1	475	100.0
2-5 years	53.2	46.8	1,401	100.0
6-9 years	53.0	47.0	842	100.0
TOTAL	52.6	47.4	3,195	100.0

Table 13. Prevalence of abnormal anthropometric indices among Southeast Asian refugee screened children through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

Age Group	No. Exam.	Height-for-Age % Below 5th Percentile	Weight-for-Height % Below 5th Percentile	Weight-for-Height % Above 95th Percentile
< 3 months	149	4.0	2.0	5.4
3-5 months	59	15.3	-	23.7
6-11 months	128	25.0	3.1	3.1
12-23 months	404	28.2	13.1	3.7
2-5 years	1,184	35.4	4.2	3.5
6-9 years	704	37.9	5.3	1.1

Table 14. Prevalence of abnormal hematologic values among Southeast Asian refugee screened children through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

Age Group	Hemoglobin		Hematocrit	
	No. Exam.	Low*	No. Exam.	Low*
6-11 Months	63	9.5	62	9.7
12-23 Months	153	13.1	170	2.9
2-5 Years	451	4.7	613	5.6
6-9 Years	299	16.7	377	17.3

*Using current standards

than the reference population. The 59 refugee children between the ages of 3 and 5 months of age were the most overweight group of children, with about 24% being above the 95th percentile weight-for-height. Measurement errors and/or small sample size may account for this high prevalence of overweight.

Hematology

The prevalence of abnormal hematologic values among refugee children is presented in table 14. In comparison with other groups of children reported to the surveillance system, refugees less than 2 years old had the highest prevalence of low hematologic values in 1980. By contrast, refugees aged 2 through 9 years of age tended to have the lowest prevalence of low values.

Native American Children

In 1980, 11,129 Native American children were initially screened in 20 States (figure 7). Eighty percent of these children resided in Arizona (68.4%) and Wisconsin (11.6%).

The vast majority (86.7%) of these children were initially screened for WIC certification. Approximately half (50.7%) of the screened Native American children were under 6 months of age. The sexes were nearly evenly divided.

Anthropometry

In table 7 we presented the prevalence of abnormal anthropometric indices for Native American and other ethnic groups reported in 1980. The prevalence of short stature was low (3.5%) for the youngest group of Native Americans--those less than 3 months of age. The prevalence of short stature increased with age until the peak prevalence of 13.9% was reached at age 12 through 23 months, followed by a subsequent decrease to 2.7% among children 6 through 9 years of age.

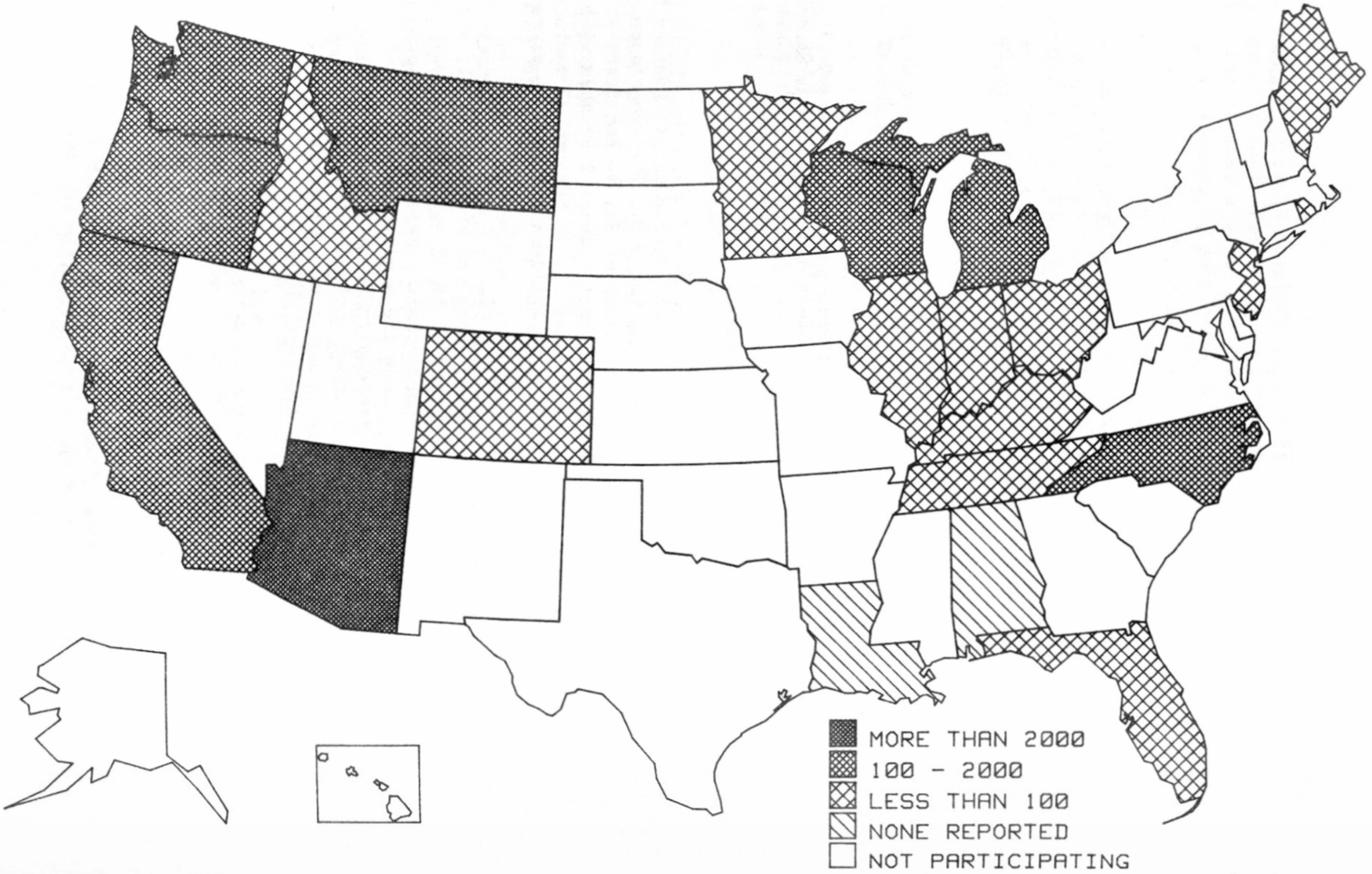
The prevalence of overweight was also lowest among the youngest (5.4%) and oldest (5.3%) age groups, the peak prevalence of 16.3% being found among those 2 through 5 years of age. Relative to other ethnic groups, Native American children 6 months through 5 years of age have the highest prevalence of high weight-for-height. Whether this early propensity for overweight is associated with ethnic-specific feeding patterns or other environmental factors cannot yet be determined. However, the prevalence reflects a clear pattern of risk of overweight for one out of six Native American children.

Of the 6,448 Native American children who were screened and who were less than 2 years of age, 552 (8.6%) children were thin, a number 70% higher than expected.

Hematology

There were 5,103 hematologic determinations reported from Native American children, representing about 45% of those seen initially in 1980. Of all

Figure 7. Native American screened children through 9 years of age — 1980
CDC Pediatric Nutrition Surveillance System



ethnic groups, the Native American children through 9 years of age tended to be the least anemic group (tables 9, 10).

A lower prevalence of abnormal hemoglobin values was also found among the 2,823 Native American women whose values were reported to the Pregnancy Nutrition Surveillance System in 1980.

In summary, anthropometric data indicate that younger Native American children are less likely to be short than children of other ethnic groups, while among older children values for Native Americans are similar to or slightly higher than those for other ethnic groups. The prevalence of low hemoglobin or hematocrit values is generally lower for Native Americans than for other ethnic groups.

Multiple Abnormalities

The prevalence of multiple abnormalities in individual children was tabulated. These data are presented in table 15. Multiple abnormalities were defined for this analysis as the presence of two or more of the following abnormalities in each child, with the maximum possible being three in any one child.

1. Height-for-age less than the 5th percentile;

2. Hemoglobin and/or hematocrit less than the age-specific standard;

3. a. Weight-for-height less than the 5th percentile; or

   b. Weight-for-height greater than the 95th percentile.

This analysis included only children for whom all three anthropometric indices (height-for-age, weight-for-height, and weight-for-age) and at least one hematology index (hemoglobin-for-age or hematocrit-for-age) were reported.

In virtually all age and ethnic groups, less than 5% of the children had two or more abnormalities. As expected the prevalence of all three abnormalities in any one child was low, occurring in only 243 out of 237,857 (0.1%) children. The prevalence of two abnormalities ranged from 2.2% among whites to 4.9% among Asians. With the exception of Asian children, for most age and ethnic groups the prevalence of one or more abnormalities ranged between 20% and 30%. Generally, the prevalence of one or more abnormalities was highest among children in the 12- to 23-month-age group and lowest among children 6-9 years of age. Whites demonstrated the lowest and Asians the highest prevalence of multiple abnormalities.

Table 15. Prevalence of indicated number of abnormalities* among screened children through 9 years of age — 1980
CDC Pediatric Nutrition Surveillance System

Ethnic Origin & Age Group	% With Indicated Number of Abnormalities				Total	
	0	1	2	3	No.	%
White						
6-11 Months	75.9	21.6	2.4	0.1	20,742	100.0
12-23 Months	71.6	25.7	2.6	0.1	28,135	100.0
2-5 Years	75.7	21.9	2.3	0.1	68,587	100.0
6-9 Years	82.0	16.8	1.1	-	19,648	100.0
TOTAL	75.8	21.9	2.2	0.1	137,112	100.0
Black						
6-11 Months	70.9	25.0	3.9	0.2	11,925	100.0
12-23 Months	67.3	28.9	3.7	0.1	15,385	100.0
2-5 Years	73.6	23.7	2.6	0.1	35,881	100.0
6-9 Years	81.8	17.1	1.1	-	11,542	100.0
TOTAL	73.1	23.9	2.8	0.1	74,733	100.0
Hispanic						
6-11 Months	72.2	24.7	3.0	0.1	3,159	100.0
12-23 Months	66.1	29.7	4.0	0.2	4,211	100.0
2-5 Years	69.0	27.3	3.5	0.2	9,804	100.0
6-9 Years	78.9	19.4	1.7	-	1,197	100.0
TOTAL	69.5	26.9	3.4	0.2	18,371	100.0
Native American						
6-11 Months	73.6	24.2	2.2	-	879	100.0
12-23 Months	63.9	32.5	3.6	-	1,037	100.0
2-5 Years	69.7	27.3	3.0	-	2,335	100.0
6-9 Years	86.2	13.8	-	-	217	100.0
TOTAL	69.9	27.2	2.8	-	4,468	100.0
Asian**						
6-11 Months	67.3	28.3	4.1	0.3	339	100.0
12-23 Months	53.1	41.1	5.4	0.3	625	100.0
2-5 Years	57.6	37.2	5.2	0.1	1,577	100.0
6-9 Years	58.2	37.0	4.3	0.5	632	100.0
TOTAL	57.9	37.0	4.9	0.2	3,173	100.0

*Abnormalities included were:

1. Height for age < 5th percentile.
2. Hemoglobin and/or hematocrit < 5th percentile.
   a. Weight for height < 5th percentile; or
   b. Weight for height > 95th percentile.

**Includes Southeast Asian Refugees

PREGNANCY NUTRITION SURVEILLANCE

Background

The concept of pregnancy nutrition surveillance was developed to provide data to assess community needs for maternal nutrition services. Since 1979, the CDC has been collecting data on those various nutrition-related and risk behavior indices which may affect pregnancy outcome. At that time the State public health nutrition directors identified indices determined to be necessary for monitoring the course of pregnancy in terms of nutrition/dietary intervention. Indices such as height, weight, hematocrit, and hemoglobin are used along with other variables, such as urinary protein and sugar, blood pressure, cigarette smoking, use of vitamin and mineral supplements, participation in food stamp and WIC programs, and pregnancy outcome including status of the infant and/or infant birth weight and breast-feeding status at the first post partum visit.

The primary focus of pregnancy nutrition surveillance is to provide useful information as quickly as possible to public health personnel for assessing, implementing, planning, and evaluating nutritional intervention.

During 1980, about 16,000 records from 13 States (figure 8) were submitted to the Pregnancy Nutrition Surveillance System. These data came primarily from MCH, WIC, and other health programs providing prenatal care.

The prevalence of selected risk factors among prenatal patients seen during 1980 and reported to the CDC Pregnancy Nutrition Surveillance System can be seen in table 16. More white women of all age groups smoke cigarettes (39.0%) than do women in other ethnic groups. Black women are second; 26.4% smoke. Very few women had high blood pressure. Low hematocrit levels were evident in 25.1% of the women, while 16.4% had low hemoglobin levels. As data from the Pediatric Nutrition Surveillance System also showed, black women have the highest prevalence of low hematologic levels.

Breast feeding

The percentage of women breast feeding at the first post partum visit (6 through 10 weeks of age) was 32.0% (table 17). Breast-feeding mothers tended to be older than mothers who did not breast feed.

Native American mothers were more likely to breast feed than other ethnic groups, with 46.7% having breast fed their infants. Among white mothers 41.6% breast fed, among Hispanic mothers 24.2%, and among black mothers, only 16.8% breast fed their infants.

Birth weight

As part of the Pregnancy Nutrition Surveillance System, information is collected at the first post partum visit on the birth weight of the infant.

Figure 8. State participation in pregnancy nutrition surveillance — 1980
CDC Pregnancy Nutrition Surveillance

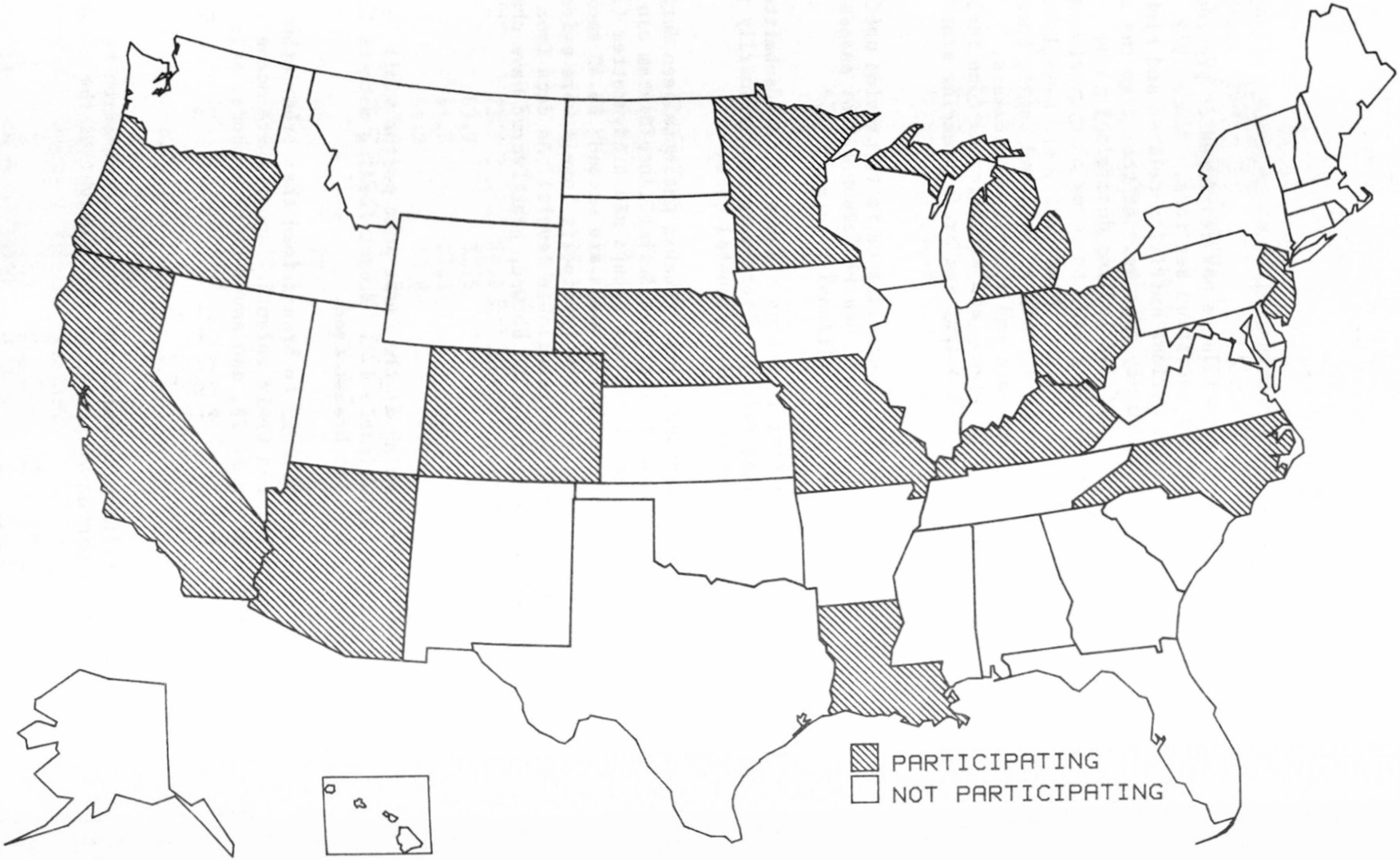


Table 16. — Prevalence of reported selected risk factors among pregnant women — 1980
CDC Pregnancy Nutrition Surveillance System

Age Group & Ethnic Origin	No. Examined	Smoking		Blood Pressure		Hematocrit		Hemoglobin	
		No. Responding	% Yes	No. Responding	% High	No. Responding	% Low	No. Responding	% Low
< 15									
White	57	53	37.7	25	-	36	5.6	20	15.0
Black	108	76	11.8	30	-	63	44.4	40	37.5
Hispanic	53	52	17.3	34	-	35	20.0	22	13.6
Nat. Amer.[1]	28	28	-	8	-	26	11.5	2	-
Asian[2]	-	-	-	-	-	-	-	-	-
15-19									
White	1,929	1,748	42.9	909	0.6	1,293	20.3	644	10.7
Black	1,487	1,109	24.0	310	0.6	890	43.5	526	38.0
Hispanic	1,216	1,145	16.5	834	-	956	24.5	394	12.7
Nat. Amer.[1]	720	707	3.7	273	0.7	629	19.1	71	15.5
Asian[2]	13	10	30.0	5	-	11	27.3	4	-
20-34									
White	3,398	3,125	37.2	1,274	0.9	2,248	17.5	1,336	7.3
Black	2,422	1,975	28.5	438	0.2	1,481	35.3	885	27.0
Hispanic	2,018	1,842	18.8	1,180	0.3	1,549	20.7	717	11.4
Nat. Amer.[1]	1,892	1,859	3.0	732	0.4	1,707	18.2	174	5.7
Asian[2]	68	47	14.9	18	-	51	25.5	32	-
35-49									
White	129	119	32.8	61	1.6	79	16.5	50	4.0
Black	86	70	20.0	13	15.4	50	34.0	39	28.2
Hispanic	161	144	16.7	98	-	115	20.9	65	13.8
Nat. Amer.[1]	222	220	0.9	72	1.4	204	15.2	10	40.0
Asian[2]	6	3	33.3	1	-	5	-	1	-

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees

Table 17. Number and percent of breastfed infants 6 to 10 weeks of age by age group and ethnic origin of mother — 1980
CDC Pregnancy Nutrition Surveillance System

Age Group & Ethnic Origin	No. Responding	% Breast Feeding
<15		
White	22	18.2
Black	23	-
Hispanic	24	4.2
Nat. Amer.[1]	16	50.0
Asian[2]	-	-
15-19		
White	719	27.1
Black	308	9.7
Hispanic	584	19.5
Nat. Amer.[1]	411	41.8
Asian[2]	3	33.3
20-34		
White	1,264	49.8
Black	517	21.5
Hispanic	902	27.7
Nat. Amer.[1]	1,155	48.3
Asian[2]	11	36.4
35-49		
White	57	50.9
Black	17	23.5
Hispanic	74	24.3
Nat. Amer.[1]	141	47.5
Asian[2]	1	-
All Ages		
White	2,062	41.6
Black	865	16.8
Hispanic	1,584	24.2
Nat. Amer.[1]	1,723	46.7
Asian[2]	15	33.3
Total	6,855	32.0

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees.

Table 18. Prevalence of low birth weight by indicated maternal risk factor by age and ethnic origin of mother — 1980 CDC Pregnancy Nutrition Surveillance System

Age Group & Ethnic Origin	All Women Examined		Without Indicated Risk Factors		Smoking				High Blood Pressure				Low Hematocrit				Low Hemoglobin			
					Yes		No		Yes		No		Yes		No		Yes		No	
	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW	No.	% LBW
< 20 Years																				
White	1,986	7.0	1,010	5.6	770	9.4	1,031	5.2	5	20.0	929	6.6	265	6.4	1,064	7.0	72	12.5	592	6.4
Black	1,595	10.5	858	9.7	275	14.2	910	9.5	2	-	338	10.4	415	10.4	538	9.1	215	13.5	351	10.0
Hispanic	1,269	6.0	844	6.2	198	9.6	999	5.4	-	-	868	6.2	241	3.3	750	6.0	53	1.9	363	7.2
Nat. Amer.[1]	748	4.7	599	4.2	26	3.8	709	4.8	2	-	279	7.2	123	8.1	532	3.6	11	18.2	62	3.2
Asian[2]	13	23.1	9	33.3	3	-	7	42.9	-	-	5	40.0	3	-	8	25.0	-	-	4	25.0
TOTAL	5,611	7.5	3,320	6.6	1,272	10.3	3,656	6.3	9	11.1	2,419	7.1	1,047	7.4	2,892	6.5	351	11.7	1,372	7.4
20+ Years																				
White	3,527	4.8	2,003	3.1	1,200	8.3	2,044	2.6	13	-	1,322	5.5	407	3.4	1,920	4.9	100	4.0	1,286	4.8
Black	2,508	8.7	1,395	7.0	577	13.3	1,468	6.3	3	-	448	8.7	540	9.4	991	7.9	250	13.2	674	7.4
Hispanic	2,179	4.7	1,485	3.8	371	8.1	1,615	4.2	4	-	1,274	4.6	344	5.8	1,320	4.3	91	6.6	691	5.2
Nat. Amer.[1]	2,114	4.4	1,722	4.1	58	5.2	2,021	4.3	4	-	800	4.0	341	6.2	1,570	3.9	14	-	170	1.8
Asian[2]	74	8.1	54	9.3	8	-	42	7.1	-	-	19	10.5	13	7.7	43	9.3	-	-	33	9.1
TOTAL	10,402	5.6	6,659	4.4	2,214	9.4	7,190	4.2	24	-	3,863	5.3	1,645	6.5	5,844	5.1	455	9.5	2,854	5.4
All Ages																				
White	5,513	5.6	3,013	3.9	1,970	8.7	3,075	3.5	18	5.6	2,251	6.0	672	4.6	2,984	5.7	172	7.6	1,878	5.3
Black	4,103	9.4	2,253	8.0	852	13.6	2,378	7.5	5	-	786	9.4	955	9.8	1,529	8.3	465	13.3	1,025	8.3
Hispanic	3,448	5.2	2,329	4.7	569	8.6	2,614	4.7	4	-	2,142	5.2	585	4.8	2,070	4.9	144	4.9	1,054	5.9
Nat. Amer.[1]	2,862	4.5	2,321	4.1	84	4.8	2,730	4.4	6	-	1,079	4.8	464	6.7	2,102	3.9	25	8.0	232	2.2
Asian[2]	87	10.3	63	12.7	11	-	49	12.2	-	-	24	16.7	16	6.3	51	11.8	-	-	37	10.8
TOTAL	16,013	6.3	9,979	5.1	3,486	9.8	10,846	4.9	33	3.0	6,282	6.0	2,692	6.9	8,736	5.6	806	10.4	4,226	6.1

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees.

The overall prevalence of low birth weight (less than 2501 grams) in this population was 6.3% (table 18). The prevalence of low birth weight was higher among infants born to women less than 20 years of age and to black and Asian women. The lowest prevalence of low birth weight was seen among Native American infants. The prevalence of low birth weight by maternal risk factor and by age and ethnic origin is also displayed in table 18. Mothers who smoke were almost twice as likely to deliver low birth weight babies as those who did not smoke. For both age groups, black mothers who smoked had a higher likelihood of delivering low birth weight babies than did women of other ethnic groups.

Low maternal hemoglobin appears to be a factor associated with a higher risk of having a low birth weight baby, again with black mothers most likely to be at high risk. The prevalence of low birth weight was only slightly higher for mothers with low hematocrit levels as compared with mothers who had normal hematocrit levels.

Data on the birth weight of all children less than 2 years of age have been part of the CDC Pediatric Nutrition Surveillance System since its inception.

The overall prevalence of low birth weight in this group of infants was 9.8% (table 19). The prevalence was highest among black infants (13.1%) and lowest among Native American infants (7.0%). A cross tabulation of birth weight status with various anthropometric indices demonstrates a strong association of low anthropometric indices with low birth weight (table 20).

Children in the low birth weight group were shorter, lighter, and thinner, while children in the high birth weight group (>4000 gm.) are taller, heavier, and more at risk of overweight. Almost 30% of the low birth weight children had low height-for-age as compared with 7.7% of the "normal" birth weight children (2501-3999 gms.) and 2.6% of those with high birth weight.

The same association holds true for low weight-for-height and, to a lesser degree, for low weight-for-age. Low height-for-age appears to be a major problem among low birth weight children at all ages through 5, supporting other observations that the lack of linear growth of the fetus carries over to the infant and preschool child; the prevalence of low height-for-age is 16.7% at ages 3 through 5. The prevalence of overweight (greater than the 95th percentile weight-for-height) was higher among children with high birth weights (13.3%) than among children with normal (8.4%) or low birth weights (6.8%).

Table 19. Prevalence of low birth weight by ethnic origin for screened children through 1 year of age born and reported in 1980 CDC Pediatric Nutrition Surveillance System

Ethnic Origin	No. Reported	% Low Birth Weight (< 2501 grams)
White	55,590	8.7
Black	29,354	13.1
Hispanic	11,534	8.7
Nat. Amer.[1]	4,918	7.0
Asian[2]	923	7.7
Total	102,319	9.8

[1]Nat. Amer. = American Indian or Alaskan Native.
[2]Includes Southeast Asian Refugees.

Table 20. Prevalence of abnormal anthropometric indices by birth weight and age of screened children through 4 years of age — 1980
CDC Pediatric Nutrition Surveillance System

Anthropometric Index & Age Group	Birth Weight (gms) < 2501 No. Exam.	< 2501 % < 5th	< 2501 % > 95th	2501-3999 No. Exam.	2501-3999 % < 5th	2501-3999 % > 95th	4000+ No. Exam.	4000+ % < 5th	4000+ % > 95th
Height-for-Age									
< 3 Months	2,408	32.4	0.2	45,768	4.0	7.5	4,210	0.8	22.4
3-5 Months	1,983	41.6	0.5	18,537	8.7	4.2	1,841	2.1	15.2
6-11 Months	3,119	30.4	0.6	27,732	9.0	3.3	2,784	2.7	10.3
1 Year	3,559	25.7	0.7	30,969	10.5	2.5	3,245	3.8	6.1
2 Years	1,029	22.4	1.3	7,957	10.4	2.1	862	5.9	5.2
3-4 Years	1,056	16.7	1.6	8,435	9.0	3.2	939	4.0	6.9
TOTAL	13,154	29.4	0.7	139,398	7.7	4.5	13,881	2.6	13.1
Weight-for-Height									
< 3 Months	2,408	10.4	4.6	45,768	3.7	5.7	4,210	0.7	9.9
3-5 Months	1,983	2.3	10.5	18,537	2.7	11.4	1,841	2.7	12.2
6-11 Months	3,119	6.2	7.5	27,732	4.2	8.6	2,784	2.8	12.0
1 Year	3,559	8.5	5.8	30,969	4.8	10.1	3,245	1.7	18.6
2 Years	1,029	8.3	9.7	7,957	2.9	12.9	862	1.0	21.5
3-4 Years	1,056	7.4	3.6	8,435	2.9	5.7	939	0.9	9.2
TOTAL	13,154	7.2	6.8	139,398	3.8	8.4	13,881	1.6	13.3
Weight-for-Age									
< 3 Months	2,408	22.4	0.2	45,768	2.1	7.2	4,210	0.1	40.4
3-5 Months	1,983	13.4	0.7	18,537	2.5	6.1	1,841	0.9	21.8
6-11 Months	3,119	18.2	1.0	27,732	4.7	4.7	2,784	1.4	14.4
1 Year	3,559	16.9	1.5	30,969	6.3	5.4	3,245	1.5	14.8
2 Years	1,029	17.1	2.0	7,957	6.2	4.3	862	1.9	8.7
3-4 Years	1,056	14.9	1.1	8,435	6.2	3.1	939	1.9	9.4
TOTAL	13,154	17.5	1.0	139,398	4.1	5.7	13,881	1.0	22.7

REFERENCES

1. Centers for Disease Control: Sources of error in weighing and measuring children. Nutrition Surveillance (HEW Publication No. CDC 78-8295) September 1975

2. Centers for Disease Control: Normalized NCHS/CDC Anthropometric Reference (unpublished and undated)

3. World Health Organization: A Growth Chart for International Use in Maternal and Child Health Care. Geneva, 1978

4. World Health Organization: Nutritional Anemias (WHO Tech Rep No. 503). Geneva, 1972

5. Owen GM, Yanochik-Owen A: Should there be a different definition of anemia in black and white children? Am J Public Health 1977;67:865-866

6. Reeves J et al: Screening for anemia in infants: evidence in favor of using identical hemoglobin criteria for blacks and Caucasians. Am J Clin Nutr 1981;34:2154-2157

7. Dallman PR, Siimes MA: Percentile curves for hemoglobin and red cell volume in infancy and childhood. J Pediatr 1979;94:26-31

APPENDIX

Reference Curves for Anemia Screening

Currently accepted reference values for low hemoglobin and hematocrit generally use stepwise increases by age to accommodate the developmental changes in normal values during childhood. However, because their normal or expected hemoglobin values are lower, the younger children in an age group are more likely to be identified as anemic by those or any other stepwise references than are older children in the age group. Dallman and Siimes have pointed out that a hemoglobin difference of only 0.5 gm/dl can result in as many as 10% of the children being misclassified as anemic or non-anemic (7). Because the usual hemoglobin references use relatively large step increases (usually 1.0 gm/dl), there has thus been a considerable risk of misclassifying those children near the lower limits of an age interval.

For example, a 23-month-old child with a hemoglobin of 10.0 gm/dl would not be considered anemic. One month later, at 24 months (or 2 years), the child would be labeled as anemic even if the hemoglobin had risen during that interval to a level as high as 10.9 gm/dl.

To overcome these difficulties with current standards, CDC has developed reference curves using National Health and Nutrition Examination Survey I (NHANES I) data which include values from individuals of all ethnic groups. Exclusions were made only on the basis of unknown or missing values. NHANES I hemoglobin and hematocrit data were aggregated into 6-month age intervals from ages 12 months to 18 years. For each interval, means and standard deviations were calculated. Smooth curves for these values were then developed by computer. Figures 9-12 indicate selected percentiles for each sex for hemoglobin and hematocrit.

Traditional threshold values are indicated on the figures for comparison.

Tables 21 and 22 present the percentages of children below these 5th percentiles by age and ethnic groups and indicate comparative data using traditional standards.

Table 21. Prevalence of hemoglobin values below current standard (for age) and below 5th percentile (for NHANES I[1] data) through 9 years of age – 1980
CDC Pediatric Nutrition Surveillance System

Age Group & Ethnic Origin	No. Exam.	% Below 5th Percentile	% Below Traditional Standard for Age Group
6-11 Months			
White	4,893	2.8	6.0
Black	4,043	3.2	6.6
Hispanic	1,458	1.5	4.9
Nat. Amer.[2]	156	0.0	2.6
Asian[3]	119	5.9	8.4
12-23 Months			
White	7,156	4.4	5.5
Black	6,176	5.0	6.5
Hispanic	1,854	3.9	5.2
Nat. Amer.[2]	123	4.1	6.5
Asian[3]	248	6.9	12.1
2-5 Years			
White	13,703	7.4	12.8
Black	10,210	11.6	20.5
Hispanic	4,063	5.2	9.0
Nat. Amer.[2]	286	1.7	3.8
Asian[3]	635	4.1	7.4
6-9 Years			
White	1,877	6.8	14.8
Black	1,464	15.5	28.3
Hispanic	446	2.5	7.6
Nat. Amer.[2]	19	10.5	21.1
Asian[3]	328	4.0	13.1

[1]See appendix for definition.
[2]Nat. Amer. = American Indian or Alaskan Native.
[3]Includes Southeast Asian Refugees.

Table 22. Prevalence of hematocrit values below current standard (for age) and below 5th percentile (for NHANES I[1] data) through 9 years of age – 1980 CDC Pediatric Nutrition Surveillance System

Age Group & Ethnic Origin	No. Exam.	% Below 5th Percentile	% Below Traditional Standard for Age Group
6-11 Months			
White	17,667	6.3	5.8
Black	9,934	6.6	6.4
Hispanic	2,345	8.3	7.4
Nat. Amer.[2]	884	4.6	2.8
Asian[3]	274	8.8	6.9
12-23 Months			
White	23,543	5.7	3.6
Black	12,099	8.1	5.5
Hispanic	3,204	7.8	4.5
Nat. Amer.[2]	1,052	6.5	1.2
Asian[3]	521	6.1	4.0
2-5 Years			
White	58,482	5.8	12.5
Black	29,225	8.2	17.0
Hispanic	7,373	7.7	15.7
Nat. Amer.[2]	2,283	4.2	7.6
Asian[3]	1,315	3.7	8.0
6-9 Years			
White	20,149	4.2	22.7
Black	12,002	6.2	29.2
Hispanic	1,053	4.3	26.7
Nat. Amer.[2]	236	3.4	19.1
Asian[3]	465	2.6	17.2

[1]See appendix for definition.
[2]Nat. Amer. = American Indian or Alaskan Native.
[3]Includes Southeast Asian Refugees.

Figure 9. Hemoglobin by age references for boys compared with traditional cutoff levels used in screening for anemia

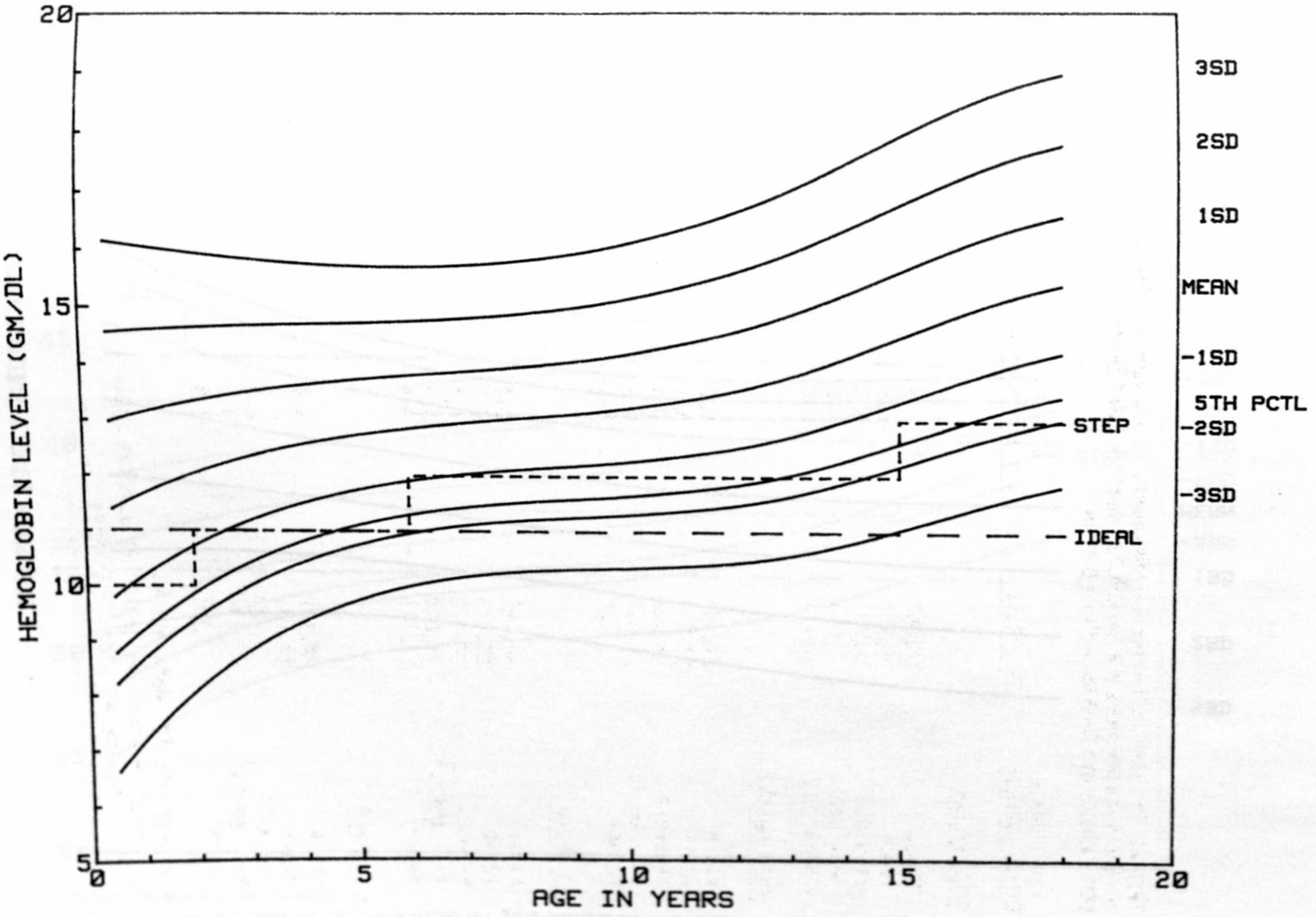


Figure 10. Hemoglobin by age references for girls compared with traditional cutoff levels used in screening for anemia

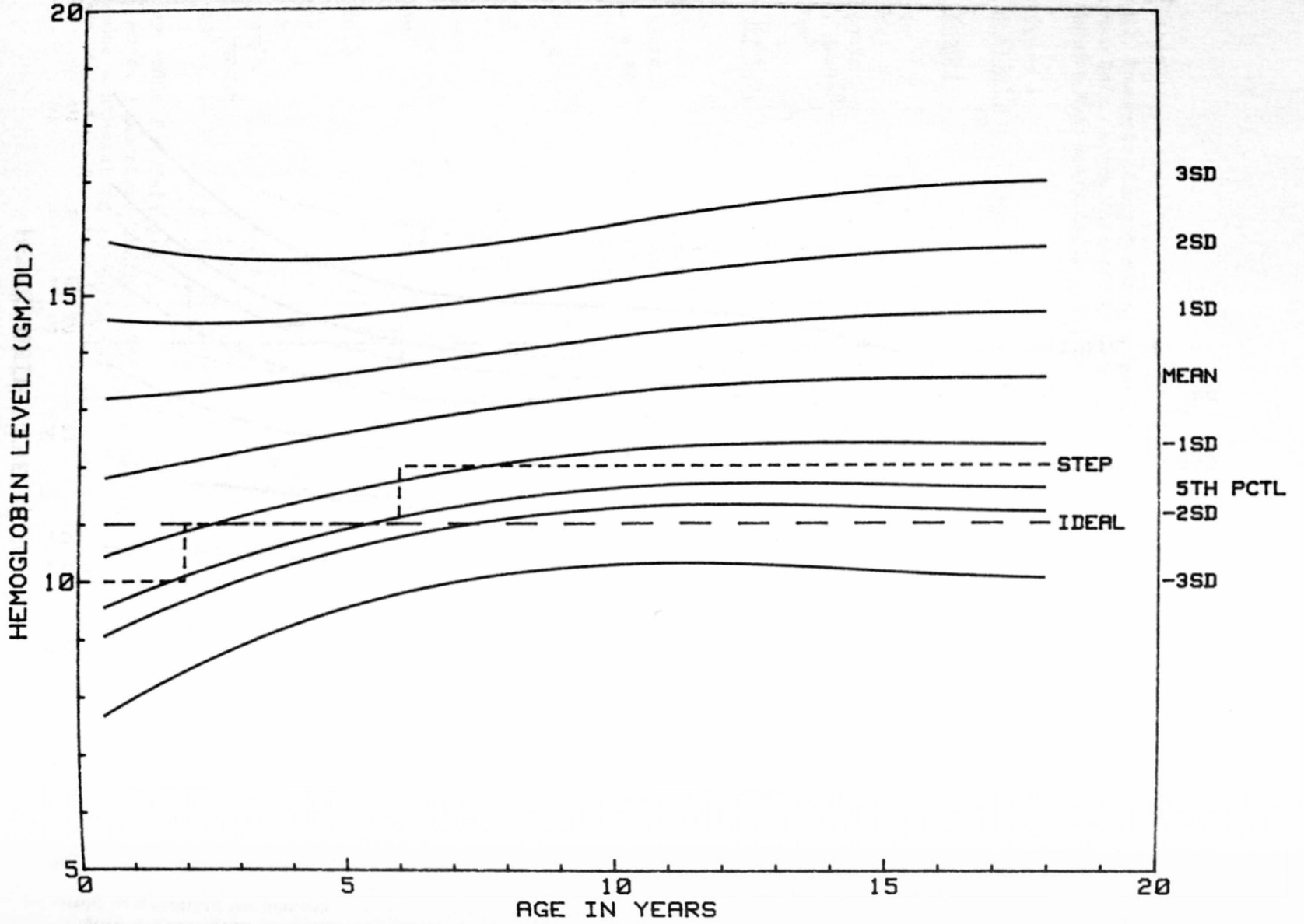


Figure 11. Hematocrit by age references for boys compared with traditional cutoff levels used in screening for anemia

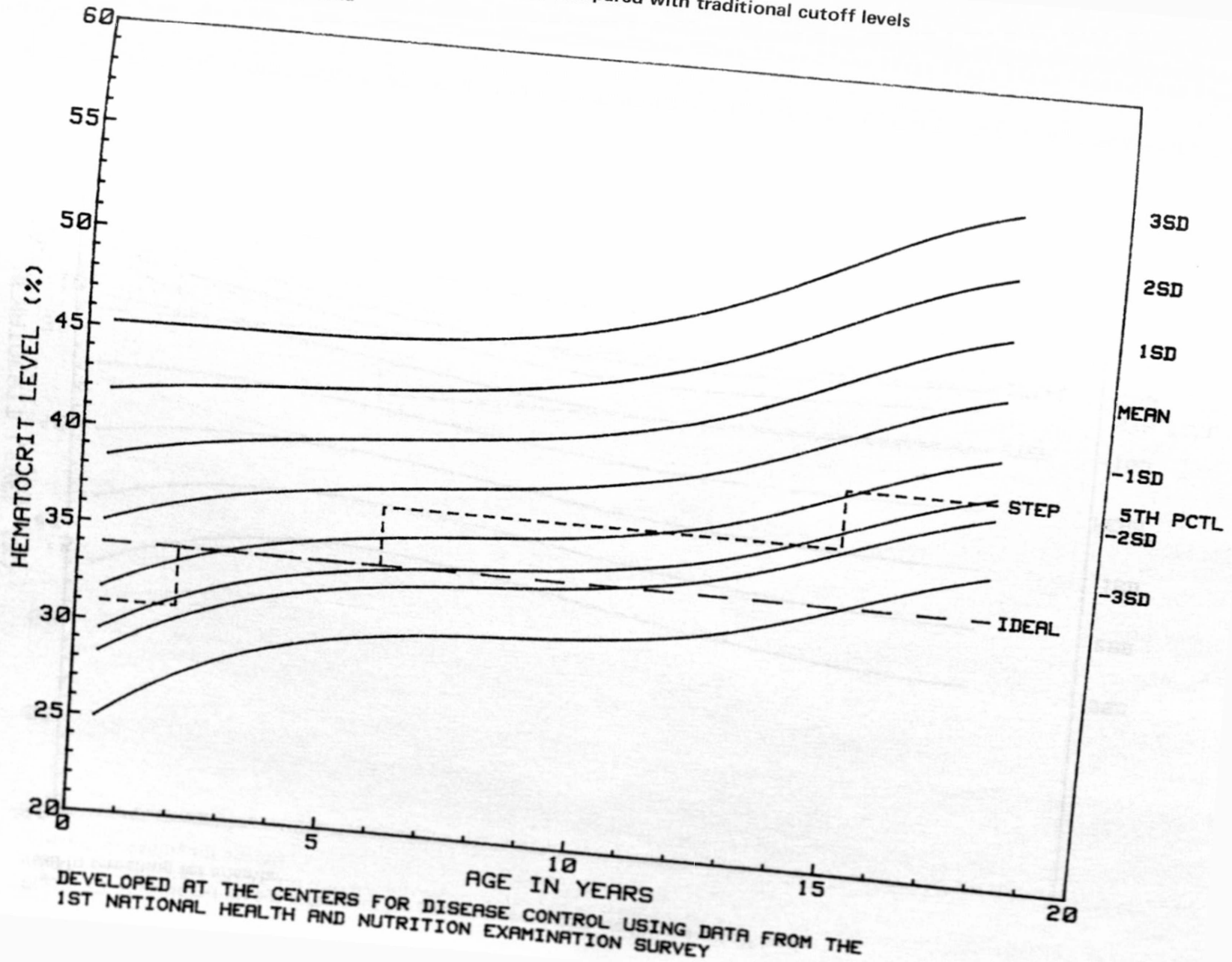
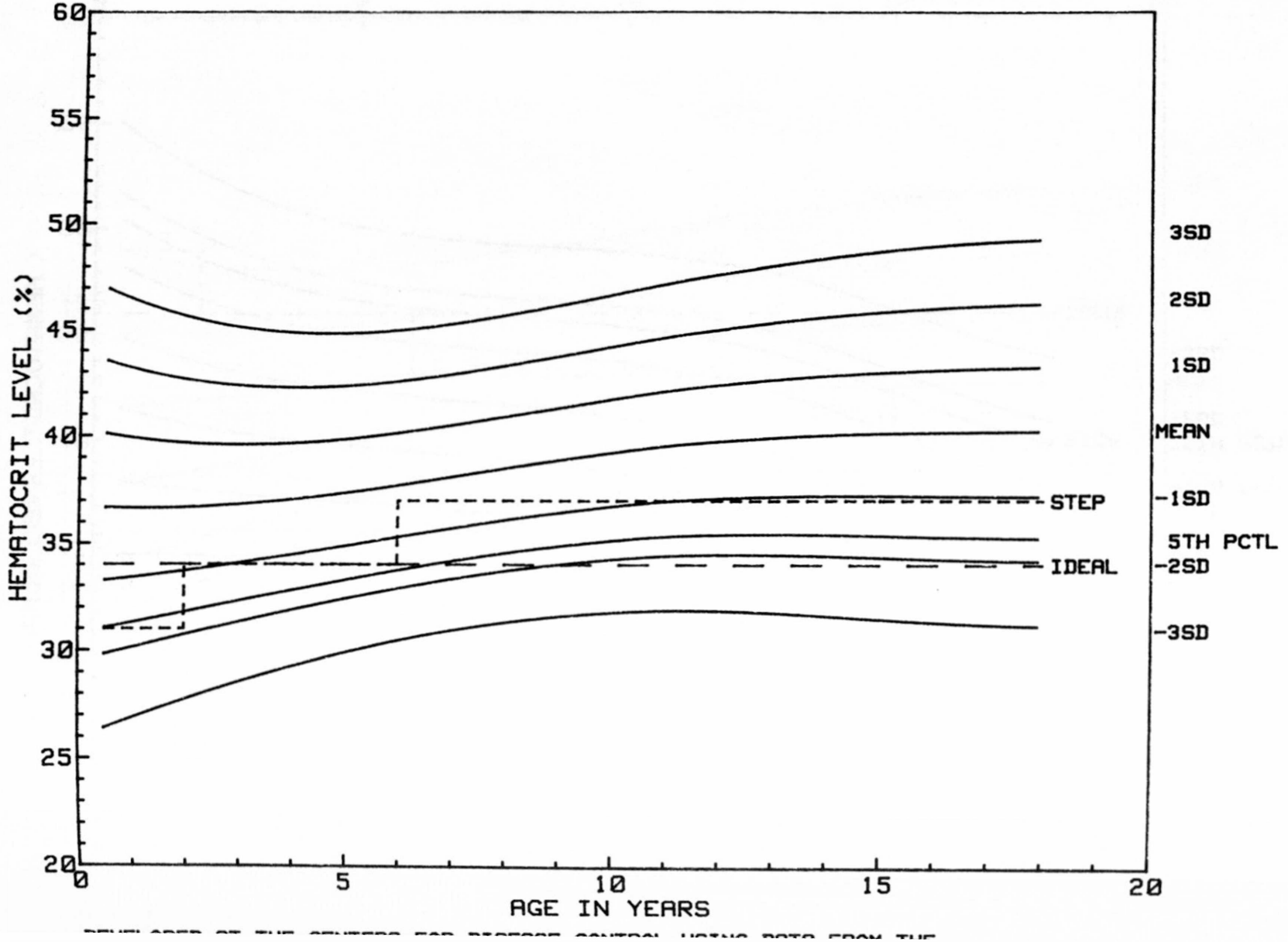


Figure 12. Hematocrit by age references for girls compared with traditional cutoff levels used in screening for anemia



*U.S. GOVERNMENT PRINTING OFFICE:1983-546-010/8254 REGION NO. 4