Heights and weights of Northern Cheyenne children : comparison to the international growth reference
by Mary Margaret Dodson

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Nursing
Montana State University

Abstract:
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There is substantial controversy over whether growth charts should be developed which are specific to certain ethnic populations. This is of even more concern with the American Indian tribes due to the secular trend toward obesity (Roche & McKigney, 1978; Sugarman et al. 1990). Development of normalized curves for each Indian population may be highly impractical. However, health care workers should be aware of the differences between Northern Cheyenne children and the national reference population.

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A thesis submitted in partial fulfillment
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APPROVAL

of a thesis submitted by

Mary Margaret Dodson

This thesis has been read by each member of the graduate committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Signature Mary McDonald

Date 4-14-92

To my mother, Thelma, who died during the second quarter of my graduate school program, and who set an example for me by returning to school herself when I was young.

To my father, Doug, who told me as a child that I could accomplish anything to which I set my mind.

To my sister, Diane, who taught me how to relax and say no sometimes, and other times encouraged me to "persevere".

To my children, Kathy, Cordy, and Peggy Ann, who have always loved me, encouraged me, supported me, believed in me, and had patience with me.

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To my friend, and former advisor, Dr. Janice Buehler, who inspired me, guided me and kept me going until the time of her retirement, and has continued as a friend since retirement. Without her help I probably would not have made it through my first quarter of graduate school.

VITA

Mary Margaret Dodson was born March 9, 1935, in Denver, Colorado, to G. E. and Thelma R. Douglass. She grew up in Montana, Oregon, and California, graduating from Folsom High School in California in 1953.

In 1959, Mary received her Bachelor of Science degree in Nursing from the University of California at San Francisco. She was the first person in the United States accepted into the Navy Nurse Candidate program in 1958, which paid for her last year of school. As a part of this program she was immediately activated upon graduation as an Ensign in the United States Navy Nurse Corps, where she served for over four years. Other work experience includes 2 1/2 years with the Visiting Nurse Association in Washington, DC; 3 1/2 years as a civil service nurse in a Naval hospital; 6 years as a public health nurse, working for the Montgomery County Health Department in Maryland; and 13 years as an officer in the Commissioned Corps of the United States Public Health Service. At the present time she is a captain in the Public Health Service, stationed on the Northern Cheyenne Reservation, in Montana, as the Director of Public Health Nursing. She returned to graduate school in 1989 to work on her Masters degree in nursing at Montana State University College of Nursing, where she will graduate this Spring.

Mary is an active member of Sigma Theta Tau, the nursing honorary society, and also belongs to the American Nurses Association, and the Montana Public Health Association. She is a Certified Community Health Nurse, and a Certified Childbirth Educator.

Mary is married to Claude C. Dodson, Jr., and has three children, Peggy Ann, who will graduate from High School this Spring; Carl who lives with his wife in Polson, Mt; and Kathleen, who lives in Seattle, WA.

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ABSTRACT

The standardized growth curves used in the United States to screen for growth and nutritional status in infants and children may not be appropriate for use with Northern Cheyenne children (National Center for Health Statistics, 1977). Literature (Effler, 1980; Sugarman, White, & Gilbert, 1990; The Canadian Paediatric Society, 1987) supports the probability that other American Indian populations are significantly different from the reference population used to develop the National Center for Health Statistics standardized growth curves (1977).

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There is substantial controversy over whether growth charts should be developed which are specific to certain ethnic populations. This is of even more concern with the American Indian tribes due to the secular trend toward obesity (Roche & McKigney, 1978; Sugarman et al. 1990). Development of normalized curves for each Indian population may be highly impractical. However, health care workers should be aware of the differences between Northern Cheyenne children and the national reference population.

CHAPTER I

INTRODUCTION

Problem Statement

Anthropometric data have been recognized all over the world as providing the most valid assessment of physical growth and general nutritional status (Burns, Carriere, & Rohde, 1988; Roche & McKigney, 1976; Waterlow, Buzina, Keller, Lane, Nichaman, & Tanner, 1977). Accurate growth monitoring has been accepted as one of the primary means of detecting risk factors leading to reduction in infant mortality. The UNICEF endorsed child survival program, "GOBI" (growth monitoring, oral rehydration, breast feeding and immunization) is stated to have the potential of saving an estimated 20,000 children's lives per day (Wagstaff & De Vries, 1986). The standard growth curves used in the United States to screen for growth and nutritional status in infants and children may not be appropriate for use with American Indian children. The author has observed over a period of twelve years of working with the Northern Cheyenne population that given a normal term pregnancy, newborns seem to be above average in weight, head circumference, and sometimes height.

Although the published literature specific to Native American populations in this respect is somewhat limited, a number of Indian Health Service (IHS) health care providers have observed that the average American Indian neonate is above average in the weight parameter. Dr. Dean Effler (1980), an Indian Health Service pediatrician, kept track of birth weights of term infants born to healthy mothers on an east coast reservation for one year. The infants averaged one pound above the national average. Byron (1990) collected growth data for Indian children of another tribe and found them to be significantly larger than the National reference at birth and through the third year, especially in weight. The Indian and Inuit Health Committee, Canadian Paediatric Society (1987) concluded that Indian and Inuit infants were likely to be of average length, above average in weight and, in some parts of the country, above average head circumferences compared to Caucasian infants. Sugarman, White, and Gilbert (1990) surveyed school age children on the Navajo Indian Reservation, comparing data from 1955 to 1989 to the National Center for Health Statistics (NCHS) (1977) reference data. Data indicated a secular change in height, weight and obesity in Navajo children during this period of time. An earlier study of birth weight and growth among Navajo children reported the children tended to have low length-for-age and high weight-for-length measures relative to the national reference population (Peck, Marks, Dibley, Lee, & Trowbridge, 1987).

Nurses and physicians who assess American Indian infants' weight and height on standard infant growth curves may not be alerted to deviations from the norm. The weight may appear to be within normal range on the growth chart when it actually is not. For example, an infant born three weeks early and weighing 6 lb. 4 oz. might be thought of as smaller than average, but not enough to be concerned. If that weight were comparable to 5 lb. 6 oz. in a Caucasian child however, it would be assessed quite differently. Physicians and nurses unfamiliar with the Native American population on the Northern Cheyenne Reservation frequently overlook the possibility of low birth weight or poor weight gain when assessing infants because the infants fit the standard infant birth and growth curves.

Neonatal and postneonatal mortality rates have declined substantially during the past 30 years for all races, but the postneonatal mortality rates for the non-white population continue to be significantly higher than for the white population in almost all cases (Effler, 1988; Murphy & Landsberger, 1980; NCHS, 1974). These mortality statistics hold true on Billings area Indian reservations, where in 1984 the infant mortality rate was almost the same as for the United States as a whole, but the postneonatal mortality rate was significantly higher according to Indian Health Services statistics (Effler, 1988). Birth weight specific postneonatal mortality risks were reported to be more than three times as high in Native Americans compared to Caucasians in a study by Vanlandingham, Buehler, Hogue, and Strauss (1988). Growth charts

which are applicable to the particular ethnic culture are considered to be one of the least expensive and most important tools for proper assessment of birth and growth data (Roche & McKigney, 1976; Wagstaff & De Vries, 1986; Waternaux, Hebert, Dawson, & Berggren, 1987).

Nurses have been involved in the study and development of tools for assessing infant growth and development. Barnard (Barnard et al., 1987; Barnard & Douglas, 1974; Barnard, King, & Hoehn, 1981) set a precedent by researching and developing infant assessment tools. Powell (1981) also researched and published guidelines for assessing growth and development of children. Roberts was a nurse co-researcher who studied heights and weights of Canadian Indian and Eskimo children (Partington & Roberts, 1969). Growth charts are an important tool used by public health nurses in screening for growth and nutrition problems. It is necessary for nurses to have tools which accurately assess growth and nutrition for the population of children to whom they provide nursing services.

CHAPTER II

REVIEW OF LITERATURE

There is a plethora of literature related to growth assessment, nutritional assessment, and growth parameters. Much of this literature is specific to growth curves and charts as assessment or screening tools. There is limited published material related directly to the assessment of growth, growth parameters and the use of growth charts in relation to American Indian populations in the United States.

Growth Curves and Charts

The significance and use of growth charts as a tool in screening for growth problems in infants and children is well documented. Most of the experts agree that the National Center for Health Statistics (NCHS) and Center for Disease Control (CDC) growth curves for children birth to 18 years are the best tools available for practical quick screening purposes (Hamill, Drizd, Johnson, Reed, Roche, & Moore, 1979; Indian and Inuit Committee, Canadian Paediatric Society, 1987; Johnson, Moore & Jeffries, 1978; Pereira & Barbosa, 1986; Roche & Himes, 1980; Roche & McKigney, 1976; Ryan & Martinez, 1987). The NCHS (1977) developed these growth curves using both longitudinal

data from the Fels Research Institute and cross-sectional data from the National Health and Nutrition Examination Surveys (Dibley, Goldsby, Staehling, & Trowbridge, 1987). The set of charts for children birth to 36 months of age were based on anthropometric measurements collected at the Fels Research Institute during the 1929-75 period, birth to 36 months, separately by sex. The Fels sample of infants and children was derived from generally middle-class, nearly all white families in one major city in Ohio. There was no elimination for low birth weight and most of the infants were bottle-fed (Ryan & Martinez, 1987).

Research data since have confirmed that these growth charts are still appropriate and probably will be for some years to come (Baumgartner, Roche & Himes, 1986; Ryan & Martinez, 1987). The World Health Organization in 1978, recommended that the NCHS/CDC growth curves be used as an international growth reference (Dibley, Goldsby, et al., 1987). Hence, they are now used all over the world.

Studies of birth and growth curves in Inuit and Indian infants have been done in Canada. One study (Partington & Roberts, 1969) looked at birth and growth data and secular trends in three tribes: Eskimos on the east coast of Hudson Bay, Cree Indians in the region of James Bay, and Mohawk Indians of the Tyendinaga Reservation. In general the Indian babies were larger at birth, but the Eskimos were not. The heights varied with each tribe. Moffatt, Kato and Watters (1984) reported in their study that Cree children in the James Bay area of

Quebec were heavy but not long for their age compared to Caucasians. Another study (Lavallee, 1988) related that these same people were larger than American children at birth in weight, height, and head circumference, and developed specific growth curves for this population. A study (Postl, Carson, Spady & Schaefer, 1984) of Inuit and Indian children in the Northwest Territories reported the mean heights and weights for both Inuit and Indian showed mean weights above the 50th percentile using American standard growth curves. Indian newborns in the Sioux Lookout Zone, Ontario were found to have significantly higher birth weights than the Canadian norms despite impoverished living conditions (Munroe, Shah, Badgley, & Bain, 1984).

The Indian and Inuit Health Committee, Canadian Paediatric Society, published a consensus statement in 1987 after reviewing the studies of growth patterns of Indian and Inuit infants in Canada. They concluded that Indian and Inuit infants were likely to be of average length but heavier than Caucasian infants and, in some parts of Canada, they seemed to have larger heads. They felt that due to regional variations, standardized growth curves could not be developed that would fit all native children. Some populations were small and it would be impractical to try to develop charts for each population.

Meadows, Till, Leaf, Hughes, Jani and Larcher (1986) in a study done in London stated that undiscriminating application of standard weight percentile charts derived from white infants, to infants from diverse ethnic groups, could result in an overestimation of the incidence

of intrauterine growth retardation in these groups. Trowbridge (1983) felt that the use of a single reference population for all ethnic groups could distort the prevalence of nutritional abnormalities. Growth assessment as a neonatal nutrition controversy is discussed by Pereira and Barbosa (1986). They stated that growth charts were non-controversial for normal term infants but that for preterm and low birth weight infants, none of the extrauterine growth charts were satisfactory, and intrauterine growth standards should be derived from a population of similar ethnic, demographic, and socioeconomic characteristics.

Waterlow et al. (1977) stated that the question of whether all populations of children throughout the world have the same genetic potential for growth is still unanswered. They differentiated between the concept of reference and that of a standard. The growth potential of children in industrialized countries may not be a realistic target for children from different genetic and environmental backgrounds.

Studies from Other Countries

Other countries have studied the needs of various populations for special growth charts and supported the need for growth charts specific to particular ethnic and socioeconomic groups (Cameron, 1986; Huey, Tanner, & Cox, 1987; Ishakawa, Furuyama, Ishikawa, Ogawa, & Wada, 1987; Persson, Stanjenberg, Lunell, Brodin, Holmberg, & Vaclavenkova, 1986). Habicht, Martorell, Yarborough, Malina, and Klein (1974) studied the growth of well nourished preschool children of different ethnic

backgrounds, and children in developing countries of different ethnic backgrounds. They found ethnic effects on growth and development were much less significant than environmental effects. Evidence to corroborate this study was reported in a study of White Mountain Apache preschool children (Owen, Garry, Seymoure, Harrison, & Acosta, 1981).

The Northern Cheyenne Reservation

The Northern Cheyenne Indians live on a rural reservation with an exceptionally low per capita income and a high rate of unemployment (Hartfield, 1986). A comprehensive primary care clinic is available, with well child clinics being held weekly. A Women, Infants, and Children (WIC) program is available at the clinic. Fifty percent of the infants are breast-fed, at least initially (Women, Infants, and Children, 1988). Other food related programs such as food stamps and commodity programs are readily available on the reservation.

Conceptual Framework

Growth as a concept is a dynamic positive process of change. In human beings, it starts at conception and continues until death. Growth in its various forms and phases is one of nursing's major focuses. Waechter and Blake (cited in Stanhope & Lancaster, 1984) define growth and development as two distinct concepts: (a) the measurable aspects of the increase in size of individuals, and (b) the

observable aspects of the progressive changes in the individuals as they adapt to their environment.

The theoretical basis for this study is the four concepts of nursing's metaparadigm: Person, environment, health, and nursing (Fawcett, 1984). A conceptual model (Figure 1) has been developed to illustrate how infant growth and development fits into the framework of nursing's metaparadigm. The cultural belief of the Northern Cheyenne people is that life is a circle beginning with birth, going through the stages of life, and ending up at the time of death back at the beginning of the circle so that there is neither beginning nor end (see Appendix A). This circular way of thinking was used in the development of this model.

The infant is the person and is the core in the model. Another circle immediately surrounds the infant with arrows pointing outward representing growth and development (expansion). Ethnicity, socioeconomic factors, living conditions, parenting, and availability of health care are factors which can influence growth and development in children and are viewed as environmental factors, represented by another circle which orbits around the infant.

Health is understood holistically by the Northern Cheyenne people. It is a complete state of wellness in mind, body, and spirit, and a continuing lifelong growing process. Health is an abstract concept, particularly influenced by ethnicity, environment, and socioeconomic factors. It is represented in the model by another orbiting circle which

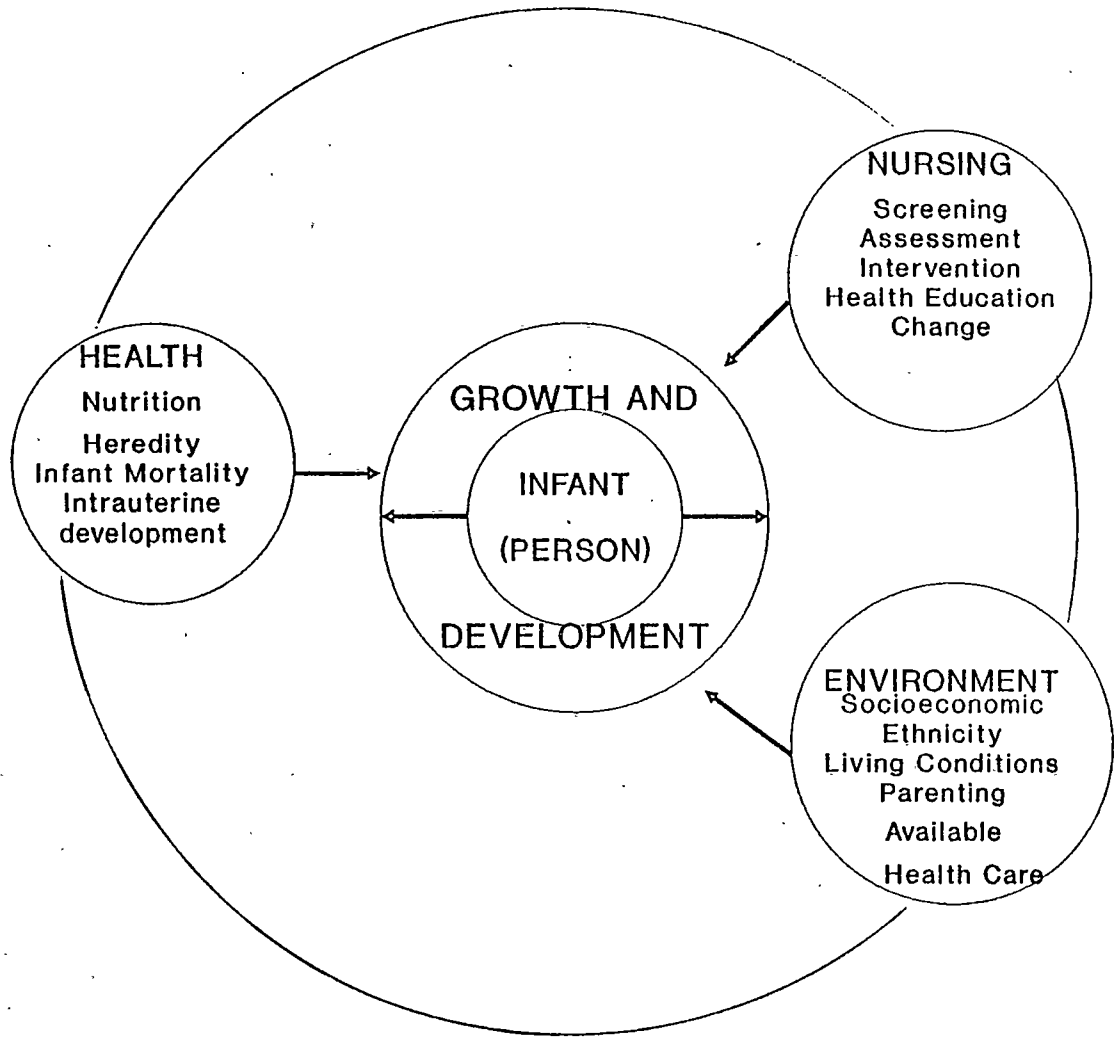

Figure 1. Conceptual Model of Infant Growth Development.

includes such influences as nutrition, heredity, infant mortality, and intrauterine development.

Nursing, the final concept, is viewed as another circle orbiting and influencing the infant. Nurses are seen as agents of assessment, intervention and change in this model (Fawcett, 1984), with screening and health education being a part of this process. Growth curves and charts are among the many tools used by nurses in assessing growth of children, and enter the framework at this point. Arrows point from each of the circles around the orbit and also lead to the infant, showing the holistic, inter-relationship between each of the four concepts of the paradigm.

Assumptions related to these concepts and relevant to the proposed study are:

1. Growth is a dynamic positive process of change that is essential to the health and well being of children (Roche & Himes, 1980).

2. Nurses who are culturally sensitive can act as change agents in working with American Indian children and their families toward optimum growth and development.

Definitions of terms:

Term infant: An infant of 37-42 weeks gestational age at birth (Klaus & Fanaroff, 1973).

Definitions of anthropometric variables (Moore & Roche, 1982):

1. Recumbent length: The measurement of the linear extent of the long axis of the body extended horizontally on a measuring board. This measurement should be used until at least 24 months, and depending on the child's ability to stand alone and cooperate, up to 36 months. Recumbent length was the measurement used in this study due to the young age of the subjects. Height may refer to either recumbent length or standing height (stature).

2. Height-for-age: The anthropometric measurement which crosses the age on the vertical axis with the height on the horizontal axis, on a percentile growth curve.

3. Weight-for-age: The anthropometric measurement which crosses the age on the vertical axis with the weight on the horizontal axis, on a percentile growth curve.

4. Weight-for-height: The anthropometric measurement which crosses the height on the vertical axis and the weight on the horizontal axis, disregarding age, on a percentile growth curve.

5. Chronological age: The most influential variable for measuring growth in rapidly growing children; exact age is required (Hamill et al. 1979). Date of birth was used to define chronological age in this study.

Purpose

The overall purpose of this study was to improve understanding and knowledge of the growth parameters of children of the Northern

Cheyenne people living on the Northern Cheyenne Reservation in Montana. The specific aims of the study were: (a) To document the height and weight curve from birth to two years of age for the Northern Cheyenne infants born in 1988 and 1989, and (b) to look at the central tendencies of these data and compare them to the reference population.

CHAPTER III

METHODS

Design

This was a retrospective longitudinal study using primary analysis of existing data from health records. The scope of this study was limited to the Northern Cheyenne infants living on the Northern Cheyenne Reservation in Montana, with a total population of 4,642 people (Program Analyst, Office of Program Planning, Information, and Evaluation, Billings Area Indian Health Service, 1991a). The average number of deliveries per year is 144 (Dodson, 1991a). The Northern Cheyenne Service Unit, an IHS medical facility located on the Northern Cheyenne Reservation, is open 24 hours per day, 7 days a week for emergencies. Comprehensive primary care and preventive health care services are also available at the clinic weekdays. The nearest Indian Health Service Hospital is located 42 miles away on the Crow Indian Reservation. It is at this hospital that most of the expectant American Indian mothers deliver their babies. If there are complications of pregnancy or delivery, the mother must go to larger health care facilities in cities 100 miles distance.

Sample

Prenatal records, infant records and birth records from the Northern Cheyenne Service Unit on the Northern Cheyenne Reservation were reviewed for all infants born in the years 1988 and 1989. These were the two most recent years offering complete data for infants birth to two years of age and were felt to be representative of recent growth and development of Northern Cheyenne children of this age group. A review of the epidemiologic data available for the Northern Cheyenne Service Unit revealed that there were no extraordinary epidemics, economic factors, or nutritional variances during the years 1988 and 1989 (Dodson, 1988 & 1989a; Program Analyst, Office of Planning, Information, & Evaluation, Billings Area Indian Health Service, 1991b; Women, Infants, and Children (WIC), Northern Cheyenne Service Unit, 1989 & 1990).

A total of 199 infants, consisting of 91 girls and 108 boys were included in the study. Selection criteria were used to assure that the data were not skewed by abnormal pregnancy outcomes or unhealthy children. In order to qualify for the study the infant had to be healthy and the product of a normal term pregnancy, using the guidelines used by NCHS in the development of their growth curves (Persson et al. 1986; National Center for Health Statistics, 1977; Ryan and Martinez, 1987). Twins were included if they were not premature, as in the National Center for Health Statistics (1977) growth curve studies. The

mother's blood quantum also had to be at least one quarter Northern Cheyenne, as verified by health records. There are many factors such as maternal use of alcohol and tobacco and maternal age which could skew the data. However, as these were not addressed as selection criteria in the National Center for Health Statistics surveys, they were not used as selection criteria in this study. All birth and growth data available for the children included in the study were used. Anthropometric data were collected for the first two years of life because children over 24 months of age are often measured differently (stature rather than recumbent length) leading to confusion in data. Additionally, for children over 24 months, data forming the reference population are based on other populations and cross-sectional rather than longitudinal studies (Trowbridge, 1983).

Data Producing Instruments

The data producing instruments in this study were existing patient records of both infants and mothers at the Indian Health Service (IHS) Clinic on the Northern Cheyenne Reservation. The birth logs and prenatal registry located in the Public Health Nursing Department at the IHS Clinic were used to obtain names of those to be screened by use of selection criteria. Some selection criteria data were also derived from the computerized patient registry located in the same place.

Data Collection

Data collection began by first going to the birth log for this reservation, located in the files of the Public Health Nursing Department. The live birth records were reviewed for 1988 and 1989 to determine if selection criteria were met. Identification and birth dates were entered on data collection tables (see Appendix B). Birth weights and birth lengths were obtained from the clinic records and entered into the data collection tables. Growth data from birth through 24 months of age were also obtained from clinic records and entered into the tables.

Data Analysis

All entries from the data collection tables were entered into the Epi Info, Version 5 (Dean, Dean, Burton, & Dicker, 1990), anthropometric data analysis program. Z-scores were computed and percentile curves and bar graphs were developed.

The Center for Disease Control in Atlanta, Georgia and the World Health Organization in Geneva, Switzerland have collaborated to produce Epi Info, version 5 (Dean et al., 1990), a series of microcomputer software programs. Chapter 23 of this software package is devoted to anthropometric data analysis programs. The anthropometric data package is based on the CDC standard deviation derived growth reference curves (Dibley, Staehling, Nieburg, & Trowbridge, 1987). It receives anthropometric measurements, dates of

birth and gender, saves them, organizes them, and returns percentiles, percent of medians and standard deviations or Z-scores.

Percentile curves and percent of median, the classical methods of developing growth reference data in the past, have limitations. The percentile curves were suitable for monitoring growth of individual children in clinical settings, but they were not suitable for some of the purposes for which the international growth reference was needed. An inability to monitor the growth of children with abnormal growth patterns who attained growth above or below the outer percentiles of the reference was the primary limitation. Percent-of-median indicators were developed as the classic approach to these limitations and were used for many years. However, a given percent of median for an indicator is not constant across ages and does not have the same meaning for different indicators. For this reason, a new method was developed by the CDC that measures deviation of anthropometric measurement from the reference median in terms of standard deviation or Z-scores (Dibley, Goldsby, et al., 1987).

Human Subjects

Existing health records of Northern Cheyenne infants and their mothers, from the Indian Health Service Clinic in Lame Deer, Montana, were the sources for this study. Permission to use records and permission to present and publish the data was gained from the Northern Cheyenne Service Unit and the Northern Cheyenne Board of

Health, Lame Deer, Montana (see Appendix C). Permission was also gained from the Billings Area Office, Indian Health Services, Billings, Montana (see Appendix C). A proposal was prepared for submission to the Montana State University Human Subjects Review Committee and approval to proceed with data collection was granted by the committee May 6, 1991 (see Appendix C).

There were no risks to subjects, because of the use of existing records rather than persons. Data were accessed by the principal investigator and a medical student who assisted with the collection of data. Data were reported anonymously. No names or other personal identifying information were contained in printed or reported data, reports, publications or presentations. Benefits to the Northern Cheyenne Tribe will be derived from learning more about growth in American Indian children, and how it can best be measured and monitored.

CHAPTER IV

RESULTS

The overall purpose of this study was to improve understanding and knowledge of the growth parameters of children of the Northern Cheyenne people living on the Northern Cheyenne Reservation in Montana. Findings indicated that the Northern Cheyenne children weighed more at birth and continued to weigh more than the national average throughout the first two years of life. The average height was also greater, but the discrepancy was less than for weight. Boys and girls increased approximately equally over the national average in both height and weight.

Records of the Northern Cheyenne children surveyed indicated that they were generally taller and, more significantly, heavier than the national reference population. The larger size of Northern Cheyenne children was noticed first at birth (see Tables 1 and 2). The median birth weight for the girls was 7.76 pounds and for the boys the median was 8.18 pounds. The national median birth weight is 7.11 pounds for girls and 7.2 pounds for boys. The median birth weight for Northern Cheyenne children was approximately equal to the national 75th percentile. The bar graphs in Figures 10 and 11 (see Appendix D) show

Table 1. Birth Weights/Northern Cheyenne Infants.

Sex	Obs.	Total	Mean	Variance	Std. Dev.
F	91	705	7.746	1.193	1.092
M	108	875	8.100	1.029	1.014

Sex	Minimum	25%ile	Median	75%ile	Maximum
F	5.490	7.250	7.760	8.440	11.07
M	5.600	7.500	8.180	8.750	11.60

National Means for Birth Weight (NCHS)

Sex	25%ile	Median	75%ile
F	6.45	7.11	7.75
M	6.60	7.20	8.02

Table 2. Birth Lengths/Northern Cheyenne Infants.

Sex	Obs.	Total	Mean	Variance	Std. Dev.
F	53	1107	20.879	0.528	0.727
M	64	1335	20.856	0.849	0.922

Sex	Minimum	25%ile	Median	75%ile	Maximum
F	19.250	20.500	21.000	21.500	22.500
M	19.250	20.000	21.000	21.500	23.000

the distribution of birth weights for Northern Cheyenne boys and girls in half pound increments.

Figures 12 and 13 (see Appendix D) show the girls and boys weight for age percentiles in bar graph format. These graphs demonstrate that the majority of the measurements of Northern Cheyenne children fall in the higher percentile ranges. The mean percentile for girls is 67.11% and for boys 66.78% The mean percentile for height, 60.09% for girls and 59.02% for boys, are lower than the mean percentiles for weight, yet are still above the national average (see Figures 14 and 15). The Northern Cheyenne children were larger in both weight and height than the national average, but they were a great deal larger in weight than in height. This is demonstrated in the weight for height graphs (see Figures 16 and 17). They weighed more at birth and continue to weigh more than the national average in both height and weight in the first two years of life.

Comparisons can also be made using percentiles of the national norm. The Northern Cheyenne girls and boys percentile distributions are listed in Tables 3 and 4.

The Northern Cheyenne children continue to grow above the national average, especially in weight parameter, as can be seen by the growth curves (see Figures 18 and 19, Appendix D). Each point on these growth curves represents the average weight or height for all the boys or girls measured within the stated one month interval. Some of the points represent a large number of measurements (up to 108), while

Table 3. Northern Cheyenne Boys' Centile Distributions.

	Centiles										
Index	0.0-9.9	10.0-19.9	20.0-29.9	30.0-39.9	40.0-49.9	50.0-59.9	60.0-69.9	70.0-79.9	80.0-89.9	90.0-100.0	Total
H/A no.	20	46	56	74	66	119	99	93	87	99	759
%	2.6	6.1	7.4	9.7	8.7	15.7	13.0	12.3	11.5	13.0	100.0
W/H no.	44	41	53	59	58	77	106	86	114	121	759
%	5.8	5.4	7.0	7.8	7.6	10.1	14.0	11.3	15.0	15.9	100.0
W/A no.	23	42	40	51	81	85	111	138	143	204	918
%	2.5	4.6	4.4	5.6	8.8	9.3	12.1	15.0	15.6	22.2	100.0
	Reference Population										
%	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	100.0

Table 4. Northern Cheyenne Girls' Centile Distributions.

	Centiles										
Index	0.0-9.9	10.0-19.9	20.0-29.9	30.0-39.9	40.0-49.9	50.0-59.9	60.0-69.9	70.0-79.9	80.0-89.9	90.0-100.0	Total
H/A no.	32	35	52	52	62	71	77	89	94	106	670
%	4.8	5.2	7.8	7.8	9.3	10.6	11.5	13.3	14.0	15.8	100.0
W/H no.	17	33	45	57	57	78	76	91	84	131	669
%	2.5	4.9	6.7	8.5	8.5	11.7	11.4	13.6	12.6	19.6	100.0
W/A no.	27	39	49	40	66	78	97	95	108	232	831
%	3.2	4.7	5.9	4.8	7.9	9.4	11.7	11.4	13.0	27.9	100.0
	Reference Population										
%	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	100.0

others, after 18 months of age when fewer children are being measured with consistency, may represent as few as two measurements.

Figures 2 through 7 demonstrate the Z-score distributions of the growth measurements taken of the Northern Cheyenne children compared to the national reference curve. The Northern Cheyenne girls and boys weight and height curves were all shifted to the right of the national reference curves. The shift in the weight curve was more pronounced than for the height curve.

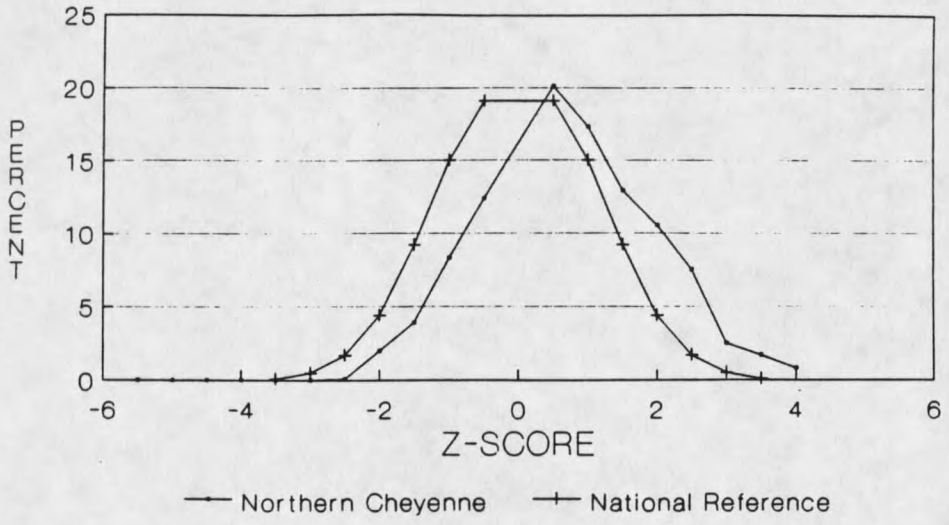

Figure 2. Girls' Weight/Age Distribution, 0-2 Year Old Northern Cheyenne Children, 1988-1989.

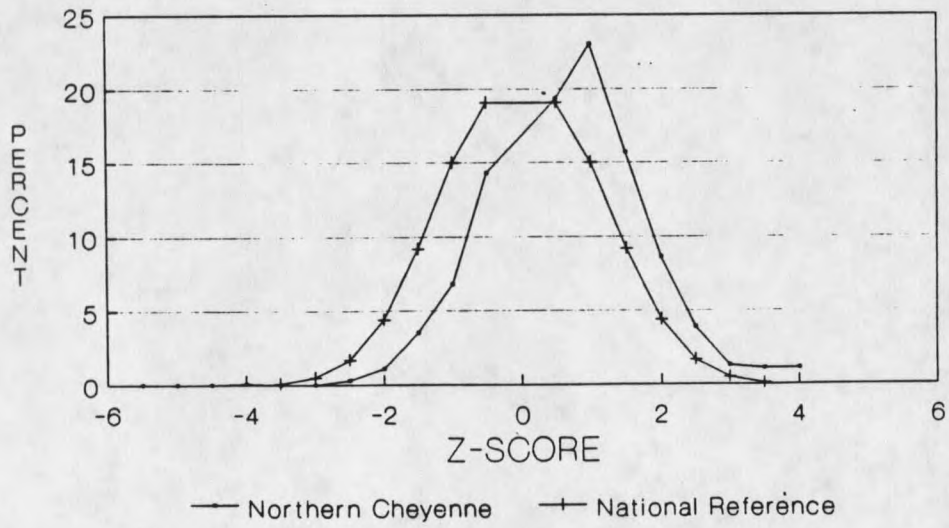

Figure 3. Boys' Weight/Age Distribution, 0-2 Year Old Northern Cheyenne Children, 1988-1989.

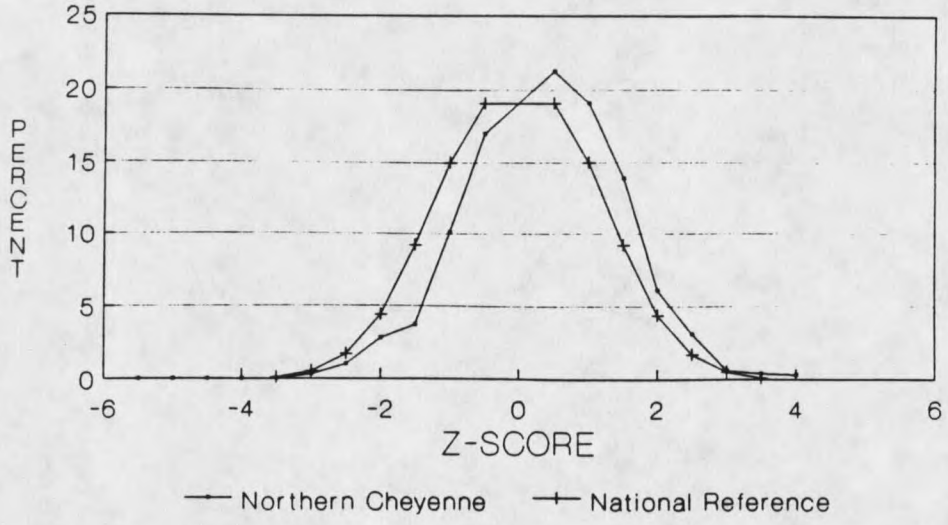

Figure 4. Girls' Height/Age Distribution, 0-2 Year Old Northern Cheyenne Children, 1988-1989.

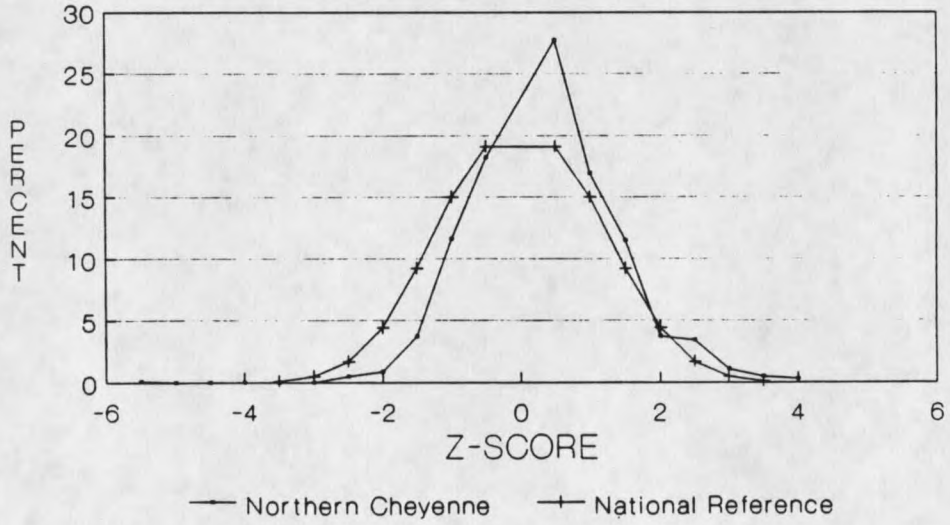

Figure 5. Boys' Height/Age Distribution, 0-2 Year Old Northern Cheyenne Children, 1988-1989.

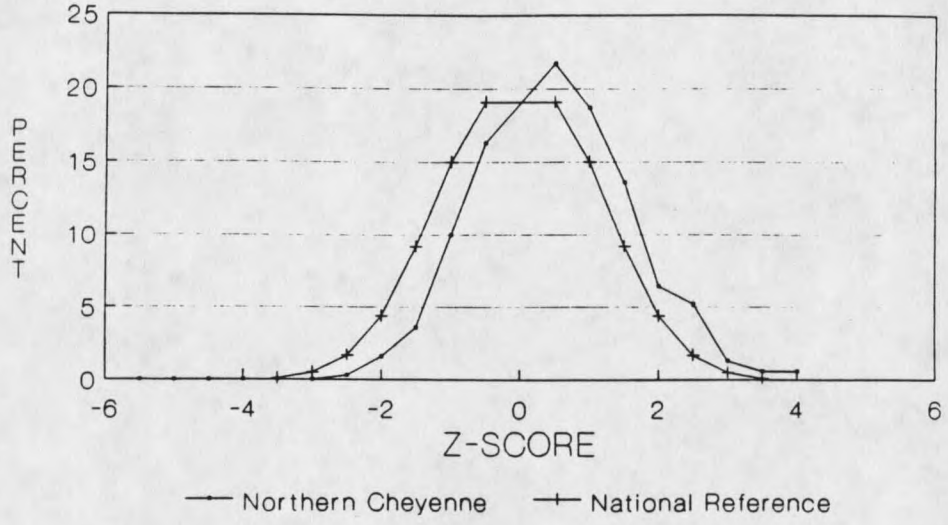

Figure 6. Girls' Weight/Height Distribution, 0-2 Year Old Northern Cheyenne Children, 1988-1989.

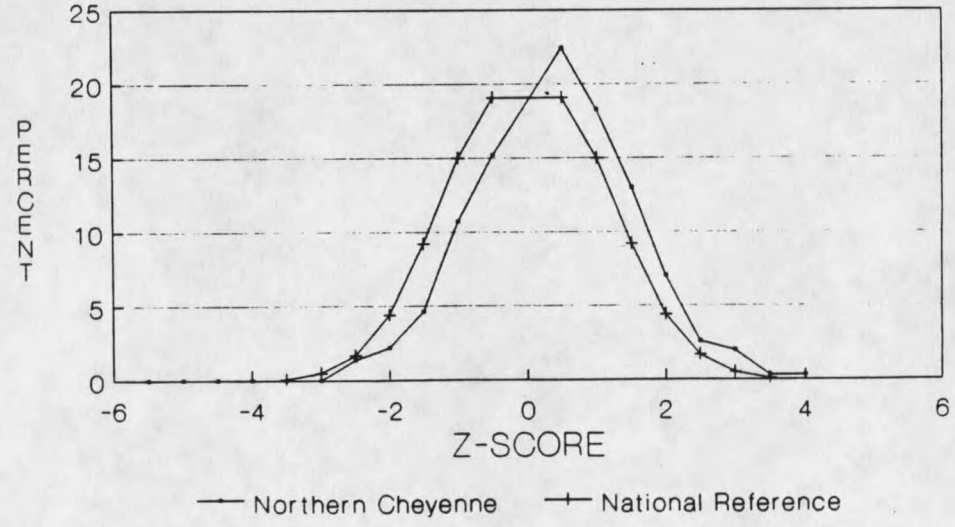

Figure 7. Boys' Weight/Height Distribution, 0-2 Year Old Northern Cheyenne Children, 1988-1989.

CHAPTER V

DISCUSSION

These data substantiate the clinical impression that Northern Cheyenne children are above average in height and considerably above average in weight, compared to the NCHS/CDC international reference curves, in the first two years of life. Other studies of American Indian children, using various age groups, have also identified this pattern of above average weights (Lavallee, 1988; Moffatt et al., 1984; Munroe et al., 1984; Roche & McKigney, 1976; Sugarman et al., 1990; Trowbridge, 1983). Height varies a great deal, from one report of growth stunting in Native American children in general (Trowbridge, 1983) to a report of above average heights in Mohawk Indians in Canada (Partington & Roberts, 1969).

Genetically based differences in growth potential or in body proportions have been proposed as a possible explanation for observed height and weight differences between Native American children and the NCHS/CDC international growth reference (Partington & Roberts, 1969; Roche & McKigney, 1976; Trowbridge, 1983). However, genetic differences are considered to be a minor factor. Socioeconomic and

environmental factors are felt to have a greater influence on growth than genetic factors.

Trowbridge (1983) observed that Native American children had both the highest prevalence of obesity, reflected in the high weight-for-height, and the highest prevalence of growth stunting, reflected in the low height-for-age. He proposed that this may be due to a diet which is relatively adequate in terms of quantity but deficient in quality, such as a relative inadequacy of high quality protein, or essential minerals and vitamins. The author's observations over a period of years have been that the average Northern Cheyenne diet is high in simple starches and fats, but low in mineral and vitamin rich foods.

Another concern is the possibility that there may be a trend in older children toward increasing obesity. This study has only looked at the first two years of life. Due to decreased well child clinic visits after two years of age, longitudinal data is much more difficult to obtain in sufficient numbers to give good growth curves after this age.

A nationwide cross-sectional survey of American Indian school children was conducted by Indian Health Service and Tribal dietetics programs in 1990 (Jackson, 1991). There were a total of 9454 American Indian School children from nine Indian Health Services areas, 310 of which were from the Northern Cheyenne reservation. They were compared to the National Health and Nutrition Examination Survey II population (NHANES II) (Dibley; Goldsby, et al., 1987) for underweight and overweight status. The American Indian children included in this

survey were similar in height, but weighed more than their NHANES II counterparts at every age and for both sexes. Overweight acquired during childhood or adolescence may continue into adulthood and increase the risk for certain chronic diseases later in life (Jackson, 1991).

Another possible explanation for the significantly higher weights in Northern Cheyenne children could be related to the rise in the prevalence of non-insulin-dependent diabetes mellitus (NIDDM) in the Northern Cheyenne people. The number of identified cases of NIDDM in Northern Cheyenne Indians has more than doubled in the past eight years (Dodson, 1992). A similar pattern is being seen all over the United States among Indian populations, with some areas having greater increases than others (see Appendix E). Although there is more than one type of NIDDM, patients are generally overweight (Krupp, Chatton, & Werdegar, 1985). Overweight is considered to be a predisposing factor to impaired insulin responsiveness (Kilo, 1982). There is also a high rate of elevated 50 gram glucose challenge tests in Northern Cheyenne women during pregnancy, but the three hour glucose tolerance tests are usually normal (Dodson, 1992). To date, there is no evidence of an increase in the prevalence of gestational diabetes in Northern Cheyenne women.

The quality of childhood nutrition, overweight in American Indian children and adolescents and the rise in NIDDM are all related to diet and life style. Efforts to help parents change their own and their

children's dietary intake have not been very fruitful. This is due in part to the economics (low per capita income and high rate of unemployment) of the Northern Cheyenne Reservation. Other factors such as dietary and lifestyle practices which have developed over the past 50 years are difficult to impact. Economic factors and dietary practices are slow to change even with improved knowledge.

A cooperative multidisciplinary approach is important. Nurses, physicians, dietitians, health educators, and administrators need to network with the community in efforts to bring about the accomplishment of community based health goals. Further investigation into other socioeconomic and cultural factors which influence health practices and change is important (Dodson, 1989b, 1991b). Nursing can and should play an important role in gathering this kind of data and disseminating it to those who provide health care to the Northern Cheyenne Indians.

The data of this study do not substantiate a secular change toward higher weights in Northern Cheyenne children. It is not known at this time whether the large size of Northern Cheyenne children is a genetic factor that has existed for a long period of time, an indication of high quantity and poor quality of dietary intake, or a trend toward obesity possibly related to a metabolic disorder such as NIDDM. A comparison of populations of previous years to the 1988 and 1989 children is requisite to determining whether there might be a secular change toward higher weights in Northern Cheyenne children. A study

of future years could also reveal evidence of trends in growth and/or obesity patterns. Other data, such as studies of the diets of the children and environmental and social risk factors, would also help in the analysis of the meaning of these higher weights.

The national reference population from which the growth charts for children birth to 3 years of age were developed was drawn from a convenience sample of Caucasian middle-class families living in Yellow Springs, Ohio (National Center for Health Statistics, 1977). There are definite socioeconomic and ethnic differences between the reference population and the Northern Cheyenne. This means that when the international growth curves are used for Northern Cheyenne children their placement on the curves is misleading.

The data substantiate reason for concern regarding the usage of the NCHS growth curves to screen for nutritional and growth deficiencies in individual Northern Cheyenne children. There is controversy over whether individualized growth curves should be developed for different ethnic groups. There is a special dilemma with American Indians and Alaska Natives as more evidence becomes available for a secular change in obesity among some tribes (Sugarman et al. 1990), indicating a possible need for population specific growth curves. The consensus statement of the Indian and Inuit Health Committee, Canadian Paediatric Society (1987) recognized the likelihood that Indian and Inuit children in Canada will be heavier than Caucasian children, but concluded that due to regional variations and

small populations it would be impractical to try to develop growth curves for each population. Some researchers, especially those from other countries, have supported a need for growth charts specific to the particular ethnic or more especially, socioeconomic group (Cameron, 1986; Habicht et al 1974; Huey et al. 1987; Ishikawa et al. 1987; Persson et al. 1986). Other groups of researchers (Meadows et al., 1986; Roche & McKigney, 1976; Trowbridge, 1983; Waterlow et al. 1977) believe that reference anthropometric standards for different ethnic populations would be useful, but difficult and problematic to develop. Various recommendations have been made by these researchers: to do further data collection and investigation into the specific differences that exist in various ethnic populations, particularly American Indians; to use alternate methods of assessing growth and nutritional status; or to make certain adjustments in the present growth curves for use in certain populations.

Clinicians are generally concerned with the growth of individual children, whereas public health officials are concerned with the growth of groups of children. The usual concept of a growth standard is one showing the potential upper limit of mean growth for the population, not the individual. In developed countries most standards are so similar that any growth standard may be used, however, in developing countries these criteria, if used for intervention, would overtax the system (Habicht et al., 1974). Northern Cheyenne children do not fit perfectly into either the model of a developed country, or that of a

developing country, such as is referred to in most of the studies of other countries.

One of the criteria for inclusion in this study was that the mother's blood quantum be at least one quarter Northern Cheyenne. The results of this study are not generalizable to other Native American populations. Development of growth curves specific to small tribal populations is not practical and would be difficult. If research were to show similarities in all or most of the Indian populations it would make sense to develop growth curves for larger populations of Indian people, but much work is still to be done in the study of other Native American populations before this will be possible.

Implications for Nursing

Community assessment and program development is a major part of the responsibility of Public Health Nursing on the Northern Cheyenne Reservation. Providing maternal and child health and well child services are a major part of that process. Information that Northern Cheyenne children may be larger on the whole, especially in weight, can be important in planning health care for this population.

Clinic nurses and public health nurses work with children and their parents in many settings, from preventive health teaching to emergency care. They are in a position to observe, assess and intervene when necessary. The implications of overweight in children and adolescents, and the possible risks if it continues into adulthood,

should be understood by nurses in order that their assessment and intervention process with each individual patient will be appropriate.

Regular anthropometric measurements should be taken and plotted throughout childhood. Nurses need to understand how to accurately measure children and how to use and interpret birth and growth measurements. The use of the NCHS growth curves for Northern Cheyenne children without the knowledge of their specific growth patterns could lead to misinterpretation of growth and nutritional status and inappropriate interventions. In-service education on anthropometric measurements can be presented for staff on a regular basis by public health nurses, dietitians and other knowledgeable persons. Further investigation of growth pattern changes should continue in order to identify population risk factors.

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APPENDICES

APPENDIX A

Cheyenne Circles

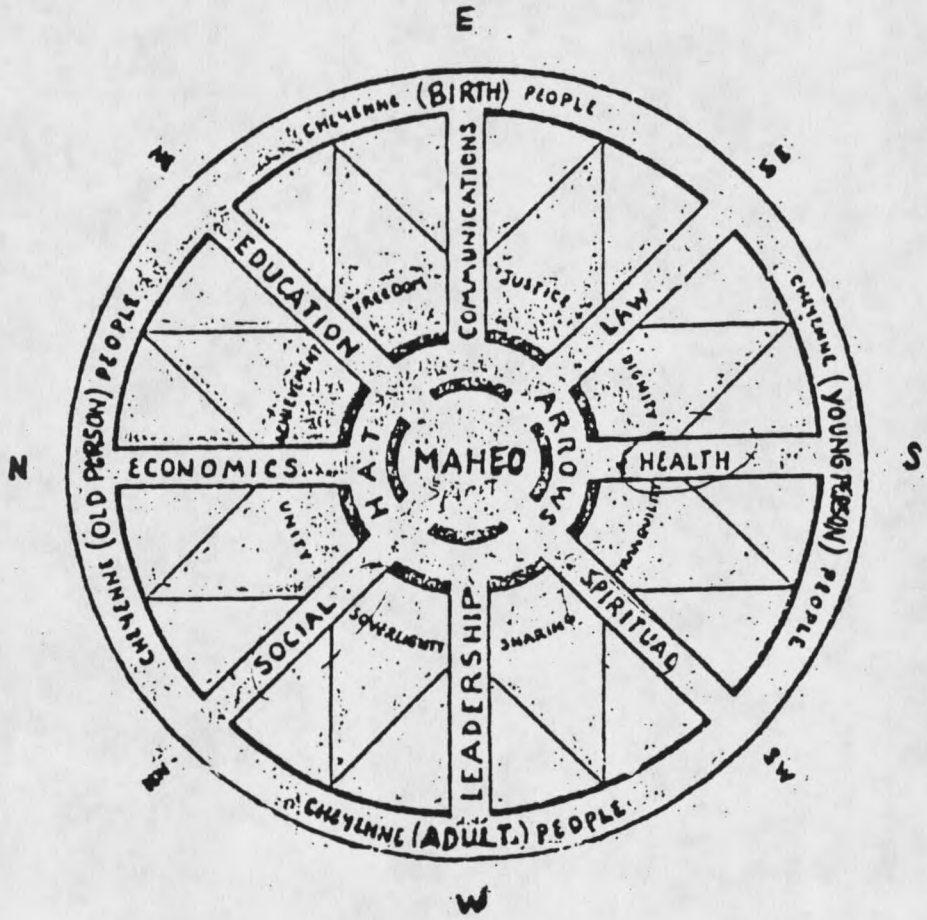

Figure 8. Circle of Knowledge from Northern Cheyenne Circle of Life.

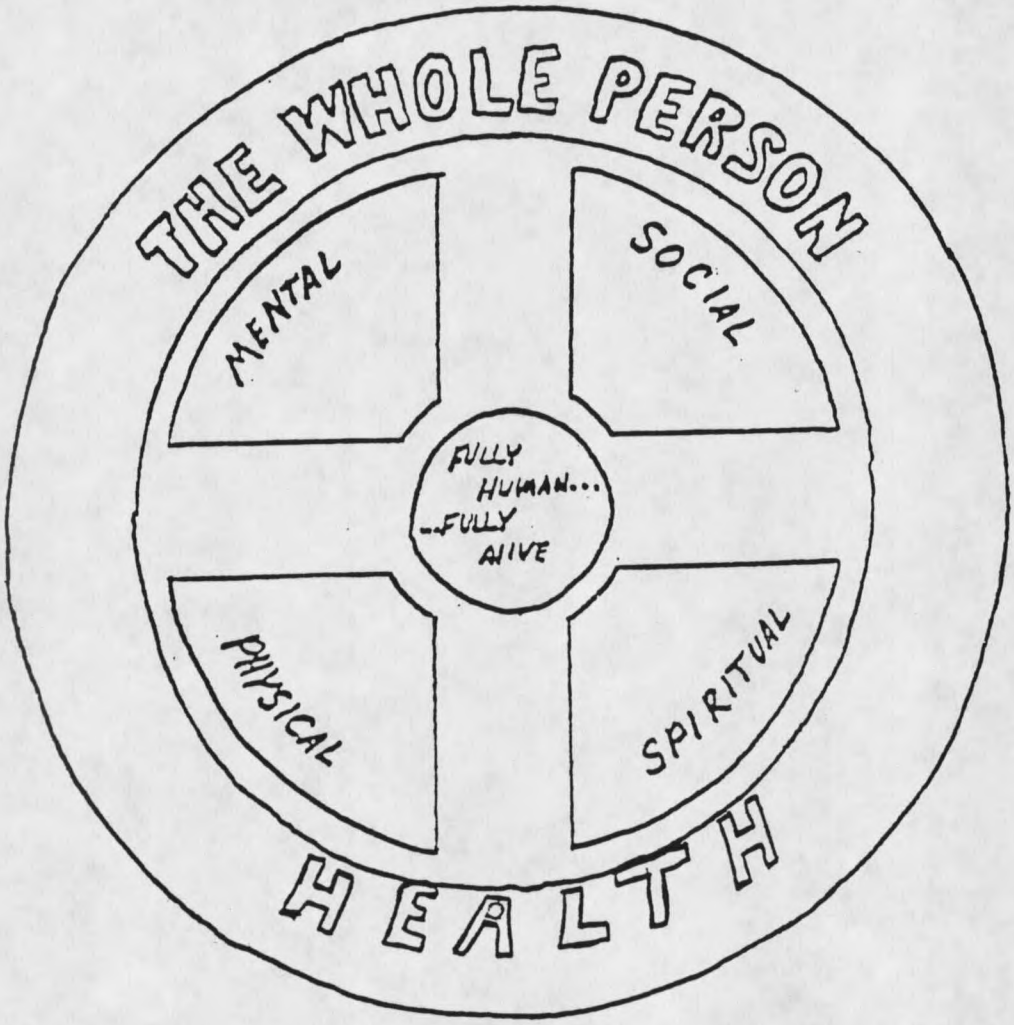

Figure 9. Whole Person Health Concept.

APPENDIX B

Data Collection Worksheet

Data Collection Worksheet

ID	D.O.B	Gender	Birth Weight	Birth Length	Date Weight	Date Length	Date Weight	Date Length	Date Weight	Date Length	Date Weight	Date Length	Date Weight	Date Length	Date Weight	Date Length	Date Weight	Date Length	Date Weight	Date Length

APPENDIX C

Permission to Collect Data and Publish

NORTHERN CHEYENNE BOARD OF HEALTH

P. O. BOX 128
LAME DEER, MONTANA 59043
(406) 477-6775

November 19, 1991

Mary M. Dodson, RN, BSN
Director, Public Health Nursing
PHS Indian Health Center
Lame Deer, MT 59043

Dear Ms. Dodson:

We support your research regarding the national reference growth curves compared to growth curves in Northern Cheyenne children, and believe it to be of benefit to health assessment of Northern Cheyenne children.

We encourage and approve of your continued research in this respect.

The Northern Cheyenne Board of Health grants you permission to present this research at conferences, and publish it, in order to disseminate this knowledge to other health professionals and other Indian tribes.

Sincerely,

Rosella Killsnight

Rosella Killsnight
Chairperson
Northern Cheyenne
Board of Health

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service
Indian Health Service

APR 17 1991

Billings Area
Indian Health Service
711 Central Avenue
P.O. Box 2143
Billings, MT 59103

Our Reference: DE

Mary Dodson, R.N., Director
Public Health Nursing
PHS Indian Health Center
Lame Deer, Montana 59043

Subject: Infant Growth Curves/Masters Theses

Dear Ms. Dodson:

Thank you for the opportunity to review the protocol for your study "The Use of Standard Infant Growth Curves in a Native American Population". After reading the protocol, I find it is exempt from review by the Institutional Review Board for the following reasons:

- The anonymity of subjects is assured.
- The study involves the collection of existing data.
- The study dose not involve the treatment of or risk of to any individual.

If you have plans to publish the results of your study, please submit a "relatively final" draft for review first. Since publication requires review at two levels, be sure to allow plenty of lead time.

As to your question on the use of the medical student to assist in the collection of data, you need to talk with the Service Unit Director and others you mentioned.

Best of luck on your project. The question your study addresses is certainly significant for the Service Unit population.

Sincerely yours,

James D. Vesbach, D.D.S., M.P.H.
Chairman, Area Research Committee
Billings Area Indian Health Service

cc: Assistant Area Director, Office of Health Care Programs, Billings Area IHS
Service Unit Director, PHS Indian Health Center, Lame Deer, Montana

FORM B

MONTANA STATE UNIVERSITY
COLLEGE OF NURSING

UNIVERSITY HUMAN SUBJECTS COMMITTEE SUMMARY

Name of Proposal: The Use of Standard Infant Growth Curves in a Native American Population

Name of Investigator/s: Mary M. Dodson, BSN, RN, C

(Circle one: undergraduate student/s, graduate student/s, faculty member/s)

Faculty Advisor (if student research): Jean N. Gullicks, Ph.D, RN, Assistant Professor

Date of College of Nursing Review: 5/6/91

Reviewed by:

(List College of Nursing reviewers involved by names and type of committee, e.g. J. Doe, Great Falls Extended Campus Committee)

Ruth Leidemann, M.S., R.N.

Carolyn Hanson-Wenger, M.S.N., R.N.

Approved by:

Campus H.S.R. Committee [signature]

Education Director [signature], R.N., C.S.

Brief Description of Subjects (age, sex, health status, etc.)

(To Be Completed by the Investigator/s) The subjects will be the existing Health records of infants, birth to 12 months of age, and their mothers. The records are located at the Indian Health Services Clinic in Lame Deer, Montana, on the Northern Cheyenne Indian Reservation.

Brief Description of Procedure (what is to be asked of or done to subjects)

(To Be Completed by the Investigator/s) The records of infants will be reviewed for anthropmetric measurements at birth, 2 months, 4 months, 6 months and 1 year. Mother's records will be reviewed for any complications during gestation and delivery. There will be no direct contact of human subjects; no names of persons will be used, or written into the data. The data will be compiled in statistical form and entered into a computer program for analysis.

[X] Exempt Under Federal Reg. 45 CFR 46 46.101 (2) (b) 46.101 (5)
(Insert number and letter as appropriate)

OR

[ ] Questionable or Ruled Not Exempt Under Federal Reg. 45 CFR 46

*Proposal sent to College of Nursing Dean for Review on _____

APPENDIX D

Birth and Growth Data

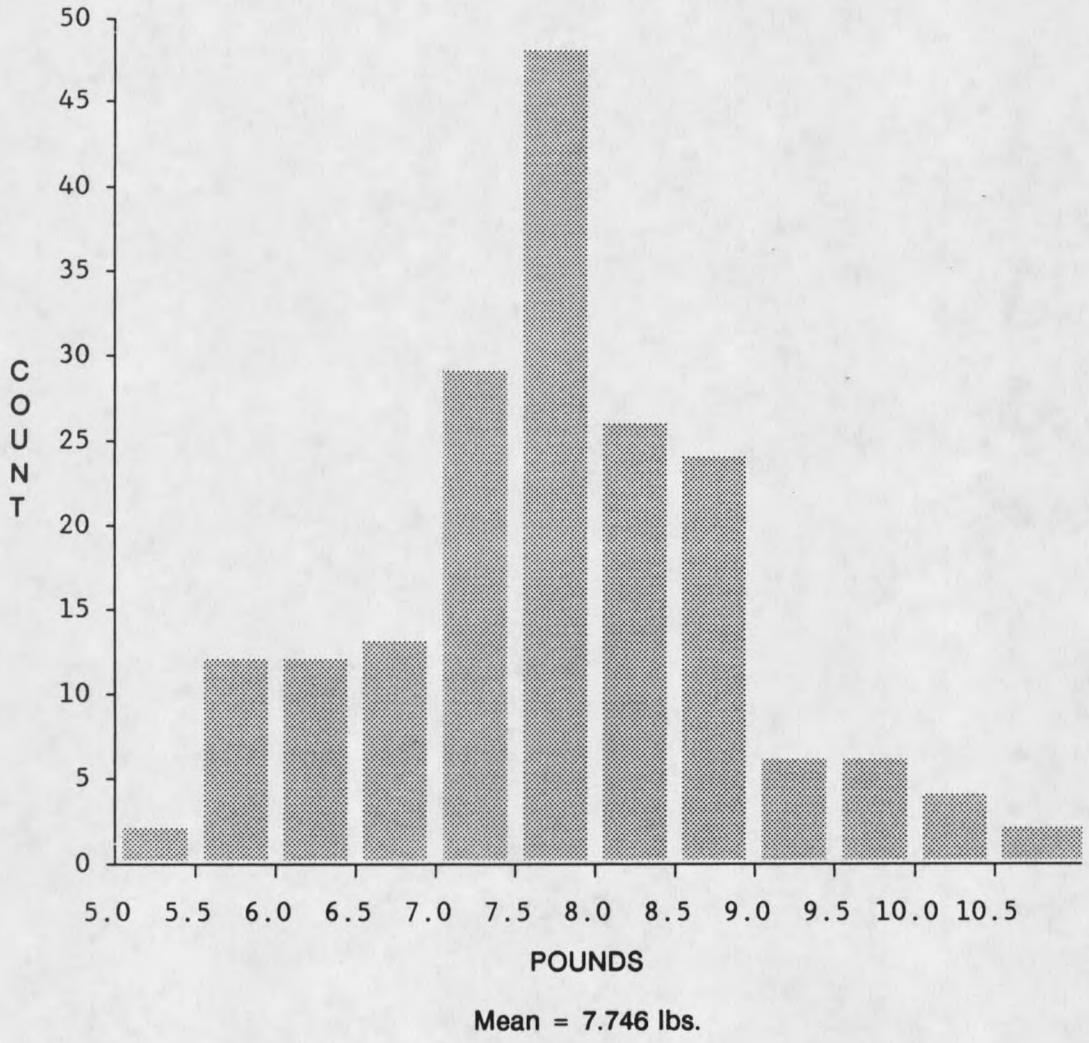

Figure 10. Northern Cheyenne Girls' Birth Weight.

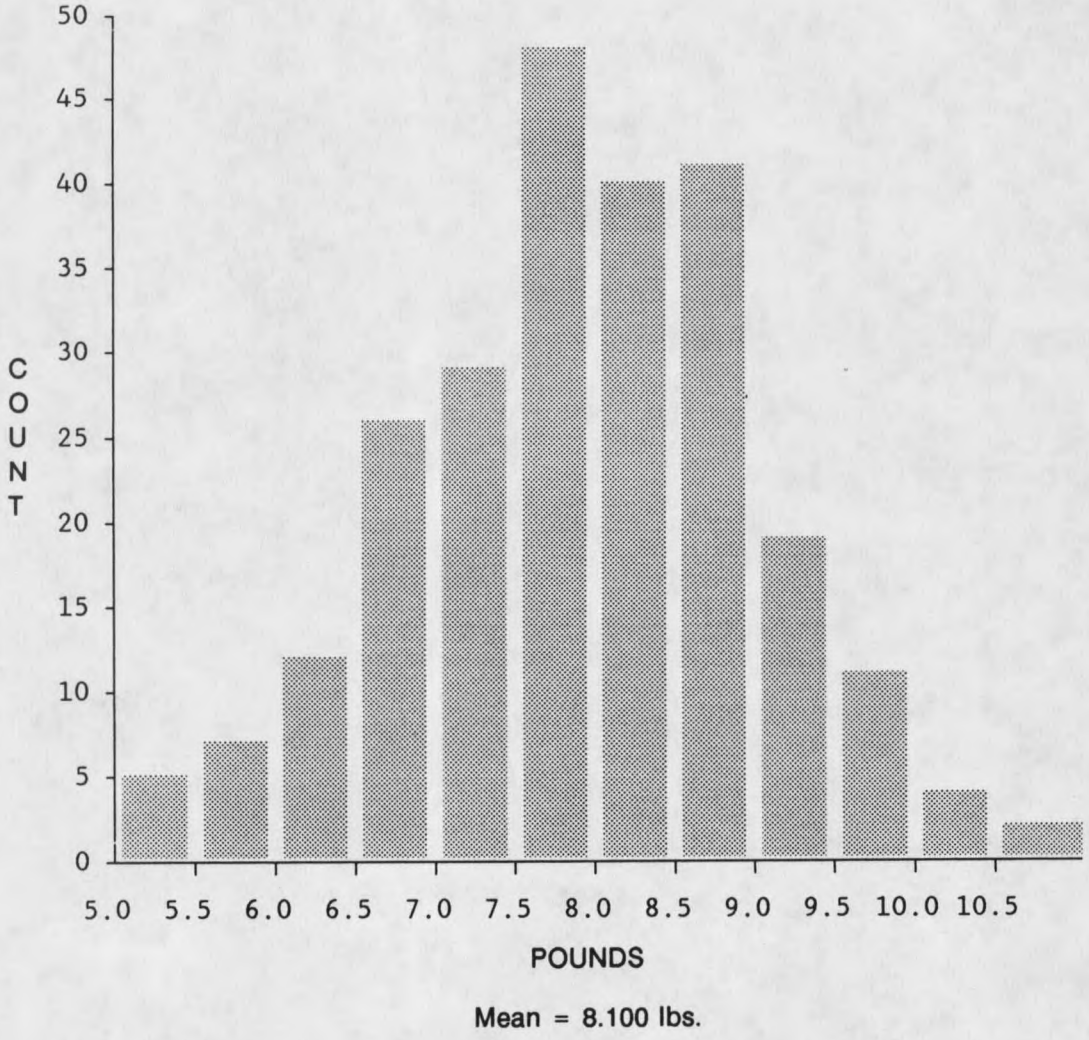

Figure 11. Northern Cheyenne Boys' Birth Weight.

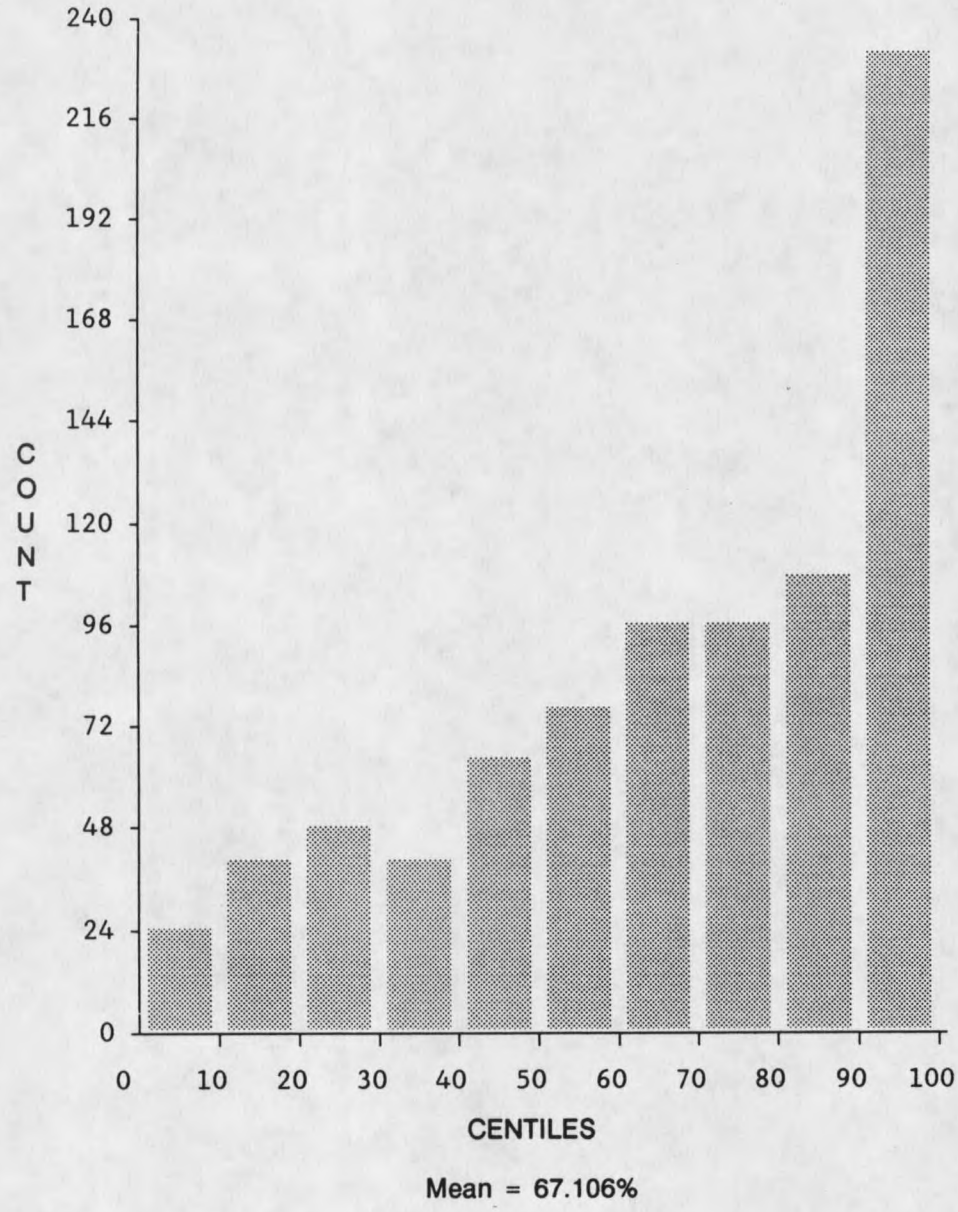

Figure 12. Girls' Weight-for-Age Centile Bar Graph.

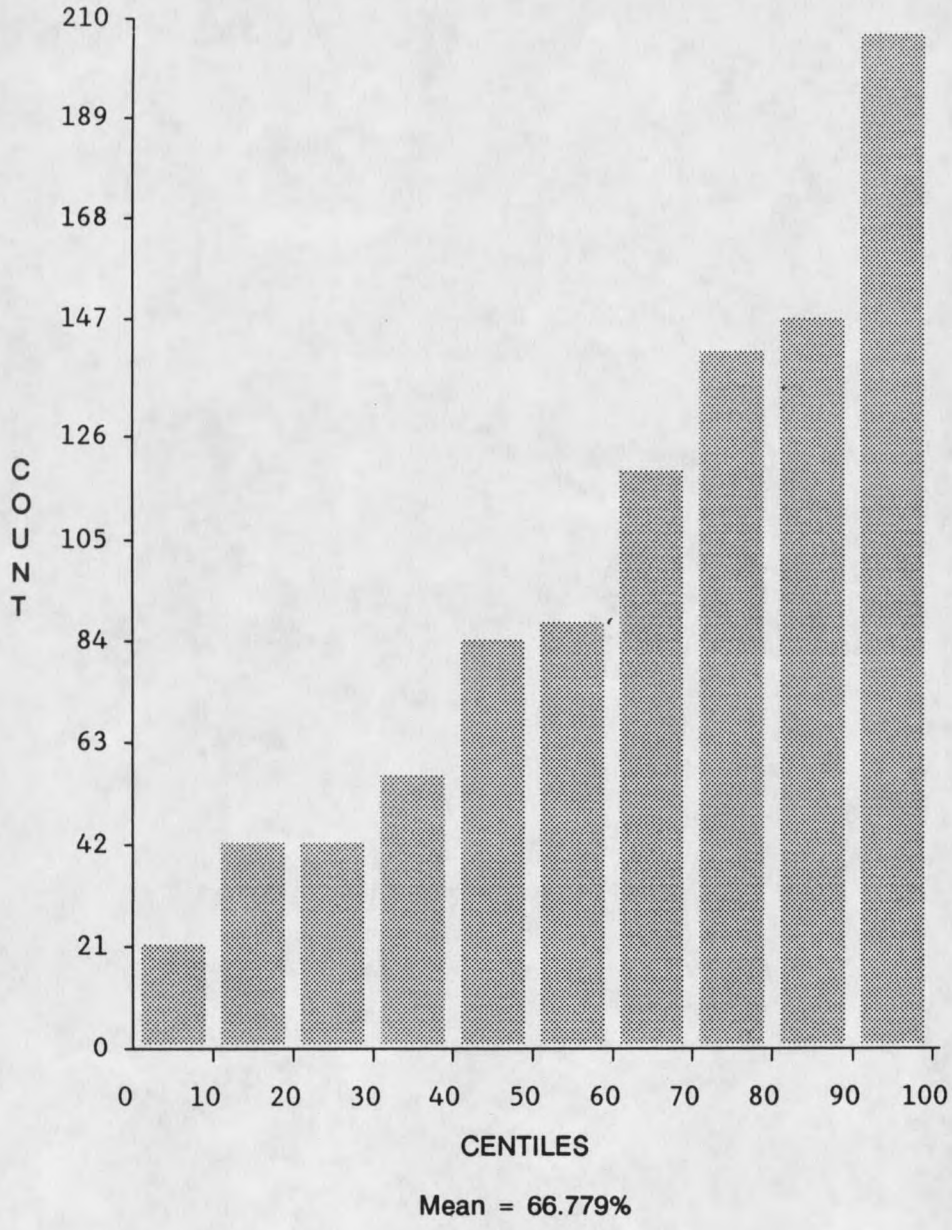

Figure 13. Boys' Weight-for-Age Centile Bar Graph.

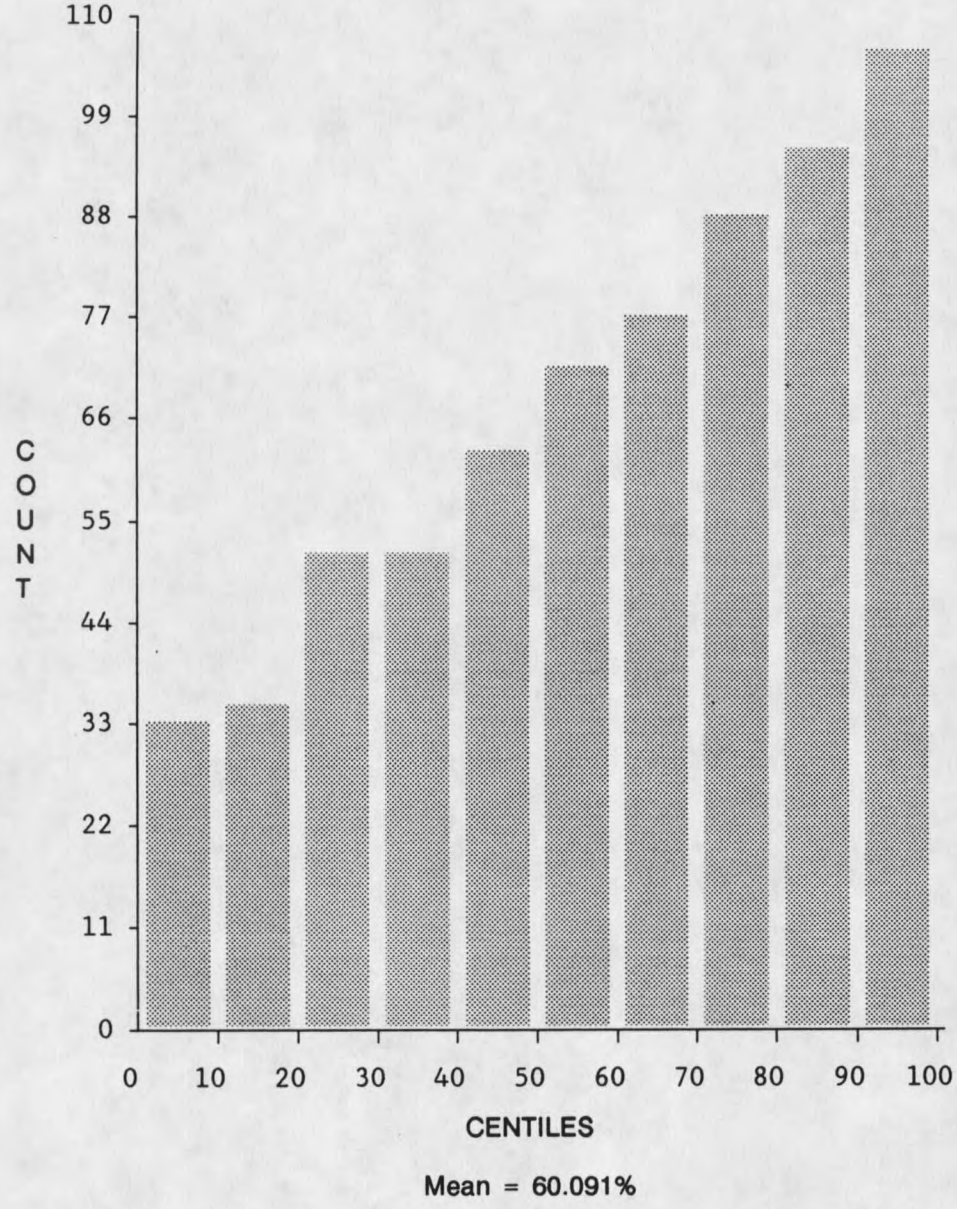

Figure 14. Girls' Height-for-Age Centile Bar Graph.

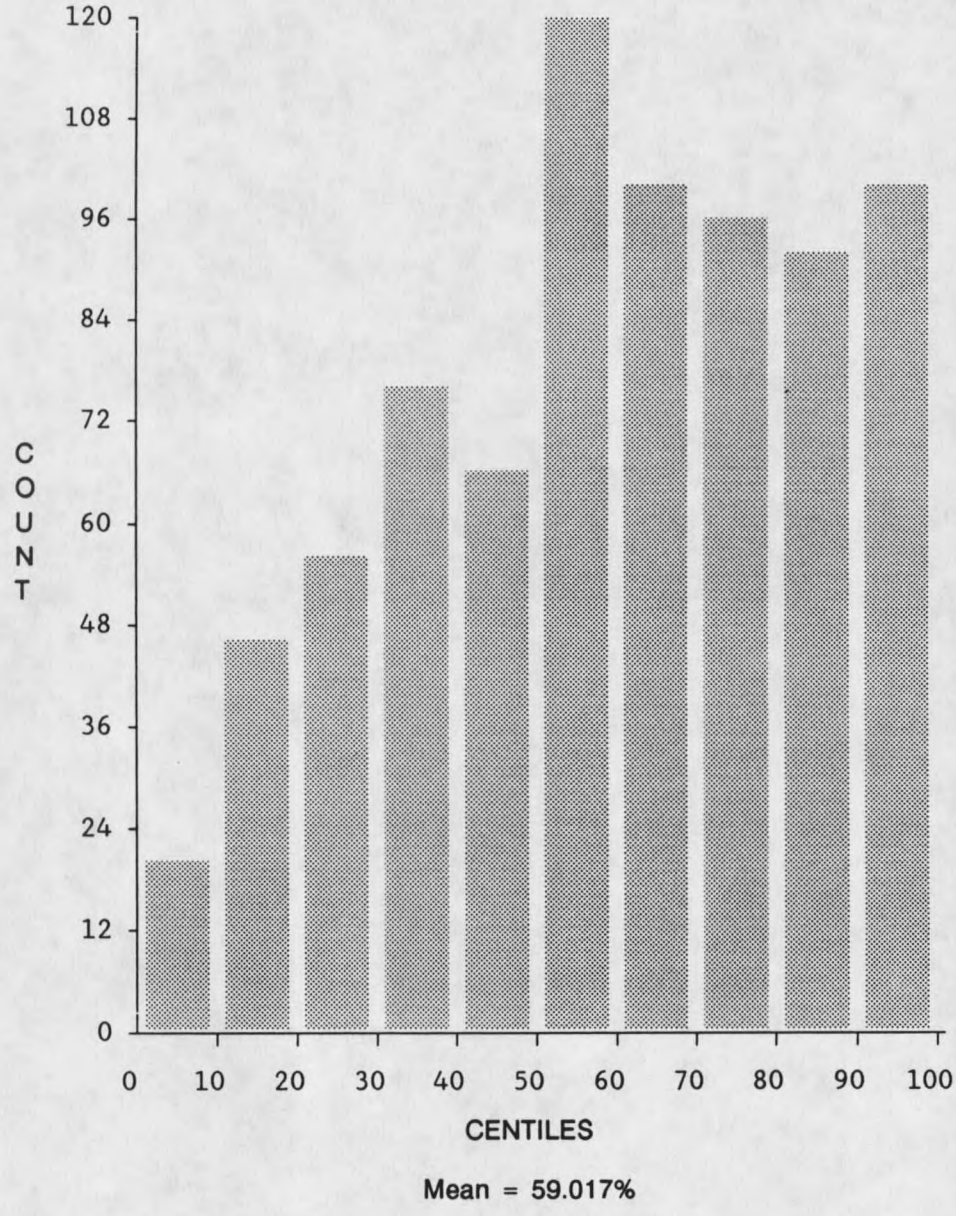

Figure 15. Boys' Height-for-Age Centile Bar Graph.

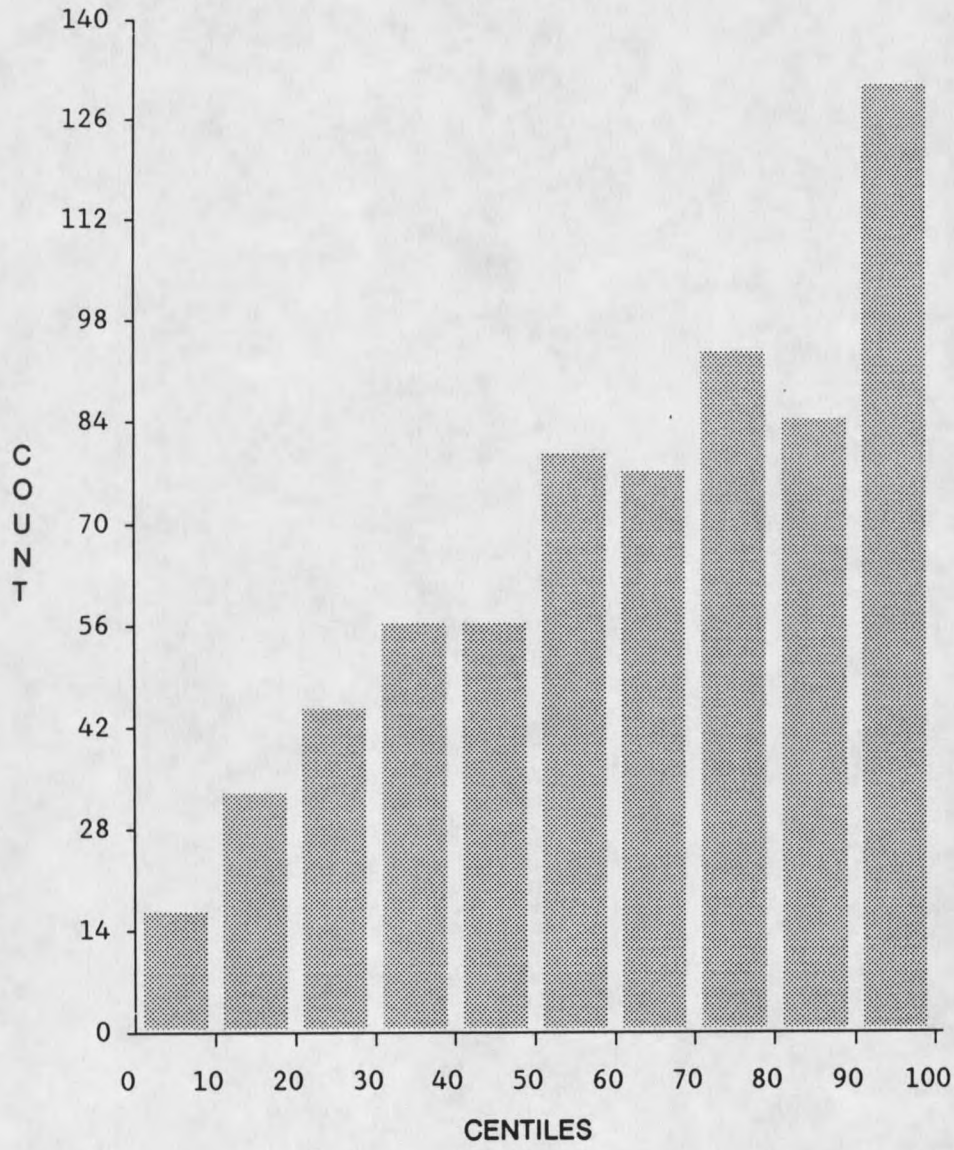

Figure 16. Girls' Weight-for-Height Centile Bar Graph.

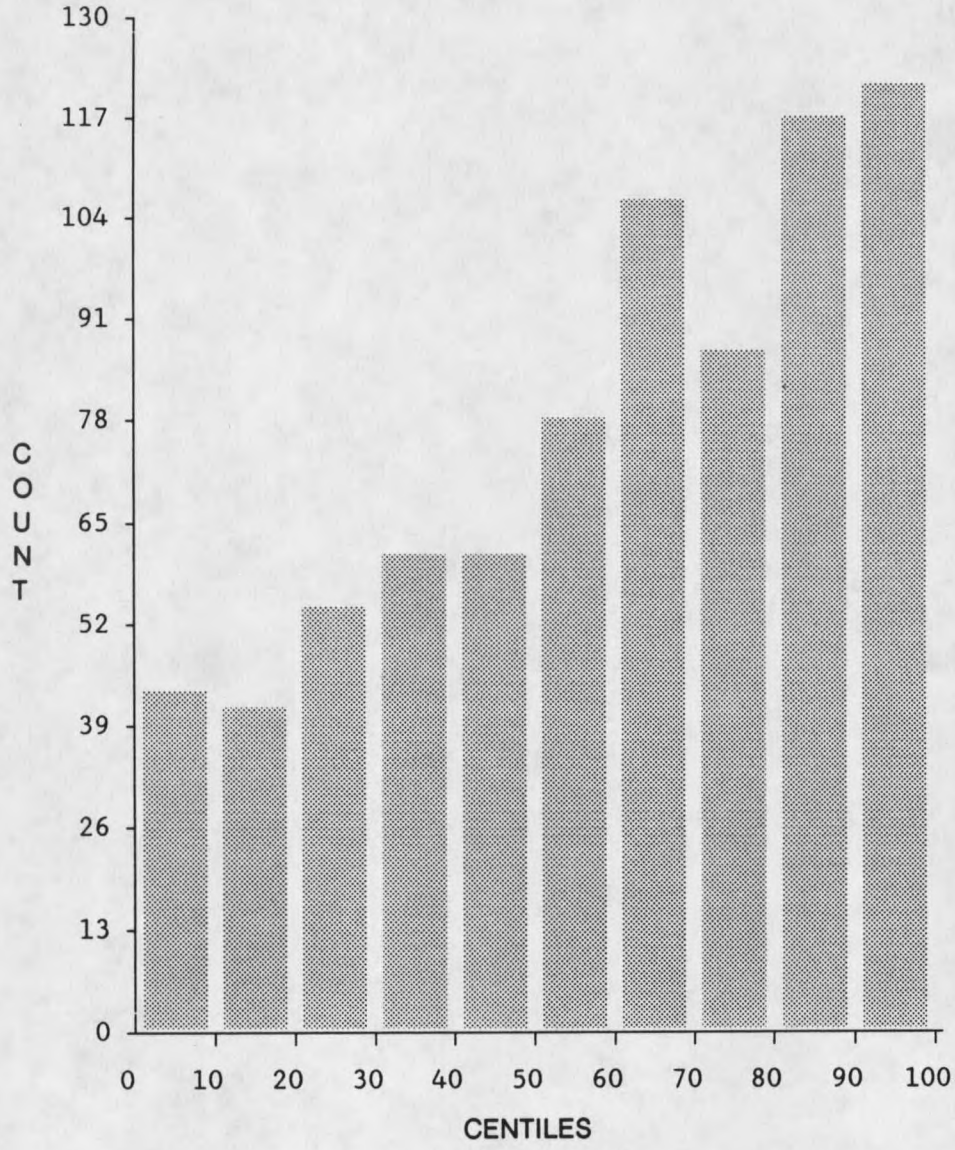

Figure 17. Boys' Weight-for-Height Centile Bar Graph.

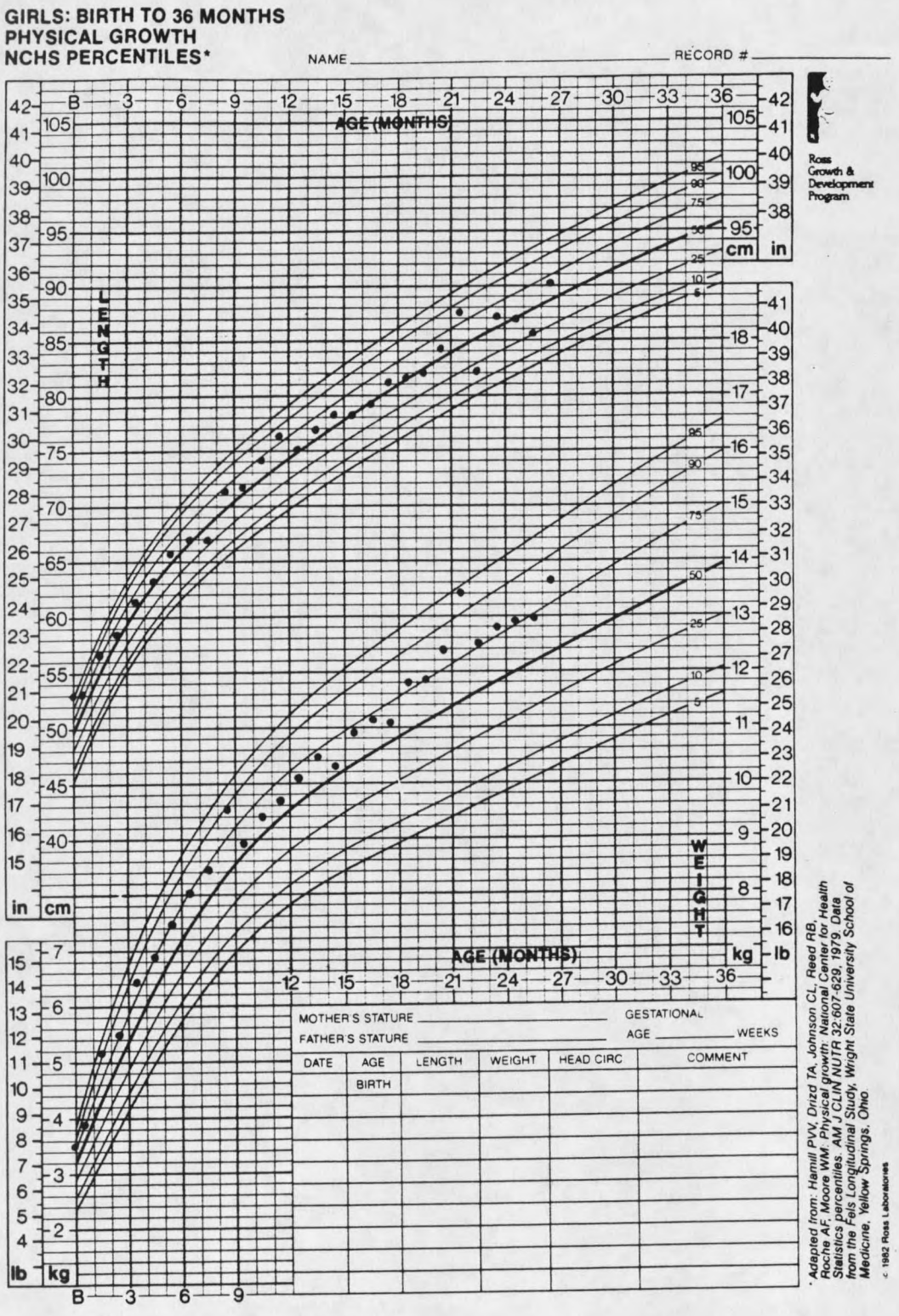

Figure 18. Girls: Birth to 36 Months Physical Growth NCHS Percentiles.

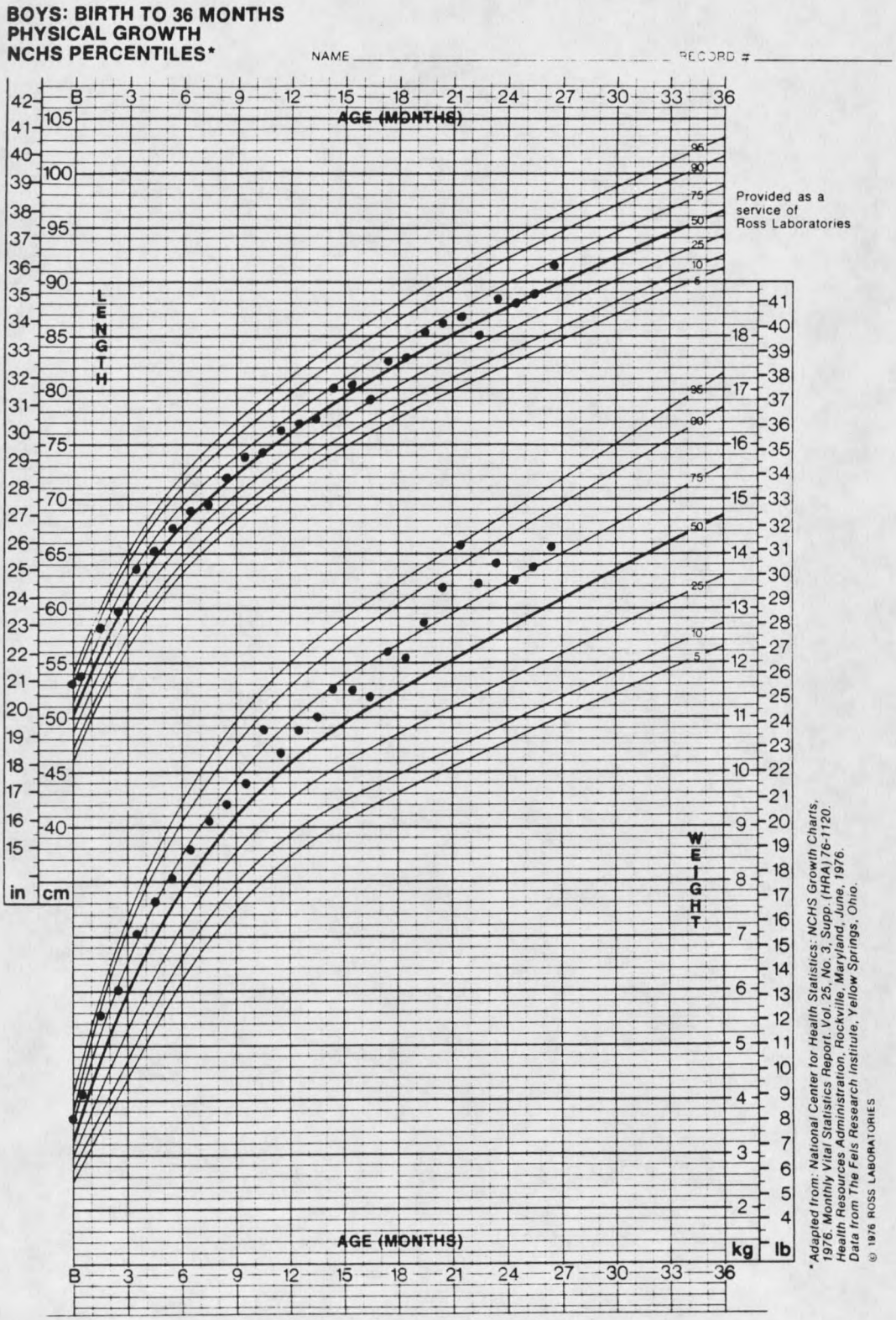

Figure 19. Boys: Birth to 36 Months Physical Growth NCHS Percentiles.

APPENDIX E

Prevalence of Diagnosed Diabetes in Indian Patients

Table 5. Prevalence Rates for Diagnosed Diabetes per 1000 Persons, by IHS Area, APC Data, 1989.

Area	Age-Adjusted Rate*	
	15+ years	All Ages
Tucson	197.8	153.3
Aberdeen	136.0	105.7
Albuquerque	131.8	102.3
Phoenix	128.9	100.1
Bemidji	124.6	96.7
Billings	110.3	85.8
Nashville	108.9	85.8
All Areas (Indian)	90.6	70.5
Navajo	85.2	66.1
Oklahoma	84.8	66.1
Portland	68.8	53.6
California	46.1	36.0
Alaska	22.5	17.5
US Rate**	33.3***	24.7

* 1980 US population used as standard
** 1979-1981 National Health Interview Survey
*** Rate for persons 17+ years of age

Northern Cheyenne	50.0

NOTE. Prevalence Rates for Diagnosed Diabetes per 1000 Persons, by IHS Area, APC Data, 1989, by Program Analyst, Office of Planning, Information, and Evaluation, Billings Area Indian Health Service.

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