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Jia-Yau Doong

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GROWTH MONITORING IN LOCAL HEAD START CHILDREN

By

Jia-Yau Doong

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ABSTRACT

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This research was designed to determine the growth status of low-income children ages 3-5 years old, and the relationships between birthweight, social-demographic factors and growth status. Subjects were 856 preschool children entering Head Start in 4 mid-Michigan counties. Children's Medicaid height and weight data were linked anonymously to Head Start enrollment data of birthweight. The prevalence of short stature (7.5%) and overweight (9.3%) both were higher than expected. The low birthweight (LBW) children were significantly shorter and thinner than optimal birthweight children (OBW). There was a 14.9% prevalence of short stature in LBW children compared to 3.9% in OBW ($p<.05$). By contrast, overweight was higher in OBW (12.6%) than in LBW children (2.8%). Results suggest: 1) a high prevalence of growth stunting and obesity in this population; 2) LBW children remained shorter and thinner than average; 3) not considering the high rate of LBW in low-income preschooler might overestimate short stature and underestimate overweight.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

Growth monitoring, or the measuring, recording, and interpreting an individual's growth over a period of time, is an important part of health supervision and promotion. Such monitoring is especially important at stages of life when rapid growth occurs in pregnancy, infancy, childhood and puberty (Jelliffe, 1990). "The period of childhood from birth through five years of age is one of great vulnerability and great opportunity" (National Center for Children in Poverty, 1990). Protecting young children and promoting their health and development during these early years can enable them to become healthy and productive adults. Growth monitoring of children from birth to 5 years of age is a tool to promote and sustain good health and growth in this vulnerable age group and to detect early growth failure due to an inadequate diet, infection, social influences or a combination of these (Jelliffe, 1990).

In a number of nutrition surveys, it has been reported that the prevalence of growth problems is higher among children from low socio-economic families than among children from middle and upper class families (Alvarez et al., 1984; Brown et al., 1986; CDC-PNSS, 1987). Growth problems in low income children include growth stunting, underweight, and increasingly overweight. Alvarez and colleagues (1984) found the prevalence of growth stunting to be 21% and of under-nutrition, 14%, among low-income black and Hispanic children in a neighborhood health center in Boston. Brown and colleagues (1986) reported a 15.4% prevalence of overweight and 13.1% of short stature in children from birth to six years of age from low-income areas of an urban county in Minnesota. Based on the data collected in Pediatric Nutrition Surveillance System (PNSS), the Centers of Disease Control (CDC) (1987) reported an excess of short stature, underweight, and overweight among infants and preschool children in several age-racial/ethnic groups. Among these children, the prevalence of short stature was greater than the 5% expected for all age and ethnic groups as compared with the National Center for Health Statistics (NCHS) reference population. Also in the CDC's analysis, for children of all ethnic groups between 24-60 months of age, the prevalence of short stature and overweight tended to increase with age.

Few U.S. studies have considered the impact of low birth weight (LBW) in estimates of the growth status at age 4-5 years (Binkin et al., 1988). Gayle et al.(1987) analyzed data on 374,554 children under 24 months old from

Centers for Disease Control-Pediatric Nutrition Surveillance System (CDC-PNSS) and found that 20-40% of the prevalence of low Height-for-age in the first two years of life could be attributed to low birth weight. Investigators concluded that national prevalence estimates of Height-for-age might overestimate the extent of low Height-for-age due to postnatal factors, if the underlying prevalence of LBW in the low income population is not considered.

Binkin and Yip (1988), conducted a cross-sectional study based on CDC's Pediatric Nutrition Surveillance System (PNSS) growth data which was linked to Tennessee State birth certificates. Growth data for children up to 5 years of age were compared for 500 g birth weight categories from 1,000 to 4,999 g. The lower birth weight children remained lighter and shorter than their higher birth weight counterparts. This study also found the prevalence of obesity was associated positively with birth weight. In children age 36-41 months, the rate of obesity (Weight-for-height's Z-score ≥ 2.0) among children who weighed 1,000 to 1,499 g at birth was only 1.0%, increasing in a linear fashion to 8.7% for the children who weighed 4,500 to 4,999 g at birth. This finding by Binkin and Yip might have relevance to national prevalence estimates of obesity in children. National surveys of children from low socio-economic populations have reported a high prevalence of overweight (CDC-PNSS, 1987; Graber et al., 1987; Yip et al., 1992). Such reports might actually be underestimates of obesity due to the high prevalence of LBW in the low income population. If LBW also contributes to a higher than expected percentage of low Weight-for-height and Weight-for-age, then the prevalence of overweight for the normal birth weight children in the low socio-economic population might be underestimated at present.

Low birth weight in infants is strongly associated with the socioeconomic status of the mother. Married women with family income less than $12,000/year are 20% more likely to have a premature birth than are women with incomes of over $24,000/year (Taeusch et al., 1987). In Michigan, the 1987 rate of LBW for black infants was nearly 3 times greater than that for white infants, 14.4%:5.5%, (MDPH, 1989). For these LBW infants from these high risk populations, there are still no available data to monitor their growth at age 3-5 years.

In this study we assessed the growth status, controlling for low birth weight, of predominately low income, 3-5 years of age of local Head Start program entrants. There are two unique aspects of this growth monitoring project: 1) the focus on children who are 3-5 years of age; and 2) examination of the impact of low birth weight (LBW) children on growth status at age 3-5 years. For children not yet in public school, school breakfast and lunch are unavailable. Although at risk, low income children are eligible for the Women, Infant and Children Food Supplement Program (WIC) and Head Start program, most eligible 3-5 year old do not participate due to limited federal and state funding. Children 3-5 years of age grow less rapidly than infants and toddlers, but do continue to grow at a slow, steady rate until puberty. Careful monitoring of preschool children's growth can aid normal development by early detection and intervention growth abnormalities.

Research Questions

1. How does the growth status of Lansing Area Head Start children 3 to 5 years of age compare to NCHS reference values (1963 - 1974) and to Michigan's 1990 EPSDT reports?

2. How does the prevalence of low birth weight (birth weight <2,500 g) in Lansing Area Head Start children compare to that other children in Michigan.

3. How does the growth status (Height-for-age, Weight-for-age and Weight-for-height) of the low birth weight children at ages 3 to 5 years compare to that of other children in the Head Start program?

4. How do socio-demographic factors such as parents' race, education, martial status, family size and social welfare participation relate to the children's growth status controlling for low birth weight?

Hypotheses

Hypothesis 1.

H_1 There will be no differences in growth status [Height-for-age percentile (HAP), Weight-for-age percentile (WAP) and Weight-for-height percentile (WHP)] between Lansing Area Head Start children and Michigan's children with EPSDT data or the NCHS reference population.

Hypothesis 2

H_2 There will be a greater proportion of children in Lansing Area Head Start who are low birth weight than in Michigan as a whole.

Hypothesis 3

H_{3a} The growth status [Z score of Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ)] of Lansing Area Head Start children who had optimal birth weight (OBW, birth weight between 3,500 and 4,000g) will be higher than that of low birth weight (LBW, birth weight less than 2,500g) children.

H_{3b} The growth status (HAZ, WAZ and WHZ) of Lansing area Head Start children who were LBW and preterm but appropriate for gestational age, will be higher than that of LBW children who were small for gestational age.

Hypothesis 4

H_{4a} When socio-demographic factors are controlled, there will be a positive relationship between growth status (HAZ, WAZ and WHZ) and birth weight.

H_{4b} When birth weight is controlled, there will be a relationship between growth status (HAZ, WAZ and WHZ) and all socio-demographic factors combined.

A conceptual model depicting the relationships of the factors examined related to growth status of Head Start children and the comparison model can be found in Figure 1.0.

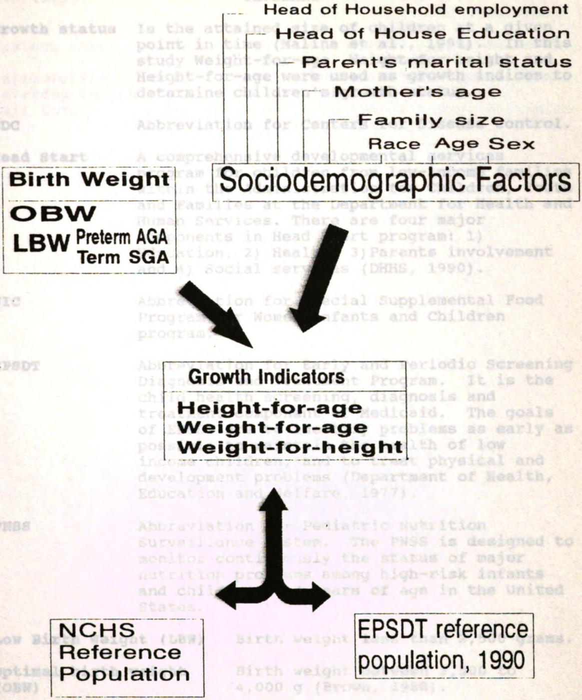


Figure 1.0 **Conceptual model of factors that may be related to growth status.**

GLOSSARY

Growth status	Is the attained size of children at a given point in time (Malina et al., 1991). In this study Weight-for-age, Weight-for-height and Height-for-age were used as growth indices to determine children's growth status.
CDC	Abbreviation for Centers for Disease Control.
Head Start	A comprehensive developmental services program for children from low-income families within the Administration for Children, Youth and Families at the Department for Health and Human Services. There are four major components in Head Start program: 1) Education, 2) Health, 3) Parents involvement and 4) Social services (DHHS, 1990).
WIC	Abbreviation for Special Supplemental Food Program for Women Infants and Children program.
EPSDT	Abbreviation for Early and Periodic Screening Diagnosis and Treatment Program. It is the child health screening, diagnosis and treatment component of Medicaid. The goals of EPSDT are to identify problems as early as possible to maintain the health of low income children, and to treat physical and development problems (Department of Health, Education and Welfare, 1977).
PNSS	Abbreviation for Pediatric Nutrition Surveillance System. The PNSS is designed to monitor continuously the status of major nutrition problems among high-risk infants and children 0-17 years of age in the United States.
Low Birth Weight (LBW)	Birth weight less than 2,500 grams.
Optimal birth weight (OBW)	Birth weight between 3,500 to 4,000 g (Brown, 1988).
Short stature	Also referred as "Stunting", child's height-for age is under the 5th percentile of the NCHS-CDC growth reference.
Underweight	Weight-for-height is under the 5th percentile of the NCHS-CDC growth reference.

Overweight Weight-for-height is above the 95th percentile of the NCHS-CDC growth reference.

Preterm infant Gestational age less than 37 completed weeks.

Intrauterine growth-retarded infants, full term Infants who were term (gestational age $\geq$37 weeks and have a birth weight less than 2,500 g (Binkin et al., 1988; Gopalan, 1988).

CHAPTER 2

REVIEW OF THE LITERATURE

The literature reviewed in this section includes topics regarding the growth status of low-income preschool children in the United States, the growth of low birth weight infants, and consideration of using height and weight to assess children's nutritional status.

Growth Status of Low Income Preschool Children

Low income (or low socioeconomic status) is a shorthand label that includes family groups with individuals who have poorly paid jobs or are unemployed, families living in substandard housing, and families likely to have only one parent in residence (DHHS, 1991). In 1989, 5.1 million or 23 percent of children under age six were living below the poverty level (Nation Center for Children in Poverty, 1991). Among these children 41% were non-Hispanic white, while 59% were minorities (National Center for Children in Poverty, 1991). Black or Hispanic children are nearly three times more likely to live in poverty than are white children (Food Research and Action Center, 1991). Health disparity between poor people and those with higher incomes are almost universal for all dimensions of health. Habicht and colleagues (1976) reviewed several studies of preschool children from both developing and developed countries and found estimated differences of 12% for height and 30% for weight due to socioeconomic class. In the first part of this literature review, several recent studies regarding the growth of low-income preschool children in the United States are reviewed to assess the growth problems in this population.

National Health and Nutrition Examination Survey II (NHANES II), 1976-1980

The NHANES survey was designed to provide health and nutritional information for the civilian, noninstitutionalized population of the United States, ages 6 months to 74 years of age, and to describe changes in health status occurring since NHANES I. A stratified multistage probability sample identified approximately 20,300 individuals for the survey including 7,011 children age six months to 17 years. Those groups considered to be at risk for impaired nutritional status were overrepresented to improve statistical reliability of the data for them. These included young children, those below poverty level, and older adults. The protocol included questions on demographic variables, medical history, diet, use of medications and dietary supplements, a medical examination and anthropometric and biochemical assessments.

Jones and his colleagues (1985) using NHANES II data examined associations between various measures of child growth (height, weight, triceps, and subscapular skinfold thickness) and poverty status of 13,750 black and white children aged 1-17 years. In general, children above the poverty level were found to be taller and fatter than poor children, a finding that is consistent with previous U.S. surveys. All race/sex groups showed higher mean heights for non-poor, but only 8 of 12 groups were statistically significant. However, in all race/sex groups, for children ages 1-5 years the mean heights were significantly lower by 1.3 cm in the poor compared to the non-poor. When compared to the NHANES I data, the differences between the height of poor and non-poor children did not show any consistent changes between NHANES I and II. As in previous surveys, black children were taller than whites until adolescence.

In NHANES II, weight values also were higher in the non-poor groups during the preschool period. Weight differences between the poor and the non-poor decreased in older ages between NHANES I and II, but no significant changes occurred in the youngest children, ages 1 to 5 years. Poor children had 3-8% smaller skinfold measurements than the non-poor, and the gap did not narrow significantly from the first to the second survey.

While there appears to have been a general improvement in the growth of poor children from NHANES I and NHANES II, many of the differences do not reach statistical significance. Therefore, the authors concluded that growth differences associated with poverty, while improving, have not been eliminated.

Centers for Disease Control: Pediatric Nutrition Surveillance System (PNSS)

PNSS is designed to monitor the nutritional status of low-income children enrolled in clinics served by publicly funded health and nutrition programs such as the Special Supplemental Food Program for Women, Infants and Children (WIC), Head Start, Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) programs, and other programs that are funded by Maternal and Child Health (MCH) block grants (Yip et al., 1992). Since many more children are eligible for public services than actually receive them, surveys based solely on clients of these services may produce selection bias in the direction of underestimating nutrition problems.

PNSS, 1986.

In 1986, data were reported for 800,000 children under 60 months of age. Of these children 49.6% were white, 34.1% black, 13.3% Hispanic, 1.5% American Indian/Alaskan Native and 1.0% Asian/Pacific Islander. The prevalence of short stature was greater than the 5% expected. Asian had the highest prevalence of short stature which may reflect nutritional deficits as well as genetic factors (Centers for Disease Control, 1987). Prevalence of short stature was lowest among blacks, except before 1 year of age when they had the highest prevalence, most likely reflecting a higher rate of low birth weight in this group. The low prevalence of short stature after one year of age in black children may reflect genetic differences for growth potential or improved nutritional status (Centers for Disease Control, 1987).

Overweight rates were also greater than the expected 5%. Hispanic children had the highest prevalence of overweight, except for age 1 to 11 months. Overweight was also prevalent among American Indians and Alaskan native, although not to the extent observed in PNSS 1982.

The prevalence of underweight was less than the 5% expected and tended to decrease with age in all groups except Asian/Pacific Islanders. Hispanics had the highest rates in the 0-11 month age group, and Asians, the highest rates in the older age groups (Centers for Disease Control, 1987).

Gayle et al., (1987) examined the contribution of low birth weight to prevalence of low length-for-age by analyzing data from the PNSS on 377,544 children under 24 months of age. Overall rates for low birth weight in this sample were 9.2% for whites, 13.4% for blacks, and 9.2% for Hispanics. The mean prevalence of low length-for-age during the first two years of life was reported as 10.4% for whites, 12.0% for blacks and 11.7% for Hispanics. The mean proportion of low length-for-age attributable to low birth weight was 28.9% for whites, 27.6% for blacks and 21.3% for Hispanics. The authors believe that this demonstrated the need to consider the prevalence of low birth weight when reporting population estimates of malnutrition.

PNSS, 1991.

Yip and his colleagues (Yip et al., 1992) reported the trends and characteristics of the nutritional status of the infants and children monitored by the PNSS during the period 1980 to 1991. Overall, the trend of the prevalence of short stature was stable from 1980-1991. With the exception of Asian children, race- and ethnicity-specific trends were also stable. For Asian children 2-5 years of age, the mean Z-score in 1980 was -1.03; by 1991 it had increased to 0.33. This general improvement of 0.7 in a Z-score over a ten year period indicates a substantial change in the socio-economic and nutritional status of Southeast Asian refugee families since they arrived in the United States in the late 1970s and early 1980s. In 1991, the Height-for-age distribution of children in the PNSS was slightly shifted to the left of the reference distribution, and the PNSS distribution also slightly wider spread, indicating a higher proportion of short and tall children; however the difference was small.

The trends of underweight and over weight were also stable during this period, except for a few sub-groups. With the exception of Hispanic children, the prevalence of low Weight-for-height for all racial/ethnic groups was below the excepted level of 5%. An increase in underweight for Hispanic children was found during the late 1980s. This increase was possible due to the addition of Puerto Rico to the surveillance system in 1984 (Yip et al., 1992). There are substantial variations in the prevalence of overweight and mean Z-scores among different racial/ethnic groups; the Hispanic and Native American children consistently had the highest Weight-for-height status (Yip et al., 1992). From 1980 to 1991, Hispanic children showed a relative increase in prevalence of overweight of nearly 20% and 50%.

Although most children monitored by PNSS are from low-income families, nutritional status varies somewhat among different race or ethnic groups. Overall, Hispanic and Native American children had the highest rate of overweight, and Asian children had the highest rate of stunting. Further efforts by public health and nutrition programs to target preventive services for the subset of low-income children at greatest risk may be one strategy for improving the nutritional status of low-income children.

Minnesota Survey, 1983

Ethnic group differences in the nutritional status of preschool children were studied in a sample of 566 preschool children selected from low-income urban areas in St. Paul, Minnesota (Brown et al., 1986). Data were collected through interviews on demographic and economic characteristics and participation in public food and nutrition programs. About 13% of children had short stature and 15% were overweight. Only 1.8% were underweight. Southeast Asian children, especially those foreign born, had a higher prevalence of short stature than any other ethnic group. A relatively high education level was found in this studied sample, most likely due to the participation of high number of children of low-income university students; and their health risks may be different from a less educated poor population. Also 28% of eligible households selected did not participate, so results may have been biased by selective participation.

District of Columbia Survey, 1985

Kumanyika et al. (1990) analyzed height and weight measurements for 5170 four- and five-year-old children (91.9% black, 5.5% white, 2.6% Hispanic) enrolled in District of Columbia kindergartens in the fall of 1985. Although low-income was not a preselected factor in this study, when compared to the overall District of Columbia population white children and children from high-income census tracts were underrepresented. In this study, black girls and boys were taller than average. Hispanic boys were relatively short, 9% of them were under the 5th percentile of Height-for-age. Underweight was virtually absent in this population. The distribution of Weight-for-height showed that the District of Columbia population was heavier than the NCHS reference population. Excess overweight was noted in all sex-racial groups, particularly among Hispanic children. Among Hispanic children 27% of girls and 18% of boys were in excess the 95th percentile of Weight-for-height.

Growth Problems of Low Income Children, a Discussion

A summary of previous anthropometric studies of low-income pre school children is shown in Table 2.0. When using height and weight to assess children's growth status, short stature and overweight are the most prevalent problems among low-income preschool children. As in the studies reviewed above, underweight was not a problem among low-income preschool children in the United States. However, the mean weight values in poor children were still lower than those of the non-poor (Jones et al., 1985). The high prevalence of short stature indicates that some of the low-income preschool children had experienced inadequate nutrition or increased frequency of infections. The overall Height-for-age distribution based on the mean Height-for-age

Table 2.0 Previous anthropometric studies of low-income preschool children

Study	No. of subjects	Findings
CDC-PNSS, 1991 (Yip et al.,1992)	6,339,720 records 2-5 years of age	Short stature 5.3-12.2% Overweight 5.7-11.9% Underweight 1.6-3.3%
CDC-PNSS, 1986 (CDC, 1987)	800,000 children < 60 months	Short stature 6-13% Overweight 5-16% Underweight 1-8%
Minnesota suvey (Brown et al., 1986)	556 preschool children	Short stature 13.1% Overweight 15.4% Underweight 1.8%
District of Columbia Survey, 1985 (Kumanyika et al., 1990)	5,170 4- and 5- -year-old	Short stature 3-9% Overweight 7-27% Underweight 2-3%

Z-score from the PNSS data, was only slightly lower than that of the NCHS reference population (Yip et al., 1992). This finding suggests that the general nutritional status of low-income children, calculated on the basis of growth parameters, was comparable with the normal population in the United States.

For the studies reviewed above, all the Weight-for-height percentile greater than 95th percentile were exceeded the 5% expected value. This finding showed that low-income children still had risk of obesity, even though the mean weights of poor children were less than those of the non-poor. The cause of obesity in children appears to be very complex. The relative roles of overeating and underactivity in obesity have been subjects of extensive study and debate. In several studies, energy intake and the proportion of calories from fat and carbohydrates between obese and nonobese children was not found to differ significantly (Dietz, 1983). The importance of underactivity in the development of obesity has been supported by several studies. Lower levels and lower intensity of physical activity have been observed in obese children (Walberg and Ward, 1983). Relationships have been found between the number of hours of television viewing and obesity in children (Gortmaker et al., 1987). Differences in activity levels can be identified in infancy with obese babies being quieter, more placid and consuming a moderate intake of food as compared to thinner babies who are more active, tense, and with increased amounts of crying and greater food intake (Richmond et al., 1983).

Prevalence of obesity is associated with several environmental variables. Obesity prevalence is greater in density populated urban areas than in rural areas (Dietz et al., 1983; Gortmaker et al,. 1987). Mother's low educational level also is associated with increased prevalence of obesity (Dietz, 1983, 1986; Garn and Clark, 1976). Family variables appear to be very important determinants of childhood obesity. Parental obesity, especially of both parents, is highly correlated with child obesity. If one child in a family is obese, the chance of an obese sibling are 40 to 80% (Garn and Clark, 1976). These data suggest genetic determinants which are supported by an adoptive study by Stunkard et al. (1986). A strong association was found between the body mass of adopted children and their biological parents and no relationship with the body mass of their adoptive parents. However, Garn and Clark (1976) conclude that familial fatness is due to primarily to family similarities in calorie intake and expenditure and attitudes regarding food and eating. It is likely that obesity prevalence is influenced by both genetic and environmental factors to greater or lesser degrees within families.

Ethnic Differences in Growth of Low-income Preschool Children, a Discussion

Ethnic and racial differences have also been related to the growth of preschool children. In general, black children are taller, Asian and Hispanic children are shorter, and Hispanic children are heavier than the average. It has been reported that Mexican-American children have proportionly more subcutaneous fat on the trunk compared to the white children and consistently are shorter than black and white children (Malina et al., 1991; Martorell et al., 1988). A nutrition survey in Arizona among low-income Mexican-American preschool children found 16% of the children fell below the 5th percentile for height, and 13% were above the 95th percentile of Weight-for-height (Yanochik-Owen et al., 1977). Race and ethnic specific patterns of growth may reflect true racial differences in body structure or may indeed be due to environmental factors such as nutritional status related to income and cultural food and feeding patterns.

Ascribing differences in growth status for Hispanics to their ethnicity is controversial and complex because of the mixed gene pool, that is Caucasian, African and Native American. Similarity, Hispanic Americans originate From diverse cultural background including Mexico, Cuba, Puerto Rico and other Central and South American countries. Hispanic children from Hispanic Health and Nutrition

Examination Survey (HHANES) showed no significantly difference of iron status between Hispanic children and children of NHANES II (Castillo et al., 1987). Two studies of growth status of Mexican-American migrant children found the growth status similar to the NCHS standards, although a high prevalence of overweight was still reported (Dewey et al., 1983; Dunn et al., 1984). These immigrant children were living in state-run migrant worker camps for the summer and enrolled in day care centers providing meals and health care. The children's rate of growth for weight and height accelerated during their summer residence in the US, indicating that the adequate growth status of these migrant children might have been related to improved conditions for growth while in the US.

The Joint Nutrition Monitoring Evaluation Committee (DHHS and USDA, 1986) concluded that "several researchers have investigated racial or ethnic differences in body size and concluded that, for prepubescent children, genetic differences are insignificant when compared with environmental differences in their effect on average body size". A good example is that the Asian children in the CDC's PNSS data which showed marked improvement in both Height-for-age and Weight-for-age from 1980-1991 (Yip et al., 1992). By 1991, the growth status of Asian children, especially those <2 years of age, had equaled or approached that of children from other racial/ethnic groups (Yip et al, 1992). The improvement among Asian refugee children is related to the fact that in contrast to their economic circumstances in Southeast Asia, their current socioeconomic condition in the United States has substantially improved, even though their income is low (Yip and Trowbridge, 1992). This finding confirms the previous impression that general nutritional status is closely related to socio-economic status.

Growth of the Low Birth Weight Infants

The infant mortality rate in the United States has declined steadily over the last two decades, from 20 per 1,000 live births in 1970 reaching 10.1 in 1987 (DHHS, 1990). The decline in infant mortality is attributable largely to an increased understanding of perinatal physiology which has led to improved neonatal intensive care and increased survival of low birth weight infants.

Birth weight is recognized as an important measure of pregnancy outcome as well as a powerful predictor of the infant's survival and subsequent growth and health status (Institute of Medicine, 1985). Low birth weight is associated with higher neonatal and infant mortality, poor growth, and possible neurologic or developmental deficits (Gayle et al., 1988). Whether preterm low birth weight infants ultimately have normal growth compared with normal birth weight full term infants, and when this growth occurs, remain controversial because of a variety of methodologic problems in prior research.

In this paper, several recent studies regarding the growth patterns of the low birth weight infants are reviewed. The purpose of this review is twofold: 1) to provide an overview of the factors related to low birth weight; and 2) to consider the growth patterns of low birth weight infants. To determine how each low birth child can develop optimally, it is necessary to understand the growth dynamics of low birth weight infants and the factors related to their growth.

Definitions of Gestational Age, Preterm and Low Birth Weight and Gestation Corrected Age (GCA)

Gestational age

By definition, gestational age is the number of completed weeks that have elapsed between the first day of the last normal menstrual (DLNM) period, not the presumed time of conception, and the date of delivery. (American Academy of Pediatrics, 1988).

The clinical use of DLNM to estimate the duration of gestation has been established for over 130 years (Alexander, 1990). The "average" pregnancy conventionally lasts 280 days or 40 weeks from the DLNM, with a normal biologic range of 266-294 days, or 38 to 42 weeks. In the pre-ultrasonography era, the calculation of the interval between the date of delivery and the DLNM was promoted as an acceptable method for estimating gestational age and has proven to have greater statistical and biological validity than gestation based on physician's estimate (Kiely, 1992). Although the use of the DLNM to calculate the gestational interval has a long history, problems with the completeness and quality of the reporting of DLNM have persisted. In addition to errors in recording the DLNM, possible explanations for extraordinary gestational age interval include variations in the preovulatory interval and misidentification of the actual DLNM by the female due to sporadic bleeding, previous unrecognized abortion or other factors.

In recent years, increasing reliance has been placed on ultrasound imaging examination for gestational dating. Rossavilk and Fishburne (1989) compared the estimate of fetal gestational age by ultrasonography in two groups of women for whom the date of conception was known. They found that current polynomial dating equations produced considerable systematic and random errors as well as errors related to fetal growth (Appendix A). The authors concluded that for women who have regular periods and know the date of their last menstrual period, estimation of gestational age on the basis of menstrual history supported by a pelvic examination in the first trimester may be more reliable than even the best ultrasound method to estimate gestational age.

Estimation of fetal age by ultrasonography must rely on technical excellence plus dating equations for the estimate of gestational age. These equations are usually based on a curvilinear relationship between the gestational age and anatomic dimensions of the fetus. Evidence suggests these equations may not be correct for all stages of gestation. Also, ultrasonic scanning measures fetal size, not fetal age, and further validation of using ultrasonography to estimate gestational age is required (Kiely, 1992).

<u>Preterm and low birth weight infants</u>

Until 30 years ago all babies who weighed less than 2,500 g (5.5 lb) at birth were designated "premature" whatever their length of gestation or physiological state. This definition used by WHO from 1948 to 1960 caused much confusion and is no longer used. We now accept that babies less than 2,500 g at birth are low birth weight babies (WHO, 1961). The low birth weight population consists of two major groups: 1) preterm infants, but appropriate for gestational age (AGA); and 2) intrauterine growth-retarded infants (IUGR) or so called "small weight for gestational age" (SGA) infants. Preterm delivery usually has been defined as less than 37 completed weeks (37 weeks + 6 days) of gestation (Battaglia, 1967). Intrauterine growth retardation or small weight for gestational age infant has been defined preferentially by obstetric and pediatric clinicians as below the 10th percentile of birth weight for gestational age (Kiely, 1992). SGA infants can be either term or preterm.

Postmenstrual Age or Gestational Corrected Age (GCA)

The concept of catch-up growth has eased its way into the literature without a clear understanding of its mechanism. Many studies have failed to take into account the child's prematurity when charting growth (Karniski, 1987). Some clinical studies have used an age corrected for prematurity or GCA produced by subtracting the time between the actual and predicted date of full-term birth from the chronological age of the child. For example, this procedure assumes that an infant two weeks premature will be delayed developmentally by two weeks after birth.

Factors Related to Low Birth Weight Infants

Although many factors contribute to LBW, weight gain during pregnancy consistently accounts for the largest proportion of variation in the birth weight of infants born at term (Brown et al., 1986). Pre-pregnancy weight status (as determined by Weight-for-height), has the second strongest effect on the birth weight of term infants (Brown et al., 1986; Friesen, 1990).

Many risk factors, in addition to pregnancy weight gain and pre-pregnancy weight status, have been associated with LBW. Demographic risk factors associated with low birth weight include: 1) age less than 17 and older than 34; 2) black race; 3) low socioeconomic status; 4) single married status; and 5) low level of education (Institute of Medicine, 1985). High altitude also is associated with a reduction in infant birth weight, presumably through an effect on fetal oxygenation. Infants born at high altitudes have lower birth weights and larger placentas (Kruger et al., 1970).

Medical and obstetric factors which predate pregnancy and are linked to low birth weight include: 1) poor obstetric history, including a previous LBW infant or multiple spontaneous abortions; 2) maternal infection with rubella or cytomegalovirus which is often associated with fetal and placental infection and thus intrauterine growth retardation; 3) diseases such as diabetes and chronic hypertension; 4) parity of either zero or more than four births; and 5) maternal genetic factors, such as low maternal birth weight (Institute of Medicine, 1985). Additional risk factors hypothesized to influence birth weight include: 1) low diastolic blood pressure; 2) both low and high maternal hemoglobin values; 3) drugs such as crack, cocaine, or heroin and alcohol use (Battaglia et al.,1978; Friesen, 1990). Coffee and caffeine consumption also have been associated with an increased risk of low birth weight infants (Friesen 1990; Martin and Bracker, 1987; Munoz et al., 1988). In contrast, other studies have found that there is no association between caffeine consumption and the delivery of low birth weight infants (Brooke et al., 1989; Linn et al., 1982). Although the relationship between caffeine consumption and birth weight remains unclear, it is recommended that pregnant women who choose to use caffeine containing beverages use them in moderation (Worthington-Robert et al., 1993).

Growth Patterns of Low Birth Weight Infants

Monitoring the physical growth of low birth weight preterm infants provides an excellent indicator of their continued well-being; likewise, abnormal growth is often an early sign of disease (Hack et al., 1984). Unfortunately, growth patterns of LBW preterm infants are not well described, making it difficult to distinguish normal from abnormal growth. A controversy has arisen regarding the potential for premature LBW infants to "catch up" to the expected pattern of growth for term infants of the same age. Cross-sectional and longitudinal studies have yielded results to support both sides of the controversy (Brandt et al., 1978; Casey et al.,1990). In this paper several recent studies are reviewed to determine the validity of the concept of catch up growth among LBW infants.

Bonn Study

In the most carefully documented report, Brandt (1978) monitored the growth of 107 preterm and LBW infants and 80 full-term infants. These children were born to middle- or upper-middle-class white parents in Bonn, West Germany, between 1967-1975. In this study, Brandt divided LBW infants into two groups, AGA (n=64) and SGA (n=43) infants. Among AGA infants, 40 were born with a gestational age of 35 weeks and below and a birth weight of 1,500g or less. Birth weight of all 43 SGA infants fell below the 10th percentile of the Lubchenco growth curve (Lubchenco et al., 1963) and 35 had a birth weight of 1,500g or less. All anthropometric measurements, weight, supine length (to 2 1/2 years of age), height (2 1/2 to 5) and head circumference, were made by the author at weekly intervals before 40 weeks gestational age, at monthly intervals during the first year, at three-month intervals in the second year and at six-month intervals until 5 years of age. According to the author, gestational age at birth was determined with particular care from: 1) obstetric history; 2) clinical external characteristics of the newborn and especially 3) repeated neurological examinations of the preterm infants (Brandt 1978).

From 32 postmenstrual weeks to 1 month postterm, mean attained weights of AGA preterm infants followed the 10th percentile of intrauterine curves for normal full-term infants. Mean weights of infants from 2 to 18 months of age ranged from 0 to 1 SD below the mean of the normal term infants. From 2 to 5 years of age, weight gain in the preterm infants was similar to that of the full-term control infants, although there was a tendency of the preterm infants to have slightly lower but statistically insignificant values.

From birth to 40 weeks of gestational age, rate of weight gain in AGA preterm infants, calculated in grams per month, ranged only from 380 g to 890 g/month and was significantly less than in the first and second month after term, when it was 1000 g/month. From term to between 1 and 2 months postterm, growth velocity of AGA preterm infants without a serious medical illness during the catch-up growth phase exceeded that of term infants of the same postmenstrual age. Velocity of weight gain of both groups coincided after 2 month of age.

From 30 to 40 postmenstrual weeks, mean length of AGA infants fell below the 50th percentile of intrauterine curves (from different cross-sectional sources). Between 40 weeks postmenstrual age and 18 months the mean length difference between AGA preterm infants and full-term control infants decreased from 2.5 cm at 40 weeks GCA to 1.2 cm at 18 months. The differences in length were no longer significant after 21 months. From two to five years of age the growth curves of preterm infants and full term infants showed no statistically significant differences, although the preterm infants tended to be 0.3-1.2 cm shorter on average. The author suggested this difference was due to the differences in the mid-parent height (the average of father's and mother's height); mid-parent height of the preterm infants was 168.3 cm and 169.8 cm for the full-term infants. Thus, this small difference in height between the groups at 2 to 5 years may be attributed to genetic factors and not to prematurity.

When length velocity was calculated in centimeters per year, the preterm AGA infants grew at 44.6 cm/yr in the 2nd month, 29.7 cm/yr in the 5th and 17.5 cm/yr in the 8th month, always significantly faster than the full term control infants. From 9.5 months to 5.5 years, the growth velocity of preterm infants averaged 0.1-0.8 cm/yr faster than that for the full term control infants.

In the SGA infants who were preterm, 21 of the 43 infants had catch up growth for head circumference. The SGA infants who exhibited catch-up growth had smaller head circumferences than AGA preterm infants from 34 weeks of GCA to 12 months postterm. A similar catch up growth of SGA infants was found in the Hack et al. (1984) study; 35 SGA infants (46%) had weight less than 2 SD's of normal weight at age 33 months.

The author of the Bonn study concluded: 1) if nutrition and postnatal care are adequate, the growth pattern of AGA preterm infants depends largely on gestational age, irrespective of chronological age; 2) if environmental conditions are favorable and age is corrected for prematurity, the growth and development of even very small AGA preterm infants are similar to those of full-term control infants; 3) weight should be corrected for gestational age of the child at birth until 24 months, when differences between corrected and uncorrected abe s are no longer statistically significant; 4) length and height should be corrected for gestational age until 3.5 years, after which age a mean difference of 1 cm between corrected and uncorrected values until 5 years of age. 5) head circumference catch-up growth in SGA infants seems to exist only in the first 6 to 8 postnatal months; thereafter growth velocity decreased markedly.

IHDP Study

A different result was found in the Infant Health and Development Program (IHDP) study completed in the United States in 1985. Growth patterns of LBW infants from birth to 3 years of age, based on the growth data from a large sample of low birth weight preterm infants, was conducted by Casey and his colleagues (Casey et al., 1990). They monitored 985 infants longitudinally in an eight-site collaborative program. All infants were monitored in a special follow-up program that provided high-quality medical care and referrals to appropriate health and community agencies. Among these children 34% were white, 52% were black and 14% were Hispanic. In this study, the infants were categorized by birth weight as ≤1,250 g (Group I; n = 149), 1,251 to 2,000g (Group II; n = 474) and 2,001 to 2,500g (Group III; n = 362). Infants whose gestational age exceed 37 weeks, those who were triplets or quadruplets, and who were the twin of an ineligible child were excluded from this study. Weight, length and head circumference were measured at birth and at 40 weeks gestational-corrected age (GCA) and 4, 8, 12, 18, 24, 30 and 36 months GCA.

In this IHDP study, groups I, II and III differed significantly from each other at all ages for length and weight in both boys and girls before 12 months GCA. The 50% (average), 90%, and 10% of weight and length by sex and birth weight group are depicted in Figures 2.0 and 2.1. Growth measurements of term infants taken from the NCHS growth reference population (Hamill et al., 1979) were used for comparison.

For all measures, the heavier preterm group was above term infant size (weight and length) at 40 weeks after conception except for female length (Figure 1); all continued so through 4 months GCA. For almost all measures, growth status varied in the 3 groups at 8 and 12 months GCA. There was little tendency for catch-up growth, even when GCA was used. From 12 to 36 months GCA, boys in groups I, II and III differed significantly at all ages for length, weight and head circumference. Girls in the three groups

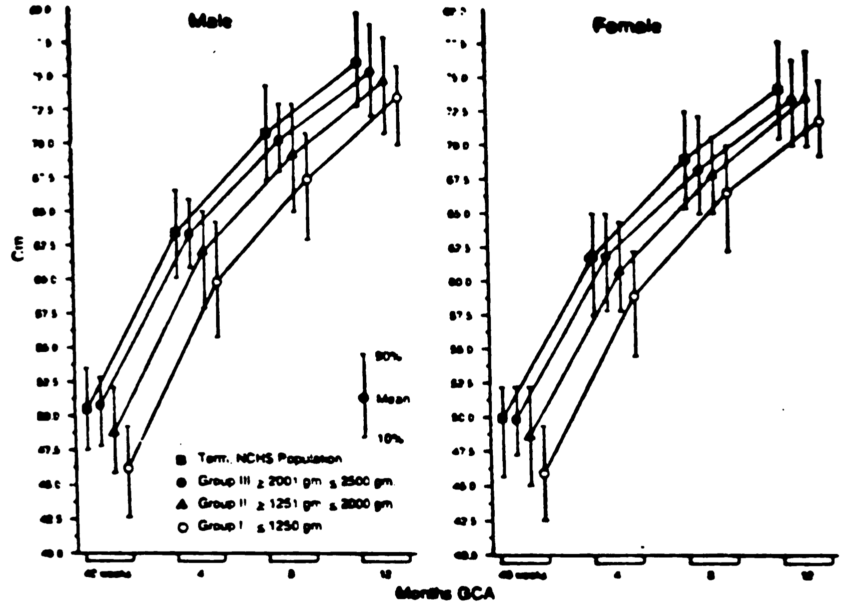


Figure 2.0. Average, 90% and 10% length growth patterns presented by birth weight groups at 40 weeks of postmenstrual age and at 4, 8, 12 months GCA (Casey et al., 1990).

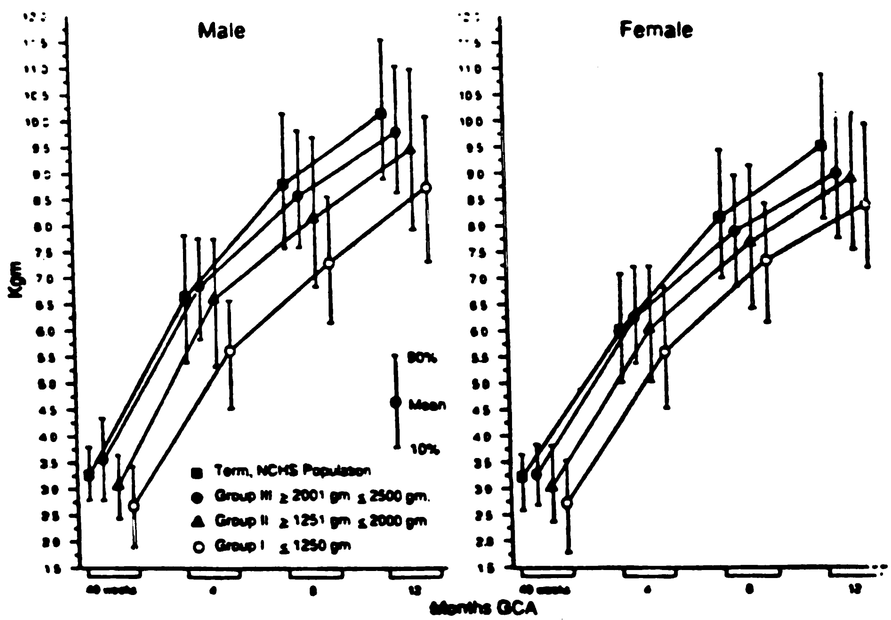


Figure 2.1. Average, 90% and 10% weight growth patterns presented by birth weight groups at 40 weeks of postmenstrual age and at 4, 8, 12 months GCA (Casey et al., 1990).

differed significantly in head circumference at all ages, in weight until age 24 months, and in length until 18 months.

There were no significant differences in weight growth rate at anytime among the three birth weight groups, suggesting little catch up growth occurred during the first 3 years of life. In fact, the weight growth rate for the smallest infants was less than that of the largest infants at 24 and 36 months' GCA, directly the opposite of what would be expected for compensatory growth. The length growth rates were significantly different between weight groups at GCA of 12 months for both boys and girls but not at GCA of 24 or 36 months. The direction of this difference suggested some catch up growth during the first year only.

Comparison of Bonn and IHDP's study

The Bonn and IHDP studies of the growth pattern of preterm low birth weight infants are both well designed and longitudinal with a relatively large sample size. The differences in results of these two studies as previously described may be due to a number of factors. The different sample characteristics and study designs may explain part of the differences in results (Table 2.1).

In the Bonn study, the catch-up growth in weight occurred during the first and second months GCA. However, the first measurement intervals in the IHDP study were at birth, 40 weeks GCA and 4 months GCA; therefore the interval was too long to identify this catch-up growth phase if it occurred during the 1st and 2nd months GCA. In the IHDP study, the growth rate of length in the first year suggestive of catch up growth agreed with the Bonn study in that catch up growth occurred between the 2nd and 8 months of GCA. Also, in the IHDP study the growth of length among the LBW preterm infants was still shorter than for the National Center for Health Statistics (NCHS) reference children. However, the mid-parent height of these LBW preterm children was not considered. In the Bonn study the lower length of AGA infants may have been due to the lower mid-parent height of the LBW children when compared to that the normal term infants. Also, NCHS growth data were used in IHPD's study for comparison of growth of term infants. For children <36 months of age, the NCHS reference curves were based on a sample of children from Yellow Springs, Ohio, who were measured by investigators at the Fels Research Institute. These children happened to be taller than average U.S. children (Dibley et al., 1987).

Table 2.1 A comparison of study design and sample characteristics between the Bonn and IHDP studies.

	Bonn study[a]	IHDP study[b]
Study time frame	1967-1975	1985-1989
Sample demographics	middle or upper-middle class white babies	34% white 52% black 14% Hispanic
Sample Classification	a. AGA infants BW 900 - 2700 g b. SGA infants BW 780 - 1950 g all preterm	Group 1 <1250 g Group 2 1250-1999 g Group 3 2000-2499 g all preterm
Measurement Made	birth weight, birth length, supine length (to 2 1/2 yrs), height (2 1/2 to 5 yrs) weight, head circumference	birth weight, birth length, supine length, weight, head circumference
Intervals of measurement	weekly before 40 wk GCA monthly in 1st year every 3 month in 2nd yr every 6 month from 2 to 5 yrs.	at birth, 40 wk GCA, 4, 8, 12 18, 24, 30, 36 months GCA
Standards used for comparison	control group compared normal term infants (n=80)	NCHS growth curve

[a] Brandt, 1978
[b] Casey et al., 1990.

Other studies related to growth of LBW infants

Binkin and Yip (1988) conducted a cross-sectional study by linking collected growth data from the Centers for Disease Control Pediatric Nutrition Surveillance System (PNSS) to Tennessee's state birth certificates. Growth data for children <5 years of age were compared for 500 g birth weight intervals from 1000 to 4,999 g. To examine the differential effects of prematurity and intrauterine growth retardation on growth during the first 4 years of life, infant with a birth weight between 2,000 to 2,499g were subdivided into preterm (gestational age <37 weeks) and growth retarded (gestational age >37 weeks) groups. Gestational age determinations were computed from the mother's last normal menstrual date. The findings in this study showed that the lower birth weight children appeared to have accelerated growth during the first 2 years of life when compared with their higher birth weight counterparts. Those with higher birth weights appeared to grow at a slower rate. However, the lower birth weight infants, especially those who were intrauterine growth retarded, rather than premature, remained shorter and lighter than their higher birth weight counterparts throughout childhood. For example, the percentages of children age 36-41 months of age who had a height for age less than -2 SDs declined with increasing birth weight, from 12.3% for those weighing 1,000 to 1,499 g at birth to 0.5% for the those weighing 4,500 to

4,999g. Results of Weight-for-age and weight-for-height Z-scores by birth weight were similar to those of height for age. Children with intrauterine growth retardation had lower heights and weights in childhood than those of the same birth weight born prematurely. This suggested that prematurity results in a less permanent growth impairment than does growth retardation which begins in utero. Because children included in the PNSS database were primarily from low-income families, the results are not representative of all children in United States.

Kimble et al. (1982) studied 66 VLBW (birth weight < 1,501 g) infants who were appropriate for gestational age and who participated in follow-up program at ages 1, 2, and 3 years. These children had normal developmental histories and physical examinations at age 3 years. However, these infants remained smaller than the NCHS growth norms at 1, 2 and 3 years of age even when AGA infants' age was corrected for prematurity. Ross et al.(1985, 1990) examined the growth achievement of a group of VLBW premature children to determine whether such children remain smaller than normal at 7 years of age. Of the 79 children 47% were middle or upper class and weighed <1,501g but appropriate weight for gestational age at birth. Follow up measurements of weight, length (height) and head circumference were conducted at 12 months postterm, at 3 years and at 7 years of age. This study found that as a group these prematurely born children were significantly smaller than average in weight and height, but not in head circumference at 1 year GCA and were smaller on all growth measures at 3 to 4 years of age. However, at the 7 to 8 year examination, these premature children remained smaller but did not differ statistic significantly from normal children on any of the growth measurements. These findings suggest that there may be a period between preschool years and 7 to 8 years of age in which the AGA low birth weight infants have a growth spurt. This study also found that maternal height best explained the variance in children's height at age 7 years and maternal height, birth weight and social class were highly associated with children's weight at age seven.

Conclusions and Area for Future Research

Do LBW infants demonstrate catch up growth or not? The studies reviewed above suggest that catch up growth may occur in LBW infants if a suitable environment and adequate nutrition are provided. Normally, catch up growth for weight will occur during the first six months of life; for length it will occur during the first year of life; then the child will follow a growth rate similar to the normal term infants. However, among LBW preterm infants, poor later catch up growth still occurred in those infants who were the least mature, smallest, sickest, and of lowest socioeconomic status.

The timing, duration and severity of the growth failure, the quality and quantity of nutritional intake, and the degree of environmental stimulation are the determinants of whether the catch up growth can be fully achieved or not (Prader et al., 1963). For a proper analysis of growth patterns of preterm infants, both postmenstrual age at birth and the assessment of intrauterine development have to be considered. Furthermore, the genetic background, social environment, and nutrition, immediately after birth as well as in the first year of life, play important roles in the evaluation of growth (Brandt, 1978).

Many studies have used long intervals between measurements, and therefore the process of growth cannot be described (Kitchen et al., 1989, 1992; Ross et al., 1990). As a result, there is inadequate understanding of the dynamic changes in growth of LBW preterm infants, particularly those which occur in the first year of life.

Another problem in studying the growth of LBW infants is that most studies have small numbers of preterm infants with samples of narrow socio-demographic, geographic, and size ranges at birth. Even the few studies with longitudinal data have small samples, usually less than 100 infants (Georgieff et al., 1989; Karniski et al., 1987).

When determining the growth pattern of low birth weight infants, researchers have usually divided these infants into SGA and AGA infants or into different weight categories.

Neither classification is optimal to determine catch up growth in LBW preterm infants since there are many other factors which may contribute to the growth of an infant who was born too small or prematurely.

The health and nutrition of the infants are also important factors which need to be assessed when determined the growth of LBW preterm infants. Preterm infants have a far greater risk of developing respiratory distress syndrome, apnea, intracranial hemorrhage, sepsis, retrolental fibroplasia and other conditions related to physiologic immaturity (Institute of Medicine, 1990). Also an immature immune system in these children can lead to greater risk of other infectious diseases. The early growth of LBW preterm infants remains constrained by the presence of life-threatening respiratory and other diseases, and by their relative intolerance of fluid, dextrose, and enteral feedings. Increased perinatal illness and suboptimal early nutrition may account for the relative poorer growth achievement in LBW preterm infants.

Considerations for Use of Height and Weight in Assessing Children's Nutritional Status

Anthropometric measurements have been used to provide important information on the nutritional and health status of individuals and communities. A child's growth reflects, perhaps better than any other single index, his or her state of health and nutrition and often his or her psychological situation as well (Eveleth and Tanner, 1990). Similarly, the average values of children's heights and weights reflect accurately the state of a population's public health and the average nutritional status within this population. Thus a well-designed growth study is a powerful tool with which to monitor the health of a population, or to pinpoint subgroups of a population whose share in economic and social benefits is less than it might be (Eveleth and Tanner, 1990).

Height and weight measurements are the most commonly used anthropometric methods to assess the health and nutritional status of population of children. The advantages of using height and weight measurements are that they are: 1) relatively economical to carry out; 2) objective; 3) understandable by the population at large; 4) give results which can be numerically graded; and 5)supply information concerning adequate growth, early protein-energy malnutrition and obesity not easily or economically obtainable by other methods (Jelliffe, 1989). Conversely, limitations of using height and weight as health indicators include: 1) considerable potential for inaccuracy of measurement due to instrument and observer error; 2) need for reasonably precise ages of young children; 3) limited nutritional diagnostic relevance; and 4) problems with the selection of appropriate reference data and of cut-off points to suggest abnormality (Jelliffe, 1989).

Following is a review of the considerations for using height and weight data to assess children's nutritional status relevant to the interpretation of anthropometric findings in this study. The use of anthropometry at the population level, rather than for an individual, is focus of this part of the literature review.

National Center for Health Statistic (NCHS) Growth Reference

The National Center for Health Statistic's (NCHS) growth reference charts were compiled from careful measurements of large survey populations, birth to 18 years of age, from different economic and ethnic groups in the United States (Hamill et al., 1979). The growth reference was formulated based on data from four separate surveys into two growth charts. For birth to 3 years, the smoothed observed percentile curves of Weight-for-age, length-for-age, and weight-for-length were based on anthropometric measurements collected by the Fels Research Institute as part of a longitudinal study of growth from 1929 to 1975. The children measured in the Fels study were a convenience sample of 867 children from white, middle-class families living near Yellow Springs, Ohio. The Fels sample was genetically, geographically, and socioeconomically restricted and therefore, the children measured cannot be taken as representative of children in this age range throughout the U.S. (Dibley et al, 1987; Hamill et al, 1979), although in practice they are and have been for 25 years.

For the 2-18 years, the smoothed observed percentile curves of Weight-for-age, height(stature)-for-age and Weight-for-height were based on three surveys: 1) US National Health Examination Survey (NHES) cycle II for ages 6-11 years (1963-65); 2) NHES Cycle III for ages 12-17 years (1966-70); and 3) the first National Health and Nutrition Examination Survey (NHANES I) for ages 2-17 years (1971-74). Stratified probability sampling was used to select the children for measurement, therefore these data can be regarded as reliable population estimates of the attained growth of children in the United States (Dibley, 1987).

Based on the NCHS growth reference population, the NCHS/CDC also developed single normalized growth curves of Weight-for-age, Height-for-age, and Weight-for-height from 0 to 18 years of age. These NCHS/CDC reference growth curves were formulated in 1975 and adopt by the World Health Organization for international use in 1978 (WHO, 1978; Yip et al., 1989). Although both NCHS and NCHS/CDC (international) growth charts are based on the same populations, the slight differences between NCHS growth charts and the international growth chart are shown in Table 2.2.

The NCHS/CDC (international) growth reference has served many useful purposes by providing a single set of growth references that can permit comparison of growth data from different populations and from different countries. Nevertheless, despite its usefulness and advantages, there are limitations which can complicate the interpretation of growth data from nutrition surveys and surveillance. These limitations are summarized as follows:

1) Overestimation of length-for-age and weight-for-length from 12 to 23 months of age in the lower percentiles. This is the result of difference in length status between the children in the Fels Research Institute sample and those in the U.S. representative samples, i.e. the children in Fels study were taller than the average children in the United States (Yip et al., 1989).
2) A marked discrepancy in estimated Height-for-age and Weight-for-height status immediately before and after 24 months of age. This discontinuity results from intrinsic differences in the reference populations used to define the growth curves for children of different ages, i.e. 0-2 years are Fels data and 2-18 years are NHES cycle II, III and NHANES I data (Binkin, et al., 1989; Jelliffe, et al., 1989; Yip et al., 1989).

Table 2.2. Differences between NCHS growth curves and NCHS/CDC growth reference (international growth reference).

	NCHS Growth curves	NCHS/CDC growth reference
Age intervals	0-36 months 2-18 years	0-18 years
Reference population used	0-36 months from Fels study 2-18 years from NHES cycle 2,3, and NHANES I	0-2 years from Fels Study 2-18 years from NHES cycle 2,3, and NHANES I
Growth chart	2 sets for each gender Smoothed percentile curves	1 set for each gender Smoothed and normalized percentile curves

3) Growth data were derived from some obese children (Gortmaker et al, 1987) and adolescents.

In recent years, more and more anthropometric studies are using the NCHS/CDC reference population as a standard, discussion has continued regarding whether or not it is necessary and appropriate to use as an international reference (Goldstein and Tanner, 1980; Graitcer and Gentry, 1981; Habicht, et al., 1974). In general, current evidence indicates that genetic influences on body size and proportions seem to increase in importance with age, especially around puberty, in different well-nourished, ethnic groups (WHO Working Group, 1986). This means that genetically-specific anthropometric reference data are more likely to be required for older children or adults than for preschool children (1-4 years) on whom the effect of the environment factors, especially nutrition, usually predominate (Graitcer and Gentry, 1981; Gopalan, 1988; Habicht et al., 1974). Numerous studies indicate that growth during the preschool period (1-4 years) is comparable in most ethnic groups (Jelliffe, 1989).

There is not sufficient evidence at present to justify the conclusion that one set of standards should represent the ideal growth of young children of all races. It is accepted that there may be some ethnic differences between groups, just as there are genetic differences between individuals, but for practical purposes they are not considered large enough to invalidate the general use of NCHS population as a national and international reference standard (WHO Working Group, 1986).

Use and Interpretation of Anthropometric Indices

Weight-for-age

Weight-for-age has been the most widely used anthropometric index of nutritional status in the past. It is readily understood and it's arguably the most accessible for field personnel (Gorstein, 1989). However, as a composite index, it reflects growth in terms of both body mass (adiposity and musculature) and skeletal (or linear) development. As a consequence, Weight-for-age cannot distinguish between children who are short and fat and those who are tall and skinny. This difference is important in classification of growth and nutrition status. It has been shown that Weight-for-height and Height-for-age together account for more than 95% of the variance in Weight-for-age (Keller, 1983). This means that Weight-for-age represents the sum of the information given by the other two indices. Because Weight-for-age cannot distinguish between acute and chronic, or present or past malnutrition, in 1976, the FAO/UNICEF/WHO Expert Committee on Nutrition Surveillance recommended the use of Height-for-age and Weight-for-height as the primary indices of nutritional status in children (Joint FAO/UNICEF/WHO Expert Committee, 1976). On the other hand, Weight-for-age may still be practical for giving an overview of the distribution of nutritional problems in a country on the direction of change (WHO Working Group, 1986).

Height-for-age

Because linear (skeletal) growth is a slower process than growth in body mass, and because children can fail to gain height but cannot lose their height, the index of Height-for-age has been promoted as a means of assessing overall, cumulative physical development (WHO working Group, 1986). Low Height-for-age, also referred to as "shortness" or "stunting", reflects the long-term health and nutritional history of a child or population. On an individual level, the shorter stature of some children is related to factors such as lower birth weight or shorter parental status. Short stature can also be the result of long-term poor nutrition, increased frequency of infections or both. On a population level, lower Height-for-age is frequently found to be associated with poor overall economic conditions which gives rise to inadequate living conditions, such as chronic food deficits or chronic, endemic infections.

<u>Weight-for-height</u>

The low Weight-for-height, or "wasting", indicates a deficit in tissue and fat mass compared to the amount expected in a child of the same height or length, and may result either from failure to gain or from acute loss weight (WHO Working Group,1986). In developing countries, wasting indicates acute malnutrition, which is mainly the result of starvation, persistent diarrhea or both. Unlike low Height-for-age, which is associated strongly with economic status, the prevalence of low Weight-for-height is usually less than 5%. Exceptions occur during disaster conditions, such as famine and war, which result in severe food storage and disease outbreaks (Yip, et al., 1992). One of the main characteristics of wasting is that it can develop very rapidly; under favorable conditions body weight can be restore rapidly (Ashworth, 1969). High Weight-for-height or overweight, an indicator that correlates well with obesity, is related to an imbalance of energy intake and energy expenditure for the individual, and often associated with excess food consumption, inadequate physical activity, or both for the individual child.

Selection of Cutoff Points for Nutritional Risk

From many purposes the most useful way of describing the nutrition situation in a population is to choose cutoff points to present an estimate of the number or proportion of children who might be considered at risk. Cutoff points can be expressed in terms of: 1) percentiles; 2) Z-scores; and 3) percent of the median.

Z-scores

Z-score, also referred to as standard deviation (SD) units, are frequently used. The Z-score for a growth index as child is calculated by the following formula:

$$Z = \frac{\text{(observed value) - (reference mean value)}}{\text{(reference standard deviation value)}}$$

The Z-score for the reference population has a normal distribution with mean of zero and SD of 1. For example, if a study population has a mean of Weight-for-height of 0, this would mean that it has the same median Weight-for-height as the reference population. For surveillance, applying the Z-score-based growth indices to characterize a population's nutritional status has an advantage over prevalence data. Because the Z-score scale is linear, summary statistics such as mean, standard deviations and standard errors can be computed from Z-score values (Yip, 1992). The Z-score-based summary statistics are also helpful for grouping growth data by age and sex (Yip, 1992). The Z-score cutoff point recommended by WHO, CDC, and others to classify low anthropometry levels is less than -2 SD units from the reference for each of the three growth indices. The proportion of the population that falls below a Z-score of -2 is generally compared with the reference population in which 2.3% of children fall below the cutoff. A example of growth charts using Z-scores and percentiles as cutoff points are located in Appendix B.

<u>Percentiles</u>

Percentiles, or 'centiles', range from zero to 100, with the 50th percentile representing the median of the reference population. Cutoff points for low anthropometric results are generally <5th percentile or 3rd percentile. For the CDC's Pediatric Nutrition Surveillance System (PNSS), the cutoff level for abnormal growth indices is below the 5th percentile or above 95th percentile, corresponding to a Z-score of <1.65 and >1.65 (CDC, 1984). The reason that more generous cutoffs were applied for PNSS is because the public health program involved in PNSS uses growth indices for screening and evaluation and more generous cutoffs enable program personnel to identify children with borderline growth status (CDC, 1984).

In the reference population, 5% of the population falls below the 5th percentile by definition; this percentage can be compared with the proportion that falls below this cutoff point in the study population. A prevalence in the study population above the baseline level of 5% would be cause for concern. However, the percentile scale is not linear, it cannot be further analyzed statistically. Another disadvantage of using percentiles for cut-points is that the number at extreme degree of risk cannot be quantified e.g. a Z-score of -4.0 represents the 0.0032nd percentile (Shann, 1993). There are many populations in less developed countries where large numbers of children fall outside the range of the reference population. These children cannot be accurately classified by percentiles except by back-calculation from the standard deviation (WHO Working Group, 1986).

<u>Percent of median</u>

The percent of median is the third method to estimate nutritional risk in a population of children. Although this method has been around for many years and the calculations are easy, it does not take into account the distribution of the reference population around the median (Sullivan et al., 1991). Therefore, the interpretation of the percent of median is not consistent across age and height levels and not across the different anthropometric indices (Figure 2.2). For example, 60% weight-for age suggests severe malnutrition in infants but only moderate malnutrition in school children; and 60% Weight-for-age suggests severe malnutrition whereas 60% Weight-for-height is incompatible with life (Shann, 1993).

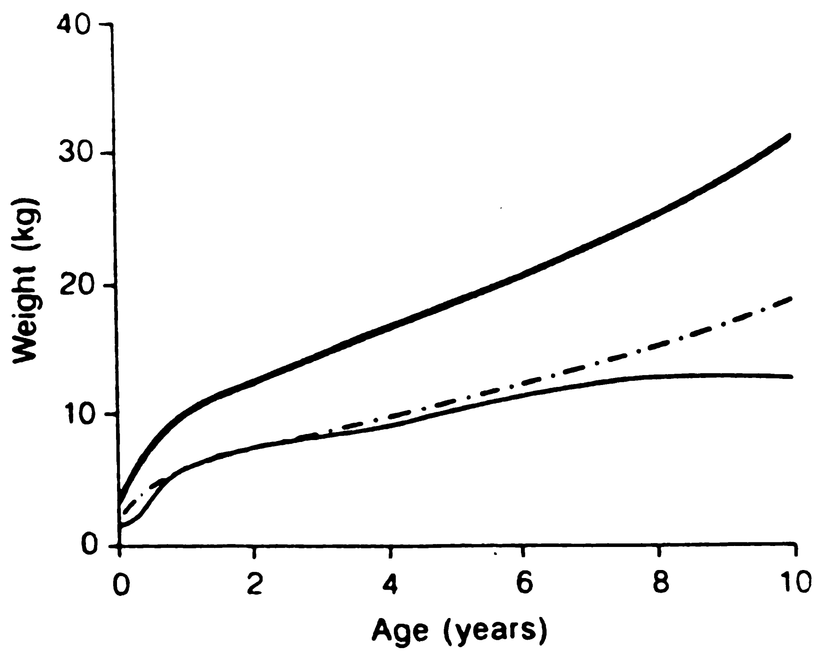


Figure 2.2. Comparison of 60% of median Weight-for-age for males (------) with 4 SD below the median (————); the boldline is the median (Shann, 1993).

Z-scores and percentiles are directly related. Both rely on the fitted distributions of the indices across age and height values and are consistent in their interpretation across anthropometric indices. Z-scores are useful because they have the statistical property of being normally distributed, thus allowing a meaningful average and standard deviation for a population to be calculated. In addition, with Z-scores one can more readily determine the proportion of a population that falls below extreme anthropometric values than with percentiles. Percentiles are useful because they are easy to interpret, e.g. in the reference population 3% of the population falls below the 3rd percentile. Percentiles, however, are generally not normally distributed. In presenting height and weight data to describe the nutritional status of children from relatively well-nourished populations, percentiles distributions of Height-for-age and Weight-for-height are the most appropriate (Waterlow et al., 1977). Traditionally, in the United States, percentiles are used as cutpoints to determine abnormal growth. In developing countries many malnourished are below the first percentiles of NCHS reference population, so either Z-scores or percentage of the median are used, although WHO favors the use of Z-scores (WHO Working Group, 1986).

Epi Info

In 1990, a free computer program for calculating anthropometric data was developed to assist community health professionals to monitor the children's growth status. The anthropometric program is a part of the software, Epi Info (Dean et al., 1990), which was developed by CDC for use by the public health community. The user only needs enter each child's sex, birth date, height and weight, the Z-score, percentile, and percent of median for three anthropometric indices to be computed automatically by Epi Info. By using this computer software, public health workers can save much time in plotting or computing the anthropometric data and decrease the errors occurring during calculation (Hartgerink, 1993).

Chapter 3

METHODS

The purpose of this research was to determine the growth status of low income children ages 3-5 years old, and the relationships between birth weight, social economic factors and growth status in this population.

Subjects

The potential subjects were all 987 children who participated in the Capital Area Community Service (CACS) Head Start program from September 1, 1991 to May 31, 1992. Head Start is a federal program, initiated in 1965 that provides low-income preschool children with a comprehensive program addressing educational, psychological, emotional, health and nutritional needs (Kauffman, 1990). The Administration for Children, Youth and Families of the U.S. Department of Health and Human Services oversees Head Start, but local-level agencies are responsible for operations in their area (DHHS, 1990). Children who enroll in a Head Start program must be at least 3 years of age and have a family annual income less than the U.S. poverty income guidelines. In 1991, the poverty guideline for a family of four was an annual income of less than $13,400. Poverty income guidelines and other selection criteria of the Head Start program are in Appendices C and D. Children in the CACS Head Start program were from Clinton, Eaton, Ingham, and Shiawassee Counties around Lansing, Michigan.

Only the data collected from 856 children were analyzed for this study. A total of 32 children were missing their height and weight data. The remaining 99 children were excluded either because files were missing or files were mixed with the 1992 files.

Pilot Study

A pilot study was done to determine the validity of using Head Start classroom teacher's measurements to assess children's growth status. Seven classes of 95 of Head Start children were randomly selected. Height and weight were measured by train investigators on calibrated equipment to compare the reliability and validity of the classroom teachers' measurements. The results of this pilot study showed that the classroom teachers' measurements were not sufficiently accurate to interpret children's growth status. A brief report of this study can be found in Appendix E.

Instruments

Two sets of data were used in this study: 1) the growth data from the Early and Periodic Screen, Diagnosis, and

Treatment Program (EPSDT) (Appendix F); and 2) the data already collected on the Head Start enrollment form (Appendix G). The children's growth data from EPSDT (height and weight) were collected primarily from public health clinics in the surrounding area. Only in a few cases were data obtained from private clinics participating in EPSDT. Michigan's EPSDT data are part of the Centers for Disease Control's Pediatric Nutrition Surveillance System (PNSS), which are used to monitor the nutritional status of low income children in the United States.

Data from Head Start enrollment forms were self-reported by the head of household for the Head Start child. A Head Start office social service worker assists parents in completing the questionnaires and double checks responses for completion and accuracy. Data items selected from the enrollment forms for this study included the child's sex, birth weight, birth date, and socio-demographic factors such as race/ethnicity, family income, parents' marital status, educational level and occupational status, number of children, household size and social welfare participation.

Parents sign a medical release form for their child's health records when the child is enrolled in the Head Start (See Appendix H). This release form provides consent that Head Start is authorized to release children's social, medical or other information for the benefit of the child or to help provide the most appropriate service for child.

Procedures

After the research proposal was approved by the Michigan State University's University Committee for the Review and Investigation of Human Subjects (UCRIHS) (Appendix I), the growth data and the data from Head Start enrollment form were entered into a computer coding form in the Head Start office during Fall term 1992. For each child, an identification number was given to both the EPSDT data and the data from the Head Start enrollment form. The growth data were entered into the anthropometric software Epi Info to calculate the percentiles and Z-scores for three growth indices, Weight-for-age, Weight-for-height and Height-for-age, for each child. Body Mass Index (BMI) [$Wt(kg) / HT(m)^2$], computed from height and weight measurements, was used here to compare the growth status of Head start children to the population from The Second National Health and Nutrition Survey (NHANES II). These growth data and data from the enrollment forms were matched and merged into a SPSS system file for analysis.

Age was computed by subtracting the child's date of birth from the date of growth assessment (obtained from the EPSDT report). Birth weight was determined from the head of household's self-report (primarily the child's mother) on the Head Start enrollment form; data such as hospital records or birth certificates were not available to check the reported birth weights. Result of a study by Gayle et al. (1988) suggested that maternally reported birth weight are valid enough for research purposes when birth certificate is not readily available. These investigators examined the validation of maternally reported birth weights among 46,637 Tennessee WIC program participants. They found 89% of the maternally reported birth weights were within one ounce of birth certificate birth weights. Based on maternally reported birth weight only 1.1 percent of the birth weights would have been incorrectly classified into low or normal birth weight categories (above or below 2,500g).

To study the possible role of birth weight in childhood growth status, birth weight was categorized as "low" (below 2,500g) and "optimal" (3,500 to 4,000 g) to minimize misinterpretation that might result from a broader range of categories, e.g. below 2,500g and above 2,500g. Low birth weight categories were divided into two subgroups: 1) full-term, small for gestational age (SGA), or intrauterine growth retarded, gestational age >37 weeks and birth weight between 2,000 to 2,500 g; and 2) preterm, appropriate for gestational age (AGA) where gestational age is $\leq$37 weeks and birth weight between 2,000 to 2,500 g. The reason to chose this relatively narrow birth weight category is because it makes the mean birth weight of the preterm AGA and term SGA groups more comparable (Binkin et al., 1988; Gopalan, 1988).

The gestational age used here is also based on parent or guardian self-reported gestational age.

Subjects' height and weight data were collected from EPSDT reports. In Michigan's EPSDT, height and weight were measured by clinic nurses according to the techniques outlined by the Michigan EPSDT anthropometric measurement procedures manual (MDPH, 1987). Michigan Department of Public Health schedules training classes for EPSDT nurses six times a year to assure of the accuracy and reliability of growth measurements recorded for EPSDT (Dunbar, 1992). An EPSDT training schedule for 1992 can be found in Appendix J.

Evaluation of Growth Status

Growth status was evaluated against growth data from the growth reference curves developed by the NCHS and CDC using data from the Fels Research Institute and US Health Examination Surveys (Dean et al., 1990). Height-for-age and Weight-for-age percentile scores are sex-specific and age adjusted observations. Weight-for-height percentiles are sex specific but assumed to be age independent (Hamill et al., 1979).

The prevalence of short stature, underweight, and overweight was calculated using the Centers for Disease Control's Pediatric Nutrition Surveillance System (CDC-PNSS) definitions (Trowbridge, 1982), as follow:

short stature = Height-for-age <5th percentile;

underweight = Weight-for-height <5th percentile;

overweight = Weight-for-height >95th percentile.

Z-scores of Weight-for-age, Weight-for-height, and Height-for-age were used for comparisons between groups. The calculations of percentiles and Z-scores of three growth indices were performed by the Epi Info software developed by CDC (Dean et al., 1990). An example of the printout is found in Appendix K. To avoid errors occurring due to miscoding, the growth data or measurement errors, any Height-for-age, Weight-for-height and Weight-for-age Z-score below -6 or above +6 were reexamined in comparison with the measurements by Head Start classroom teachers. Corrections were made accordingly where appropriate.

Data Analysis

All data were entered and analyzed on an IBM compatible CompuAdd 386/25 personal computer in the Nutrition Assessment Laboratory at Michigan State University. Data from EPSDT reports and Head Start enrollment forms were linked and processed using the Statistical Package for the Social Sciences (SPSS/PC+) (Norusis, 1990). A codebook for the data can be found in Appendix L.

Descriptive statistics were used to characterize the sample and compare the differences in growth status among Head Start, Michigan's EPSDT data and NCHS populations.

Non-paired *t*-tests were use to compare the mean Z-scores of three growth indices between birth weight groups. Chi-square was used to compare observed prevalence of short stature, underweight, and overweight between birth weight groups.

Correlation and multiple regression analysis were used to determine the strength of relationship between independent variable (birth weight and socio-demographic factors) and dependent variables (growth indices), to determine any interaction effect and to determine which factors accounted for the largest portion of growth status. A "forced entry" regression procedure was used for the multiple regression models reported in this study.

In this study statistical significance was reported when the probability level attained a value of 0.05 or less. The following variables were coded as follow's for the correlation and multiple regression's prediction equation: 1) sex as "1" male and "2", female; 2) head of household educational level from "0" none to "7" advanced degree; 3) head of household employment as "0" unemployed, "1" part-time work, "2" full-time work; 3) Parents' marital status as "1" married, and "2" single (which include never married, divorced and widowed). Race/ethnicity was treated as three variables black, white and Hispanic; black was coded as "0" not black, "1" black; white was coded as "0" not white, "1" white; and Hispanic was coded as "0" not Hispanic, "1" Hispanic.

CHAPTER 4

RESULTS

Characteristics of the sample population

The age distribution of CACS Head Start children is shown in Table 4.0. The mean age for the 856 children in the final sample was 50 months old, with a range of 27 to 65 months. Ninety-four percent of the children were 3 and 4 years old. The broad age range in this study was due to children who might have received their EPSDT health screen up to one year before they entered the program. Such EPSDT reports are acceptable by Head Start office. Table 4.1. shows the majority of subjects were white (55%), 28% were black and 11% were of Hispanic origin. The majority received social welfare assistance and came from single parent families (65%). Eight-one percent of the subjects participated in Medicaid, 78% received Food Stamp and 22.4% were enrolled in WIC. The educational level of head of household was high school or below (70%); 72% were currently unemployed.

Table 4.0. Age distribution of CACS Head Start children, 1992

Age (months)	n	Percent
Under 36	10	1.2
36-41.99	77	9.0
42-47.99	199	23.2
48-53.99	338	39.5
54-59.99	191	22.3
Above 60	41	4.8
Total	856	100.0

Hypothesis 1

H_1 There are no differences in growth status [(Height-for-age percentile (HAP), Weight-for-age percentile (WAP) and Weight-for height percentile (WHP)] between Lansing Area Head Start children and Michigan's children with EPSDT data or the NCHS reference population.

The observed percentile distribution is shown in Figure 4.0 as the percent of Head Start children who fell within in each decile of the NCHS reference criteria (Dibley et al. 1987). The assumption of using this approach is that if the observed distribution is identical to the reference distribution, 10% of the observations will fall with in each reference decile (Kumanyika et al., 1990).

Table 4.1. Selected demographic characteristics of the sample (N=856).

Characteristic	Frequency	
	Number	Percent
Sex		
Male	412	48
Female	444	52
Race		
Asian or Pacific Islander	32	4
Black	235	28
Hispanic	97	11
White	473	55
Others or missing data	19	2
Number of children in the family		
1	150	18
2	338	40
3	223	26
4 or more	145	17
Parents' marital status		
married	294	34
single	558	65
missing data	4	0
Employment: head of household		
Full time	129	15
Part time	98	11
unemployed	617	72
missing data	12	1
Education: head of household		
none	2	0
K to 6th grade	18	2
7 to 11th grade	209	24
High school equivalent	370	43
Post high school	161	19
College	66	8
Advanced degree	15	2
Social welfare participation		
WIC	192	22
Food Stamp	670	78
Medicaid	696	81

The Height-for-age graph in this population shows a downward gradient from about 14% in the shortest reference decile to about 7 and 9.4% in the deciles at the tallest end of the reference deciles. The observed Weight-for-age distribution in this sample was roughly comparable to the NCHS reference distribution except for the very highest decile. An upward shape of graph was found for the observed Weight-for-height distribution indicating that the Head Start children as a whole were heavier for their height than expected.

When the growth data of these Head Start children are compared to Michigan's 1990 EPSDT children age 3-5 years in Figure 4.1, the prevalence of both short stature (7.5%) and overweight (9.3%) in Lansing Area Head Start children exceeds the prevalence in the EPSDT reference population. The prevalence of underweight in these Head Start children was 1.5%, the same as the EPSDT reference values. For short stature and overweight in both Lansing Area Head Start children and Michigan's EPSDT children are higher than the 5% expected value for the NCHS reference population.

The data collected for the NCHS reference population were from 1963-1974 and might be too old for appropriate interpretation of children's growth status in 1992. Therefore more recent Body Mass Indices from NHANES II, 1976-1980, were used for comparison to the growth status of

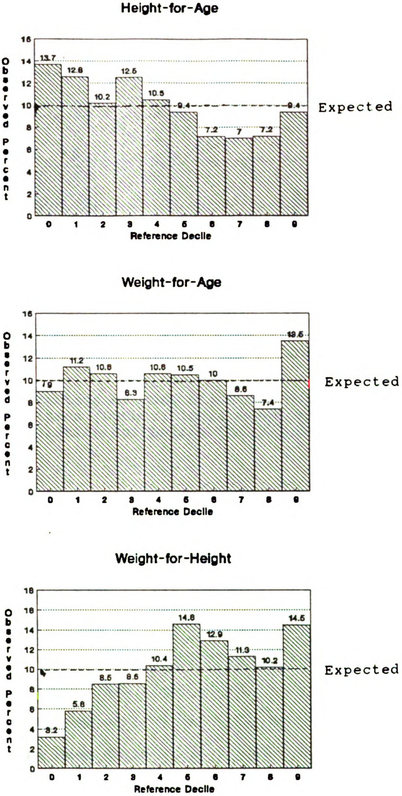


Figure 4.0. Percent of Lansing Area Head Start children who fell within each decile of the NCHS reference percentiles (Diebly et al., 1987).

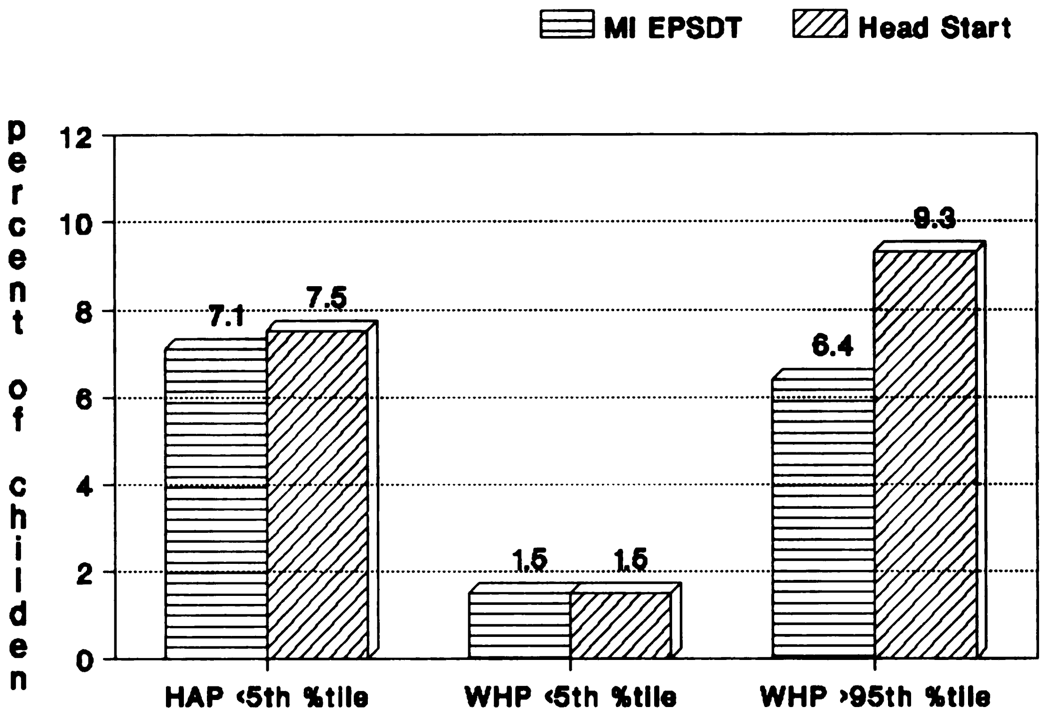


Figure 4.1. Percentage of Head Start and Michigan's EPSDT children (Dunbar, 1992) compared to NCHS population cut points (Dibley et al., 1987).

our sample. The mean BMI of children 3 and 4 years old from Head Start and NHANES II reference population are shown in Table 4.2. The mean BMI of both male and female children in Head Start appeared higher than the mean of NHANES II reference population at age 4 years, but not at 3 years.

The mean Z-scores of the anthropometric variables for each race/ethnic group are given in Table 4.3. Because the sample sizes of the Asian/Pacific islanders and the Native Americans for the Head Start children were too small to represent their ethnicities, only white, black and Hispanic children were analyzed in this study. The mean Z-score of

Table 4.2. Body Mass Indices of 3 to 4 year old children from both the Lansing area Head Start program and NHANES II reference population (NCHS, 1987).

	Head Start			NHANES II		
	N	Mean	(SD)	N	Mean	(SD)
Male						
3 years	124	16.0	(2.1)	418	15.9	(1.2)
4 years	268	17.9	(2.8)	404	15.8	(1.4)
Female						
3 years	152	15.9	(2.8)	366	15.6	(1.3)
4 years	261	17.2	(2.6)	396	15.5	(1.4)

Height-for-age in black children was significantly higher than that those for white and Hispanic children (Table 4.3). Both the white and Hispanic children's mean Z-scores for Height-for-age were below the expected value of 0. Overall mean Z-scores of Weight-for-age were above the expected value of 0 in all three ethnic groups. The mean Z-score of Weight-for-age of black children are significantly higher than white children by about 0.25 SD units. There were no significant differences in mean Z-scores of Weight-for-height among three groups and all three groups were higher than the mean of reference population by 0.3 to 0.5 SD units.

The specific prevalence by race/ethnicity of short stature, underweight and overweight is shown in Figure 4.2. The prevalence of short stature was higher than the 5%

Table 4.3. Z-scores of Height-for-age, Weight-for-age and Weight-for-height of children by race/ethnicity[a]

Height-for-age

Race Category	N	Mean (SD)	F	p
Black	235	.24[b] (1.11)	17.79	.000
Hispanic	97	-.41 (1.05)		
White	473	-.25 (1.21)		

Weight-for-age

Race Category	N	Mean (SD)	F	p
Black	235	.31[c] (1.21)	3.55	.029
Hispanic	97	.12 (1.58)		
White	473	.05[c] (1.13)		

Weight-for-height

Race Category	N	Mean (SD)	F	p
Black	235	.31 (1.08)	1.09	.337
Hispanic	97	.52 (1.58)		
White	473	.39 (1.19)		

[a] One-way analysis of variance.
[b] different from other two groups $p<.05$.
[c] different from each other $p<.05$.

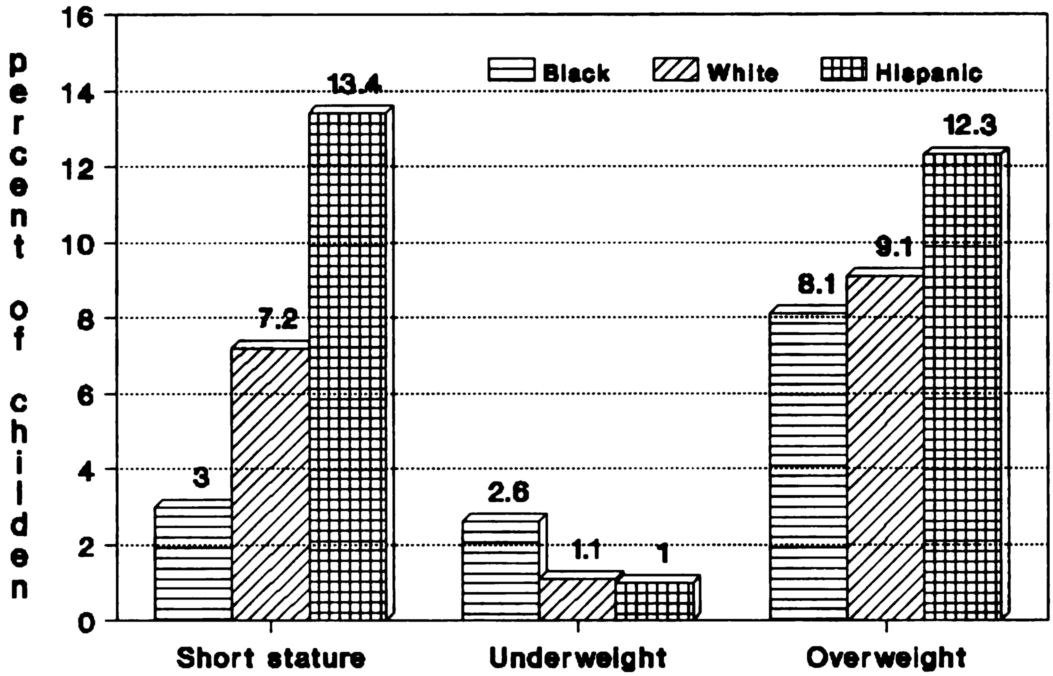


Figure 4.2. Prevalence of short stature, underweight and overweight by race/ethnicity in Head Start children.

expected value for all race/ethnicity groups except the black children. Hispanic children had the highestprevalence of short stature (13.4%). The prevalence of underweight in all three groups was less than the expected level of 5%. The 12.3% prevalence of overweight in Hispanic children was higher than those for the black and white children, 8.1% and 9.1% respectively. However, for all ethnic groups the prevalence of overweight was higher than the 5% expected level.

Hypothesis 2

H_2 There is a greater proportion of in Lansing Area Head Start who are low birth weight than in Michigan as a whole.

Currently, the percentage of children 3 to 5 years of age who were born with LBW are not available for 1992. In 1987 (most of the children in our study were born in 1987), the LBW rate was 7% in Michigan (MDPH,1989). LBW infants have a higher mortality than normal birth weight infants(Institute of Medicine, 1985). Therefore, if adjusted for neonatal mortality, the percentage of LBW children age 3 to 5 years in Michigan should be less than 7%. However, the percentage of LBW was much higher (9%, 74 out of 821) in this sample of low income Head Start children than the same age population for Michigan as a whole.

Hypothesis 3

H_{3a} The growth status [Z score of Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ)] of Lansing Area Head Start children who had optimal birth weight (OBW, birth weight between 3,500 and 4,000g) is higher than that of low birth weight (LBW, birth weight less than 2,500g) children.

Table 4.4 shows significant differences in growth status between LBW and OBW children in this sample. The mean Z-scores of three growth indices are significantly lower in LBW children than in OBW children. The difference in Height-for-age was about 1.5 SD between the two groups. Weight-for-age and Weight-for-height were about 0.8 and 0.5 SD lower in LBW than in OBW children.

Table 4.4. Comparison of mean Z scores for Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ) 36-59 month between LBW[a] and OBW[b] children for Lansing area Head Start children 36-59 months.

	LBW[a] (n=74)		OBW[b] (n=207)		*t*-value
	Mean	(SD)	Mean	(SD)	
Ht-for-age Zscore	-.70	(.95)	.97	(1.19)	-5.78*
Wt-for-Age Zscore	-.44	(1.48)	.34	(1.04)	-4.16*
Wt-for-Ht Zscore	-.01	(1.39)	.53	(1.23)	-2.88*

* $p<0.05$, one-tail separate t-test.
[a] Birth weight <2.5 Kg.
[b] Birth weight 3.5-4.0 Kg.

Table 4.5 shows the prevalence of short stature, underweight and overweight between LBW and OBW children. The prevalence of short stature in LBW children was 14.9% significantly higher than that in OBW children (3.9%). In the LBW group the 2.8% prevalence of underweight was still less than the 5% expected level for average children. Among OBW children the prevalence of overweight was significantly higher than among the LBW children and exceeded the expected level of 5%.

Table 4.5. The prevalence and relative risk ratio of short stature, underweight and overweight between LBW[a] and OBW[b] children in Lansing Area Head Start.

	LBW (n=74) Percent	OBW (n=207) Percent	Chi-Square
Short Stature	14.9	3.9	10.46*
underweight	2.8	1.4	.49
overweight	2.8	12.6	5.9*

[a] Birth weight <2,500g.
[b] Birth weight between 3,500-4,000g.
* $p<.05$.

Table 4.6. Comparison of the means of WHZ, WAZ and HAZ at age 36-59 months between preterm and intrauterine growth retardation children.

	PRE[a] (n=25)		INTRA[b] (n=21)		t-value
	Mean	SD	Mean	SD	
Wt-for-Ht Zscore	-.02	.65	-.42	.52	2.35*
Wt-for-Age Zscore	-.59	.80	-.72	.65	.60
Ht-for-Age Zscore	-.86	.89	-.54	1.03	-1.13

* $p<0.05$, separate t-test.
[a] Preterm and birth weight between 2.0-2.5 Kg.
[b] Full term and birth weight between 2.0-2.5 Kg.

H_{3b} The growth status (HAZ, WAZ and WHZ) of Lansing area Head Start children who were LBW and preterm but appropriate for gestational age will be higher than that of LBW children who were small for gestational age.

The result of the differences in growth status between preterm, but appropriate for gestational age (AGA), children and the intrauterine growth retarded children is shown in Table 4.6. The Weight-for-height Z scores in preterm AGA children were significantly higher than in children of intrauterine growth retardation. However, there were no significant differences in Weight-for-age and Height-for-age Z scores between these two groups.

Relationships between growth status and socio-demographic factors

The socio-demographic variables described in the methods chapter included the subjects' age, gender, race, number of children in the family, educational level of head of household, head of household employment, mother's age and parents' marital status. The correlations of these variables and birth weight with growth status indicators (Height-for-age, Weight-for-age and Weight-for-height Z scores) is shown in Table 4.7. Overall, the correlation of these socio-demographic variables with growth status indicators were weak with only a few reaching significance. Birth weight had the strongest correlation with growth status and is included for comparison. The subjects' age and number of children in the family are correlated with all three growth status indicators ($p<.05$). The older children had higher Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ) Z-scores than did the younger children. The more children in the family, the lower HAZ, WAZ, WHZ of the children. Mother's age was correlated significantly with her preschool child's WAZ; when mother's age increased the children tended to be thinner. Black children were taller and heavier than children who were not

Table 4.7. Relationships between Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ) Z scores and Socio-demographic factors

Variables	HAZ		WAZ		WHZ	
	r[a]	p[b]	r	p	r	p
Birth weight	.23	.00*	.26	.00*	.17	.00*
Age (n = 856)	.07	.02*	.12	.00*	.07	.02*
Sex[c] (n = 856)	-.02	.25	-.02	.25	-.04	.10
No. of children in family (n = 856)	-.09	.00*	-.09	.01*	-.06	.047*
Head of Household education (n = 841)	.04	.14	.02	.27	.01	.36
Head of Household employment (n =844)	-.05	.058	-.05	.06	-.04	.12
Parents' marital status[d] (n = 852)	.10	.00*	.05	.055	.01	.35
Mother's age (n = 781)	-.05	.07	-.08	.01*	-.06	.052
Race (n = 856)						
Black	.20	.00*	.10	.00*	-.04	.13
White	-.08	.01*	-.04	.08	.00	.47
Hispanic	-.07	.02*	.00	.46	.04	.13

[a] Pearson correlation coefficient.
[b] one-tailed significance test.
[c] male = 1, female = 2.
[d] married = 1, single = 2.
* p value <.05.

black. When parents marital status was recoded into ordinal scale (married = 1, single = 2), there was a significant relationship between marital status and Height-for-age Z score. Children who from a single parent family were taller than children from families where parents were married.

Hypothesis 4

H_{4a} When socio-demographic factors are controlled, there will still be a positive relationship between growth status (HAZ, WAZ and WHZ) and birth weight.

Multiple regression was used to determine the power of birth weight and socio-demographic factors to explain the variance in growth status. The socio-demographic variables used here included the subjects' age, number of children in the family, mother's age, parents' marital status, and race (black, white and Hispanic). Because the correlations of socio-demographic factors with growth status indicators were weak, the variables used in the multiple regression equation were only those that were significantly correlated with at least one of three growth status indicators (Table 4.7).

Table 4.8 shows the R^2 change that occurred when birth weight was added to socio-economic variables in the multiple regression equation. For all three dependent variables (HAZ, WAZ and WHZ), the R^2 change was significant when birth weight was entered into the equation. The regression equations for change in predicted HAZ, WAZ and WHZ (Table 4.8), shows that when the socio-demographic variables are controlled, the explanatory power of birth weight is reduced to 5.3% of the variance for HAZ, and 6.4% and 2.4% for WAZ and WHZ, respectively.

Table 4.8. Multiple regression of growth status indicators [Z score of Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ)] with birth weight and socio-economic factors when controlling for socio-demographic factors.

	Step 1[a] R^2	Step 2[b] R^2	R^2 change
HAZ	.06	.11	.053*
WAZ	.034	.099	.064*
WHZ	.013	.038	.024*

Regression Equation:

HAZ =.012(AGE) -.089(No. of children)+.065(marital status)+.004(mother's age)+.86 black+.23 white +.22(Hispanic)+.50(birth weight)-2.714 constant

WAZ =.018(AGE) -.065(No. of children)+.22(marital status)+.007(mother's age)+.64(black)+.31(white) +.50(Hispanic)+.53(birth weight)-2.673 constant

WHZ =.01(AGE) -.039(No. of children)+.07(marital status)+.01(mother's age)-.32(black)-.22(white) -.04(Hispanic)+.34(birth weight)-.78 constant

* $p<.05$
[a] Enter socio-economic variables which included: child's age, parents' marital status, mother's age, and race (Black, Hispanic, and White).
[b] Enter birth weight.

H_{4b} When birth weight is controlled, there will be a relationship between growth status (HAZ, WAZ and WHZ) and all socio-demographic factors combined.

The result in Table 4.9, for which birth weight was entered first and then the socio-demographic variables, shows that when socio-demographic variables were entered the R^2 changes are significant for HAP and WAP but not for WHP. The regression equations for change in the predicted HAZ, WAZ and WHZ (Table 4.9), show that when birth weight is controlled, all the socio-economic variables combined can explain 6.7% of the variance for HAZ, and 3.6% for WAZ but none for WAZ.

Table 4.9. Multiple regression of growth status indicators [Z score of Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ)] with birth weight and socio-economic factors[a] when controlling for birth weight.

	Step 1[a] R^2	Step 2[b] R^2	R^2 change
HAZ	.047	.11	.067*
WAZ	.063	.099	.036*
WHZ	.025	.038	.011

* p<.05
[a] Enter birth weight.
[b] Enter socio-economic variables which included: child's age, parents' marital status, mother's age, and race (Black, Hispanic, and White).

CHAPTER 5

DISCUSSION

This study provided evidence that there are high percentages of children with short stature and overweight entering the Lansing Area Head Start programs. Also a higher percentage of LBW children were found in this low income population than in Michigan children of the same age. Among the LBW children, the prevalence of short stature was higher than for the OBW children in this sample population.

Hypothesis 1

H_1 There are no differences in growth status [(Height-for-age percentile (HAP), Weight-for-age percentile (WAP) and Weight-for-height percentile (WHP)] between Lansing Area Head Start children and Michigan's children with EPSDT data or the NCHS reference population.

The 59% of children below the 50th Height-for-age percentile of NCHS standard, and the 7.4% with short stature are percentages consistent with other studies of the low income children ages 3-5 years old (CDC, 1987; Kumanyika et al., 1990; Lewis, 1989; Scholl, 1987; Brown, 1986; Zee 1985).

The very low prevalence of underweight in Lansing Area Head Start children was not surprising. Low prevalence of underweight among children in the United States has been reported frequently, even in populations at high nutritional risk due to low income or recent immigrant status (Brown et al., 1986; Dewey et al., 1983; Yip et al., 1992).

Overweight was the most prevalent problem identified in this low income population with 65% percent of children above the 50th Weight-for-height percentile and 9.3% overweight. The prevalence of overweight was higher than the 6.4% from 1990 Michigan EPSDT data. The higher proportion of Hispanic children in this sample may explain part of the difference. In this study, the prevalence of overweight in Hispanic children was 13.4% and higher than for black or white children.

Overall, the growth status findings in this study were comparable to those reported by the Centers for Disease Control Pediatric Nutrition Surveillance System (PNSS) with the exception of the higher prevalence found for overweight in Hispanic children (13.4%). For children 2-5 years of age, PNSS reported a 5-12% prevalence of short stature and a 6-12% prevalence of overweight in children from different racial groups, for children 2-5 years of age (1980-1991).

Most researchers agree that growth status of preschool children is influenced by environmental factors and genetic influences (Gopalan, 1988; Habicht et al., 1974; Jelliffe, 1989). Our finding that Black children were significantly taller than other ethnic groups and significantly heavier than white children is believe to be due to genetic difference (Yip et al., 1992). Although, the prevalence of short stature and overweight were highest among Hispanic children in this study, there were no significant differences in Weight-for-height between each ethnic group.

Because a higher prevalence of short stature was found in Hispanic children, it is unclear whether the higher percentages of Weight-for-height values greater than 95th percentile in Hispanic children are actually overweight or due to a difference in body composition related to stature in Hispanic children. Garn et al. (1979) have suggested that Mexican-Americans have a shorter leg length relative to total stature than do other ethnic groups, which would result in an overestimate of the incidence of obesity (Dewey et al., 1983). Measures of body fatness such as skinfold thickness would be necessary to determine the actual prevalence of overweight in these children.

The observation that this sample of low income preschool children had a higher than expected overweight and short stature, while underweight is lower, suggests some environmental factors might be problematic. Some of the investigators have targeted the diet as a major factor.

That is, the diet of preschool children from low income families might be qualitatively deficient, for example, in essential micronutrients or high quality protein, while supplying an excessive amount of calories (Gopalan, 1979). For economic reasons, children of low income families are often fed diets high in refined carbohydrates and lower in meat, fruits and vegetables (Lee, 1983). Karp and Green (1983) found that poor people buy food that seems to provide the most energy at lowest price. Besides dietary factors, physical activity, and family characteristics such as mother's education level, mother's obesity and mother's attitude toward to children also have been found related to childhood obesity (Gortmaker et al., 1990; Gallaher et al., 1991). These risk factors for obesity are highly confounded by socio-economic status and cultural factors.

Hypothesis 2

H_2 There is a greater proportion of children in Lansing Area Head Start who are low birth weight than in Michigan as a whole.

An important finding of this study was a surprisingly high prevalence of LBW children in this preschool sample from low income families. It is known that children with low weight at birth are almost 40 times more likely to die in the neonatal period and 5 times more likely to die later in the first year (Shapiro, 1980). In Michigan, the rate of

LBW infants was 7% in 1987 (MDPH, 1989). For those who were born in 1987, the infant death rate was 99.6 per 1,000 live births in LBW infants and only 3.9 per 1,000 live births in birth weight 2,500g or greater (MDPH, 1990). Because of higher mortality rate of LBW infants, the LBW infants represent a smaller proportion of survivors in later years compare to the proportion at birth. Thus, for children who were born in 1987, the LBW rate at present should be far below that of 1987. However, a LBW rate of 9% was found in this low income preschool population, much higher than expected.

A number of studies have found that LBW infants are at greater risk of increased chronic conditions, hospitalizations, perceived poor or fair health status (Overpeck, 1989) and increased risk for developmental delay (Shapiro et al., 1980). Over the last 20 years, the survival rate for LBW infants has increased markedly (McCormick, 1985). The increased survival of high risk infants raises concerns about their future requirements for special medical and educational services. An awareness of higher than expected percentages of LBW children in Head Start programs can help public health workers target high risk children to provide adequate health and educational services.

Hypothesis 3

H_{3a} The growth status (Z score of Height-for-age (HAZ), Weight-for-age (WAZ) and Weight-for-height (WHZ)) of Lansing Area Head Start children who had optimal birth weight (OBW, birth weight between 3,500 and 4,000g) is higher than that of low birth weight (LBW, birth weight less than 2,500g) children.

Similar to the finding in this sample, Binkin et al. (1988) also found the LBW children shorter and thinner than OBW children. Binkin and his colleagues found that birth weight increase per 500g resulted in an approximate .25 SD increase in mean Height-for-age and Weight-for-age, and about a .2 SD increase in mean Weight-for-height at 3-5 years of age. Garn (1984) examined the relationship between birth weight and subsequent weight gain among 8709 black term infants and found high birth weight (>97.5th birth weight percentile) boys and girls gained 2.6 kg more than their low birth weight (<2.5th birth weight percentile) peers at 7 years of age.

In this study, the LBW children had a higher prevalence of short stature (14.9%) than OBW children (3.9%). In contrast, the prevalence of overweight was significantly higher in OBW children (12.6%) compared to LBW children (2.8%). The high proportion of LBW children in these preschool children from low income families suggests that current prevalence estimates of short stature might overestimate the prevalence of short stature (Gayle et al., 1988). Also, the currently high prevalence of overweight in low income children may underestimate the prevalence of overweight in this group due to a high percentage of LBW children in the low income population.

H3b The growth status (HAZ, WAZ and WHZ) among Lansing area Head Start children who were LBW and preterm but appropriate for gestational age is higher than that LBW children who are small for gestational age.

In this study, children of the same birth weight range who were preterm but appropriate for gestational age (AGA) had higher Z scores of Weight-for-height than intrauterine growth retarded children. In fact, the Z scores of Weight-for-height in the preterm group were similar to the average Weight-for-height of NCHS reference population. However, both Height-for-age and Weight-for-age were about 0.5-0.8 SD below the mean for both groups. This finding indicates that the LBW children still remain shorter and lighter than the normal population at 3-5 years of age and that this was true for the both preterm AGA and intrauterine retarded children. Binkin et al. (1988) reported that both weight and height were lower for growth retarded children than for premature, AGA children. Similar findings were also reported in other studies (Brandt, 1978; Hack et al., 1984) where AGA infants appeared to sustain less permanent growth impairment than those who were intrauterine retarded infants. However, in this study there were no significant differences in weight status between preterm and intrauterine retarded children.

The relatively small sample size in our study might be responsible for failure to detect differences in height status between these two groups. Also, the prematurity of the children was based on mother's self report in this study, that is the exact degree of prematurity was not accessible.

<u>Hypothesis 4</u>

H4a When socio-demographic factors are controlled, there will be a positive relationship between growth status (HAZ, WAZ and WHZ) and birth weight.

H4b When birth weight is controlled, there will be a relationship between growth status (HAZ, WAZ and WHZ) and all socio-demographic factors combined.

In this study, the correlation coefficients between growth indicators and socio-economic factors were very weak and most were not significant. This might have been due in part to the homogenous population of low income children from Head Start. This preselection factor decreased dramatically the variance of socio-demographic factors among subjects. Carmicheal et al. (1990), reporting on a group of preschool children from a multi-ethnic, poor-economic status area in Australia, also found no systematic relationships between growth parameters and mother's number of years of schooling, maternal depression and family economic status.

However, some significant, but weak, correlations were found. The more children there were in families, the lower weight and height were in preschool children. Christianson et al. (1975) reported a similar finding that smaller families had a higher percentage of children with normal weight and height, and that in families with six or more children, the percentage of children with normal weight and height dropped considerably.

In this study, 65% of the children were from single parents and most of them lived with their mother. Deborah (1991) reported that family structure was strongly correlated with socio-economic status. The proportion of children living in families with incomes below the poverty threshold varied from 11% for those living with both biological parents to 66% for those living with never-married mothers. However, an interesting finding in this study was that parents' marital status was significantly related to children's height status; children from single parents were taller than children from married parents. This finding might have been an artifact of having high percentage of single mother in the study, and the fact that black children are generally taller than those of other races.

As mention above, because low-income was a selection criteria in this population, the socio-demographic factors tended to be highly correlated with each other. An awareness of this intercorrelation of factors is important to avoid misinterpreting results. For example, family income was excluded in this analysis, because higher income did not represent a high socio-economic status. High family income in this study was related to families with more children, leading to higher payments from Aid to Family and Dependent Children (AFDC).

Overall, the predictive power (R^2) of socio-demographic factors and birth weight for growth status was low in this population. This means that the most powerful factors related to growth status at 3-4 years of age were not included in this study or that the homogeneity of the sample obscured relationships with socio-demographic factors. Some other important factors for growth status are likely physical activity, dietary intake, health history and genetic influences. For the factors examined, birth weight was more predictive than several socio-demographic factors combined. As birth weight increased, the mean Z score of Height-for-age, Weight-for-age and Weight-for-height increased. This finding confirmed that from the study by Binkin et al. (1988) where growth status was compared for

500 g birth weight categories from 1,000 to 4,999g. Infants with lower birth weights remained shorter and lighter throughout childhood. Heavier infants remained taller and heavier and had a higher risk of being overweight. The fact that LBW significantly predicts growth status at age 3-4 even 6% of the variance, indicates that LBW has the power to predict growth beyond infancy. This predictive power is likely confounded by the quality of care, including diet, in early childhood.

Limitations and Strengths

The following **limitations** of this study should be considered when evaluating the data and results.

1. Children's height and weight measurements were performed by trained clinic physicians and nurses. Although these data were used in the national PNSS to assess growth status of low-income children, potential bias still exist due to measurement or coding errors.
2. Children's birth weight, prematurity and socio-demographic data were parent or guardian self reported and are therefore subject to recall errors. It has been determined that discrepancies existing between maternally reported birth weights and those recorded on birth certificates are small enough not to result in misclassification of LBWs and normal birth weights

(Gayle et al., 1988). However, the validity of maternally self-reported infant prematurity is unknown. Thus, the growth status between preterm AGA and intrauterine growth retarded children in this study must be considered conditional.

3. The Head Start program was designed to assist low-income preschool children who need to meet certain criteria to enroll in this program. Thus, parental self-reported socio-demographic data might be biased for this reason.
4. Because this study is a retrospective review of available existing data, much important information could not be gathered, such as the children's health, behavior, and developmental data.
5. The use of a Weight-for-height percentile cutpoint to determine overweight was based on population reference data. Thus, the results in this study can not precisely represent the actual prevalence of overweight or obesity in this population.

The **strengths** of this study include the following:

1. Based on analysis of the characteristics of the sample population, these children represent typical preschool children from low-income families as they enter Head Start. This suggests that Head Start children may be a useful sampling frame for selection of a representative

sample of low-income children for future surveys. Such an approach could substantially reduce the time and expense associated with identifying and recruiting representative samples.

2. This study used data already collected in Head Start, an economic way to assess a relatively large sample size and obtain valuable information regarding growth status of low-income children.

3. A computer growth monitoring program was successfully set-up in the local Head Start program office for a four county area in mid-Michigan. The Head Start staff also were trained to use the software and interpret the results. From a public service perspective, conducting this study benefitted the local Head Start Program.

Direction for Further Research

Ideally, further research should involve prospective studies to follow longitudinally low birth weight and low-income preschool children to clarify the health, environmental, and dietary effects on growth status related to growth stunting and overweight. Studies with an in-depth classification of socio-economic level and a sample with a wide range of socio-economic statuses are needed to clarify the relation to growth status. Oversampling is needed of minority ethnic groups other than black and Hispanic, such as Native American and Hmong in order to study growth status in these population. Additional studies are needed to determine the growth status of AGA and SGA infants; these infants should be followed throughout their infancy and childhood years to determine later growth patterns. Finally, Health and nutritional education intervention programs for children, parents and child care givers are needed to assist low-income preschool children to achieve fully their growth potential, especially those children who had low birth weight.

CHAPTER 6

SUMMARY

This study provides evidence that a high prevalence of short stature (7.4%) and overweight (9.3) were present in Lansing Area Head Start children. Underweight was not a problem in these low-income preschoolers; the prevalence of low Weight-for-height was 1.5%, far lower than the expected value of 5%. The prevalence of short stature and overweight were higher in Hispanic children than in black and white children.

A 9% rate of low birth weight was found in this population, higher than the 7% expected. When compared the growth status between low birth weight (LBW) and optimal birth weight (OBW) (birth weight between 3,500 to 4,000 g) children, the growth status of LBW children was significantly lower than that of OBW children in all three growth indices. The prevalence of short stature among LBW children (14.9%) was significantly higher than of OBW children (3.9%). By contrast, the prevalence of overweight in OBW children (12.6%) was significantly higher than in LBW children. Among the LBW children, those who were preterm but appropriate for gestational age had a significantly higher Z score of Weight-for-height than those who were intrauterine growth retarded children.

In general, socio-demographic factors correlated weakly with the children's growth status with only a few reaching significance. The number of children in the family were correlated significantly with all three growth indices. The more children in the family the lower the mean of Height-for-age, Weight-for-age, and Weight-for-height of the children. Analysis of the data suggested that birth weight was a more important predictor than the socio-economic factors combined to explain the growth status of this sample of low income preschool children.

Implications

This study supports the findings that short stature and overweight are the most prevalent growth problems in low income preschool populations. A higher than expected percentage of LBW children were also found in this population enter Head Start. These findings emphasize the need for nutrition monitoring so that the growth problems of the children can be addressed. Head Start remain a key vehicle to federal, state, and local concerns for providing appropriate interventions for preschool children at growth risk.

This study shows that a high proportion of LBW children in the low-income preschool population will affect estimates of abnormal growth status. If LBW is not considered, then estimate of prevalence of malnutrition measured by low Height-for-age will be overestimated and obesity measured by Weight-for-height will be underestimated.

Because the rate of LBW birth has not declined in the U.S. during the past 20 years to the same degree as the rate of infant mortality has declined, the survival of LBW infants has increased (DHHS, 1990). Therefore, the proportions of children in the preschool age groups at risk for health and developmental problems related to LBW should be increasing. The Head Start program may be an ideal program to target LBW children and to provide special medical and educational services.

In this study, the growth data from EPSDT were collected when each child entered the Head Start program. Head Start health workers should use these data for early detection of children at risk for abnormal growth and cooperate with classroom teachers and parents intervene to help these children improve growth.

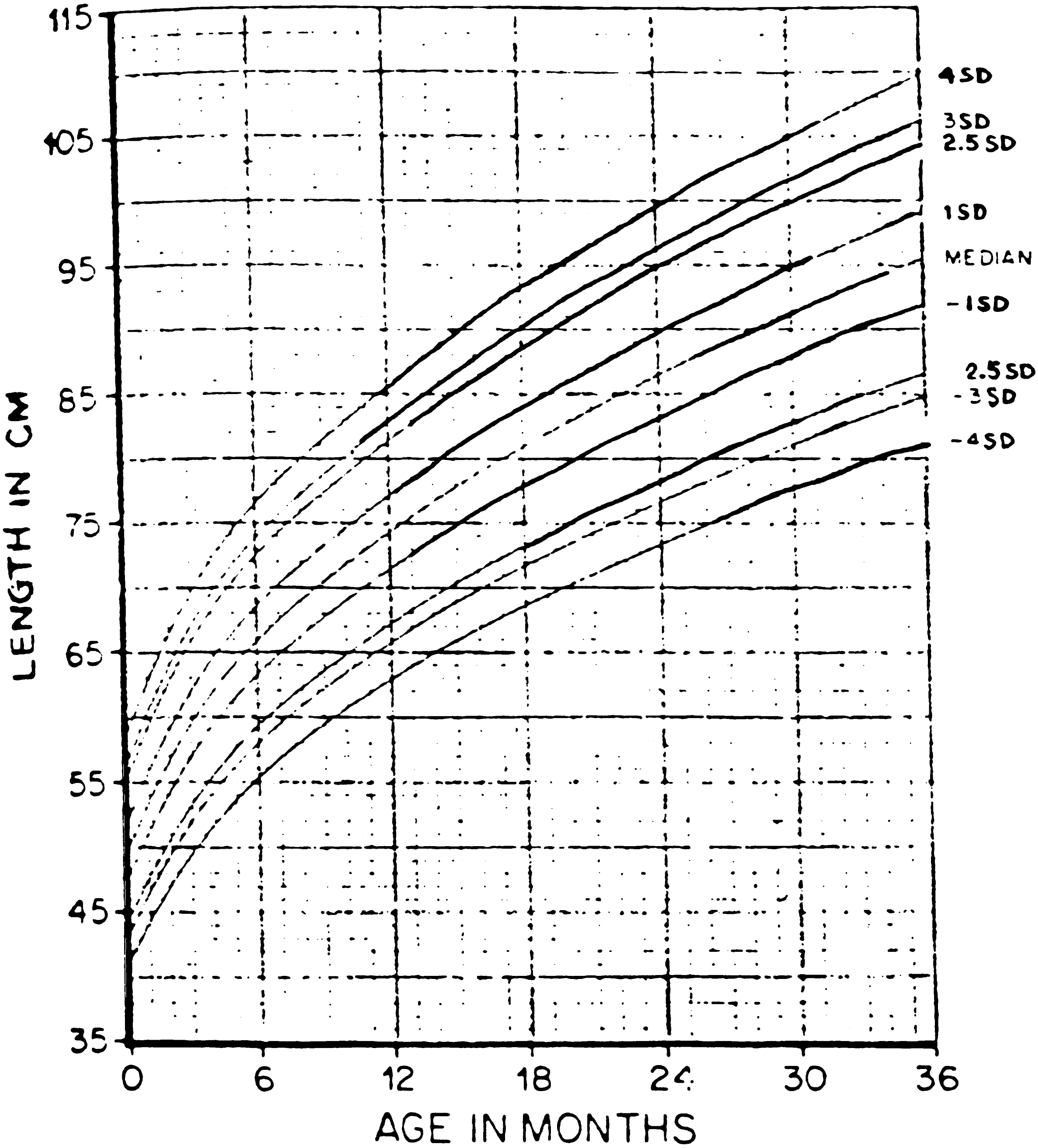
APPENDIX A

Factors affecting inaccuracy of ultrasound estimate of gestational age[a]

Factor	Estimated influence
Variation in ovulation	10%
Differences in the start of growth	7%
Technical errors	11%
Errors related to individual growth rates	25%
Random methodologic errors	22%
Systematic methodologic errors	25%

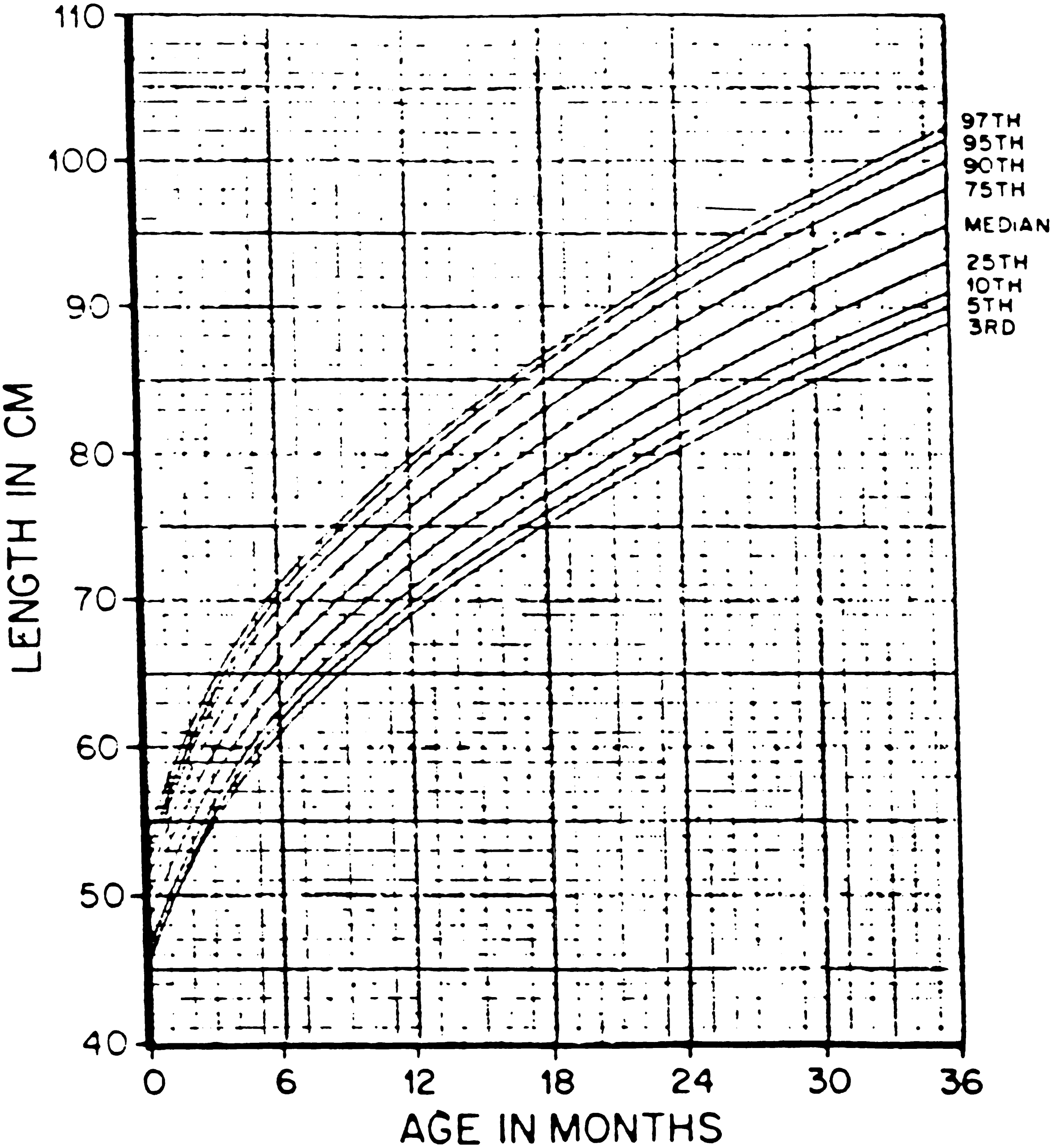
[a] From Rossavilk and Fishburne (1989).

APPENDIX B



Girls, 0–36 months, supine length by age standard deviations (reference population).

(Waterlow et al., 1977).



Girls, 0–36 months, supine length by age, percentiles (reference population).

(Waterlow et al., 1977).

APPENDIX C

1991 FAMILY INCOME GUIDELINES FOR HEAD START PROGRAMS

1991 FAMILY INCOME GUIDELINES FOR ALL STATES (EXCEPT ALASKA HAWAII), THE DISTRICT OF COLUMBIA AND PUERTO RICO

Size of Family Unit	Income
1	$ 6,620
2	8,880
3	11,140
4	13,400
5	15,660
6	17,920
7	20,180
8	22,440

For family units with more than 8 members, add $2,260 for each additional member.

FAMILY INCOME GUIDELINES FOR HAWAII

Size of Family Unit	Income
1	$ 7,610
2	10,210
3	12,810
4	15,410
5	18,010
6	20,610
7	23,210
8	25,810

For family units with more than 8 members, add $2,600 for each additional member.

FAMILY INCOME GUIDELINES FOR ALASKA

Size of Family Unit	Income
1	$ 8,290
2	11,110
3	13,930
4	16,750
5	19,570
6	22,390
7	25,210
8	28,030

For family units with more than 8 members, add $2,820 for each additional member.

APPENDIX D

C.A.C.S. PRESCHOOL PROGRAMS

Selection Criteria for 1991 - 1992

1. Diagnosed returning Special Needs K-Age income eligible children (requires diagnosis with placement plan)

2. Diagnosed Special Needs K-Age income eligible children referred by ISD or other professionals (requires diagnosis with placement plan)

3. Returning children

4. Diagnosed Special Needs income eligible 4 year old children

5. At Risk income eligible 4 year old children

6. Income eligible 4 year old children

7. Diagnosed Special Needs income eligible 3 year old children

8. At Risk income eligible 3 year old children

9. Income eligible 3 year old children

10. Other

    A. Undiagnosed K-Age returning children (requires diagnosis with placement plan)

    B. Undiagnosed K-Age referred children (requires diagnosis with placement plan)

    C. Over-income children

APPENDIX E

Pilot Study to Determine Validity of Using Head Start Classroom Teacher's Measurements to Assess Children's Growth Status

Introduction

Growth monitoring is the repeated measurement, recording, interpretation and intervention of a child's growth in order to follow-up and act on the results (Jellife et al., 1990). Worldwide, all aspects of the four parts of growth monitoring--measurement, recording, interpretation and intervention--are being reappraised. This review of all aspects of growth monitoring is motivated in part, because the later stage of the sequence--interpretation and action--depends upon the earlier ones. That is, if error occurs in the measurement and recording steps, then the money, time and human resources for interpretation and intervention will be misspent. The purpose of this study was to determine validity of height and weight data from Capital Area Community Service (CACS) Head Start program classroom teachers' measurements compared to the measurements conducted by trained graduate students in Human Nutrition at Michigan State University.

Method

Design

In this evaluation project, the investigators obtained height and weight data from a sample of the target population (CACS Head Start children). The classroom teachers' measurements were compared to measurements performed by the trained investigators with calibrated equipment on the same subjects. To control for differences due to the children's maturation, the time frame between these two measurements was within a one month interval.

Procedure

A list of classrooms was obtained from the CACS office. This Head Start program had 987 children and 25 classroom teachers in 50 different classes (Hartgerink, 1992). The locations of the 50 classes were recorded on 50 pieces of paper, and seven classes were drawn randomly. A total of 95 children and 6 classroom teachers were included in the seven classes selected.

A consent form was sent to each child's parents by the CACS Head Start office. Graduate and senior students in Human Nutrition were trained by the investigators in the Nutrition Assessment Laboratory of Michigan State University before performing the measurements in each Head Start classroom. The 95 children were measured by the trained investigation team for height and weight on May 6, 7 and 8th, 1992.

A portable, heavy duty spring scale (SECA) was used for weight measurement and was calibrated at the start of each class section. Weight was measured twice to the nearest 1/2 pound without shoes with a minimum of indoor clothing. For height measurements, a metal wall tape was mounted in a doorway location in each classroom and used with a hand-held triangle head board after positioning the child's head. The children's height was measured twice to the nearest 0.25 inch without shoes, with the back of the head, shoulders, buttocks, and heels touching the wall.

Data Analysis

All the data were coded and entered on an IBM compatible personal computer and processed using the statistical Package for the Social Sciences, SPSS/PC+ (Norusis, 1990) version 4.01. Descriptive statistics and paired t-tests were used to demonstrate the differences between teachers' and the investigators' measurements. Height-for-age percentiles, Weight-for-age percentiles and Weight-for-height percentiles were categorized as <5th %tile, 5 to 95th %tile and >95 %tile. The prevalences of short stature, underweight, and overweight were calculated using the Centers for Disease Control's Pediatric Nutrition Surveillance System (CDC-PNSS) definitions, as follows:

short stature = Height-for-age <5th percentile;
underweight = Weight-for-height <5th percentile; and
overweight = Weight-for-height >95th percentile.

The proportion of growth status in the sample that would have been incorrectly include in teachers measurements was assessed to determine validity.

Results

Table E.1. indicates the mean differences of height and weight between teachers' and investigators' measurements. For both weight and height, the teachers' measurements were heavier and taller than investigators' measurements (0.77 lb and 0.19 inch). These differences were due primarily to the teachers measuring the children with their shoes on (personal observation).

Only 11.6% of the weights and 13.7% of the heights measured by the teachers were identical to those measured by the investigators. Only 46.3% of the weights were within a half pound; 49.5% of height measurements were within 1/4 inch (**Table E.2.**). About 13.7% of the weights differed more than 3 pounds and 2.1% of heights differed more than 2 inches.

When we examined how errors in teachers' measurements would affect the classification of children into abnormal growth categories (short stature, under- and overweight), we found that notable differences were found between the teachers' and investigators' measurements (**Figure E.1.**). Based on teachers' measurements the prevalence of short

Table E.1. Mean differences of height and weight between teacher's and investigator's measurements.

	Measurement		Difference	p
	Teacher	Investigator		
Weight (lb)	42.12 (7.48)	41.35 (7.35)	.77	.002
Height (in)	42.40 (2.26)	42.21 (1.97)	.19	.011

Table E.2. Distribution of differences of height and weight between teachers' and investigators' measurements.

Absolute difference	Frequency	Percent	Cumulative percent
Weight			
0 lb	11	11.6	11.6
1/2 lb	19	20.0	31.6
1 lb	14	14.7	46.3
2 lb	29	30.5	76.8
3 lb	10	10.5	87.3
more than 3 lb	13	13.7	100.0
Total	95	100.1	100.0
Height			
0 in	13	13.7	13.7
1/4 in	34	35.8	49.5
1/2 in	21	22.1	71.6
1 in	19	20.0	91.6
2 in	6	6.3	97.9
more than 2 in	2	2.1	100.0
Total	95	100.0	100.0

stature was underestimated. One child with short stature was misclassified with normal growth children. The teachers' measurements also tended to overestimate the prevalences of underweight and overweight. Three normal growth children were misclassified as underweight. and six 6 normal growth children were misclassified as the overweight. One overweight child was misclassified as normal weight. Overall, about 1.1% of children were misclassified by stature and 10.6% of children misclassified by weight.

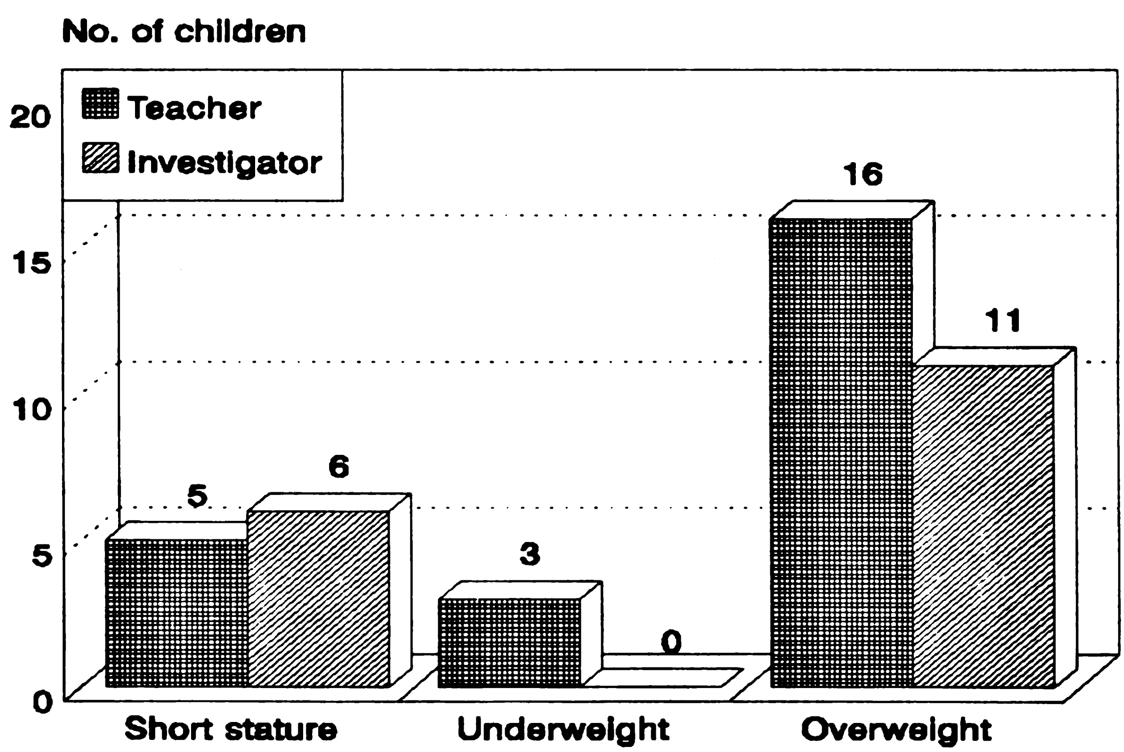


Figure E.1. Differences in the prevalence of short stature, underweight and overweight between Head Start teachers and the investigators' measurements.

Discussion

In this pilot study, we demonstrated a high degree of inaccuracy in height and weight measurements conducted by the classroom teachers. Based on the data analyzed, the height measurements from the teachers seemed to be relatively more accurate than did the weight measurements; about 72% of height were within half inch of the investigators' measurements. However, for growth monitoring of children, we are often only interested in those with abnormal growth patterns. This means that in this study, failure to detect one child of short stature meant that 17% of the short stature children (one in six) were misclassified. The results of this study showed teachers' measurements were not valid for use to target the children at abnormal growth, because the errors occurred often in the upper or lower 5th percentiles. Six of 16 children were misclassified as overweight, and all three children in the underweight category were misclassified by the classroom teachers. The reason for the errors might have been due to the teacher misreading the weight scale or measuring the children with their shoes on. Also in some of the classes, teachers failed to calibrate the scales before measuring.

Classroom teacher is not a trained health worker. Due to high workload, lack motivation, and without adequate equipments of the classroom teachers, an unacceptable result was found in this study was not surprising.

APPENDIX F

JAN 0 9 19..

[redacted]

[redacted], Lansing, MI 48911

PARENT OR GUARDIAN [redacted]

[redacted]

Work

PHONE

PHONE

I. ... As reported by parents

A. IMMUNIZATIONS

	Dates			Booster
Diphtheria				
Tetanus	[illegible]	[illegible]	[illegible]	
Pertussis				
Polio (Oral)	[illegible]	[illegible]		
Measles (Rubeola)				
Rubella	[illegible]			
Mumps				
Other				

B. TUBERCULIN TEST

Type: Date: Result:

C. Conditions which may require special care such as allergies, fainting, diabetes, seizures or other:

D. Health problems which need special attention or care:

II. SCREENING TESTS

	Within Normal Limits* Yes	No	Where Referred, Already Under Care, or Other
Hearing	✓		
Vision		✓	failed acuity - Mother to make appt.
Height (inches): 43 1/4	✓		
Weight (pounds): 48 1/2	✓		
Blood Pressure: 92/62	✓		
Hematocrit (%): 43	✓		
Sickle Cell			
Blood Lead 019	✓		
Urine Sugar: N Alb: N	✓		
Denver Developmental Screening Test (If delays, describe sector and recommendations)		✓	÷ delay in Fine Motor (failed thumb wiggle) passed thru age line

III. PHYSICAL INSPECTION

	Yes	No	
General Appearance	✓		
Cranium, Hair & Face	✓		
Ears, Eyes & Nose	✓		
Mouth & Teeth	✓		
Skin	✓		
Chest & Back	✓		
Abdomen	✓		
Muscle Tone	✓		
Arms & Legs	✓		

IV. ADDITIONAL RELEVANT HEALTH INFORMATION

Date 1-5-82

Signature [illegible]

Agency & Address CHC

Child Health Services
Ingham County Health D...

Completion: Voluntary

APPENDIX G

C.A.C.S. INC., PRE-SCHOOL

ENROLLMENT PACKET

PROGRAM YEAR 1992 - 93

CHILD'S NAME: ______________________________

DATE OF BIRTH: ______________________________

NAME OF PARENT(S): ______________________________

PACKET COMPLETED BY: ______________________________

Items Needed:	Date Received:
______________________________	____________________
______________________________	____________________
______________________________	____________________

CAPITAL AREA COMMUNITY SERVICES, INC.
PRESCHOOL PROGRAMS
101 E. Willow, Lansing, MI 48906
(517) 482-1504

INSTRUCTION TO PARENTS: **Return ONE completed copy of the Family Size and Income Data form to the address indicated above**

MICHIGAN CHILD CARE FOOD PROGRAM
For the Period of July 1, 1992 through June 30, 1993

Dear Parent or Guardian

Households with incomes less than or equal to the level shown on the Child Care Food Program income scale below are eligible for "A" (free) or "B" (reduced price) meals. In addition, each child for whom you receive Food Stamps or AFDC assistance is automatically eligible for free meals. Your child care center serves nutritious meals every day without additional charges because it receives additional reimbursement for each child whose family income qualifies for these meals.

In order for your Family Size and Income Data form to be approved, please answer all questions on the form which pertain to you.

FOOD STAMP OR AFDC RECIPIENTS: Include the child(ren)'s first and last names and the food stamp or AFDC case number for each child using the child care site in Part 1 and the signature of an adult household member in Part 3.

HOUSEHOLDS NOT RECEIVING FOOD STAMPS OR AFDC ASSISTANCE: Include the child(ren)'s first and last names f each child using the child care site in Part 1. List the names of all household members and the monthly household income received b each family member by source in Part 2. Part 3 must include the signature of an adult household member and the adult's social security number or the word "NONE" if the adult does not have a social security number.

If, during the year, there are increases in household income which exceed $50/month or $600/year, OR if your household size decreases, OR if Food Stamp/AFDC assistance is terminated for the child(ren), you must report such changes to the child care cente

Children having parents or guardians who become unemployed are eligible for "A" (free) or "B" (reduced price) meals during the period of unemployment, provided that the loss of income causes the family income during the period of unemployment to be within eligibility standards for those meals.

In certain cases, foster children are eligible for "A" or "B" meals regardless of household income. If such children are living with yo and you wish to apply for such meals, please contact your center.

Households with incomes greater than the levels shown on the Child Care Food Program income scale below do not need to complet the attached Family Size and Income Data form.

The Child Care Food Program Income Scale is as follows:

	INCOME	
FAMILY SIZE	YEARLY	MONTHLY
1	$12,599	$1,050
2	17,002	1,417
3	21,405	1,784
4	25,808	2,151
For each additional family member, add	4,403	367

In the operation of the Child Care Food Program no child will be discriminated against because of race, color, national origin, sex, age, or handicap. Any person who believes that he or she has been discriminated against in any USDA related activity should write immediately to the Secretary of Agriculture, Washington, DC 20250

CAPITAL AREA COMMUNITY SERVICES, INC.
PRESCHOOL PROGRAMS

MICHIGAN CCFP FAMILY SIZE AND INCOME DATA FORM

Part 1 - ALL HOUSEHOLDS
List the first and last name* of each child in your household using the child care site

* If you are now receiving Food Stamps or AFDC assistance for children listed, write the CASE NUMBER (*assigned to each child*) in the space below

NAME	FOOD STAMP #	OR	AFDC #

* If all the children indicated in Part 1 are certified to receive assistance under the Food Stamp or AFDC Programs, you do not need to complete Part 2. In addition to providing the name(s) of child(ren) and the appropriate case number(s), you must provide an adult household member signature in Part 3 for your Family Size and Income Data form to be approved.

HOUSEHOLDS NOT RECEIVING FOOD STAMPS OR AFDC ASSISTANCE:
If you did not list a Food Stamp Number or AFDC Number for each child in Part 1, you MUST also complete the information requested in Part 2, SIGN the form, and print your social security number or the word "NONE" if you do not have a social security number in Part 3.

Part 2 - **HOUSEHOLD MEMBERS:** List the names of everyone living in your household, including yourself and the children listed above. If you need more space, use a separate sheet of paper.
INCOME: Indicate source and amount of income received last month on the same line with the person who receives it. You must list gross income BEFORE deductions for taxes, social security, etc. List each amount under the correct title.

LIST ALL HOUSEHOLD MEMBERS:

Name (last, first)	Age	Monthly Earnings from Work (before deductions)	Monthly Welfare, Child Support, or Alimony Benefits	All Other Income (Indicate source and amount)

Part 3 - ALL HOUSEHOLDS:
I certify that all of the above information is true and correct and that all income is reported. I understand that this information is given for the receipt of federal funds, that program officials may verify the information on the application, and that deliberate misrepresentation of the information may subject me to prosecution under applicable state and federal laws.

X ______________________ X ______________________
Signature of Adult Household Member — Social Security Number**

______________________ ______________________ ______________________
Home Telephone No. — Work Telephone No. — Printed Name of Adult

______________________ ______________________ ______________________
Street Address — City/State/Zip — Date

FOR SPONSOR USE ONLY

TOTAL HOUSEHOLD MEMBERS ________ TOTAL MONTHLY INCOME $ ________ CIRCLE A, B OR C: **A B C**

SPONSOR SIGNATURE X ______________________ DATE ______________________

FAMILY INFORMATION

HEAD OF HOUSEHOLD:

Last Name:________________ First Name:_____________ MI:____ DOB:________ Sex:___

Str#:_________ St.Name:______________ Apt#:________ City:______________________

State:_______________ Zip Code:_______________ Telephone#:______________________

Marital Status:____________ Educ.Lvl:___________ Soc.Sec#:______________________

No. Adults:_______ No.Children:_______ No.Handicap:_______ Total in HH:________

****

INCOME INFORMATION

	Type Income	Annual Income	Ver.Y/N
1.HH Income			
2.Spouse Income			
3.Child Income			
4.Other Income			

Total Annual Income: ___________________

****

Food Stamps: Yes No P.A. Case#:______________________________

OTHER ADULTS IN HOUSEHOLD

Last Name	First Name	Relation to H.H.	D.O.B.	Sex M/F	Educ. Lev.	Social Security #

CHILDREN IN HOUSEHOLD

	Last Name	First Name	Sex	D.O.B.
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				

I certify that all of the above information is true and correct to the best of my knowledge. I understand that any deliberate misrepresentation of information may result in prosecution under applicable state and federal penal statutes.

Parent Signature:______________________________ Date:____________________

Witness Signature:_____________________________ Date:____________________

White = Main File Yellow = FSW

CHILD DEMOGRAPHIC/ENROLLMENT FORM

Last Name:______________________ First Name:____________________

D.O.B.:__________ Sex:______ Relationship to HH:____________________

Ethnicity: (Circle one)

1= Am Indian or Native Alaskan
2= Black
3= Asian or Pacific Islander
4= Mexican
5= Puerto Rican
6= Other Hispanic
7= White
8= Middle Eastern

Language: (Circle one)

0= English
1= Spanish
2= Indo-Iranian
3= Slavonic
4= Native American
5= Asian____________________
6= Italic
7= Germanic
8= African Dialect
9= Other____________________

Handicapped: (Circle one)

0= Not Handicapped 1= Suspected Condition 2= Confirmed Condition

Soc. Sec.#:__________________ Birth Verification:____________________

School Year:____1993__________ Years in Program: 1 2 3

****

Eligibility: (Circle one)

1= Income Eligible
2= Overincome
5= Income Eligible and Special Needs
6= Over Income and Special Needs

Classroom assigned:__________________________ Session: A.M. P.M.

Home Base Teacher:____

CCFP Eligibility: (Circle one)

1= Category A (Free) 2= Category B (Reduced) 3= Category C (Full)

Is child on a Special Diet? (Circle one) Yes No

Remarks:____

____

____

WHITE - Main File YELLOW - FSW

EMERGENCY INFORMATION

Last Name:____________________ First:________________ D.O.B.:___/___/___
Address:____ Phone #:______________

****

EMERGENCY CONTACTS:

	1.	2.	3.
Name:			
Address:			
Home Tel:			
Work Tel:			
Work Days:	Hrs.:	Hrs.:	Hrs:
Relation:			

****

Medicaid #:________________ Hospital Preferred:______________________
Insurance Co.:_________________________ Insurance No.:_________________
Doctor Name:___________________ Phone #:____________ Last Visit:_______
Dentist Name:__________________ Phone #:____________ Last Visit:_______
Allergies:____
Medical Cond:____
Remarks:____

****

Transportation Pick-up:____________________ Drop-off:___________________
Special Instructions:____

****

ADULT EMERGENCY HEALTH INFORMATION

Does the parent(s) have a physical condition which the staff should be aware: (i.e., seizure disorder, heart condition, diabetes, etc.)?

Please list below any health conditions of the parent(s) who may be volunteering in the classroom or attending any of the Head Start workshops.

Name of Mother:____
Health condition(s):____________________________________
Name of Father:____
Health condition(s):____________________________________
Additional Remarks:____

WHITE - Main File YELLOW - FSW

CHILD HEALTH SUMMARY

Last Name:______________________ First:___________________ D.O.B.:__/__/__

****

IMMUNIZATIONS: Source of Documentation:____________________________

	1st	2nd	3rd	4th	5th
Dpt:	___/___/___	___/___/___	___/___/___	___/___/___	___/___/___
Pol:	___/___/___	___/___/___	___/___/___	___/___/___	___/___/___

Meas: ___/___/___ Mump: ___/___/___ Rubella: ___/___/___ HIB: ___/___/___

****

HEALTH SCREENING

	Date	Result		Date	Result
Vision:	___/___/___	______	Lead:	___/___/___	______
Hearing:	___/___/___	______	Urine:	___/___/___	______
Sickle:	___/___/___	______	Develop:	___/___/___	______
TB:	___/___/___	______	Speech:	___/___/___	______

Hct: ___/___/___ ______ ________% Hgb: ___/___/___ ______ ________gm.

Ht1: ___/___/___ ______ ___-___in. Ht2: ___/___/___ ______ ___-___in.

Wt1: ___/___/___ ______ ___-___lb. Wt2: ___/___/___ ______ ___-___lb.

Bp: ___/___/___ ______ ___/___ Comment:______________________________

****

HEALTH HISTORY

Is Child on a special diet?	Yes	No	Specify:____________________
Any suspected dietary problems?	Yes	No	Specify:____________________
Is child overweight/underweight?	Over	Under	Remarks:____________________
Food Allergies:	Yes	No	Specify:____________________
Medication Allergies:	Yes	No	Specify:____________________
Insect Allergies:	Yes	No	Specify:____________________
Asthma:	Yes	No	Indicate Medication:____________
Diabetes:	Yes	No	Indicate Medication:____________
Heart Condition:	Yes	No	Indicate Medication:____________
Convulsions/Seizures:	Yes	No	Indicate Medication:____________
Freq. Ear Infections:	Yes	No	Indicate Medication:____________
Kidney Problems:	Yes	No	Specify:____________________
Other Med. Conditions:	Yes	No	Specify:____________________
Is Child on Medicaid:	Yes	No	Medicaid #:__________________

WHITE - Main File YELLOW - Teacher PINK - FSW

CHILD HEALTH HISTORY

CHILD'S NAME: ______________________ D.O.B.: __________

PREGNANCY/BIRTH HISTORY	YES	NO	EXPLAIN "YES" ANSWERS
Did Mother have any health problems during this pregnancy or during the delivery?			
Did the Mother visit a physician on a regular basis during pregnancy?			
Was child born more than 3 weeks early or late?			
What was child's birth weight?			
Was anything wrong with child at birth or shortly after?			
Did child or mother stay in hospital for medical reasons longer than usual?			
Is Mother pregnant now?			
If child was premature, is child being seen at Developmental Assessment Clinic (DAC)?			
HOSPITALIZATIONS AND ILLNESSES			
Has child ever been hospitalized or operated on? If "Yes", please explain:			Date:
Has child ever had a serious accident or illness? If "Yes", please explain:			
HEALTH PROBLEMS			
Does child have frequent sore throat, cough, stomach pain, vomiting, diarrhea, constipation? (Circle correct item)			
Does child have difficulty seeing? (Squint, cross eyes, look closely at books.)			
Is child wearing (or supposed to wear) glasses?			
Can others understand your child when he/she talks?			
Is child taking any medicine now?			
Has child had bleeding tendencies, seizure disorder, liver disease, rheumatic fever, sickle cell disease, hives, polio?			
Does child have any ongoing medical condition?			
Is child under the care of a physician at this time? Physician's Name:			

PLEASE CONTINUE ON BACK ....

CHILD DEVELOPMENT QUESTIONNAIRE

Child's Name:______________________________ D.O.B.:____________

Parent: Mother_______________________ Father___________________

Phone:__________________ Center/Homebase:______________________

****

1. **Is there anything you would like to have your teacher know about your child that would help meet his/her needs?**

____

____

____

2. **What is one thing you especially like about being a parent?**

____

____

____

3. **Tell me one or two things you especially like about your child?**

____

____

____

4. **Is there anything about your child that you wish someone would help you with (anything that frustrates, confuses, or worries you?)**

____

____

____

5. **Is there anything about being a parent that we could help you with?**

____

____

____

6. **What do parents of pre-schoolers need more information about?**

____

____

____

FAMILY SOCIAL SERVICE INFORMATION

Head of Household: Last__________________________ First______________________

Child(ren) enrolled in Head Start:____

____

Form of Transportation Available:

1= Private   3= Friend/Relative   5= None
2= Public   4= Other____________

Is Child Care Available?

1= Yes, always   3= Yes, difficult to arrange   5= None Needed
2= Yes, must be arranged   4= None available

Is Head Of Household Employed?:

1= Yes, full time
2= Yes, part time
3= Yes, seasonal or periodic
4= No

Is Spouse Employed?: N/A

1= Yes, full time
2= Yes, part time
3= Yes, seasonal or periodic
4= No

Is Head of Household Handicapped?:   Yes   No
Is Spouse Handicapped?: N/A   Yes   No

Level of Education of H.H.:

1= Lower Elem (K-3)
2= Upper Elem (4-6)
3= High School (7-11)
4= High School Diploma/GED
5= Post High School (trade/college)
6= College (Assoc. Degree)
7= College (BS/BA Degree)
8= Advanced Degree
9= None

Level of Education of Spouse: N/A

1= Lower Elem (K-3)
2= Upper Elem (4-6)
3= High School (7-11)
4= High School Diploma/GED
5= Post High School (trade/col
6= College (Assoc. Degree)
7= College (BS/BA Degree)
8= Advanced Degree
9= None

Agencies other than Head Start with which family is involved:

Please list: ______________________   ______________________
______________________   ______________________

****

HOUSING:

Do you own or rent housing? (Circle one)   Own   Rent

Do you live in a(n): (Circle one)

House   Apartment   Trailer   Condominium   Duplex   Townhous

WHITE - Main File   YELLOW - FSW

PARENT INVOLVEMENT INFORMATION

Head of Household: Last_______________________ First____________________

Name of Head Start child(ren):____

****

Name of Spouse if married:____

Person to notify in case of adult emergency:_______________________________

<><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>

Topic interests of Head of Household and/or Spouse. Write HH under topic if an interest of Head of Household and S for topic of interest to Spouse.

Cont.Ed.	Drug Prev.	Reading	Parent.	Self-Est.	First Aid	Career Dev.	Job Search	Nutrition
________	________	________	________	________	________	________	________	________

<><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>

Do you have difficulty reading(i.e. newspaper, direction, notes from school)

Mother: Yes No Father: Yes No

****

We believe that Head Start is Parent Involvement and you are the primary educator of your child; therefore, we need input from you. We are excited to meet you and share the goals that we have for both children and parents.

PARENT /CHILD ORIENTATION

This is an opportunity for both the child and parent to become familiar with the classroom routine, sign emergency cards, ask any questions, and experience what Head Start will be like for your child.

PARENT CENTER/CLUSTER MEETINGS

All parents are encouraged to attend monthly meetings which provide an opportunity for parent input, staff comments, planning activities for parents and children, and training on a variety of topics.

PARENT CLASSROOM VOLUNTEER

Parents are an essential part of Head Start's day-to-day operations. The largest area of need is the bus rider/teacher aides and group experience aides. We need you at least once a month to ride the bus and spend time in your child's classroom.

TRANSPORTATION AGREEMENT

Transportation services to and from our centers will be provided for children living outside the walk-in center area. Since we are required by law to have bus riders on buses transporting pre-school age children, please understand that you are responsible for one of the following:

Program Transported Children

Since my child will be transported to and from the assigned center, I understand that I am responsible for riding the bus one (1) day per month. If I am unable to ride the bus one (1) day per month, I am responsible to secure an appropriate replacement. I fully understand and agree that, if I fail to keep my commitment for riding the bus or my replacement cancels, transportation privileges for my child may be withdrawn and I will be responsible for transporting my child to and from the center for the remaining part of the school year.

I understand that I am responsible for signing the bus rider calendar minimally one (1) day per month, and my failing to sign up will result in my being assigned to ride on a day when there is no designated rider.

Self-Transport/Walk-In Children

Since I live in a walk-in center area, or I have agreed to transport my own child, I understand that I am responsible for the following:

I (or my authorized person) will be responsible for bringing my child to and from the assigned classroom on time for the session.

Furthermore, I understand that I am needed to assist in the classroom one day per month.

****

NO CHILD WILL BE RELEASED TO ANYONE NOT AUTHORIZED IN WRITING BY THE CHILD'S PARENT/GUARDIAN OR LISTED ON THE EMERGENCY CARD.

****

Child's Name:______________________________ **D.O.B.:**____________

____ ________________

(Signature of Parent/Guardian) **Date**

PERMISSION FORM

Child's Name: ______________________________________ D.O.B.: ______________

PROVISION ONE (1)

TRANSPORTATION. I (we) hereby give consent for my child to be transported to and from Head Start classrooms. I (we) understand that any child whose parent is not at home for any reason when the child is delivered by Head Start will be taken to the Head Start office and held for one (1) hour. During this hour, Head Start will make every effort to contact or release the child to the parent(s) or a responsible adult listed on the Emergency Card. The Police Station closest to the center will be notified and assume responsibility for the child's welfare, if no one on the Emergency Card can be contacted. If this incident occurs twice, the parent(s) will assume responsibility for transporting his/her own child.

PROVISION TWO (2)

FIELD TRIPS: I (we) hereby give consent for my (our) child or children to take part in field trips or excursion trips to fulfill program goals for the 1992 - 1993 School Year.

PROVISION THREE (3)

PHOTOGRAPHS and VIDEO TAPES: I (we) hereby give consent for pictures to be taken of my (our) child or children to be used in the program for the purpose of program promotion. Photographs may include news release items, slides, television announcements or other related materials.

PROVISION FOUR (4)

EDUCATIONAL INFORMATION: I (we) hereby give consent to release educational information to the appropriate school district if requested by said school district.

I (we) have read and understand the above four (4) provisions and hereby release C.A.C.S. Inc., - Head Start from any legal responsibilities in respect to these four (4) provisions.

(Signature of Parent/Guardian)	Date	Relationship
(Signature of Witness)	Date	Title

****

CAREGIVER CERTIFICATION

THE DEPARTMENT OF SOCIAL SERVICES RECOGNIZES VOLUNTEERS AS CAREGIVERS IN A CLASSROOM. AS A RESULT, WE NEED TO ASK ALL CURRENT AND PROSPECTIVE STAFF AND VOLUNTEERS TO SIGN A STATEMENT OF CERTIFICATION.

CERTIFICATION

I hereby certify in good faith that a case of abuse or neglect has not been substantiated against me nor have I been named the Respondent in any petition which is pending for child abuse or neglect in either the juvenile or in criminal court of a felony charge. I understand that by falsely signing this certification, or if subsequent to my employment, a case of abuse or neglect is substantiated against me or I am charged in criminal court for abuse or neglect, that I may be subject to discharge from employment.

(Signature of Parent/Guardian)	Date
(Head Start Staff Signature)	Date

WHITE - Main File   YELLOW - Teacher   PINK - Parent

PRELIMINARY HEALTH AGREEMENT

Child's Name:____________________________________ D.O.B.:__________________

Head Start is interested in the health and development of each child. Immunizations, dental, medical, nutrition, and mental health services all contribute to a child's well-being. The parent's input and involvement in their child's health care is so important.

The following requirements must be met in order for your child to participate in the Head Start program.

IMMUNIZATIONS: _______ Complete _______ Needed

Immunizations Needed:____

HEALTH SCREENING: Location:________________________________

Date:____________________________________

I arranged the above Health Screen appointment.

Parent Signature:________________________________

DENTAL EXAM: Dentist:____

Date:____

****

HEALTH RELEASE

I hereby give my permission for my child to receive the necessary screenings, dental examinations, and immunizations required by Head Start and for C.A.C.S., Inc. - Head Start to forward my child's Health Records to the appropriate school at the completion of the Head Start Program.

I consent for C.A.C.S. Head Start to transport my child for any appointments which are necessary to fulfill the above requirements. I understand that the transportation will be provided only if necessary, and that I, the parent, will accompany the child to these appointments.

____ ____________________

Signature of Parent/Guardian **Date**

WHITE - Main File YELLOW - Teacher PINK - FSW

PROGRAM YEAR 1991 - 1992

RELEASE OF INFORMATION FOR HEALTH DEPARTMENT

Scheduled Appointment:______________

I,________________________________, hereby request and authorize
(Name of Parent/Guardian)

the Health Department, Medicaid Screening Clinic, Immunization Clinic, W.I.C., and Well Child Clinic to release to C.A.C.S., Inc. Head Start all relevant information and records concerning the health of:

________________________________ ________________
(Name of Child) Date of Birth

________________________________ ________________
(Signature of Parent/Guardian) Date

Address:_______________________________Phone:________________

PROGRAM YEAR 1991 - 1992

RELEASE OF INFORMATION FOR HEALTH DEPARTMENT

Scheduled Appointment:______________

I,________________________________, hereby request and authorize
(Name of Parent/Guardian)

the Health Department, Medicaid Screening Clinic, Immunization Clinic, W.I.C., and Well Child Clinic to release to C.A.C.S., Inc. Head Start all relevant information and records concerning the health of:

________________________________ ________________
(Name of Child) Date of Birth

________________________________ ________________
(Signature of Parent/Guardian) Date

Address:_______________________________Phone:________________

RELEASE OF INFORMATION

TO: Name____________________ Agency:____________________

Address:____

REGARDING: Child's Name____________________ D.O.B.__________

Insurance #____________________ Center/HB____________________

We are requesting information regarding the above named child. Your assistance will be greatly appreciated. This information will be used to help us provide the most appropriate services for this child.

INFORMATION REQUESTED: (Please provide information only on items checked)

______ IMMUNIZATION RECORDS

______ INCOME VERIFICATION

______ MEDICAL INFORMATION / RECORDS*

______ BIRTH CERTIFICATE

______ EDUCATIONAL RECORDS* Specify: ____________________

______ MENTAL HEALTH RECORDS*

______ HEALTH SCREENING (if from other than County Health Dept.)

______ OTHER:____________________

*If requesting this information, please complete the attached form(s).

****

C.A.C.S., Inc. - Head Start is authorized to obtain from or give to the following professional pertinent social, medical, or other information about the above named child, for whom I am legally responsible. I understand all information will remain confidential and that all information will be used for the benefit of the child named above. I release the C.A.C.S. Head Start Program and its Staff and the professional named above from any legal liability for giving or receiving information which I have permitted by signing this form. This consent is valid for one year after the date signed.

______________________________ ______________

Signature of Parent/Guardian Date

Return to: C.A.C.S., Inc. - Head Start
101 East Willow
Lansing, Michigan 48906

WHITE - To Agency/Provider YELLOW - Main File

STUDENT IDENTIFICATION CRITERIA

Children eligible for MECEP must be four, but less than five years of age as December 1 of the year in which the program is offered. Children must be identified by one or more of the following characteristics which place them "at risk" of being educationally disadvantaged and in need of special assistance.

Child's Name: ______________________ D.O.B.: ______________

"AT-RISK" FACTORS	YES	NO
1. Low birth weight		
2. Developmentally Immature		
3. Physical and/or sexual abuse and neglect		
4. Nutritionally deficient		
5. Long-term or chronic illness		
6. Diagnosed handicapping condition (mainstreamed)		
7. Lack of a stable support system of residence		
8. Destructive or violent temperament		
9. Substance abuse or addiction		
10. Language deficiency or immaturity		
11. Non-English or limited English speaking household		
12. Family history of low school achievement or drop-out		
13. Family history of delinquency		
14. Family history of diagnosed family problems		
15. Low parental/sibling educational attainment or illiteracy		
16. Single parent		
17. Unemployed parent/parents		
18. Low family income		
19. Family density		
20. Parental loss by divorce or death		
21. Teenage parent		
22. Chronically ill parent (physical, mental or emotional)		
23. Incarcerated parent		
24. Housing in rural or segregated area		
25. Other		

Staff Signature: ______________________ Date: ______________

White - Main File Yellow - FSW

HEAD START DENTAL RECORD

Head Start requires that all children have a complete and current dental exam. Our records show this child has been or will be seen in your office. To document this, we appreciate your completing and returning this form.

Child's Name __________ Date of Birth __________

Parent Guardian __________ Phone __________

Address __________ City __________ Zip __________

Date of Upcoming Appointment __________ Dentist __________

HEALTH HISTORY

1. Does your child drink fluoridated water at home? Yes No Unknown

2. Does the child have any trouble with teeth, gums, or mouth that the parent knows about? Yes No

3. Has child previously seen a dentist? Yes No

4. Is child currently receiving any medication? Yes No

5. Child is reported to have:

	yes	no		yes	no
Allergies	___	___	Heart Vascular Dis	___	___
Asthma	___	___	Liver Disease	___	___
Bleeding	___	___	Rheumatic Fever	___	___
Diabetes	___	___	Sickle Cell Anemia	___	___
Epilepsy	___	___	Other: ______	___	___

6. Is child currently under a physicians care? Yes No

If yes, Physicians name __________

Date of last Dental exam __________ Services provided by: (name) __________

I GIVE PERMISSION FOR MY CHILD TO RECEIVE A DENTAL EXAMINATION AND TREATMENT AS NECESSARY AND FOR MY CHILD'S DENTAL RECORDS TO BE RELEASED TO C.A.C.S. PRE-SCHOOL PROGRAMS BY

Name of Dentist/Clinic: __________ Address: __________

Parents Signature: __________ Date: __________

HeadStart Staff: __________

DENTAL OFFICE USE ONLY

This form is not to be used for billing purposes. If C.A.C.S. Pre-School Programs is responsible for payment, please include a statement. C.A.C.S. Pre-School payment for extensive treatment requires PRIOR approval. Thank you.

Examination and Treatment Record (List recommended services also.)

Description	Date Completed	Cost of Service	Comments
EXAM			
CLEANING			
FLOURIDE			
BITEWINGS			

Add. Treat.	Date Completed	Cost of Service	Tooth	Surface

1. All planned treatment (___ is ___ is not) complete. If not, please list next appointment: ______ ; ______ ; ______

2. Is there evidence of baby bottle mouth? Yes No

3. Dental services NOT provided:
   - ____ Child uncooperative
   - ____ Child referred to:

Dentist's Name: __________

Estimated cost of Treatment: __________
Exact final cost of Treatment: __________
Treatment was billed to: __________

Dentist's Name: __________ Date: __________

Return completed form to:
C.A.C.S Pre-School Programs
101 E. Willow, Lansing, MI 48906

Phone 482 1504

C.A.C.S. HEAD START - FAMILY LOG SHEET

Child's Name:__________ DOB:________ Sex:_____ Race:_______

Address:________________ Returning:____ New:____ Spec. Needs:____

Mother:__________ DOB:______ FSW/HB Teacher:__________

Father:__________ DOB:______ # under 5 Yrs:____ Total # in HH:____

Telephone#:__________ Contact#:__________ Insurance:__________

Date	Contact	Type of Information	Comments
		Enrollment	
		Health Screening: Date________	
		Dental Screening: Date________	
		Immunizations: Comp._____ Incomp._____	
		Shots Needed:________	
		Birth Certificate:________	
		Referral for Services:	
		1. Commodity Food________	
		2. Parenting Class________	
		3. Clothing________	
		4. Emergency Food________	
		5. Education________	
		6. Dually Enrolled____ Where?______	
		7. Other________	

WHITE - Main File YELLOW - FSW

FAMILY NEEDS ASSESSMENT

____
HEAD OF HOUSHOLD

____
CHILD

____
FAMILY SERVICE WORKER

The Federal Government has requested that all Head Start families complete a Family Needs Assessment form. The purpose of the Family Needs Assessment is to help Head Start families realistically look at what they are doing now and some of the things they would like to change or do differently. The Family Service Workers are responsible for helping Head Start families complete the form, make referrals for services and assist in developing a plan to accomplish the goals that the families have chosen.

Your participation in completing this form and working with the Family Service Worker is totally voluntary. However, we would like to have your participation.

Are you willing to participate? YES _____ NO ______

Contact Notes: ______________________________________

____

____

____

____

____

____

____

FAMILY NEEDS ASSESSMENT

The following is a list of common areas of needs or concerns in all families. Please describe this family's present situation in each area. Indicate specific needs or concerns in each area.

FINANCIAL ASSISTANCE/EMPLOYMENT

Current Status: ______________________________

____

Needs/Concerns:

_____ Public Assistance
_____ Re-evaluation of grant amount/allowance
_____ Employment
_____ Better paying job
_____ Budgeting money
_____ Employability skills training
_____ Others ______________________________

Comments: ______________________________

____

____

EDUCATION/TRAINING

Current Status: ______________________________

____

Needs/Concerns:

_____ Reading Skills
_____ High School Completion
_____ College
_____ Vocational Training
_____ Others ______________________________

Comments: ______________________________

____

____

HOUSING

Current Status: ______________________________

____

Needs/Concerns:

_____ Homeless
_____ Better living conditions
_____ Adequate space
_____ Affordable housing
_____ Landlord/tenant concerns
_____ Plumbing, lighting, heating
_____ Utilities assistance
_____ Others ______________________________

Comments: ______________________________

____

FAMILY NEEDS ASSESSMENT, CONTINUED

TRANSPORTATION

Current Status: ____________________

____

Needs/Concerns:

- _____ Access to public transportation
- _____ Affordable personal transporatation
- _____ Car seat
- _____ Insurances, repair
- _____ Others ____________________

Comments: ____________________

____

____

HEALTH/NUTRITION

Current Status: ____________________

____

Needs/Concerns:

- _____ Doctor referral
- _____ Dentist referral
- _____ Medical expenses
- _____ Special health equipment needed
- _____ Others ____________________

Comments: ____________________

____

____

PARENTING/FAMILY RELATIONSHIPS

Current Status: ____________________

____

Needs/Concerns:

- _____ Parenting classes
- _____ Stress management
- _____ Child development
- _____ Counseling referral
- _____ Substance abuse referral
- _____ Domestic violence referral
- _____ Others ____________________

Comments: ____________________

____

____

FAMILY NEEDS ASSESSMENT, CONTINUED

LEGAL ASSISTANCE

Current Status: ____

____

Needs/Concerns: _____ Legal services _____ Michigan Welfare Rights

_____ Others ____________________

Comments: ____

____

____

SOCIAL SERVICES

Current Status: ____

____

Needs/Concerns: _____ Food referral _____ Clothing referral

_____ Shoe/Boot referral _____ Child care

_____ Others ____________________

Comments: ____

____

____

APPENDIX H

RELEASE OF INFORMATION

TO: Name ______________________ Agency: ______________________
Address: ____

REGARDING: Child's Name ______________________ D.O.B. __________
Insurance # ______________________ Center/HB ______________

We are requesting information regarding the above named child. Your assistance will be greatly appreciated. This information will be used to help us provide the most appropriate services for this child.

INFORMATION REQUESTED: (Please provide information only on items checked)

_______ IMMUNIZATION RECORDS

_______ INCOME VERIFICATION

_______ MEDICAL INFORMATION / RECORDS*

_______ BIRTH CERTIFICATE

_______ EDUCATIONAL RECORDS* Specify: ______________________

_______ MENTAL HEALTH RECORDS*

_______ HEALTH SCREENING (if from other than County Health Dept.)

_______ OTHER: ______________________

*If requesting this information, please complete the attached form(s).

****

C.A.C.S., Inc. - Head Start is authorized to obtain from or give to the following professional pertinent social, medical, or other information about the above named child, for whom I am legally responsible. I understand all information will remain confidential and that all information will be used for the benefit of the child named above. I release the C.A.C.S. Head Start Program and its Staff and the professional named above from any legal liability for giving or receiving information which I have permitted by signing this form. This consent is valid for one year after the date signed.

______________________________ ______________

Signature of Parent/Guardian Date

Return to: C.A.C.S., Inc. - Head Start
101 East Willow
Lansing, Michigan 48906

WHITE - To Agency/Provider YELLOW - Main File

PROGRAM YEAR 1991 - 1992

RELEASE OF INFORMATION FOR HEALTH DEPARTMENT

Scheduled Appointment:______________

I,__________________________________, hereby request and authorize
(Name of Parent/Guardian)

the Health Department, Medicaid Screening Clinic, Immunization Clinic, W.I.C., and Well Child Clinic to release to C.A.C.S., Inc. Head Start all relevant information and records concerning the health of:

____ ____________________
(Name of Child) Date of Birth

____ ____________________
(Signature of Parent/Guardian) Date

Address:__________________________________Phone:_________________

PROGRAM YEAR 1991 - 1992

RELEASE OF INFORMATION FOR HEALTH DEPARTMENT

Scheduled Appointment:______________

I,__________________________________, hereby request and authorize
(Name of Parent/Guardian)

the Health Department, Medicaid Screening Clinic, Immunization Clinic, W.I.C., and Well Child Clinic to release to C.A.C.S., Inc. Head Start all relevant information and records concerning the health of:

____ ____________________
(Name of Child) Date of Birth

____ ____________________
(Signature of Parent/Guardian) Date

Address:__________________________________Phone:_________________

PRELIMINARY HEALTH AGREEMENT

Child's Name:________________________ D.O.B.:____________

Head Start is interested in the health and development of each child. Immunizations, dental, medical, nutrition, and mental health services all contribute to a child's well-being. The parent's input and involvement in their child's health care is so important.

The following requirements must be met in order for your child to participate in the Head Start program.

IMMUNIZATIONS: _______ Complete _______ Needed

Immunizations Needed:________________________

HEALTH SCREENING: Location:________________________

Date:________________________

I arranged the above Health Screen appointment.

Parent Signature:________________________

DENTAL EXAM: Dentist:________________________

Date:________________________

****

HEALTH RELEASE

I hereby give my permission for my child to receive the necessary screenings, dental examinations, and immunizations required by Head Start and for C.A.C.S., Inc. - Head Start to forward my child's Health Records to the appropriate school at the completion of the Head Start Program.

I consent for C.A.C.S. Head Start to transport my child for any appointments which are necessary to fulfill the above requirements. I understand that the transportation will be provided only if necessary, and that I, the parent, will accompany the child to these appointments.

______________________________________ ____________________

Signature of Parent/Guardian Date

WHITE - Main File YELLOW - Teacher PINK - FSW

APPENDIX I

MICHIGAN STATE UNIVERSITY

OFFICE OF VICE PRESIDENT FOR RESEARCH AND DEAN OF THE GRADUATE SCHOOL

EAST LANSING • MICHIGAN • 48824-1046

May 18, 1992

Jia-Yau Doong
165 Anthony Dairy Annex

RE: GROWTH MONITORING OF HEAD START CHILDREN IN TRI-COUNTY AREA, IRB #92-159

Dear Mr. Doong:

UCRIHS' review of the above referenced project has now been completed. I am pleased to advise you that since reviewer comments have been satisfactorily addressed, the conditional approval given by the Committee at its May 4, 1992 meeting has now been changed to full approval.

You are reminded that UCRIHS approval is valid for one calendar year. If you plan to continue this project beyond one year, please make provisions for obtaining appropriate UCRIHS approval one month prior to May 4, 1993.

Any changes in procedures involving human subjects must be reviewed by the UCRIHS prior to initiation of the change. UCRIHS must also be notified promptly of any problems (unexpected side effects, complaints, etc.) involving human subjects during the course of the work.

Thank you for bringing this project to our attention. If we can be of any future help, please do not hesitate to let us know.

Sincerely,

David E. Wright, Ph.D.
Chairman
University Committee on Research
Involving Human Subjects

DEW/pjm

cc: Dr. Sharon Hoerr

APPENDIX J

EPSDT TRAINING SCHEDULE

MARCH 1992 - (Lansing)	**APPLICATION DEADLINE: FEBRUARY 12, 1992**
Professional	March 4 and 5
Hearing	March 9 and 10
Measurements	March 9 and 10
Denver II	March 11 and 12
Vision	March 11 (Classroom) March 12 and 13 (Practicums)
Lab	March 6
Clerical	March 6

APRIL 1992 (Vision and Hearing Only) - This will take the place (Washtenaw - Ann Arbor) of July Hearing and Vision Training

	APPLICATION DEADLINE: MARCH 12, 1992
Hearing	April 6 and 7
Vision	April 1 (Classroom) April 2 and 3 (Practicums)

MAY 1992 - (Marquette)	**APPLICATION DEADLINE: APRIL 3, 1992**
Professional	May 12 and 13
Hearing	May 11 and 12
Measurements	May 5 and 6
Denver II	May 14 and 15
Vision	May 19 (Classroom) May 20 and 21 (Practicums)
Lab	May 7
Clerical	May 8

JUNE-JULY 1992 - (Washtenaw - Ann Arbor) (No Vision or Hearing)	**APPLICATION DEADLINE: JUNE 2, 1992**
Professional	June 23 and 24
Measurements	June 30 and July 1
Denver II	June 25 and 26
Lab	July 2
Clerical	July 2

SEPTEMBER 1992 - (Lansing)	**APPLICATION DEADLINE: AUGUST 21, 1992**
Professional	September 16 and 17
Hearing	September 28 and 29
Measurements	September 15 and 16
Denver II	September 30 and October 1
Vision	September 30 (Classroom) October 1 and 2 (Practicums)
Lab	September 18
Clerical	September 18

NOVEMBER 1992 - (Saginaw or Flint Area)	**APPLICATION DEADLINE: OCTOBER 13,1992**
Professional	November 3 and 4
Hearing	November 16 and 17
Measurements	November 3 and 4
Denver II	November 5 and 6
Vision	November 9 and 10
Lab	November 5
Clerical	November 5

2/10/92

APPENDIX K

[illegible]

APPENDIX L

CODEBOOK

LOCATION	VARIABLE	ITEM DESCRIPTION	ITEM #	CODING SCHEME
1/1-5	ID	Subject code number		#####
1/6	SEX	Subject' sex		1 female 2 male
1/7-12	DOB	Date of birth		mm/dd/yy
1/13-18	DOM	Date of measurement		mm/dd/yy
1/19-22	HEIGHT	Subject's height(in)		##.##
1/23-26	WEIGHT	Subject's weight(lb)		##.##
2/1-5	ID	Subject code number		#####
2/6-8	HCT	Hematocrit(%)		##.#
2/9	HH	Head of Household's relation with subject		1 mother 2 father 3 other
2/10	MARITAL	Parent marital status		1 married 2 single 3 separated 4 divorced 5 widowed
2/11	NCHILD	No. of children		#
2/12	HHSIZE	Household size		#
2/13-17	FINCOME	Family income		#####
2/18	FSTAMP	Have Food Stamp or not		1 yes 2 no
2/19	RACE	Subject's race		1 Am Indian 2 Black 3 Asian or Pacific islander 4 Mexican 5 Puerto Rican 6 other Hispanic 7 White 8 Middle Eastern 9 South-eastern Asian 0 other
2/20	HANDICAP	Subject handicapped or not		1 yes 2 no
2/21	YRPROGM	Years in program		#
2/22	MEDICAID	on Medicaid or not		1 yes 2 no
2/23	PRETERM	Birth early than three weeks or not		1 yes 2 no
2/24-27	BWEIGHT	Birth weight(LB)		##.##
2/28	HOSPITAL	Hospitalized or illness		1 yes 2 no
2/29	APPETITE	Appetite change		recently or not

2/30	NOTFOOD	Chewing things not food	1 yes 2 no
2/31	SWALLOW	Trouble chewing or swallowing	1 yes 2 no
2/32	CONCERN	Have any concern about child eats	1 yes 2 no
2/33	WIC	Subject on WIC or not	1 yes 2 no
2/34	HHEMPLOY	Is head of household employed	1 yes full time 2 yes part time 3 yes seasonal or periodic 4 no
2/35	SPEMPLOY	Is spouse employee	1 yes full time 2 yes part time 3 yes seasonal or periodic 4 no 5 N/A
2/36	HHEDCA	Head of household's education	1 K-3 2 4-6 3 7-11 4 High school Diploma 5 post high school 6 college (assoc.) 7 college (BS/BA degree) 8 Advance degree 9 none
2/37	SPEDUCA	Spouse education	1 K-3 2 4-6 3 7-11 4 High school Diploma 5 post high school 6 college (assoc.) 7 college (BS/BA degree) 8 Advance degree 9 none 0 N/A

3/1-2	YROB	Subject's year of birth	##
3/3-4	MOOB	Subject's month of birth	##
3/5-6	DAOB	Subject's day of birth	##
3/7-8	MOYROB	Mother's year of birth	##
3/9-10	MOMOOB	Mother's month of birth	##
3/11-12	MODAOB	Mother's day of birth	##
3/13-14	1STYROB	1st child's year of birth	##
3/15-16	1STMOOB	1st child's month of birth	##
3/17-18	1STDAOB	1st child's day of birth	##

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