

Growth Patterns of First-Generation Southeast Asian Americans From Birth to 5 Years of Age

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Objective: The objective of this study was to compare patterns of growth (height, weight, occipitofrontal circumference) of Hmong, Lao, and white children conceived and born in the United States.

Methods: The study design involved a retrospective review of longitudinal cohorts from clinic records. Participants included 146 white, 112 Hmong, and 49 Lao children on whom data were collected from birth to 5 years of age. All were patients of a community clinic in a poor urban neighborhood. The study included children whose mothers conceived and received all prenatal care in the United States and gave birth in Minnesota during a 10-year period. Measurements on family characteristics, height, weight, and occipitofrontal circumference were obtained.

Results: The white children generally approximate the medians of national (National Center for Health Statistics [NCHS]) reference data. Lao children (especially boys) are found to be short and proportionately light relative to reference data. Hmong children are found to be short relative to reference data but are disproportionately heavier, so that weight-for-height is considerably higher than reference data. In Hmong girls, mean weight-for-height z scores increase from $-0.5 z$ at birth to $1.26 z$ at 5 years, an average increase of $0.31 z$ per year.

Conclusions: Lao and Hmong children conceived and born in the United States continue to have short stature (10th to 25th percentile). Hmong children have evidence of early overweight that is distinctive when compared with Lao and white counterparts. (J Am Board Fam Pract 1996;9:328-35.)

Beginning in 1975 great numbers of Southeast Asian refugees began to emigrate to the United States as a consequence of the political upheavals in Southeast Asia. These refugees included Vietnamese, Cambodians, Lao, and Hmong (those who lived in the mountains of Laos and who, like the Vietnamese, are descendants of the Chinese; the lowland Lao and Cambodians, on the other hand, trace their ancestry to India). Southeast Asian children who had spent some or all of their lives in Southeast Asia (including the refugee resettlement camps) were found, upon their relocation, to have low weight-for-age and height-for-age¹⁻³ relative to the National Center for Health Statistics (NCHS) reference data.⁴ On arrival, these children had evidence of poor nutritional

status and high rates of exposure to infectious disease,^{5,6} which could have contributed to some of the observed growth deficiencies. The earliest study of first-generation Southeast Asian children born in America revealed a pattern of growth in length-for-age and weight-for-age approximating the median of the NCHS reference data in the early months of life, but then growing at progressively slower rates thereafter, so that at 18 months of age length-for-age and occipitofrontal (head) circumference approximated the 10th to 25th percentiles, weight-for-age approximated the 25th percentile, and weight-for-length approximated the median.⁷

More recent cross-sectional studies of Asian children in the first 5 years of life indicate there has been considerable improvement in growth status of those children in the United States who participate in the Supplemental Food Program for Women, Infants and Children (WIC).⁸ The occurrence of low height-for-age (less than the 5th percentile of NCHS reference data) remains higher than in some other groups, but it has de-

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creased dramatically since 1980. The occurrence of low weight-for-height (less than the 5th percentile) for Asian children nationally approximates that of black, Hispanic, and white children who participate in the WIC program. Presumably, these temporal changes have resulted from improved socioeconomic circumstances for these children, many of whom are presumed to have been born in Asia.

A recent cross-sectional sample in Minneapolis of Hmong children who were born in the United States indicated early growth patterns strikingly different from those reported in other studies.⁹ While the Hmong children were expectedly short relative to the NCHS reference data, by 3 and 4 years of age they had significantly greater weight-for-height than the reference data (fourfold beyond the 95th percentile). These findings suggested early obesity in a group previously considered to be at low risk for obesity. Even though this study drew attention to a potential problem, it had several shortcomings. Because the study was cross-sectional, it was unclear whether the observed patterns described the developmental course for individuals, conclusions obtainable only from longitudinal data. Whether the relative overweight was unique to Hmong children or possibly extended to other Southeast Asian children could not be ascertained. Finally, although comparisons were made with national reference data, comparisons with local white children would strengthen the conclusions.

We report here the growth patterns of a longitudinal cohort of white children and of two Southeast Asian ethnic groups (Lao and Hmong) of different ancestral background but from similarly poor socioeconomic circumstances; all children were conceived and born in the United States and received health care during the first 5 years of life. We believe it is important for clinicians to understand expected patterns of growth in Southeast Asian children so their health can be evaluated more meaningfully, especially in light of historical patterns and recently observed temporal changes. Further, if Hmong or other Southeast Asian children are, indeed, at risk of early overweight or obesity, it is important to verify this risk and to alert the clinical community so that primary preventive efforts can be instituted to minimize the psychosocial consequences often experienced by obese children and to attempt to

keep obese children from becoming obese adults, with all of the attendant medical ramifications.

Methods

The study sample comprised children enrolled at the Community-University Health Care Center/Variety Children's Clinic, a neighborhood-based clinic of The University of Minnesota Hospital and Clinic located in a disadvantaged area of Minneapolis. The clinic serves an ethnically diverse population, including a large number of Southeast Asian families. Chief Southeast Asian ethnic groups include Hmong, Lao, Vietnamese, and Cambodian. Information was obtained from clinic records for a cohort of children born in Minnesota between January 1979 and February 1989. Only children whose mothers had conceived and received all prenatal care in the United States and gave birth in Minnesota were selected.

To be included in the sample, valid measurements of weight and length (until 2 years) or stature were required at seven of the following ages: birth, 0.5, 2, 4, 6, 9, 12, 15, 18, 24, 36, 48, and 60 months. All children had measurements at birth or 0.5 months; 2, 4, or 6 months; 24 months; and on at least four additional occasions. The average number of observations per child was nine. Head circumference data were available through 24 months of age. The measurements were made according to prescribed clinic protocols at comprehensive care visits or visits for an acute illness considered unlikely to affect weight. Premature infants and infants or children with chronic medical problems were excluded.

This sampling process resulted in three semi-longitudinal ethnic samples of children: 146 white (73 male, 73 female), 112 Hmong (56 male, 56 female), and 49 Lao (25 male, 24 female). Because of missing visits at some target ages, the number of children in each ethnic and sex group for whom data were available varied somewhat from age to age. The ranges for the number of cases at an age were as follows: white male 35 to 62, white female 32 to 67, Hmong male 24 to 55, Hmong female 22 to 54, Lao male 9 to 23, and Lao female 10 to 24. Hmong and Lao ethnicities are distinct and were determined by self-declaration of parents, surname, and first language spoken. Numbers of Southeast Asian children of other ethnicities were too few to be included in the study. The ethnic-specific samples include

Table 1. Birth Weight and Family Characteristics of Hmong, Lao, and White American-Born Children from Birth to 5 Years of Age.

Variable	Hmong Mean ± SD	Lao Mean ± SD	White Mean ± SD	F or (χ^2)*	P Value
Birth weight, grams					
Male	3203 ± 470	2996 ± 424	3438 ± 464	9.0	< 0.001
Female	3144 ± 480	3093 ± 445	3262 ± 640	1.0	0.38
Maternal age, years	25.7 ± 7.0	25.5 ± 5.0	28.3 ± 5.8	6.3	0.002
Family income, \$	14,258 ± 6,019	13,054 ± 6,813	16,498 ± 10,848	1.2	0.34
Family size, n	7.4 ± 1.8	4.8 ± 1.7	4.2 ± 1.4	135.4	< 0.001
	Percent	Percent	Percent		
Maternal marital status, married	93	82	72	(13.4)	0.001
Maternal employment					
Full- or part-time	2	14	28	(37.6)	< 0.001
Student	1	6	0		
Homemaker	76	71	59		
Unemployed	14	9	12		
Other	7	0	1		

*F statistics from analysis of variance of continuously distributed variables; χ^2 statistics from categorical tests of independence.

some same-sex siblings. Nevertheless, when the analyses were repeated with one child per family, no findings were altered.

Family characteristics for Hmong and Lao children were obtained through full-time native interpreters employed by the clinic. The following data were recorded at the time of the child's birth: maternal age, annual family income, family size (parents plus children), maternal marital status, and maternal employment. For each of the family characteristics, data were available for at least 85 percent of the children. The pattern of missing data for family characteristics is not systematically related to ethnic group or to a child's height or weight. Less complete data were collected on breast-feeding practices.

To appreciate better the differences between observed patterns of growth and reference data, z scores have been recommended.¹⁰ z Scores express anthropometric variables in standard deviation units specific to each age and sex. Accordingly, a z score of 0 corresponds to the median or 50th percentile of the reference data, and a z score of -1.0 indicates the observation is -1.0 standard deviation below the median. z Scores are useful because they allow comparisons of different measurements to be made using the same scale, and they standardize observed measurements across ages for differences in normal variation. For example, a child's weight that is 1 kg lighter than the median at 3 months of age ($\approx -1.2 z$) is of more concern

clinically than if the child were 5 years old ($\approx -0.3 z$). z Scores were calculated for height-for-age, weight-for-age, and weight-for-height relative to the NCHS reference data¹¹ and smoothed mathematically across ages.¹²

Results

Birth weight and family characteristics are presented for the three ethnic groups in Table 1. Lao children had the lowest mean birth weights, and the white children had larger birth weights than either Southeast Asian group, statistically significantly so in boys. Mothers of the white children were slightly older than mothers of children in the other two groups, and fewer of the white mothers were married when their children were born. Mean family incomes were all low and did not differ significantly among groups because of the considerable variation within each group; nevertheless, the mean income for the white families exceeded mean incomes for the Southeast Asian families by 16 to 26 percent. There were marked differences in family size and patterns of maternal employment, with Hmong families 50 percent larger than families from the other groups, and Hmong mothers less likely to work outside the home.

Mean time since arriving in the United States was 4.5 years for Hmong mothers and 4.1 years for Lao mothers. Correlations between time since arriving in the United States and birth weight were

not statistically significant. Similarly, the year of the child's birth was not statistically significantly correlated with birth weight or subsequent height and weight, indicating no evidence of temporal change. The period of observation was rather short, however, to detect such differences.

Our data on breast-feeding are incomplete, but there are striking differences among groups. Based on information gathered on about 56 percent of the sample children at 2 weeks of age, the proportion of mothers reporting breast-feeding was 76 percent for the white mothers, and 8 percent and 1.5 percent for the Lao and Hmong mothers, respectively. At 12 months, 17 percent of the white mothers reported that they were still breast-feeding, but none of the Southeast Asian mothers reported breast-feeding (based on 47 percent of the sample). These estimates correspond with clinical impressions of breast-feeding practices for these groups.

The patterns of growth in median height and weight relative to the NCHS percentiles are presented in Figures 1 and 2. Median heights of the white boys and girls approximate the reference median at most ages, although they fall slightly below the reference median after 36 months of age. Median weights for white children mirror the pattern in height growth and approximate the refer-

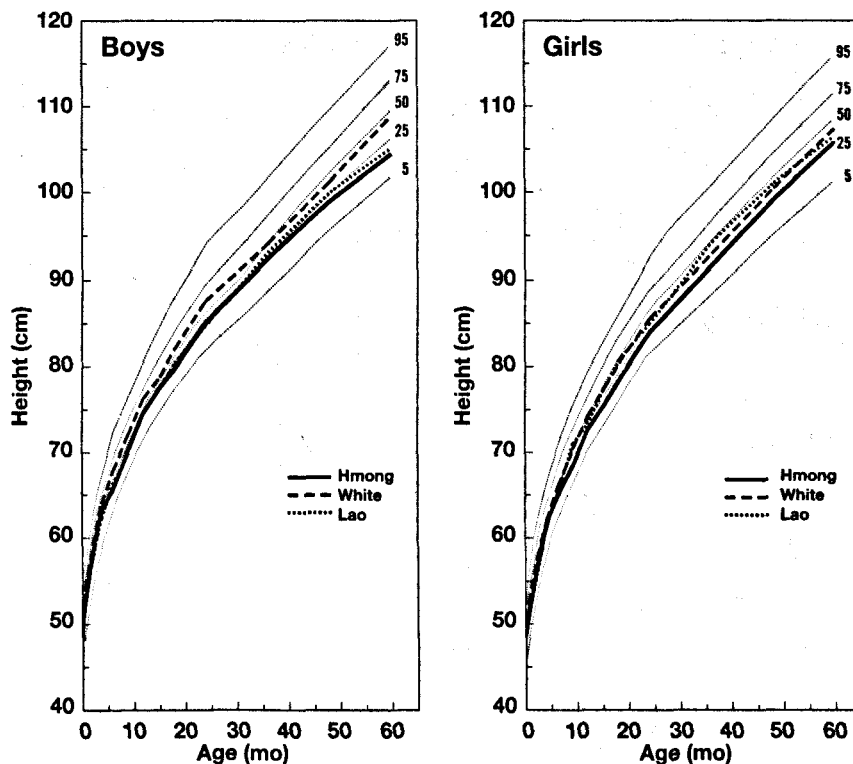


Figure 1. Median height for Hmong, Lao, and white boys and girls relative to National Center for Health Statistics reference data. Percentiles for birth to age 1.9 years are for recumbent length; those for age 2 years and above are for standing height.

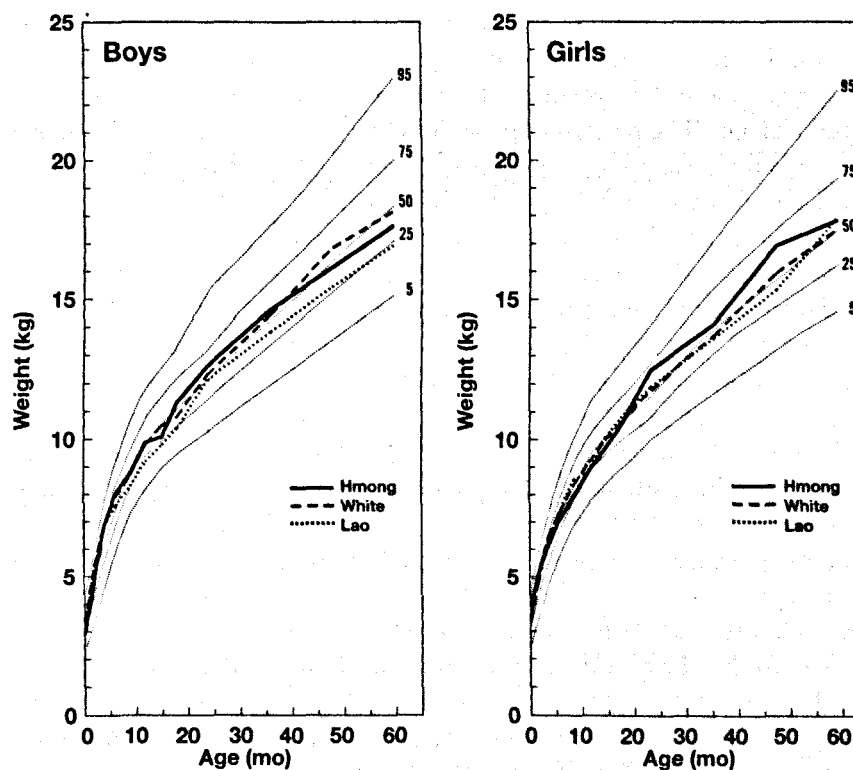


Figure 2. Median weight for Hmong, Lao, and white boys and girls relative to National Center for Health Statistics reference data.

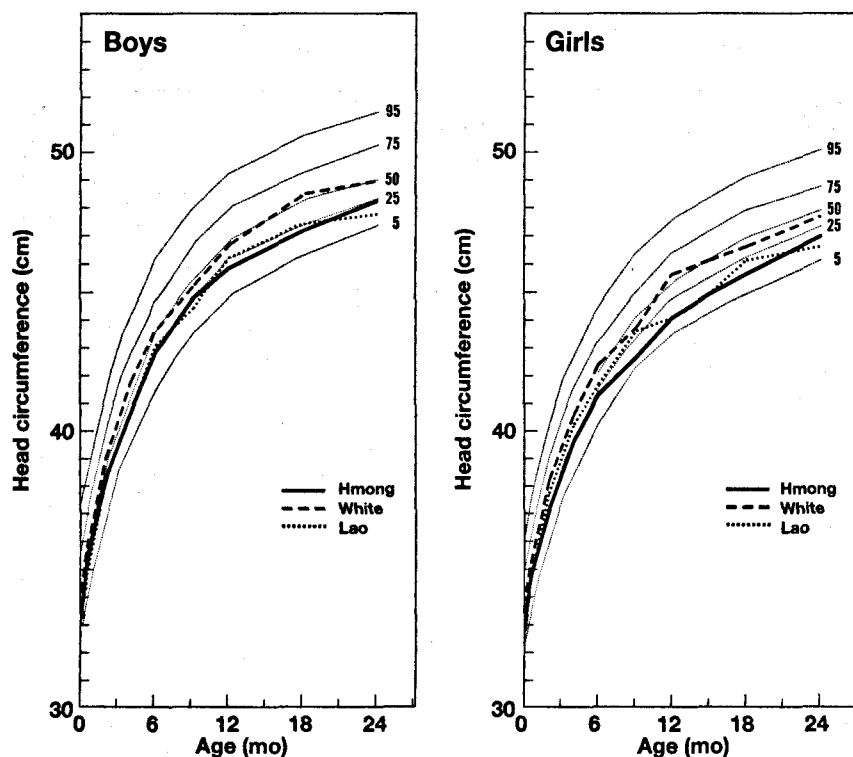


Figure 3. Median occipitofrontal circumference for Hmong, Lao, and white boys and girls relative to National Center for Health Statistics reference data.

ence median throughout the age range. In contrast, Lao and Hmong boys are shorter from birth, and their median heights approximate the 25th percentile until about 3 years of age, after which they fall to about the level of the 10th percentile at 5 years of age. The pattern of growth in height in Lao girls is similar to that of white girls, although the Lao girls are slightly shorter at most ages. Hmong girls are the shortest at every age after 4 months, and their pattern of growth in height is similar to that of Hmong boys. Median weights of Hmong and white children of both sexes and of Lao girls approximate the reference median throughout the age range studied. Median weights of Lao boys, however, approximate the 25th percentile after the first year of life, a pattern similar to their growth in height. Median head circumference for the three groups of children reflects the relative patterns observed for height, except for the white children, who slightly exceed the reference median for head circumference after 2 months of age (Figure 3).

Additional information concerning the patterns of growth in these children relative to the national reference data can be obtained from the pattern of mean z scores (Figures 4 [boys] and

5 [girls]). Some of the irregularities across age probably result from having small sample sizes; nevertheless, some important group differences can be observed that are more difficult to discern relative to reference percentiles. The marked differences between growth in height of the white boys compared with the Hmong and Lao boys are especially evident (Figure 4). By 60 months of age, mean height-for-age for Hmong and Lao boys approximates a full standard deviation below the reference median (mean $z = -1.2$, Hmong; mean $z = -0.96$ Lao). A similar, but less extreme, pattern of low height-for-age in Hmong girls is also apparent.

A disparity between patterns of height-for-age and weight-for-age for Hmong children can be seen in mean z scores for weight-for-height. In Hmong boys the mean weight-for-height z scores for these very short boys rises sharply from $-0.35 z$ at birth to $0.82 z$ at 6 months of age; weight-for-height decreases from this high value, but remains elevated at about $0.4 z$ at 60 months. In Hmong girls, mean weight-for-height z scores are similar with the other two groups until 12 months of age; after this age, mean weight-for-height z scores for Hmong girls rise throughout the next 4 years, reaching $1.26 z$ at 60 months. These findings support a conclusion of overweight in the Hmong children, especially the girls. The white children also have mean weight-for-height z scores somewhat elevated relative to the reference data after 28 months in girls and 40 months in boys.

Discussion

Studies of foreign-born Southeast Asian refugee children in the United States have documented their overall poor growth status.¹⁻³ Growth deficiencies were attributed to poor nutritional and socioeconomic conditions in their native land and

in the refugee camps where they resided before being relocated to this country. Reports differ considerably as to the specific Asian ethnic groups included, but studies are fairly uniform in describing preschool patterns of low height-for-age and low weight-for-age (10th to 25th percentiles) and weight-for-height approximating the median. First-generation Southeast Asian children (Lao, Cambodian, and Vietnamese) in Washington State displayed patterns of growth similar to foreign-born Southeast Asian refugee children in the first 18 months of life, with progressive falloff relative to the NCHS reference data after 6 months of age.⁷

Our longitudinal cohort of first-generation Southeast Asian-American children includes Lao and Hmong children who, as distinct ethnic groups, differ also in their patterns of growth in height and weight. Hmong children of both sexes and Lao boys are considerably shorter than their white local counterparts, and their median heights are at or below the 25th percentile relative to the NCHS reference data. The pattern of weight growth in the Lao children is similar to their pattern of height growth, so weight-for-height is generally similar to the reference data and the white comparison children. A qualitatively different pattern of weight and height growth occurs in Hmong children. While the Hmong children are short, their weight increases at a rate commensurate with or exceeding that of their much taller white peers, so that the Hmong become overweight. In Hmong girls average weight-for-height z scores increase at approximately 0.3 z per year from 12 to 60 months of age. A very similar pattern of low height-for-age and accompanying high weight-for-height was documented for a separate sample of Hmong children in Minneapolis participating in the WIC program.⁹

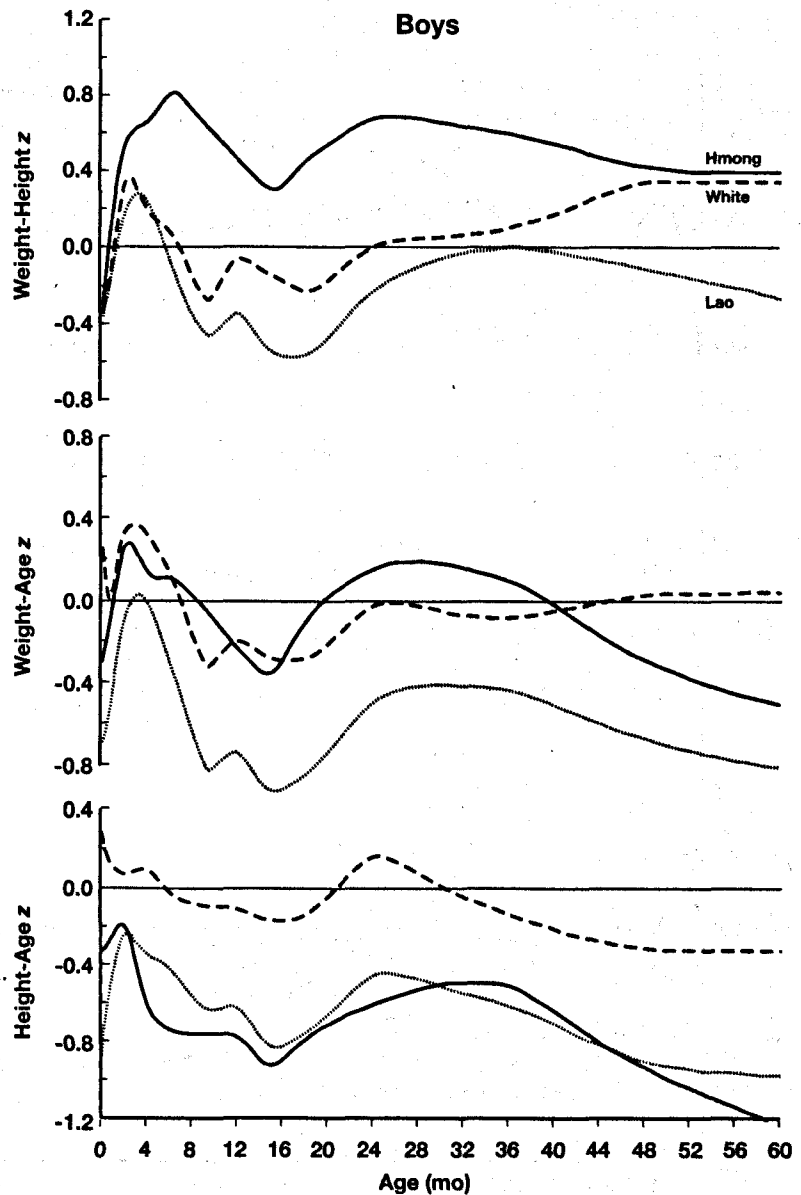


Figure 4. Mean z scores for boys relative to National Center for Health Statistics reference data.

Though not unexpected, it is not known with certainty whether such overweight children will become obese adolescents and adults, with the attendant risk factors for chronic disease. As obese school-age children, they are at risk for the psychosocial consequences of preadult obesity. Interestingly, Hmong adolescents in Minnesota are more eager to adopt US foods than are Cambodian or Vietnamese youth.¹³ In a recent study, Southeast Asian adolescents (Cambodian, Lao, Hmong, and Vietnamese) in St. Paul, Minn, were not more overweight than their black or white peers, but Hmong boys and girls had a greater mean body mass index than did those in the other

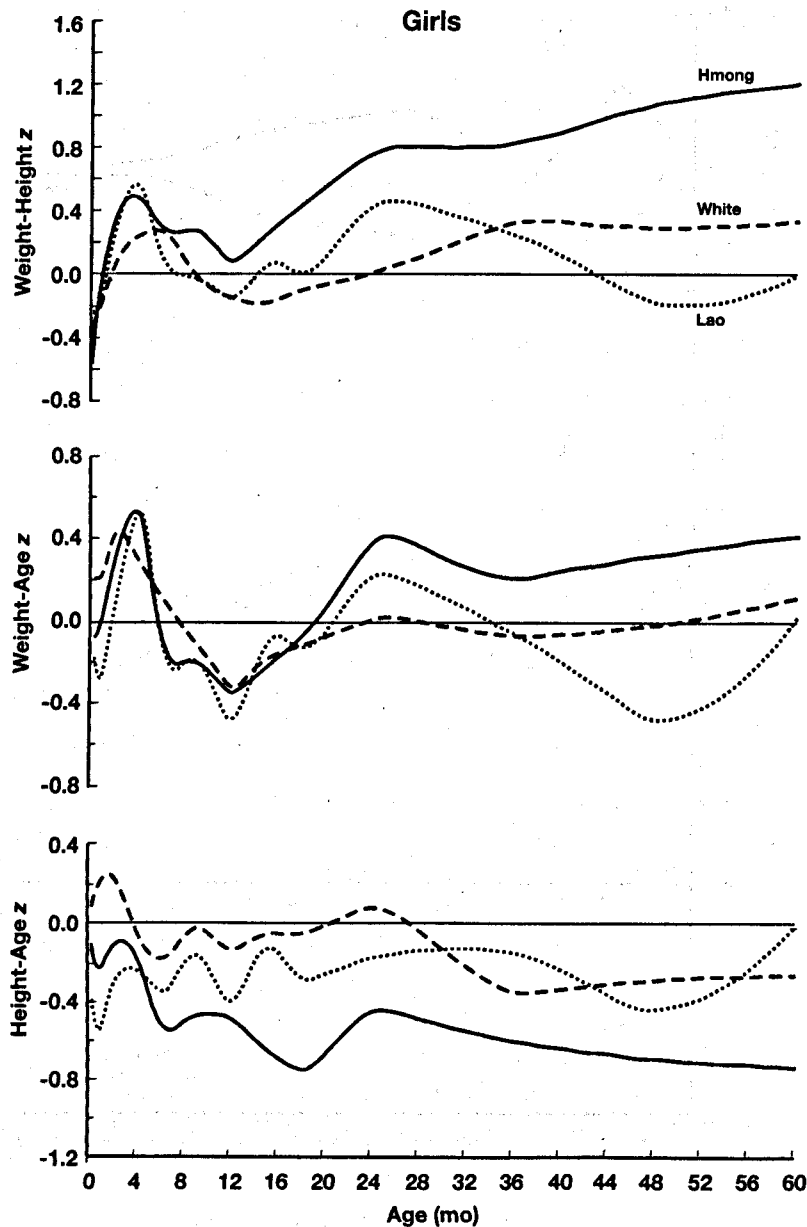


Figure 5. Mean z scores for girls relative to National Center for Health Statistics reference data.

Southeast Asian ethnic groups.¹⁴ Unexpectedly, Hmong and Lao boys and Cambodian and Hmong girls were at greater risk for hypertension than black youth and white youth of the same weight. This report did not specify how long the Southeast Asian youth had been in this country or whether they were born in this country.

The causes of differences in early growth patterns among the three ethnic groups are unknown. The group differences in family characteristics do not provide obvious explanations. The observed differences in weight and height patterns are probably due to other behavioral

practices and biological differences associated with the ethnic groups. For example, little is known regarding food preferences and preparation, cultural perceptions of overweight in children, and childhood activity patterns in the Hmong and Lao groups. Eighty-two percent of a sample of Hmong homemakers in California indicated they typically use pork lard in frying; in addition, fat children were considered healthy by 40 percent and unhealthy by only 29 percent of the respondents.¹⁵

We interviewed selected native Hmong and Lao women concerning nutritional and child-rearing practices that might be related to our findings. According to our informants, Hmong parents usually associate fatness in children with prosperity rather than ill health; high-fat foods are more common in Hmong diets than in Lao diets; Hmong parents are reluctant to allow their children to play outdoors for fear of strangers; and young Hmong girls are expected to help their mothers and not to be as active in play as are young boys. These anecdotal views are suggestive of possible factors associated with early obesity in Hmong children, but firm conclusions must await further systematic research study and evidence.

Qualitative similarities in some aspects of growth are seen in all three ethnic groups studied. Each sex and ethnic group shows rapid increases in mean weight-for-age z scores until about 4 months of age. This rise is followed by sharp declines in weight-for-age until about 12 months and a subsequent rebound in weight through the end of the second year of life (Figures 4 and 5). The reasons for this pattern are unknown. All of the children studied received care at the same clinic and presumably shared general socioeconomic features. A majority of all children were participants in WIC (81 percent Hmong, 87 per-

cent Lao, and 52 percent white). WIC provides children with iron-fortified formula throughout the first year of life and iron-fortified baby cereal and vitamin C-fortified juice from ages 6 to 12 months. After age 12 months, the WIC food package includes milk or cheese, iron-fortified cereal, eggs, dried beans, and juice. Whether the marked dip observed in weight growth in the latter half of the first year and the following rapid weight gain can be attributed to patterns of WIC supplementation or usage is unknown.

From a clinical perspective it appears that short stature (10th to 25th percentile) can be expected in Hmong and Lao children born in this country, and that such children do not require evaluation for an organic basis for that short stature and will not benefit from aggressive management. From anecdotal reports by Hmong informants, overweight in Hmong children is not a local phenomenon; it is a prominent observation in California as well, where the population of Southeast Asian families is tenfold larger than it is in Minneapolis and St. Paul. Certainly replication of early overweight in separate samples of Hmong children argues that this finding is not due to chance. We believe the data are sufficient to alert the clinical community to a possible emerging pediatric problem in a group heretofore considered to be at low risk for obesity so that efforts aimed at primary prevention can be developed and implemented.

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