

PREVALENCE OF OVERWEIGHT AND OBESITY
IN A POPULATION OF PACIFIC ISLAND CHILDREN

A THESIS SUBMITTED TO THE GRADUATE DIVISION
OF THE UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN

BIOMEDICAL SCIENCES

DECEMBER 2005

By

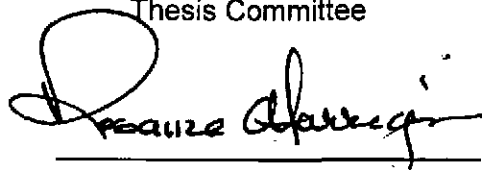
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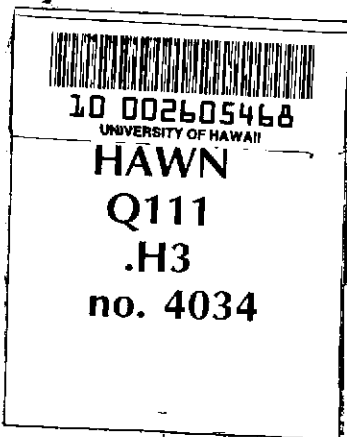
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Acknowledgment:

This work was supported by NIH NCRR #R25 RR019321 and U.S. Department of Defense Pacific Telehealth and Technology Hui, contract #1435-04-03-CT-87084. Special thanks to Drs. Rosanne Harrigan, James Davis, David Easa, Lon White and Chris Derauf for their mentorship, time and patience. Thank you also to my family for their support.

Abstract:

Background: Native Hawaiian (NH) and other Pacific Island (PI) adults have a high prevalence of obesity and obesity-related illness such as diabetes and cardiovascular disease. There is little data on childhood obesity in NH and PI children. The Wai`anae area on Oahu is an ideal place to study these children since it is home to the largest community of NH. The Wai`anae Coast Comprehensive Health Center (WCCHC) is the largest medical provider to NH.

Objective: To determine the prevalence of overweight in a population of NH and PI children who attend a health center in Hawai'i

Methods: This was a cross-sectional analysis of height, weight and demographic data obtained from WCCHC clinical electronic database. Participants were children from 1 month to 19 years of age who attended WCCHC from 1998 to 2004. Based on Center for Disease Control 2000 Growth Charts, infants <2 years old (yo) were classified as overweight if weight-for-length > 95% for age/sex. Children \geq 2 yo were classified as overweight (BMI-for-age/sex > 95%) or "at risk" (BMI-for-age/sex = 85-95%).

Results: There were 13,408 participants and 33,547 observations; 62.8% were NH, 10.1% Caucasian, 7.2% Samoan (Sam), 9.7% Filipino (Fil). Overweight status differed markedly among the ethnicities. Sam infants had much higher prevalence of overweight starting from 6-11 months, increasing to 39.3% by 18-23 months. Overweight prevalence for children \geq 2 yo exceeded NHANES 1999-2002 in all age groups except Fil teen girls. By 8-9 years almost 50% of children

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were either "at risk" or overweight. Overweight prevalence between males and females diverged in later teen years as the number of overweight girls dropped. Sam clearly showed the highest prevalence of overweight across all age groups, peaking at 62% in 14-15 yo. Based on mean BMI z-scores, Sam also had the highest degrees of overweight. Fil infants were more likely to be underweight and stunted but older Fil children still had a high overweight prevalence.

Conclusions: Overweight prevalence was high from early childhood in this health center population. Sam children clearly showed the highest prevalence and degree of overweight starting from infancy. The cause and consequence of the high prevalence and the dramatic difference between ethnic groups needs further investigation but may include prenatal and early childhood growth as well as cultural, environmental and socio-economic factors. Childhood obesity prevention, and possibly intervention programs, for NH and Sam children should begin in early childhood.

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Chapter 1

Introduction and Background:

Hawai'i has been described as one of the nation's healthiest states but Native Hawaiians have a very high prevalence of type 2 diabetes, cancer, cardiovascular disease and the shortest life spans of all the major ethnic groups in Hawai'i¹⁻⁵. Native Hawaiians and other Pacific Island (PI) adults also have high prevalence of obesity, a condition intimately related to the development of these chronic diseases⁶⁻⁸.

Despite the high prevalence of obesity among Native Hawaiians and other PI adults, there are few data on childhood obesity in Native Hawaiian and other PI children. Baruffi et al found marked ethnic differences in the prevalence of overweight among children 12 to 59 months of age in Hawai'i⁹. Samoan children from 1-4 years of age were heaviest and tallest among the ethnic groups while Filipinos were the shortest. In a study of children from 1992-1996 in a selected school district in Hawai'i, Chai et al reported that 26.5% of the Native Hawaiians children were overweight compared to 20.7% of non-Hawaiian children.¹⁰ There have been no studies to determine the prevalence of obesity among Native Hawaiian or Pacific Island children from infancy to late childhood.

Knowledge of the prevalence of childhood obesity is needed in order to address problems in populations that have disproportionately high numbers of adults with obesity-related illnesses, such as that of Native Hawaiians. It is well known that children who are obese are likely to become obese adults, especially if their parents are obese¹¹. Childhood obesity is associated with major cardiovascular risk factors including hypertension, dyslipidemia, hyperinsulinemia and insulin resistance¹²⁻¹⁴. Obese children also are more likely to have psychological problems including low self-esteem and

behavioral problems. Prevalence data in children is crucial in the development of more effective prevention and intervention strategies against obesity.

Objectives:

To determine the prevalence of overweight in a population of Native Hawaiian and Pacific Island children attending a health center in Hawai'i

Chapter 2

Materials and Methods

Study Population:

The study participants were patients who attended the Wai'anae Coast Comprehensive Health Center (WCCHC). WCCHC serves the people of the leeward coast of O'ahu and is the largest health services provider for Native Hawaiians. According to the 2000 census, Wai'anae has a population of 42,343 and is home to the largest community of Native Hawaiians in Hawaii. In 2002 WCCHC served over 22,000 patients; 52% were Native Hawaiian or part-Hawaiian, 61% were at or below poverty the level and 45% were 20 years or younger.

Methods:

This was a cross-sectional analysis of height, weight and other demographic information obtained from the WCCHC clinical electronic database. Participants were WCCHC patients from January 1998 through September 2004, ages 1 day to 19 years, who had both height and weight recorded together on at least one clinic visit.

Growth classifications were based on the Center for Disease Control (CDC) 2000 growth charts¹⁵. Infants under 24 months were classified as *overweight* if their weight-for-length/height > 95%, for age and *underweight* if weight-for-length/height < 5%. Infants were also classified as *stunted* if length- or height-for-age was < 2 z-score units below the CDC growth chart mean and *tall* if length- or height-for-age was > 2 z-score units above the CDC mean.

For children 2-19 years of age, overweight status was based on body mass index (BMI), which was calculated using the formula weight (kilograms) divided by height (meters) squared. Children 2-19 years were classified as either normal weight, *at-risk* for

overweight if their BMI for age/sex was 85% to 95%, or *overweight* if their BMI for age/sex was > 95%. Children 12 years and older were further classified as overweight if their BMI was 25 to 30, obese if their BMI was > 30 or extremely obese if their BMI was > 40.

Prevalence of overweight was compared to the National Health and Nutrition Examination Survey (NHANES) 1999-2002 in which 10.3% of 2-5 year olds, 15.8% of 6-11 year olds and 16.1% of 12-19 year olds were overweight¹⁶.

Growth percentiles and z-scores were calculated for analysis using software programs obtained from the CDC.¹⁷ Based on CDC 2000 Growth Charts, participants with extreme values in height and weight were excluded; specifically those with height z-score < -4.0 or > +4.0 or weight z-score < -4.0 or > +5.0. Children with BMI z-scores < -5 and infants with a weight-for-length/height < -5 were excluded. Participants were then placed together into specific age groups. The record with the date closest to the mid-age of the age group was retained leaving one record per child per age group for the analysis. Entries with missing values or errors were also excluded. Data was analyzed using SAS (Version 9.1) statistical software.

Chapter 3

Results

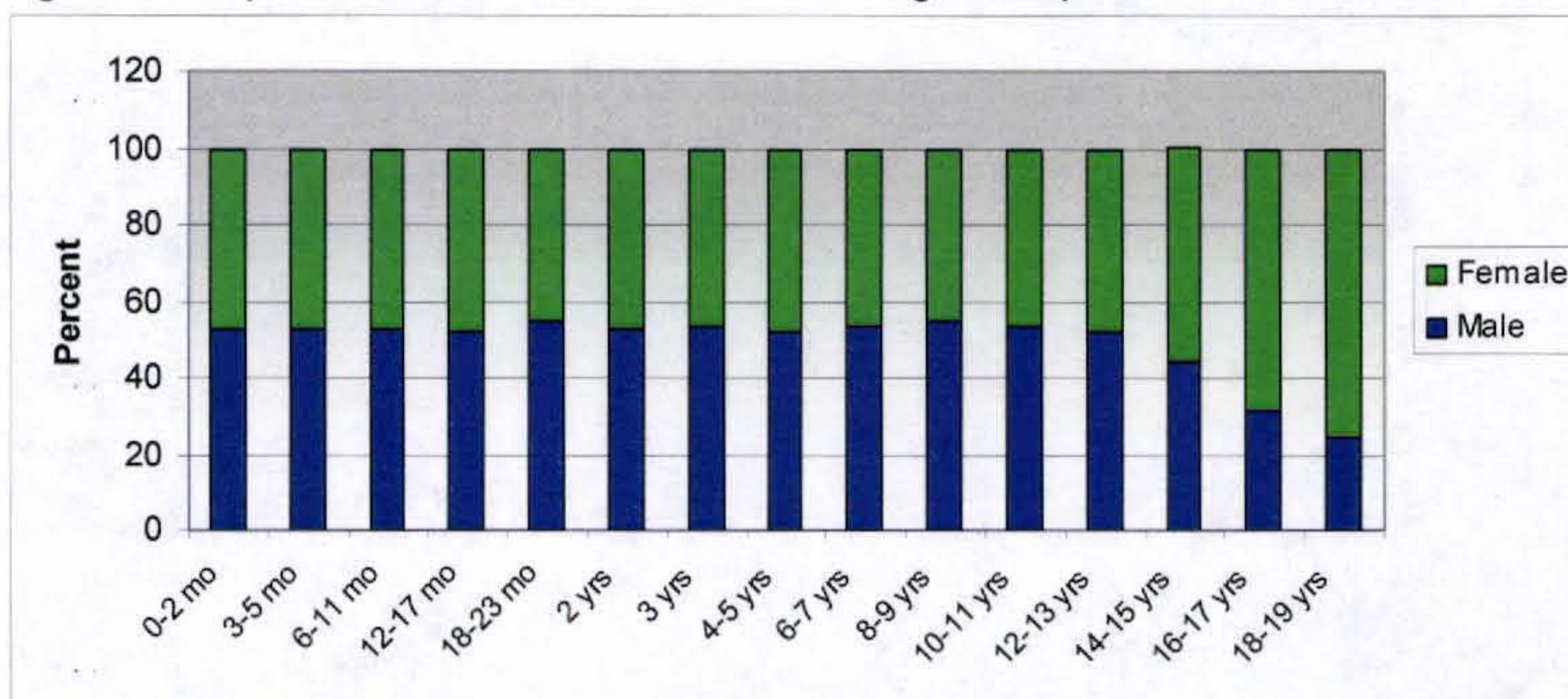
Over the six and a half year period from January 1998 to September 2004 there were 13,408 individuals in the study from 1 day to 19 years of age and 33,527 observations. Ethnicity was self-reported by the child's parent or caregiver; 62.8% were Native Hawaiian or part-Hawaiian, 10.1% were Caucasian, 7.2% were Samoan and 9.7% were Filipino. Hispanics and African Americans made up 1.8% and 1.2% of the participants respectively (Table 1).

Table 1: Characteristics of the Study Population

	All ethnic groups	Hawaiian	Caucasian	Filipino	Samoan
No. of observations	33,527	20,958	3,378	3,276	2,416
Ethnicity %		62.8	10.1	9.7	7.2
% of Males	46	48	46	30	51
% No insurance	13.2	9.3	10.2	54.5	11.2
% DSSH/Medicaid	4.7	4.4	5.8	2.5	8.4
% Private Insurance	17.1	19.0	24.1	17.4	15.9
% Quest Insurance	65.1	67.2	60.0	25.6	64.5

Males made up 45.8 % of the observations (Figure 1). The proportion of males was consistently slightly higher than females in subjects under 10 years of age. Over the age of 10, the proportion of females markedly increased; by 18-19 years 68% of the observations were on females. This imbalance is due to high utilization by teen females of the women's health services, such as family planning. This imbalance was most marked in the Filipino participants; by 19 to 20 years of age 90.5% of Filipino participants were female.

Figure 1: Proportion of Females vs. Males in all Age Groups

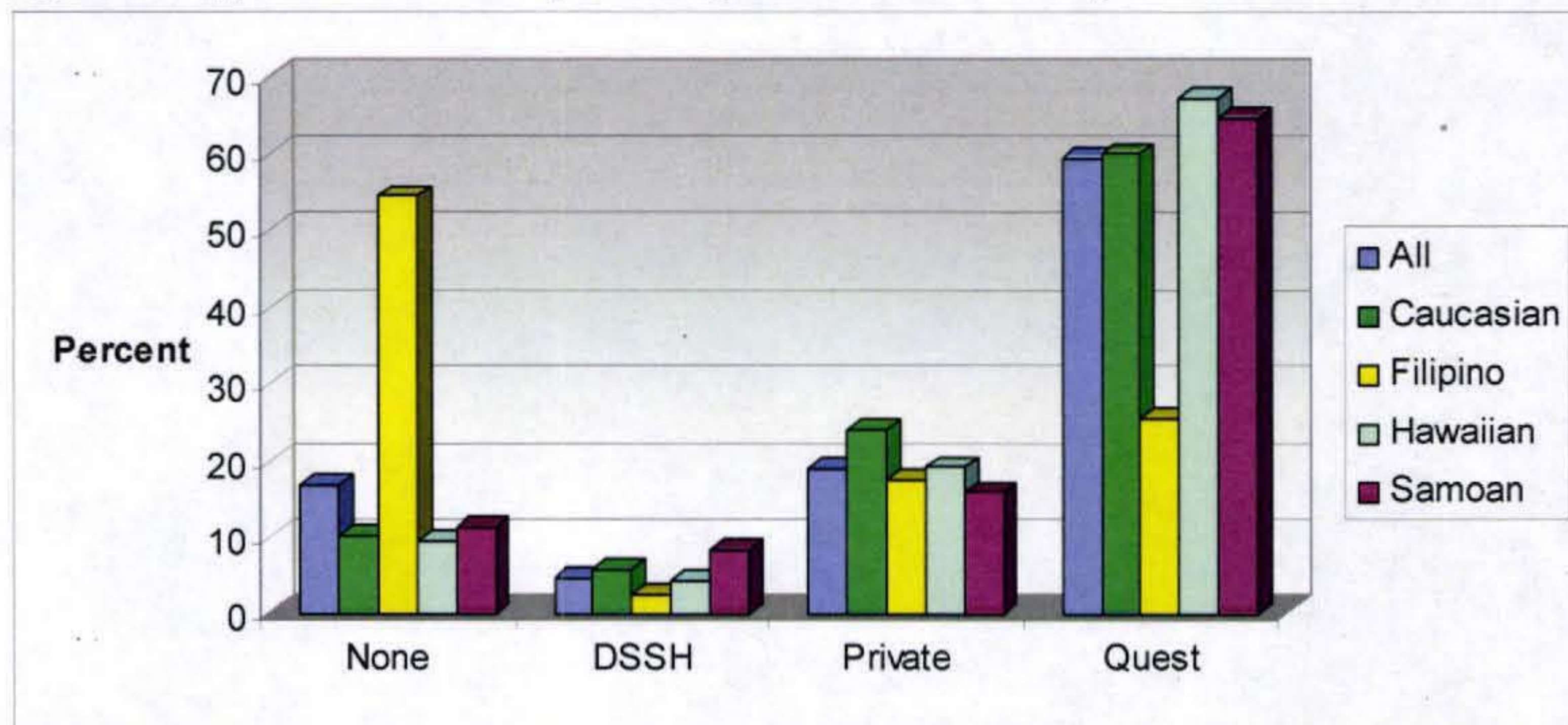


Of all the children's clinical visits, 65% were covered by the State of Hawaii's QUEST medical insurance plan for lower income residents, 17% were covered by private insurance plans, 4.7% were covered by the Department of Social Services and Housing (DSSH)/Medicaid and 13.2% were uncovered by medical insurance. The proportion of children with insurance coverage differed depending on age and ethnic group (Table 2). The number of uninsured subjects rose steadily after age 12, especially among Filipino children, peaking at 78% among 16-17 year old Filipinos. Overall, a much higher proportion of Filipino children (54.5%) ages 2 to 19 years were uninsured compared with the other major ethnic groups (Figure 2).

Table 2: Participants' health insurance

Age Group	No Insurance	DSSH	Private	Quest
Children 2-19 years (all)	13.2	4.7	17.0	65.0
Children 2-11 years (all)	4.1	4.4	17.1	74.4
Caucasian	4.1	5.9	20.0	70.0
Filipino	9.1	5.1	28.7	57.2
Hawaiian	2.8	3.5	16.3	77.4
Samoaan	7.3	7.3	13.8	71.6
Children 12-19 years (all)	26.4	5.1	20.3	48.3
Caucasian	13.8	5.8	26.7	53.7
Filipino	67.2	1.8	14.2	16.8
Hawaiian	15.4	5.3	21.7	57.6
Samoaan	14.4	9.3	17.6	58.6

Note: No insurance=No health insurance, DSSH=Department of Social Services and Housing/Medicaid, Private=Private health insurance, Quest=State of Hawaii low-income medical insurance plan. All = all ethnicities

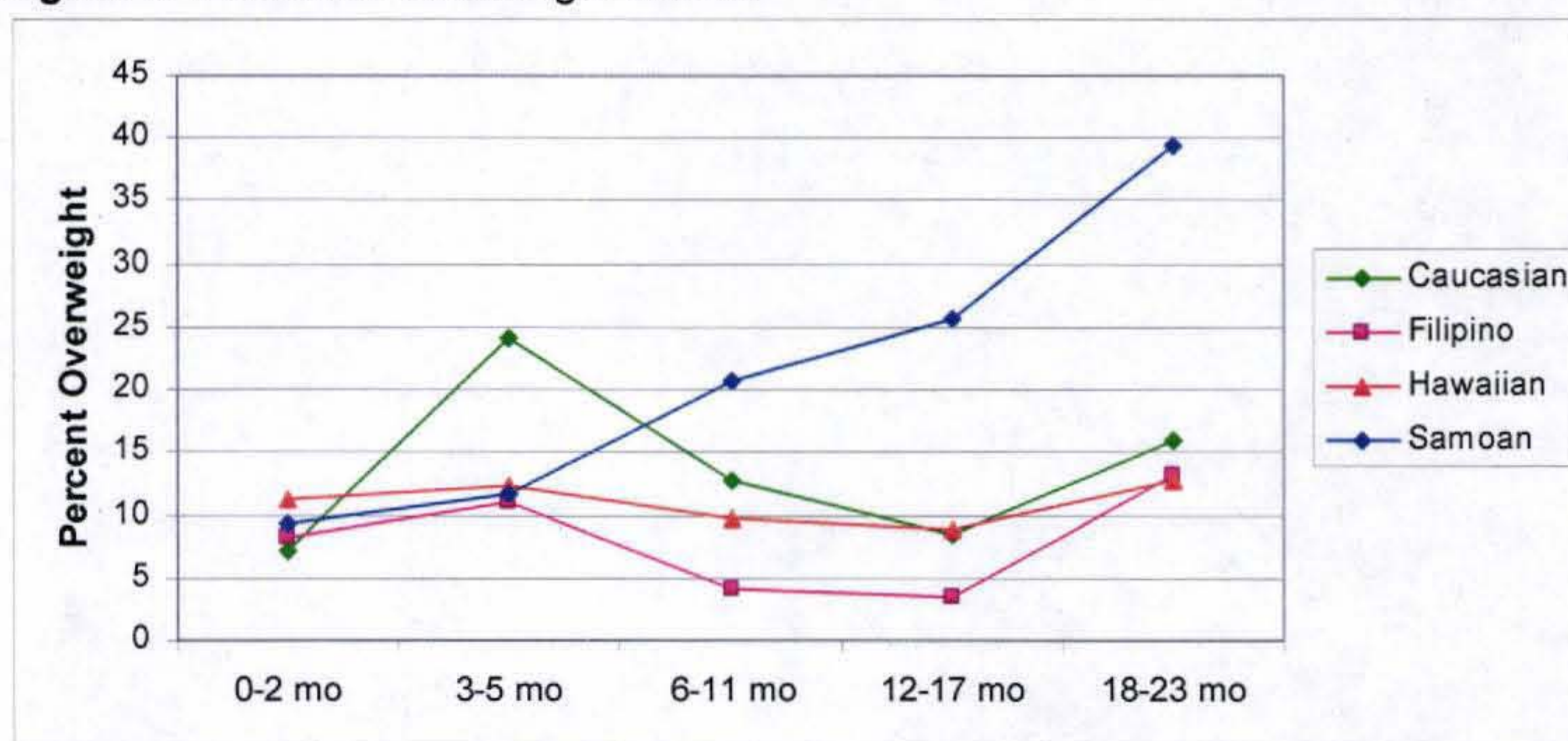
Figure 2: Type of Insurance by Ethnicity in Children 2 to 19 years

None=No health insurance, DSSH=Department of Social Services and Housing/Medicaid, Private=Private health insurance, Quest=State of Hawaii low income medical insurance plan

Infants: Birth to 23 months

There were 8,872 observations on 2,539 individuals age 1 day to 23 months. Males made up 53% of the observations. By 18-23 months 14.2% of the participants were overweight, 15% of males and 13.3% of females. Prevalence of overweight differed markedly according to ethnicity (Figure 3). Starting from 6-11 months of age, Samoans had a markedly higher prevalence of overweight compared to other ethnic groups. Overall 39.4% of Samoan children 18-23 months of age were overweight; 37.8% of Samoan boys and 41.2% of Samoan girls.

Figure 3: Percent of Overweight Infants



Filipino infants were more likely to be underweight (Table 3). This was most marked at 12-24 months of age when 16.4% of Filipino infants were underweight.

Table 3: Percent of Underweight Infants

	1-23 months	12-17 months	18-23 months
Caucasian	9.1	7.3	7.3
Filipino	12.4	16.1	14.7
Hawaiian	7.4	5.8	7.1
Samoan	5.7	6.3	1.4

Note: Underweight=weight-for-height-for-age <5% based on 2000 CDC Growth Charts

Filipino infants were also more likely to be stunted, with length- or height-for-age less than 2 z-score units below the mean. Samoan infants, on the other hand, were more likely to be tall (Table 4).

Table 4: Percent of Stunted vs. Tall Infants

	Stunted	Normal height	Tall
Caucasian	5.6	89.9	4.5
Filipino	9.1	89.5	1.3
Hawaiian	4.0	93.2	2.8
Samoan	2.1	86.9	11.0

Note: **Stunted**=length- or height-for-age<2 z-score units below mean (based on 2000 CDC Growth Charts), **Normal**=length- or height-for-age -2 to +2 z-scores units, **Tall**=length- or height for age > 2 z-score units above mean.

Comparison of length z-scores (Table 5) show that Samoan infants were significantly longer/taller than Hawaiians, the second longest group (difference 0.64, 95% CI 0.54-0.73). On the other hand, Filipino infants were significantly shorter than infants from the other ethnic groups. Mean length z-score of Filipino infants were significantly less than that of Caucasian infants, the second smallest group (difference 0.39, 95% CI -0.25 to -0.54).

Table 5: Mean Weight-for-length and Length z-scores of Infants < 24 months

	Mean Weight for length z-score ¹ Infant	Mean Length z-score ¹ Infant
Samoan	0.62	0.67
Hawaiian	0.21	0.03
Caucasian	0.18	-0.05
Filipino	-0.09	-0.44

Note: A z-score indicates how far and in what direction, an item deviates from its distribution mean and is expressed in its distribution's standard deviation. The above z-scores are based on the 2000 CDC growth charts. ¹=Infants 1 day to 23 months

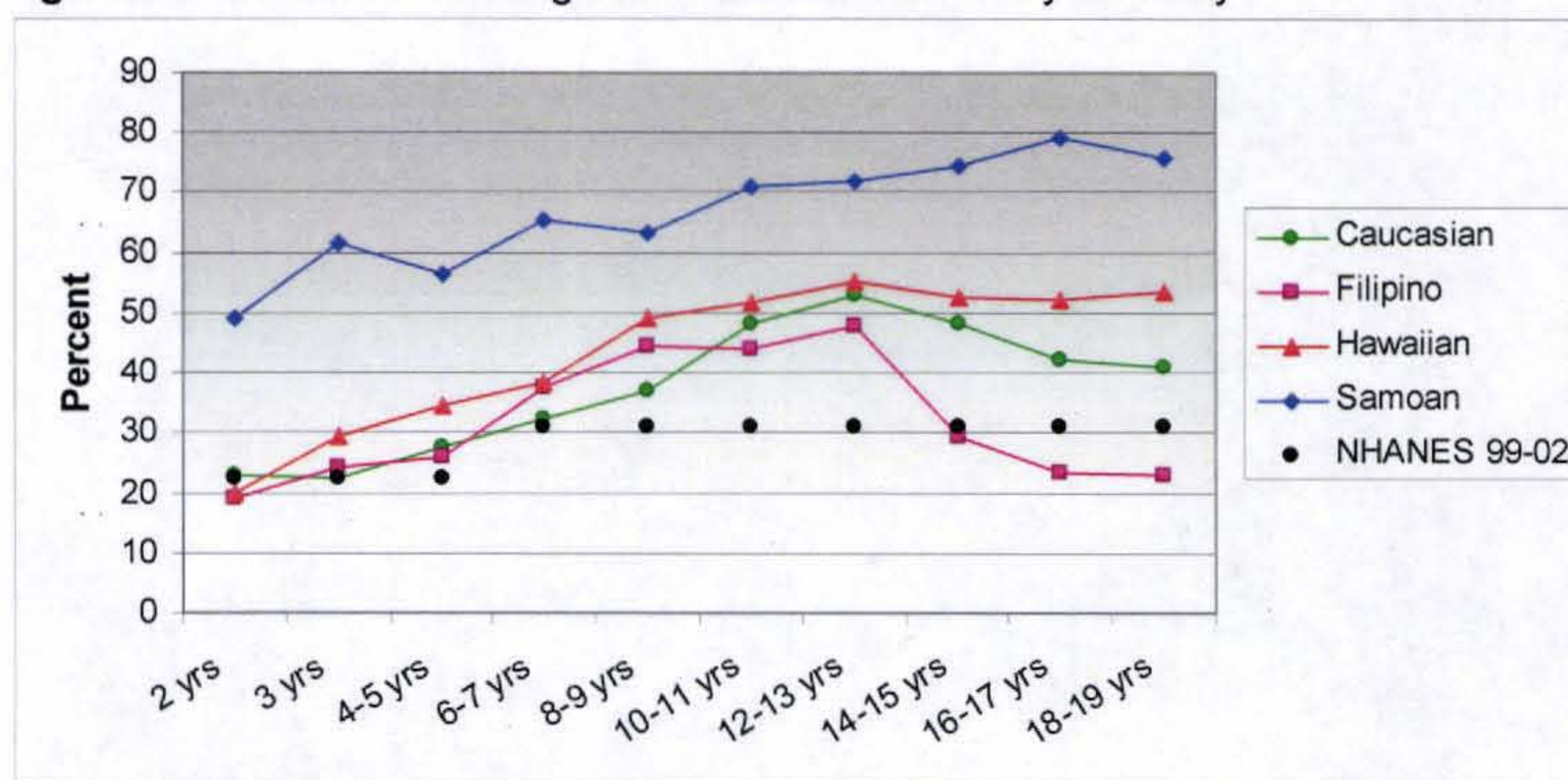
Children: 2 to 19 years

There were 24,430 clinic visits included in the analyses on 12,215 children age 2 to 19 years of age; 43% were males and 56.9% were females. As noted above, the proportion of entries of boys was slightly higher than the proportion of entries of females until the early teens when the number of females dramatically increased.

Overall, 17.1% of participants between 2 and 19 years of age were "at risk" for overweight and 26.5% were overweight. Starting at about 3 years of age, the prevalence of overweight exceeded the prevalence of overweight found in the 1999-2002 NHANES survey (Figure 4). By 8 to 9 years of age almost 50% of children were either overweight or "at risk" for becoming overweight.

Prevalence of overweight was, by far, the highest among Samoan children, apparent from 2 years of age (Figure 4). Boys in all age groups, in all four major ethnic groups, far exceeded overweight prevalence found in NHANES 1999-2002 (Table 6 and 7). Of the females, prevalence of overweight also exceeded NHANES 1999-2000 in all age groups except for Filipino teen females.

Figure 4: Percent of Overweight or "At-Risk" Children by Ethnicity



Note: NHANES 99-02=NHANES 1999-2002 survey of children¹⁶

Table 6: Prevalence of "At-Risk" for Overweight and Overweight Children 2-19 years (BMI for age/sex \geq 85%)

BOTH SEXES	WCCHC Data – 1998 to 2004					NHANES 1999 to 2002*			
	All	Caucasian	Filipino	Hawaiian	Samoaan	All	NH White	NH Black	Mexican American
2-5 yrs	31.4	25.7	24.9	30.1	45.7	22.6	20.8	23.2	26.2
6-11 yrs	46.5	40.3	41.9	46.8	67.0	31.2	28.6	33.7	38.9
12-19 yrs	47.6	45.3	25.6	53.2	76.0	30.9	27.9	36.8	40.7
BOYS									
2-5 yrs	32.8	28.0	25.3	31	57.8	23.0	21.7	20.9	27.6
6-11 yrs	48.1	38.0	48.3	48.3	71.2	32.5	29.3	29.7	43.9
12-19 yrs	54.5	48.0	46.1	54.9	76.2	31.2	29.2	32.1	41.9
GIRLS									
2-5 yrs	29.9	23.4	24.3	29.2	53.2	22.3	20.0	25.6	25.0
6-11 yrs	43.0	42.8	33.6	45.2	62.7	29.9	27.7	37.9	33.8
12-19 yrs	42.2	43.3	21.7	52	75.7	30.5	26.5	41.9	39.3

Note: All=all ethnic groups, *NHANES = NHANES 1999-2002, NH=non-Hispanic¹⁶

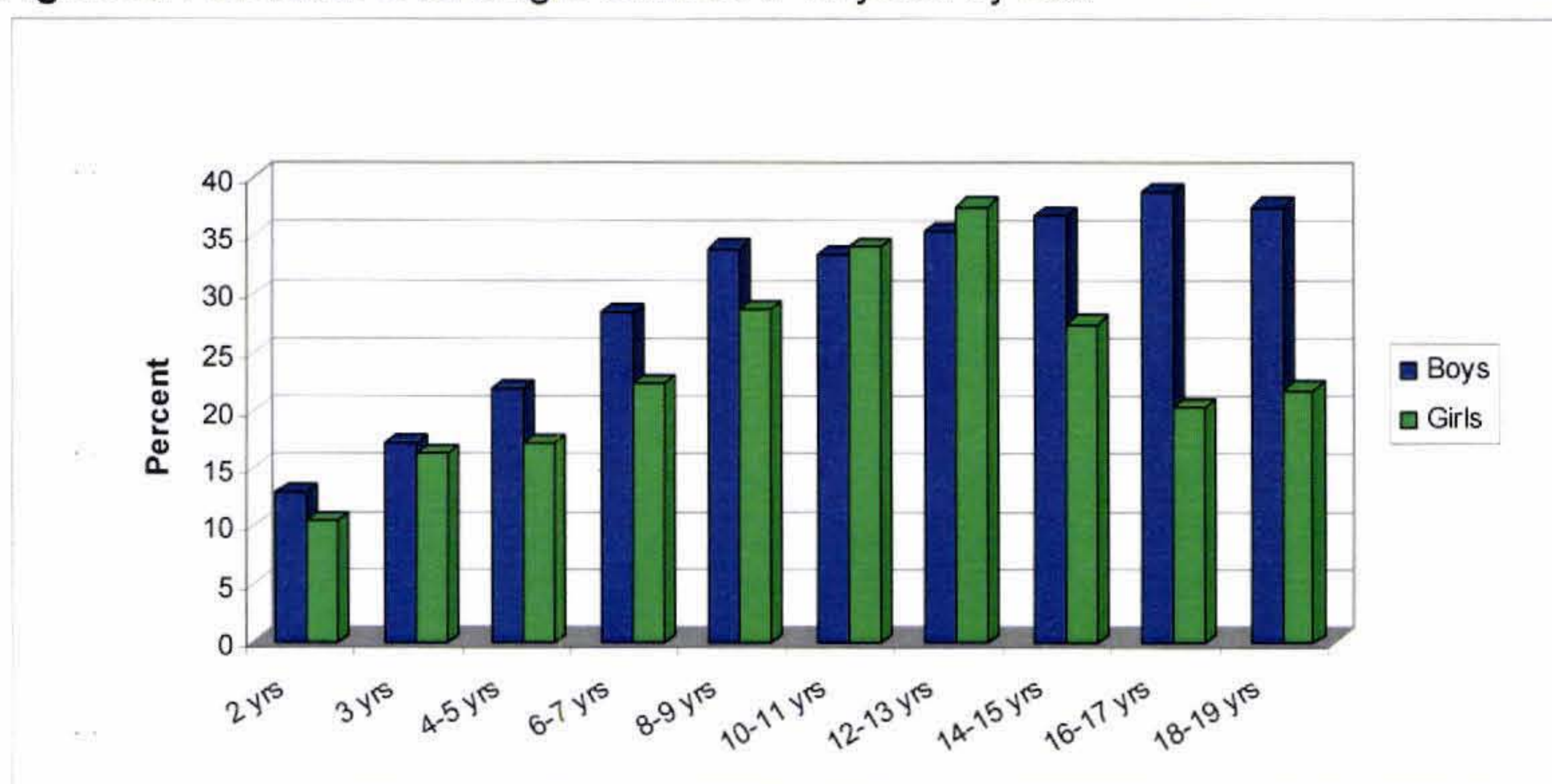
Table 7: Prevalence of Overweight Children 2-19 years (BMI for age/sex > 95%)

BOTH SEXES	WCCHC Data – 1998 to 2004					NHANES 1999 to 2002*			
	All	Caucasian	Filipino	Hawaiian	Samoaan	All	NH White	NH Black	Mexican American
2-5 yrs	17.4	13.3	13.0	16.2	36.3	10.3	8.6	8.8	13.1
6-11 yrs	30.5	25.2	29.2	30.3	48.3	15.8	13.5	19.8	21.8
12-19 yrs	28.9	27.4	11.6	32.7	58.3	16.1	13.7	21.1	22.5
BOYS									
2-5 yrs	18.9	14.0	14.2	17.2	39.9	9.9	8.2	8.0	14.1
6-11 yrs	32.0	25.1	30.4	31.3	52.0	16.9	14.0	17.0	26.5
12-19 yrs	37.1	30.2	27.6	37.3	64.4	16.7	14.6	18.7	24.7
GIRLS									
2-5 yrs	15.8	12.6	11.2	15.1	31.8	10.7	9.1	9.6	12.2
6-11 yrs	28.8	25.2	28.1	29.1	44.6	14.7	13.1	22.8	17.1
12-19 yrs	24.3	25.4	8.5	29.7	52.6	15.4	12.7	23.6	19.9

Note: All=all ethnic groups, *NHANES = NHANES 1999-2002, NH=non-Hispanic¹⁶

Overweight prevalence between the sexes diverged by 14-15 years of age as the number of overweight teen girls dropped (Figure 5). This sex difference was most pronounced in Filipinos in which 25.7% of males but only 8.7% of females 18-19 years of age were overweight. It was least pronounced in Caucasians in which 22.9% of males and 24.1% of females 18-19 years of age were overweight.

Figure 5: Percent of Overweight Children 2-19 years by Sex

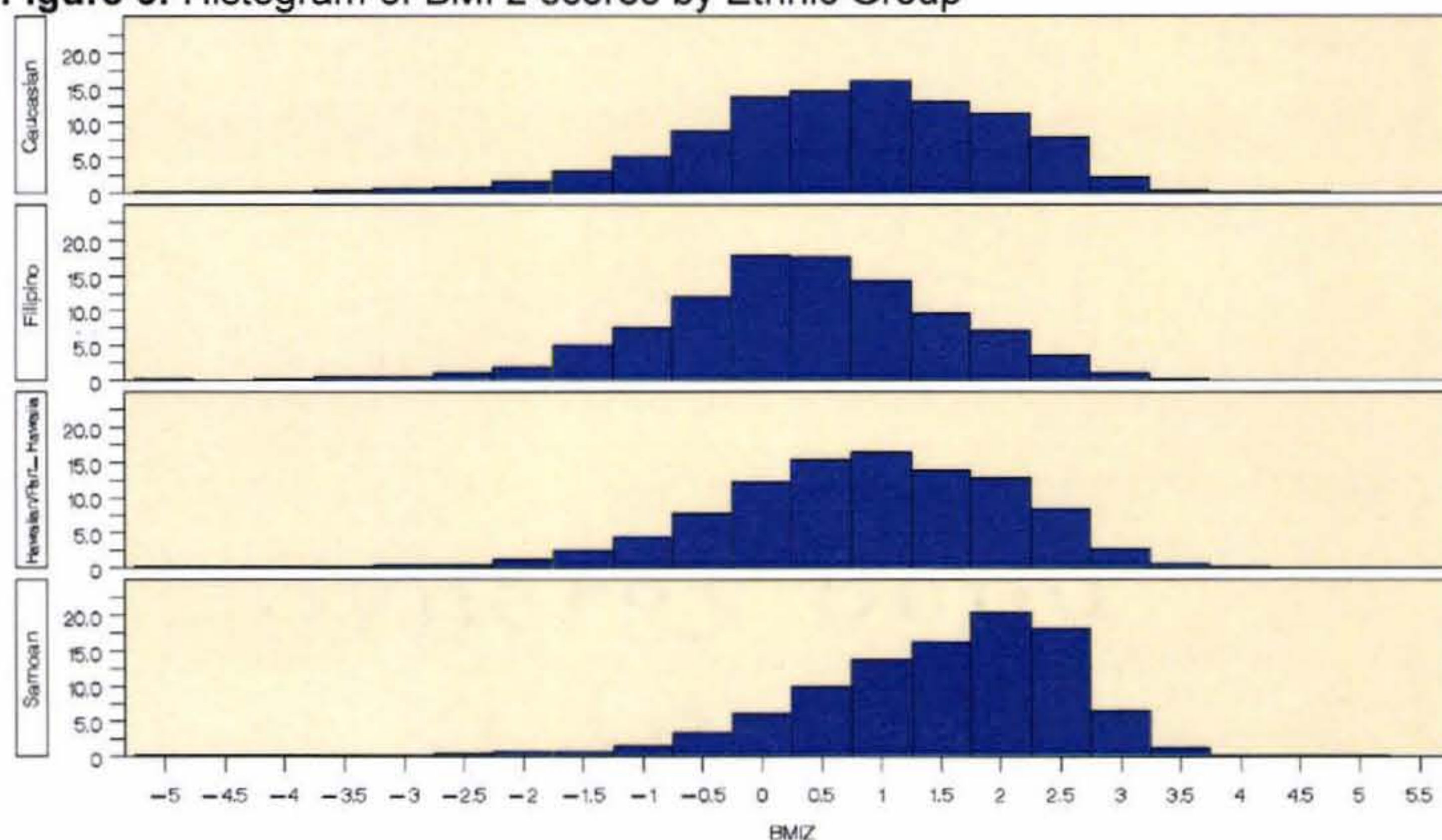


The degree to which the children were overweight also differed among ethnic groups. Comparisons of mean BMI z-scores show that Samoan children were the most overweight followed by Hawaiians, Caucasians then Filipinos (Table 8 and Figure 6). There was a significant difference between the mean BMI z-score of Samoans and Hawaiians (difference 0.62, 95% CI 0.55-0.68) and between Hawaiians and Caucasians (difference 0.14, 95% CI 0.09-0.19).

Table 8: Mean BMI and Height z-scores of Children 2-19 years

	Mean BMI z-score ² Child	Mean Height z-score ² Child
Samoan	1.46	0.35
Hawaiian	0.84	-0.15
Caucasian	0.70	-0.22
Filipino	0.34	-0.85

Note: A z-score indicates how far, and in what direction, an item deviates from its distribution mean and is expressed in its distribution's standard deviation. The above z-scores are based on the 2000 CDC growth charts¹⁵. Child=24 months to 19 years of age.

Figure 6: Histogram of BMI z-scores by Ethnic Group

Comparison of mean height z-scores show that Samoan children were also taller than the other children (Table 8). Hawaiian children were the second tallest followed by Caucasians. Filipino children were the shortest. There was a significant difference between mean height z-scores of Samoans compared with Hawaiians (difference 0.50, 95%CI 0.44-0.56) and between Hawaiians and Caucasians (difference 0.37, 95% CI 0.025-0.122).

Obesity in Children 12 to 19 years:

To assess the extent of the overweight, participants 12 years and older were classified according to adult BMI cut-offs. There were 14,016 observations on 6,957 individuals. Based on the adult BMI classification, 46.4% were normal weight, 21% were overweight with a BMI 25 to 30 and 24.2% were obese with a BMI > 30. Table 9 compares the percent of children according to the adult BMI weight classification against the percent of children in the BMI % for age/sex classification currently accepted by the Academy of Pediatrics (AAP) and the US Center for Disease Control.

Table 9: Percent of Children 12-19 years in BMI vs. BMI% age/sex weight groups

Adult BMI Weight Classification	BMI% for age/sex Classification
Underweight (BMI<18.5): 8.5%	Underweight (BMI%<5): 2.4%
Normal (BMI 18.5-24.9) 46.4%	Normal (BMI% 5-85): 50.0%
Overweight (BMI 25-29.9) 21.0%	At Risk (BMI% 85-95): 18.7%
Obese (BMI 30 and above) 24.2%	Overweight (BMI% ≥ 95): 28.9%

To further define obesity in the teens, all observations of children 12 to 19 years of age were pooled. The observation with the highest BMI attained by each individual during the 6 years of study was analyzed and all others for each individual excluded. Again, using the adult BMI classification system, older obese children were further classified as overweight, Obese Class I (BMI 30-34.9), Obese Class II (BMI 35-40) and Extremely Obese Class III (BMI>40).

Of the 12 to 19 year olds studied, 6.3% were considered extremely obese with a BMI greater than 40. There were marked ethnic differences in these groups (Table 10). Samoan children showed the largest proportion of obese children; 11.4% were obese

class II and 18.9% were extremely obese. Of the Hawaiian children, 16.3% or 553 individuals were either obese class II or extremely obese.

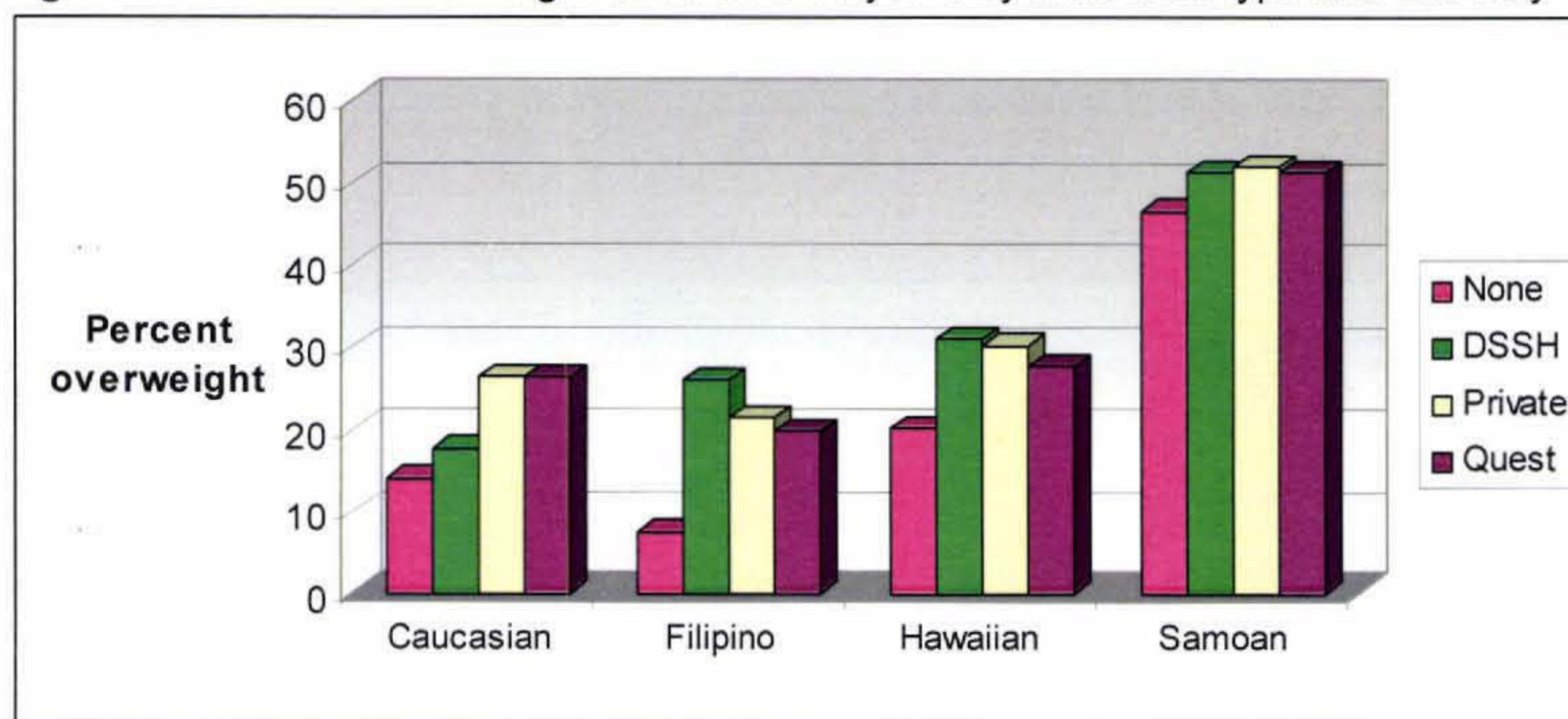
Table 10: Percent and Numbers of Children 12-19 years in the BMI Weight Groups

	Under-weight	Normal Weight	Overweight	Obese Class I	Obese Class II	Extremely Obese Class III
BMI	<18.5	18.5-24.9	25-29.9	30-34.9	35-40	>40
Caucasian	7.5 (62)	46.8 (386)	23.9 (197)	10.2 (84)	5.6 (46)	6.0 (49)
Filipino	10.9 (134)	60.2 (739)	16.9 (207)	7.6 (93)	2.6 (32)	1.9 (23)
Hawaiian	5.3 (181)	40 (1356)	24.5 (834)	14.1 (479)	7.4 (250)	8.9 (303)
Samoaan	2.6 (13)	20.1 (102)	23.0 (117)	24.0 (122)	11.4 (58)	18.9 (96)

Insurance and obesity:

Among children 2 to 19 years of age, uninsured children had a lower prevalence of overweight compared with children with other types of insurance (Figure 7). Logistic regression, including repeated measurements and adjusting for clustering of the data, showed that uninsured children were 33% less likely to be overweight compared to those with private or Quest insurance when controlling for age, sex and ethnicity (95% CI: 0.25-0.4). There was no difference between the prevalence of overweight among those with private insurance compared with those with Quest insurance for lower-income residents.

Figure 7: Percent of Overweight Children 2-19 years by Insurance type and Ethnicity



None=No health insurance, DSSH=Department of Social Services and Housing/Medicaid, Private=Private health insurance, Quest=State of Hawaii low income medical insurance plan

Chapter 4

Discussion

The results of this study confirm a large number of children who were overweight or “at risk” for overweight were found in this community health center population. The prevalence of overweight and “at risk” for overweight far exceeded that found in the NHANES survey 1999-2002 in all sex and ethnic groups, except for Filipino females 18-19 years.

Samoan children had the highest prevalence and degree of overweight starting from a very early age, about 6 to 11 months of age. It is unknown if these children are truly obese and overly fat starting from infancy or whether the growth of Samoan children is somehow different. The high proportion of older Samoan children with BMI's greater than 40 suggest that these children may be particularly susceptible to extreme weight gain. On the other hand, comparison of mean length z-scores in infants and height z-scores of older children (Table 5 and 8) show that Samoan children are taller than children from the other ethnic groups. The large proportion of Samoan children with a weight-for-height or BMI% for age/sex above the 95% (Table 7) from 6 months of age through the teen years also suggests that the CDC growth curves may not be appropriate for use in Samoan children.

There are few studies on normal growth and overweight prevalence of Pacific Island children, specifically Samoan and other Polynesian children. Baruffi's study on young children participating in the Hawaii Special Supplemental Nutrition program for Women and Children also showed that Samoan children were taller and more overweight when compared to children of other ethnicities⁹. A study in the 1980's showed that the growth of Samoan children was markedly influenced by

westernization¹⁸. Samoan children from more rural communities of (Western) Samoa were shorter, lighter, and lighter for height compared with Samoan children from the more westernized American Samoa and Hawaii. Other studies have also shown that Polynesian children, including Native Hawaiian children, are taller and heavier, with a higher BMI, when compared with accepted U.S. reference standards^{19, 20}.

Studies of Samoan, and other Polynesian adults, have shown that for a given BMI, Polynesians are leaner, with a lower percent body fat than Caucasians^{21,22}. Body composition of Samoan and other Polynesian children has not been adequately studied but may help define the degree of body fat and the significance of high BMI measurements. Such studies will help determine if CDC growth charts are appropriate for use with Polynesian children. High BMI has been associated with higher risk of adult disease but it is unclear if this risk is the same in Samoan children.

Native Hawaiian children, the largest ethnic group studied, showed the second highest prevalence of overweight. This is important in light of the fact that Hawaiian adults already have lower life expectancy and high prevalence of obesity-related disease such as diabetes and cancer^{1-3,5}. Classification using adult BMI cut-offs (Table 10) on children 12 to 19 years showed that more than 30% of Hawaiian teens were obese with a BMI>30. This includes 16.3%, or 553 teens, with a BMI>35, a huge burden for health care resources and a rural community such as Waianae since it is well known that severely obese children are difficult to treat and have a very high likelihood of becoming obese adults²³⁻²⁵. The method of selecting the observation with the highest BMI over the study period may have overestimated obesity numbers. However when we recalculated the analysis selecting the lowest BMI over the study period, the numbers were still worrisome; 26% of Hawaiian children had a BMI>30 and 13% or 443 individuals had a BMI>35.

The Filipino children in this study were different than the other ethnic groups in that they were more likely to be female, in their teens and uninsured (Table 1). During the study period from 1998 to 2004, WCCHC opened a new satellite clinic in a community with a large Filipino population. The initial clinic services promoted women's health care accounting for the large proportion of Filipino females, age 14 to 19 years, in the study.

Among the major ethnic groups, Filipino children had the lowest prevalence of overweight; however, prevalence of overweight still exceeded that of NHANES 1999-2002 in all age groups except for Filipino teen girls. Like the Hawaiians, this high overweight prevalence has serious health implications since studies show Filipino adults, when compared with other ethnic groups, have a higher prevalence of diabetes and metabolic syndrome, conditions intimately associated with obesity²⁶⁻²⁸.

Filipino children in this population were more likely to be underweight during infancy (Table 4). Based on z-scores, Filipino infants were also more likely to be stunted. The co-existence of stunted, underweight children with overweight older children and adults has been seen in other populations and may be a warning sign of future health problems for this community²⁹⁻³¹. Studies have shown that stunting in early childhood is directly associated with adult obesity^{32, 33}. Stunting has been associated with higher susceptibility to high fat diets³⁴. Rapid weight gain during infancy has been associated with obesity in adult life³⁵⁻³⁸. A large longitudinal study of Filipino children by Adair et al showed that the odds of high blood pressure more than doubled among those who were relatively thin at birth but had the highest weight gain late childhood³⁹.

More studies on the growth of Filipino children are needed to further define the association between birth factors, early childhood growth and adult disease. Body composition studies are needed to determine the degree of body fat for a given BMI and

its association with metabolic parameters such blood sugar, insulin levels, blood pressure, in this high risk group of children.

Older teen females showed a drop in overweight prevalence. This was especially pronounced in Filipino teens but also seen in Caucasian and Hawaiian teen females.

The cause of these trends is unknown but warrant further study since eating disorders are more common in the teen years.

Surprisingly, uninsured children were more 33% less likely to be overweight than children with private insurance or Quest insurance for low-income patients. It is well known that adult obesity is associated with lower incomes and education levels but little is known about the health status of the uninsured in the United States, even though this is a large and growing segment of society^{40, 41}. In this health center population, those with medical insurance for low-income families and those with private medical insurance had similar prevalence of overweight. It is unclear why the uninsured children had lower prevalence.

The large number of teens who are uninsured is partially explained by the availability of a special "teen clinic" program at WCCHC that allows teens to register anonymously in order to receive health services. Services are coded in the WCCHC computer database as though the teens have "no insurance" since costs are covered by a State of Hawaii grant and not by a specific insurance plan.

Filipino children however, were still more likely to be uninsured. It is unknown if this problem is similar to other Filipino children in Hawaii and other states. Many Filipino children who attend WCCHC, especially teens, are from first generation immigrant families and were born in the Philippines. The number of immigrant families in the US who are uninsured has risen in recent years, most likely in response to the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) which

prohibits states from providing Medicaid coverage to legal immigrants during their five years in the United States, even though they are working and paying taxes⁴². When the State Children's Health Insurance Program (SCHIP) was established in 1997, it was added to the list of programs from which recent legal immigrants are barred. Samoan children in our clinic population are also likely to come from first generation immigrant families, primarily American Samoa. However, citizens of American Samoa, a US Territory, qualify for Medicaid as well as the SCHIP and are more likely to be insured.

Chapter 5

Conclusions and Limitations

- There are large numbers of children who are overweight or “at risk” of becoming overweight in this community health center population in Hawai‘i.
- Samoan children showed an extremely high prevalence of overweight from infancy based on CDC growth curves. Further research is needed to determine if CDC growth curves are appropriate for use on Samoan and other Polynesian children.
- Factors contributing to the high prevalence of overweight in this multi-ethnic health center population need to be examined including cultural, environmental and socio-economic factors related to prenatal and early childhood periods.
- Childhood obesity prevention, and possibly intervention programs, for Native Hawaiian and Samoan children should begin early, before children are 4-5 years of age.

There were several limitations to this cross-sectional study of existing data. Methods for weight and length/height measurement were not standardized and subject to measurement error. Methods for data entry were also not standardized and subject to data entry error. Erroneous data was minimized by excluding extreme values for height, weight and BMI. Many participants had multiple entries in the database over the 6 year period. Duplicates, when found, were eliminated for each age group but patients who were frequent clinic visitors may be over-represented in this data set.

The participants represent the health center population and may not necessarily be representative of the entire community. The Filipino children in this study were different from the others in several aspects including differences in sex, insurance coverage and age distribution; inferences from this group of children should be approached with caution. Finally, this was a cross sectional study based on limited demographic information. We did not analyze other factors that could have contributed to overweight including birth factors such as birth weight, exercise and activity. We also did not examine cultural aspects to the obesity problem such as different diets and feeding practices, and the different cultural perceptions of children's body size.

Appendix A: IRB Approval

UNIVERSITY OF HAWAII

Committee on Human Studies

MEMORANDUM

September 9, 2005

TO: May Okihiro, M.D.
Lon White, M.D.
James Davis, Ph.D.
Chris Derauf, M.D.
Rosanne Harrigan, EdD
Principal Investigators
Pediatrics Department

FROM: William R. Dendle
Executive Secretary

SUBJECT: CHS #13914- "Body Mass Index and the Prevalence of Obesity in a Population of Native Hawaiian Children"

Your project identified above was reviewed and has been determined to be exempt from Department of Health and Human Services (DHHS) regulations, 45 CFR Part 46. Specifically, the authority for this exemption is section 46.101(b)(4). Your certificate of exemption (Optional Form 310) is enclosed. This certificate is your record of CHS review of this study and will be effective as of the date shown on the certificate.

An exempt status signifies that you will not be required to submit renewal applications for full Committee review as long as that portion of your project involving human subjects remains unchanged. If, during the course of your project, you intend to make changes which may significantly affect the human subjects involved, you should contact this office for guidance prior to implementing these changes.

Any unanticipated problems related to your use of human subjects in this project must be promptly reported to the CHS through this office. This is required so that the CHS can institute or update protective measures for human subjects as may be necessary. In addition, under the University's Assurance with the U.S. Department of Health and Human Services, the University must report certain situations to the federal government. Examples of these reportable situations include deaths, injuries, adverse reactions or unforeseen risks to human subjects. These reports must be made regardless of the source funding or exempt status of your project.

University policy requires you to maintain as an essential part of your project records, any documents pertaining to the use of humans as subjects in your research. This includes any information or materials conveyed to, and received from, the subjects, as well as any executed consent forms, data and analysis results. These records must be maintained for at least three years after project completion or termination. If this is a funded project, you should be aware that these records are subject to inspection and review by authorized representatives of the University, State and Federal governments.

Please notify this office when your project is completed. We may ask that you provide information regarding your experiences with human subjects and with the CHS review process. Upon notification, we will close our files pertaining to your project. Any subsequent reactivation of the project will require a new CHS application.

Please do not hesitate to contact me if you have any questions or require assistance. I will be happy to assist you in any way I can.

Thank you for your cooperation and efforts throughout this review process. I wish you success in this endeavor.

Enclosure

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