High Prevalence of Overweight and Short Stature Among Head Start Children in Massachusetts

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Synopsis

The Head Start Program measures children's heights and weights to screen for growth problems such as obesity, wasting, and short stature. At present, little public health use is made of these data. In this paper, the authors present serial cross-sectional nutrition surveillance data from Massachusetts Head Start Programs.

Nonrandom samples of local Head Start Programs provided annual screening data from 1988 to 1991 on an average of 2,664 children per year. Height and weight measurements were compared with National Center for Health Statistics (NCHS) reference populations. On average, 87 percent of the children were 36 to 59 months of age and 51 percent were white.

From 7.3 to 8.8 percent of children were below the 5th percentile of height for age each year, and from 1.2 to 3.3 percent were underweight, with weight below the 5th percentile for height ($P<0.05$ compared with NCHS population). In each year overweight (weight for height above the 95th percentile) was most prevalent, ranging from 9.6 percent to 13.3 percent ($P<0.05$ compared with NCHS) and demonstrating a statistically significant upward trend over the 4 years of study (chi-square = 9.21, $P<0.01$).

The prevalence of overweight and short stature varied by race and ethnicity. A statistically significant upward trend in overweight was seen among Hispanic children (chi-square = 5.99, $P<0.05$). Also, children who were 48 months of age or older were more likely than younger children to be overweight ($P<0.05$). The prevalence of short stature did not vary significantly by year, sex, or age.

The authors conclude that children attending Head Start Programs in Massachusetts are at risk for short stature and are at increasing risk of obesity. These risks vary by race and ethnicity. Further research is needed to determine the generalizability of these findings to other regions and to evaluate social and behavioral correlates of poor nutrition outcomes among Head Start children.

THE HEAD START PROGRAM provides supportive preschool experiences to low-income children throughout the United States. Local programs, managed through community-based agencies, focus on improving children's self-esteem, cognition, and motor abilities (*1*). Head Start also provides children with nutritious meals, health screenings, limited on-site health and nutrition services, and referrals to other nutrition, health, and social service providers as needed.

As one component of Head Start's health screenings, children's heights and weights are measured to screen for growth problems such as obesity, wasting, and short stature. Little public health use has been made of these data, although Head Start serves a large and nutritionally at-risk population. In Federal fiscal year 1991, 583,471 children attended Head Start Programs nationwide (*2*) of whom, by regulation, 90 percent were from families with incomes below the poverty level. Children in poverty are at increased risk of overweight and short stature relative to more affluent children (*3*) and to reference populations (*3,4*). Moreover, minority children are at highest risk (*4*).

The Massachusetts Department of Public Health (MDPH) conducted nutrition surveillance in the

Table 1. Demographic and nutritional risk characteristics of children attending selected Massachusetts Head Start Programs, 1988–91

	1988		1989		1990		1991	
Characteristic	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Girls	750	48.5	1,734	49.7	1,545	49.2	1,226	[1]49.2
Boys	797	51.5	1,752	50.3	1,593	50.8	1,267	[1]50.8
Total	1,547	100.0	3,486	100.0	3,138	100.0	2,493	100.0
Age 36 to 59 months	1,354	87.5	3,164	90.8	2,652	84.5	2,162	87.0
Age 48 months or older	1,055	68.2	2,350	67.4	2,304	73.4	1,827	73.5
Race and ethnicity:								
Black	156	10.1	440	12.6	706	22.5	361	14.5
White	928	60.0	2,005	57.5	1,301	41.5	1,101	44.3
Hispanic	381	24.6	785	22.5	831	26.5	739	29.8
Asian	63	4.1	167	4.8	93	3.0	80	3.2
Other-unknown	19	1.2	88	2.5	207	6.6	204	8.2
Nutritional risk characteristics:[2]								
Short stature	120	7.8	301	8.6	228	7.3	203	[1]8.1
Underweight	20	1.3	42	1.2	43	1.4	82	3.3
Overweight	148	9.6	363	10.4	418	13.3	290	11.7

[1] Based on 2,493. All other analyses in this year based on 2,485.

[2] Short stature = height for age < 5th NCHS percentile; underweight = weight for height < 5th percentile; overweight = weight for height > 95th percentile.

Commonwealth's Head Start population from 1988 to 1991 to describe indicators of nutritional status, identify problems meriting further investigation, and monitor trends. In this paper, we present descriptive, serial cross-sectional data on physical growth from these 4 years. These data were analyzed for time trends and significant associations between nutrition status indicators and demographic descriptors to identify areas warranting further study.

Methods

Study population. All data were obtained from local Head Start Programs in Massachusetts. Throughout 1988–91, 35 Head Start Programs operated in the Commonwealth serving, on average, approximately 8,500 children each year. Programs included one or more sites. Participation in surveillance was voluntary and was solicited through mailings, telephone calls, and meetings. The number of participating programs varied yearly as follows: 9 programs in 1988, 19 in 1989, 16 in 1990, and 15 in 1991.

The sample of children varied accordingly from 1,547 to 3,486. Participating programs were located throughout the State and approximately two-thirds had sites in urban settings. Most submitted data for all enrolled children, although one or two programs per year supplied data on a subset of their classrooms or sites because of staff time constraints. To our knowledge, sites included were not selected because of perceived nutritional risk. Since up to 25 percent of Head Start children remain in the program for 2 years, yearly totals contain some duplicates. The data did not permit us to identify these children.

Data collection. Programs provided heights and weights taken either in the fall (about 70 percent of children) or the spring. Because no seasonal differences were detected, all data were combined. Heights and weights were measured by Head Start staff. They were instructed by MDPH staff to weigh children to one-fourth pound using a calibrated beam balance or SECA-77000 digital scale and to remove shoes and heavy clothing before weighing. To obtain heights, measurers were instructed to use wall-mounted metal measuring tapes and head blocks (*A*), to remove shoes and obstructive hair ornaments, and to position children's heads with gaze level and with heels, buttocks, and shoulders touching the wall.

During site visits in 1990, two programs were not using recommended measuring equipment, although this was subsequently corrected. We chose to include these data because we did not observe systematic inaccuracies that would have rendered them unacceptable.

Definitions. Height and weight percentiles were those of the National Center for Health Statistics (NCHS) (*5*). A height for age below the 5th percentile was considered an indicator of possible chronic undernutrition, and children in this range were classified as having short stature. Similarly, weight for height below the 5th percentile placed children at risk of acute undernutrition; these children were considered underweight. Overweight children had a weight for height above the 95th percentile, indicating potential chronic overnutrition.

Weight for height and height for age were also examined using Z-scores (standardized values equal to the child's measurement minus the median reference population measurement for the same age and sex, the difference divided by the population standard deviation). The mean Z-score for the reference population, 0.0, corresponds to the 50th percentile, which is the population median. Two advantages of Z-scores over percentiles were exploited: first, they are better able to describe the tails of the measurement distribution, that is, outside the 5th or 95th percentiles. Second, because the distribution of Z-scores is normal, more meaningful comparisons are possible between an average computed in a study population and the reference population mean of zero. The values on which the weight-related percentiles are based are not normally distributed.

Race and ethnicity designations were assigned according to parental report and were white, non-Hispanic; black, non-Hispanic; Hispanic; Asian; other; and unknown. Because of small cell sizes the "other" and "unknown" groups were combined. Influences on yearly variation in the study population's racial composition should be noted. First, while seven programs participated every year, other programs participated for anywhere from 1 to 3 years, so racial composition in part reflects the mix of programs in a given year. For example, one program that participated only in FY 1990 was comprised of more than 500 children, most of whom were black. (The findings were the same when analyses were performed with and without this group, so we have included it in the data we present.) Second, the proportions of children who were recorded as "other-unknown" rose after FY 1989 for at least two reasons. First, several new participating sites did not routinely collect race and ethnicity data. Also, prior to 1989 the "other" category was used almost exclusively for Native American children. However, in 1990 we also asked programs to record "other" for children of mixed race or ethnicity when their parents did not state a preference as to which parent's race was recorded. Hence this group is comprised of Native American children and those of mixed race and ethnicity.

Data analysis. Data were analyzed to describe the nutritional status of the population yearly and by race and ethnicity, sex, and age. Records were excluded from analysis if they had implausible values defined as (*a*) age below Head Start's entry age of 33 months with height or weight for age above the 95th percentile (suggesting an inaccurate birth date, measurement, or both), or (*b*) a Z-score of –6.0 or less. At the other extreme, measurements corresponding to Z-scores of 6.0 or more were not excluded because we were able to validate several measurements in this range. After applying these exclusion criteria, an average of 94.5 percent of the records entered were analyzable each year.

'Our study has identified a statistically significant upward trend in the prevalence of overweight among children attending a sample of Massachusetts Head Start Programs. This is partly a result of the significant increase in overweight among the Hispanic children within this population.'

All data were analyzed using the Statistical Analysis System (*6*). Standard frequency distributions were calculated and logic checks were performed to rule out certain systematic errors. For example, checking the distribution of short stature among overweight and normal weight children suggested that heights were not systematically measured low, which would have artificially inflated the prevalence of overweight. Z-scores and 95 percent confidence intervals for the proportion of children with outlying values were calculated using CASP (*B*) and dEpid (*C*) statistical software, respectively. Prevalence estimates were considered significantly different from NCHS reference populations if 95 percent confidence intervals did not include the expected value of 5 percent.

The chi-square test was used to examine differences in the prevalence of overweight by age and sex. The Mantel-Haenszel extension to the chi-square test was used to test for evidence of statistically significant ($P<0.05$) linear trends by year and race (*7*). Differences among mean Z-scores each year were examined using Tukey's honestly significant difference (HSD) test with alpha = 0.05.

Results

Characteristics of the population by year appear in table 1. Each year, the prevalence of overweight and short stature significantly exceeded 5 percent ($P<0.05$). Although the prevalence of underweight was

Table 2. Prevalence of overweight[1] and 95 percent confidence intervals (CI) by race, ethnicity, and year for selected Massachusetts Head Start Programs, 1988–91

	1988		1989		1990		1991	
Race-ethnicity	*Percent*	*CI*	*Percent*	*CI*	*Percent*	*CI*	*Percent*	*CI*
Black	10.9	6.0–15.8	11.1	8.2–14.1	13.0	10.5–15.5	12.7	9.3–16.2
White	9.3	7.4–11.1	9.0	7.7–10.2	10.5	8.8–12.1	9.5	7.7–11.2
Hispanic	10.5	7.4–13.6	14.4	11.9–16.6	17.5	14.9–20.0	15.8	13.2–18.5
Asian	[2]4.8	...	4.8	1.6–8.0	5.4	0.8–10.0	10.0	3.4–16.6
Other-unknown	[2]10.5	...	14.8	7.4–22.2	19.3	13.9–24.7	7.4	3.8–10.9

[1]Weight for height above the 95th NCHS percentile.

[2]Confidence intervals are not presented because the normal approximation was not valid due to small cell sizes.

Table 3. Mean weight-for-height *Z*-scores (and standard deviations [SD]), by race, ethnicity, and year, for selected Massachusetts Head Start Programs

	1988		1989		1990		1991	
Race-ethnicity	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Black	[1]0.52	1.32	[1]0.56	1.19	[1,3]0.55	1.32	[1]0.56	1.63
White	[1]0.54	1.12	[1]0.53	1.12	[1,3]0.52	1.24	[1]0.42	1.20
Hispanic	[1]0.56	1.29	[1]0.62	1.24	[2]0.78	1.50	[1]0.55	1.62
Asian	[2]0.02	1.13	[2]0.10	1.10	[1]0.25	1.13	[1]0.24	1.47
Other-unknown	[1,2]0.74	0.91	[1]0.70	1.44	[2,3]0.72	1.40	[1]0.40	1.43

[1,2,3]Within each year column, means that share the same superscript are not significantly different at $P<0.05$; means that do not share the same superscript are significantly different.

Table 4. Prevalence of short stature[1] (and 95 percent confidence intervals [CI]) by race, ethnicity, and year for selected Massachusetts Head Start Programs.

	1988		1989		1990		1991	
Race-ethnicity	*Percent*	*CI*	*Percent*	*CI*	*Percent*	*CI*	*Percent*	*CI*
Black	4.5	1.2–7.7	5.2	3.1–7.3	4.3	2.8–5.7	6.9	4.3–9.5
White	8.8	7.0–10.7	10.8	9.4–12.1	10.9	9.2–12.6	11.2	9.4–13.1
Hispanic	5.8	3.4–8.1	4.8	3.3–6.3	4.2	2.8–5.6	4.5	3.0–5.9
Asian	14.3	5.6–22.9	11.4	6.6–16.2	14.0	6.9–21.0	13.8	6.2–21.3
Other-unknown	[2]0.0	...	[2]5.7	...	3.9	1.2–6.5	4.9	1.9–7.9

[1]Height for age below the 5th NCHS percentile.

[2]Confidence intervals are not presented because the normal approximation was not valid due to small cell sizes.

Table 5. Mean height for age *Z*-scores (and standard deviations [SD]), by race, ethnicity, and year, for selected Massachusetts Head Start Programs

	1988		1989		1990		1991	
Race-ethnicity	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Black	[1]0.38	1.16	[1]0.16	1.04	[1]0.30	1.14	[1]0.10	1.30
White	[3]−0.22	1.12	[2]−0.35	1.10	[2]−0.31	1.13	[2]−0.35	1.12
Hispanic	[2]0.06	1.06	[3]−0.02	1.04	[3]0.08	1.10	[1]0.11	1.17
Asian	[4]−0.69	1.05	[2]−0.48	0.93	[4]−0.71	1.15	[2]−0.44	1.18
Other-unknown	[1,2,3]0.34	1.00	[1,3]0.08	1.18	[1]0.40	1.16	[1]0.11	1.16

[1,2,3,4]Within each year column, means that share the same superscript are not significantly different at $P<0.05$; means that do not share the same superscript are significantly different.

consistently and significantly below 5 percent ($P < 0.05$), it doubled in FY 1991 compared with earlier years. The remainder of our analyses focused on overweight and short stature because of their unexpectedly high prevalence.

When the overweight data were examined by sex, no differences were apparent (data not shown). However, each year overweight was significantly more common among children at or above 48 months of age compared with younger children ($P < 0.05$). The yearly prevalence of overweight among children younger than 48 months was 6.3 percent, 8.4 percent, 10.9 percent, and 9.1 percent (for 1988 to 1991), versus 11.1 percent, 11.4 percent, 14.2 percent, and 12.6 percent for older children.

A statistically significant upward trend in overweight was detected when all children were examined together by year (chi-square = 9.21, $P < 0.01$). Subsequent stratification showed that results varied by race and ethnicity (table 2). A statistically significant upward trend was apparent among Hispanic children (chi-square = 5.99, $P < 0.05$). When Hispanic children were removed from the analysis, the trend in the remaining population was no longer significant (chi-square = 2.34, $P > 0.10$). A trend toward significance was also observed among children classified as having other or unknown race (chi-square = 3.77, $P < 0.10$). As noted earlier, this group is comprised of primarily nonwhite children. In addition, the prevalence of overweight increased yearly among black children, although this was not statistically significant (chi-square = 0.84, $P > 0.10$).

Table 3 shows that mean weight-for-height Z-scores were above the expected mean value of 0.0 among white, black, Hispanic, and "other" children each year. These children demonstrate not only a high prevalence of overweight but high mean weight for height as well. Although Hispanic children were more likely to be overweight, they did not tend to have mean weight for height Z-scores that were significantly higher than those of other children. Asian children had mean Z-scores closest to the reference population mean of 0.0.

Short stature, like overweight, was elevated in the study population each year. Race- and ethnicity-specific prevalences varied widely and were highest among white and Asian children (table 4). In these two groups, short stature was significantly more common than in the reference population. No statistically significant trends in short stature were observed either in the population as a whole or in any race or ethnicity group.

Black children and children in the "other-unknown" group had mean height for age Z-scores that were above the population mean, and they tended to be significantly taller than other children ($P < 0.05$, table 5). Mean height for age Z-scores of whites and Asians were below 0.0, while Hispanic children were consistently nearest the mean. The prevalence of short stature did not vary by sex or age (younger than 48 months versus 48 months or older) in any year (data not shown).

Discussion

Our study has identified a statistically significant upward trend in the prevalence of overweight among children attending a sample of Massachusetts Head Start Programs. This is partly a result of the significant increase in overweight among the Hispanic children within this population. An excess prevalence of short stature was observed as well, suggesting that chronic undernutrition also exists in the Head Start population. Moreover, the prevalence of acute underweight, though consistently below expected levels, doubled between 1990 and 1991, a situation which should continue to be monitored.

The causes of overweight and short stature in the Head Start population are not known at this time, nor was the Massachusetts surveillance program designed to identify these causes. Socioeconomic status, environment, and ethnicity, as well as interactions among these factors, bear investigation. Interpreting the high and rising prevalence of overweight is difficult, given the relatively short timeframe studied. It may in part reflect behavior, including the possibility that disparities are widening between calories eaten and those expended through physical activity in the population studied. Studies supporting a correlation between inactivity and childhood obesity exist, albeit among older children (*8*). Anecdotal evidence from Massachusetts also suggests that in some urban areas Head Start children do not have opportunities to run and play outdoors due to parental perceptions of danger from local violence (personal communication with H. Blake, Cambridge, MA, Head Start, 1990). Short stature may follow chronic caloric deficits which may, in turn, reflect repeated illness, household food shortages, and parental misperceptions of children's dietary needs, among other possibilities.

Our findings were consistent with other studies which confirm that low-income preschool children carry high risks of obesity and short stature, and that Hispanic preschoolers are most likely to be overweight (*4*). The literature also shows that, compared with underweight, overweight and short stature are more common among low-income preschoolers

'Studies of Mexican American and other Hispanic children have reported greater body density, weight for length, trunk circumference, and greater tendency toward centralized adiposity compared with samples of white children . . . .'

(*4,9,10*) and are more likely to be elevated compared with reference populations (*4,8*). National data have also shown that the prevalence of overweight increases with age beginning in the preschool years (*4*). National surveillance data, derived mainly from the Special Supplemental Food Program for Women, Infants, and Children (WIC), differ from ours in detecting that short stature is generally more prevalent than overweight (*4*).

Limitations. The Massachusetts surveillance system was designed to identify potential nutritional problems in Head Start using data routinely collected by local programs. The small number of demographic and health variables available limited our ability to generate hypotheses related to causality. Also, we cannot rule out possible biases stemming from the fact that participation in surveillance was voluntary. This resulted in a sample of convenience consisting of programs motivated to participate despite the additional work imposed by filling out data forms. Thus programs whose staff had concerns about nutritional problems may have had a greater possibility of inclusion. In the resulting population, blacks were underrepresented and Hispanics were overrepresented compared with the State's Head Start population in general.

Sample sizes clearly affected precision as shown in the tables. Hence, findings from groups with the fewest children in them (other, unknown, and Asian) should be interpreted with caution. While random errors are unavoidable in any growth monitoring system with many observers and data collection points, MDPH observations taken at several programs suggest that the quality of the anthropometric data was acceptable.

The analyses were based on cross-sectional data although, as we acknowledged earlier, up to 25 percent of children attend Head Start for 2 consecutive years. Repeat attendance, if associated with the nutritional outcomes under study, could have biased the findings, resulting in prevalence estimates that were too high. Although there is no reason to assume this occurred, we were unable to evaluate the possibility since children appearing in more than 1 year could not be identified.

The use of the NCHS reference data to detect nutritional problems in children deserves clarification. Height and weight are widely used to describe nutritional risks in groups of children by identifying populations with measurement distributions that differ significantly from reference data (*5*). Single measurements are not sufficient for diagnosing nutritional problems, however, and simply suggest that children with out-of-range measures need closer evaluation. Moreover, debate continues on the applicability of NCHS standards to nonwhite children. Short stature may be underdiagnosed among black children, for example, because they may be taller than white children at any given age (*11–13*). Studies of Mexican American and other Hispanic children have reported greater body density (*14*), weight for length (*15*), trunk circumference (*15*), and greater tendency toward centralized adiposity (*15–17*) compared with samples of white children or to the NCHS reference populations. The underlying causes of these and other observed anthropometric differences are not well understood, though investigators have variously favored genetic (*18*), behavioral (*16*), and socioeconomic (*13,14,19*) factors. We note that data on preschoolers are absent from these studies.

Implications. Children attending Head Start programs in Massachusetts are at increasing risk of obesity and at risk for short stature as well. These risks vary by race and ethnicity. To maximize the usefulness of our findings to the Head Start Program, it is first necessary to ensure that local programs have the capacity to obtain reliable evaluations of individual children with out-of-range measures.

In addition, researchers need to evaluate social and behavioral correlates of poor nutrition outcomes in a representative sample of Massachusetts Head Start children. To identify patterns related to overweight or short stature, studies should focus on diet and physical activity among Head Start children and their families with attention to identifying ethnically diverse practices. The data also suggest that Head Start nutrition screening data from other States as well as nationally could confirm whether our findings are generalizable to the larger Head Start population. If so, geographically broader studies of diet and physical activity in Head Start children would be useful.

Such data can help to guide local, regional, and national development and enhancement of culturally appropriate nutritional risk reduction curriculums for Head Start children and their families. A place for such efforts exists in the health and nutrition components of the Head Start Program. Although a major focus of such efforts should be obesity risk reduction, children with potential chronic or acute undernutrition are also present in the Head Start population. Hence, interventions must also continue to encourage optimal growth in stunted or underweight children.

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