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Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence[1–3]

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ABSTRACT

Background: The Centers for Disease Control and Prevention (CDC) introduced the clinical use of the body mass index (BMI; in kg/m^2) in growth charts for young males and females.

Objective: This study updates our previous report with the use of new CDC BMI charts and definitions of adult overweight and obesity to predict adult overweight or obesity.

Design: Logistic models were fitted to relate adult overweight and obesity to childhood and adolescent BMI values at each age for 166 males and 181 females in the Fels Longitudinal Study and were applied to predict adult overweight and obesity at the 75th, 85th, and 95th percentiles on the CDC charts of childhood and adolescent BMI.

Results: A child or adolescent with a high BMI percentile on the CDC BMI-for-age growth charts has a high risk of being overweight or obese at 35 y of age, and this risk increases with age. For example, the probability of adult obesity at the 85th percentile for young males was ≤ 20% to 17 y of age and 20–59.9% afterward; the corresponding probability for young females was 20–39.9% to 18 y of age and 40–59.9% afterward.

Conclusion: Our clinically applicable method assigns a child's or adolescent's BMI value to a group with a known probability of overweight or obesity in adulthood. *Am J Clin Nutr* 2002;76:653–8.

KEY WORDS Overweight, obesity, body mass index, children, adolescents, adults, risk analysis

INTRODUCTION

Recently, the Centers for Disease Control and Prevention (CDC) published revised growth charts for US children and adolescents (1). In this new set of growth charts, the CDC introduced the clinical use of the body mass index (BMI; in kg/m^2) in BMI-for-age charts for young males and females aged 2–20 y. These new BMI charts were developed by using data from the National Health Examination Survey (NHES) Cycles II and III, data from the National Health and Nutrition Examination Surveys (NHANES) I and II, and data for children from 2 to 6 y of age from NHANES III (1). The introduction of these BMI-for-age charts is in response to continued concern for the high prevalence of overweight and obesity among US children (2, 3).

Previously, we analyzed serial data from the Fels Longitudinal Study to evaluate the ability of childhood and adolescent BMI values to predict adult overweight, defined as a BMI ≥ 26 and ≥ 28 for women and men, respectively (4). In that report, a percentile value was assigned to each childhood or adolescent BMI value by using sex- and age-specific NHANES II reference data for white children (5). The assigned BMI percentile values in childhood and adolescence were related to subsequent adult overweight status by using logistic regression. The fitted logistic models estimated the probability of adult overweight at 35 y of age for children and adolescents with BMI values at the 50th, 75th, 85th, and 95th percentiles. We determined that Fels children and adolescents with high BMI values on the basis of NHANES II percentiles had a known probability of high BMI values in adulthood (4). The higher the childhood or adolescent BMI percentile and the older the child or adolescent, the greater was the risk of being overweight at 35 y of age (4). The development of overweight or obesity in childhood and adolescence is related to subsequent overweight or obesity in adulthood and an increased risk of adult morbidity and mortality (6, 7).

In light of the availability of the recently published CDC BMI-for-age growth charts in pediatric clinics and the health importance of identifying and characterizing the long-term effects of childhood and adolescent obesity (8), we revised our previous work (4) with 3 major changes. First, the definition of overweight was updated and a definition of obesity was added to reflect current knowledge and recommendations. For persons aged 35 y, adult overweight is defined as a BMI ≥ 25 and adult obesity is defined as a BMI ≥ 30. These new definitions follow the recommendations of the World Health Organization; the National Heart, Lung, and Blood Institute; the National Institutes of Health; and the US Department of Health and Human Services (9–11). Second, childhood and adolescent BMI values are now related separately to these adult definitions of overweight and obesity by using logistic regression. Third, the probabilities of adult overweight and obesity were derived from childhood and adolescent BMI values at the 75th, 85th, and 95th percentiles by using the new CDC BMI-for-age growth charts (1). This new analysis and report allow one to use these BMI-for-age charts to determine a child's or adolescent's risk of being overweight or obese as an adult. High BMI percentile values in childhood or adolescence can assist us in

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TABLE 1
BMI values at 3, 8, 13, 18, and 35 y of age by sex and by the absence or presence in adulthood of overweight or obesity or of obesity[1]

	Adult overweight or obesity (BMI ≥ 25)				Adult obesity (BMI ≥ 30)			
	Males		Females		Males		Females	
Age (y)	No (n = 94)	Yes (n = 72)	No (n = 125)	Yes (n = 56)	No (n = 146)	Yes (n = 20)	No (n = 158)	Yes (n = 23)
	kg/m²		*kg/m²*		*kg/m²*		*kg/m²*	
3	16.1 ± 1.0	16.5 ± 0.9[2]	15.6 ± 1.2	16.3 ± 1.2[2]	16.2 ± 1.0	16.6 ± 1.0	15.8 ± 1.3	16.4 ± 1.1[2]
8	15.8 ± 1.8	16.8 ± 1.7[2]	15.4 ± 1.6	17.1 ± 2.4[2]	16.1 ± 1.8	17.3 ± 2.0[2]	15.6 ± 1.8	17.9 ± 2.5[2]
13	18.0 ± 2.3	20.4 ± 3.1[2]	18.1 ± 2.3	21.7 ± 3.3[2]	18.7 ± 2.6	21.9 ± 3.5[2]	18.7 ± 2.6	23.0 ± 3.4[2]
18	20.7 ± 2.1	24.1 ± 3.0[2]	20.3 ± 2.2	24.0 ± 4.2[2]	21.7 ± 2.6	25.9 ± 3.5[2]	20.9 ± 2.6	25.8 ± 5.5[2]
35	22.7 ± 1.6	28.7 ± 2.9[2]	21.3 ± 2.0	30.1 ± 4.8[2]	24.3 ± 2.7	32.6 ± 2.0[2]	22.5 ± 3.0	34.4 ± 4.5[2]

[1] $\bar{x}$ ± SD.
[2] Significantly different from the nonoverweight or nonobese group, $P < 0.05$.

identifying and selecting children and adolescents at risk and in assigning to them probabilities of adult overweight or obesity. This health information can help those children and adolescents who are at risk and in need of close monitoring or intervention.

SUBJECTS AND METHODS

Sample

The data were obtained from 166 male and 181 female white participants in the Fels Longitudinal Study. Data for those who were pregnant or had known diseases were excluded. Fels participants were enrolled at or soon after birth and were not selected with regard to factors known to be associated with obesity (12). BMI values were computed from serial, annual Fels data for weight and stature from 3 to 20 y of age and from 30 to 39 y of age. Because of missed measurements at various ages, data are missing for some participants at some ages; thus, at any age or for any age group, the number of participants varies and therefore differs slightly from the total number of participants. The study protocol was approved by the Institutional Review Board of Wright State University, and participants signed an informed consent statement.

Statistical methods

In the Fels Longitudinal Study, data are collected at 3-mo intervals for the first year, at 6-mo intervals thereafter to 18 y of age, and every 2 y thereafter (12). There are few BMI values for Fels children aged < 3 y because recumbent length is measured instead of stature. Therefore, the analysis in the present study was conducted for each annual age from 3 to 18 y and at 20 y. An annual age is defined as the age plus or minus 6 mo (eg, the annual age for 3 y is 2.5–3.5 y). Within each annual age, the BMI values of all participants were averaged. A BMI value for each participant at 35 y of age was obtained by averaging all available BMI values from 30 to 39 y of age. Logistic regression was applied to separately relate overweight and obesity in adulthood to childhood and adolescent BMI values at each annual age with the use of PROC LOGISTIC in SAS (13). From these Fels fitted logistic models, the probabilities at 35 y of age of having a BMI ≥ 25 (overweight) or ≥ 30 (obesity) were estimated by using average BMI values at the 75th, 85th, and 95th percentiles within each defined annual age of the CDC BMI-for-age growth charts.

Receiver operating characteristic curves, which are plots of sensitivity (percentage of true-positive results) along the vertical axis against the 1-specificity (percent false-positive rate) along the horizontal axis, for BMI values at 3, 8, 13, and 18 y of age for prediction of BMI ≥ 25 and ≥ 30 at 35 y of age were plotted separately for young males and females. Each age-specific curve represents the relation between sensitivity and 1-specificity at 3, 8, 13, or 18 y of age. The height of each curve increased with age, indicating that the false-positive rate decreased or the specificity increased for a particular level of sensitivity, eg, 80%. If a curve is steep, it is an indication of a high sensitivity and specificity and an accurate prediction. These receiver operating characteristic curves were used to select cutoffs for the separate prediction of overweight and obesity. In the present study, we selected the BMI cutoffs at 18 y of age for a sensitivity level of 80%. Relative risks and their SEs were calculated for the selected childhood and adolescent cutoffs in relation to risks in adulthood (14).

RESULTS

Sample sizes and mean (± SD) BMI values at 3, 8, 13, 18, and 35 y of age are shown in **Table 1** by sex and by the absence or presence of overweight or obesity at 35 y of age. The selected ages represent early and late childhood, pubescence, and postpubescence. For both sexes, overweight or obese adults at 35 y of age had significantly higher BMI values in childhood and adolescence ($P < 0.05$) than did nonoverweight or nonobese adults.

For young males and females with childhood and adolescent BMI values at the 75th, 85th, and 95th percentiles, the probabilities of overweight or obesity at 35 y of age are shown in **Tables 2** and **3**, respectively. Overall, these probabilities increased with age. The probabilities of adult overweight (Table 2) at the 75th, 85th, and 95th childhood and adolescent BMI percentiles were significantly greater for young males than for young females ($P < 0.05$), but there was no sex difference after 13 y of age at the 95th percentile. However, the probabilities for adult obesity (Table 3) were significantly greater for young females than for young males at the 75th, 85th, and 95th percentiles at all ages. Except for those in the 95th percentile at 20 y of age, the young males and females had a greater risk of overweight than of obesity in adulthood at all of the ages from 3 to 20 y.

Receiver operating characteristic curves for BMI values at 3, 8, 13, and 18 y of age for prediction of BMI ≥ 25 and ≥ 30 at 35 y of age were calculated separately for the males and the females. The height of each curve increased with age, indicating that the false-positive rate decreased for a particular level of sensitivity, eg, 80%. At 18 y of age, the BMI values for predicting the risk of obesity with 80% sensitivity had specificity rates (1-percent false-positive rates)

TABLE 2
Probabilities of adult overweight (BMI ≥ 25) at 35 y of age for young males and females with BMI values at the 75th, 85th, and 95th percentiles on the Centers for Disease Control and Prevention BMI-for-age growth charts

	75th percentile		85th percentile		95th percentile	
Age (y)	Males	Females	Males	Females	Males	Females
3	0.53[1]	0.38	0.59[1]	0.45	0.71[1]	0.58
4	0.48[1]	0.35	0.53[1]	0.42	0.62	0.59
5	0.51[1]	0.38	0.59[1]	0.46	0.72[1]	0.65
6	0.51[1]	0.39	0.57[1]	0.49	0.69	0.72
7	0.54[1]	0.42	0.66[1]	0.52	0.86[1]	0.73
8	0.49	0.44	0.57	0.54	0.72	0.76
9	0.57[1]	0.43	0.68[1]	0.56	0.86	0.81
10	0.51[1]	0.43	0.61	0.54	0.81	0.79
11	0.53	0.46	0.64	0.61	0.84	0.86
12	0.53[1]	0.45	0.63	0.60	0.82	0.86
13	0.58[1]	0.48	0.71	0.66	0.91	0.92
14	0.59[1]	0.42	0.73[1]	0.61	0.91	0.91
15	0.60[1]	0.43	0.75[1]	0.64	0.93	0.93
16	0.57[1]	0.48	0.73	0.69	0.93	0.95
17	0.66[1]	0.56	0.84	0.80	0.98	0.98
18	0.72[1]	0.52	0.87[1]	0.72	0.98	0.95
20	0.76	0.69	0.89	0.89	0.98	0.99

[1] Significantly different from females, $P < 0.05$.

TABLE 3
Probabilities of adult obesity (BMI ≥ 30) at 35 y of age for young males and females with BMI values at the 75th, 85th, and 95th percentiles on the Centers for Disease Control and Prevention BMI-for-age growth charts

	75th percentile		85th percentile		95th percentile	
Age (y)	Males	Females	Males	Females	Males	Females
3	0.10	0.14	0.12	0.17	0.15[1]	0.24
4	0.10	0.12	0.11	0.16	0.14[1]	0.25
5	0.15	0.15	0.19	0.21	0.31	0.37
6	0.14	0.14	0.16	0.20	0.23[1]	0.43
7	0.14	0.16	0.19	0.22	0.38	0.41
8	0.12	0.16	0.14[1]	0.23	0.22[1]	0.46
9	0.14	0.17	0.17[1]	0.25	0.30[1]	0.51
10	0.11	0.15	0.17	0.23	0.37[1]	0.52
11	0.12	0.15	0.16[1]	0.25	0.28[1]	0.59
12	0.12	0.15	0.18	0.23	0.38[1]	0.50
13	0.15	0.16	0.22	0.27	0.46[1]	0.64
14	0.12	0.14	0.18[1]	0.25	0.40[1]	0.64
15	0.11	0.14	0.20	0.23	0.54	0.60
16	0.12	0.13	0.20	0.25	0.52[1]	0.70
17	0.11[1]	0.18	0.20[1]	0.32	0.52[1]	0.77
18	0.17	0.15	0.33	0.26	0.77[1]	0.68
20	0.12[1]	0.30	0.45[1]	0.65	0.98	0.99

[1] Significantly different from females, $P < 0.05$.

of 84% for the males and 76% for the females; the corresponding BMI value was approximately at the 72nd percentile. At 80% sensitivity, the accuracy of prediction for overweight and obesity in adulthood improved as a function of age, especially in the males, but at ages < 18 y, the accuracy of prediction for overweight and obesity in adulthood was better for the females than for the males.

The BMI values at 18 y of age at the 50th and 72nd percentiles were chosen as cutoffs for identifying overweight and obesity in adulthood at 35 y of age. The BMI values at these percentiles had greater sensitivity and specificity than did those at other percentiles (**Table 4**). The probability of overweight at 35 y of age predicted from BMI values at or above the 50th percentile at 18 y of age (Table 4) was 0.69 for the males (53 of 77) and 0.56 for the females (35 of 63). The sensitivities were 0.83 for the males and 0.74 for the females, and the specificity rates were 0.72 for the males and 0.73 for the females. Using the BMI cutoff of the 50th percentile at 18 y of age, the relative risks of adult overweight were 12.1 (95% CI: 5.49, 27.3) for the males and 7.92 (95% CI: 3.61, 17.4) for the females. Likewise, the probability of adult obesity predicted from BMI values at or above the 72nd percentile at 18 y of age was 0.36 for both the males (15 of 42) and the females (13 of 36). The sensitivities of the prediction of adult obesity were 0.83 for the males and 0.76 for the females, and the specificities were 0.79 for the males and 0.83 for the females. Using the BMI cutoff of the 72nd percentile at 18 y of age, the relative risks of adult obesity were 19.3 (95% CI: 5.20, 71.4) for the males and 15.7 (95% CI: 4.69, 52.5) for the females.

Probability of overweight at 35 y of age

The 75th, 85th, and 95th reference percentiles from the CDC national reference data for BMI values for young males and females aged 3–20 y are shown in **Figures 1–4**. The probabilities of adult overweight based on childhood and adolescent BMI percentiles are shown in Figures 1 and 2. The lines for the 3 percentiles in Figures 1 and 2 are shaded differentially to indicate the age ranges during which the probability of overweight at 35 y of age was < 40%, 40–59.9%, 60–79.9%, or ≥ 80%. For example, as shown in Figure 2, a girl aged 12 y with a BMI of 25 was at the 95th percentile and had a ≥ 80% probability of adult overweight. The probability of having a BMI ≥ 25 at 35 y of age increased with childhood and adolescent BMI percentile and with age. Young males with a childhood or adolescent BMI at the 75th percentile had a probability of adult overweight of 40–59.9% from 3 to 14 y of age, after which the probability was 60–79.9% until 20 y of age. Young females with a BMI in childhood or adolescence at the 75th percentile had a probability of adult overweight of < 40% from 3 to 6 y of age, of 40–59.9% from 6 to 18 y of age, and of 60–79.9% from 18 to 20 y of age. At the 85th percentile, the probability for young males was 60–79.9%, except at ages younger than 6 y (40–59.9%) and at ages older than 16 y (≥ 80%). For young females, the probability at the 85th percentile was 40–59.9% to 10 y of age, 60–79.9% from 10 to 18 y of age, and ≥ 80% after 18 y of age. The probability of adult overweight for those with a childhood or adolescent BMI at the 95th percentile was 40–59% for girls from 3 to 4 y of age and 60–79.9% for boys from 3 to 8 y of age and girls from 4 to 10 y of age; at older ages the probability was ≥ 80% for each sex.

Probability of obesity at 35 y of age

The probabilities of adult obesity based on childhood and adolescent BMI percentiles are shown in Figures 3 and 4. For a childhood or adolescent BMI at the 75th percentile, the probability of adult obesity was < 20% at all ages for young males and from 3 to 18 y of age for young females. At the 85th percentile, the probability for young males was also < 20% to 17 y of age and 40–59% after 18 y of age. For young females, the probability at the 85th percentile was 20–39.9% from 4 to 18 y of age, after which the probability was 40–59.9%. For young males, the probability of adult obesity for those with a childhood or adolescent BMI at the 95th percentile was < 20% from 3 to 4 y of age, 20–39.9% from 4

TABLE 4
Sensitivity (Se), specificity (Sp), and odds ratio (OR) of the selected BMI cutoffs at 18 y of age of the 50th or 72nd percentile for predicting overweight or obesity, respectively, in adulthood at 35 y of age

	Percentile					
	<50th or <72nd	≥50th or ≥72nd	Total	Se	Sp	OR (95% CI)
Adult overweight (BMI at 35 y of age)						
Males						
BMI < 25	61	24	85		61/85 = 0.72	
BMI ≥ 25	11	53	64	53/64 = 0.83		
Total	72	77	149			12.1 (5.49, 27.3)
P		0.69				
Females						
BMI < 25	76	28	104		76/104 = 0.73	
BMI ≥ 25	12	35	47	35/47 = 0.74		
Total	88	63	151			7.92 (3.61, 17.4)
P		0.56				
Adult obesity (BMI at 35 y of age)						
Males						
BMI < 30	104	27	131		104/131 = 0.79	
BMI ≥ 30	3	15	18	15/18 = 0.83		
Total	134	42	149			19.3 (5.20, 71.4)
P		0.36				
Females						
BMI < 30	111	23	134		111/134 = 0.83	
BMI ≥ 30	4	13	17	13/17 = 0.76		
Total	115	36	151			15.7 (4.69, 52.5)
P		0.36				

to 12 y of age, 40–59.9% from 12 to 17 y of age, and ≥60% afterward. For young females, the probability at the 95th percentile was 20–39.9% from 3 to 5 y of age, 40–59.9% from 5 to 12 y of age, and ≥60% from 12 to 20 y of age.

DISCUSSION

The present findings support our earlier work (4, 6) showing that BMI values during childhood and adolescence are important risk factors for the presence of adult overweight or obesity and the attendant risks of increased morbidity and mortality (15, 16). In the earlier article (4), we showed the value of childhood and adolescent BMI percentiles for predicting overweight at 35 y of age. In the present study, we further show the clinically predictive value of the CDC BMI-for-age growth charts for adult overweight and obesity. BMI has a high correlation with total body fat and percentage of body fat in children and adults (17), but it is not a precise indicator of overweight or obesity (18). A high BMI value for an individual child or adult can be due to high fat-free mass (19). Nevertheless, BMI is the most commonly used index of overweight and obesity for which cutoffs are established (10).

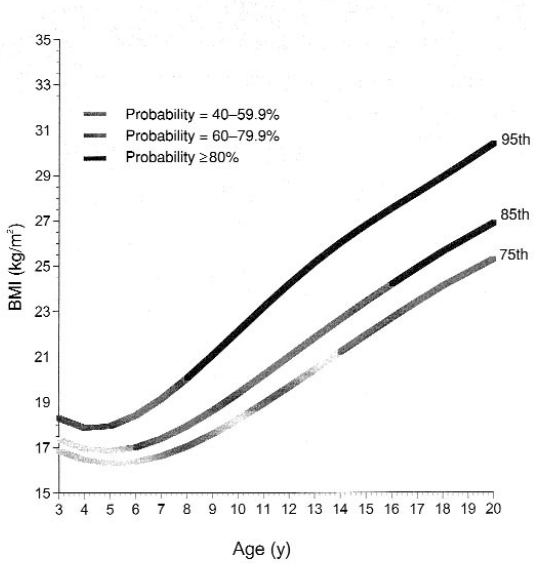

FIGURE 1. The probabilities of adult overweight for young males based on the 75th, 85th, and 95th BMI percentiles in childhood and adolescence from the CDC BMI-for-age growth charts.

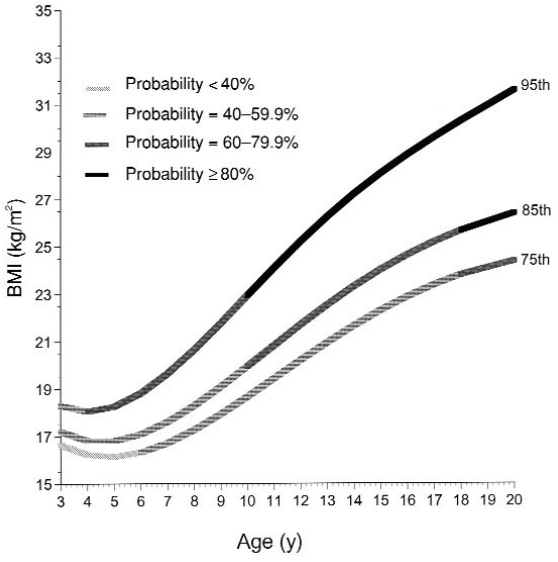

FIGURE 2. The probabilities of adult overweight for young females based on the 75th, 85th, and 95th BMI percentiles in childhood and adolescence from the CDC BMI-for-age growth charts.

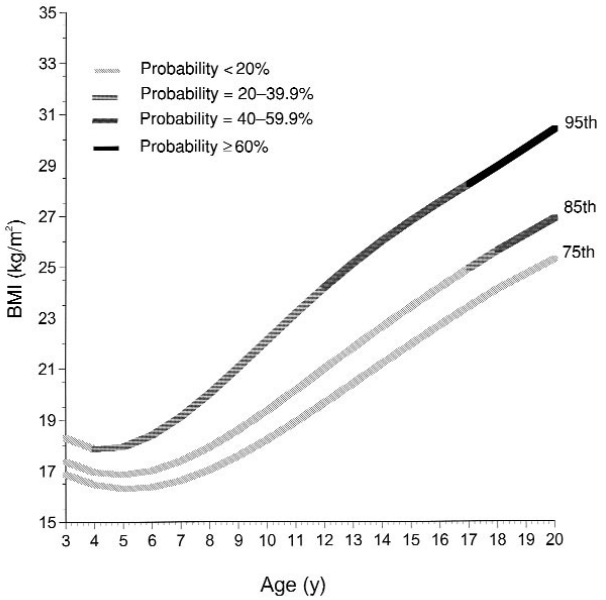

FIGURE 3. The probabilities of adult obesity for young males based on the 75th, 85th, and 95th BMI percentiles in childhood and adolescence from the CDC BMI-for-age growth charts.

In the present study, adult overweight was categorized as a BMI ≥ 25 and adult obesity as a BMI ≥ 30. The present findings, like our previous ones, show that the probability of adult overweight and obesity based on childhood and adolescent BMI values increases with age during childhood and adolescence (4). This result shows that high childhood or adolescent BMI values, ie, overweight or obesity in childhood or adolescence, are important risk factors for adult overweight and obesity. These findings, along with those of other researchers, emphasize the continued importance of adolescence as one of the significant "critical periods" in the development of adult obesity (6, 8, 20). The extent of the increase in probabilities of adult overweight and obesity with age was also greater for children with BMI values at the 95th percentile than for those with BMI values at the 75th percentile regardless of their age.

In the present study, more than one-half of the children and adolescents with BMI values at the 75th percentile on the new CDC BMI-for-age growth charts had a risk of being overweight as adults. Children and adolescents with BMI values at the 95th percentile had a 62–98% likelihood of being overweight at 35 y of age. More than 10% of the children and adolescents with BMI values at all ages at the 75th percentile on the CDC BMI-for-age growth charts had a risk of being obese as adults. Among the children and adolescents with BMI values at the 95th percentile, approximately one-fifth of the boys aged ≤ 8 y became obese adults, as did one-third of the young males aged between 8 and 13 y and more than one-half of those aged ≥ 13 y. Among the young females with BMI values at the 95th percentile, one-third of those aged ≤ 8 y, more than one-half of those aged between 8 and 13 y, and two-thirds of those aged ≥ 13 y were at risk of being obese at 35 y of age.

The sensitivity and specificity of selected childhood and adolescent BMI cutoffs in relation to adult BMI ≥ 25 and ≥ 30 were analyzed for ages 3, 8, 13, and 18 y. The age-specific cutoffs may be used to evaluate an individual child's or adolescent's BMI values. For example, an 18-y-old male whose BMI value exceeds the 72nd percentile on the CDC BMI-for-age growth charts will have an ≈40% probability of becoming an obese man at 35 y of age. The sensitivity and specificity at 3, 8, and 13 y of age were lower than those at 18 y of age for the chosen cutoff, and they were lower in the males than in the females. The sensitivity and specificity of the chosen cutoff (50th percentile for overweight and 72nd percentile for obesity) were excellent for predicting overweight and obesity at 35 y of age from BMI values at 18 y of age. This cutoff could facilitate public health screening programs by detecting children and adolescents with a high probability of being overweight or obese at 35 y of age.

When the plots of the probabilities in the present study are compared with those in our previous study (4), it is apparent that the risk of adult overweight for these children at any age has increased for those with high BMI percentiles on the 2000 CDC BMI growth-for-age charts. In our previous study, young males at the 75th BMI NHANES II percentile after the age of 14 y only had a 20–30% risk of adult overweight, but young males at these ages now have a 60–80% risk of being overweight as adults (Figure 1). Previously, boys as young as 5 or 6 y of age at the 75th percentile had a risk of adult overweight of < 20%, but boys at these ages at the 75th percentile now have a risk of 40–60% (Figure 1). Similar associations between the findings of the previous study and those of the present study occur at the 85th and 95th BMI percentiles for males and females from 3 to 20 y of age. Clearly, the increased prevalence of overweight and obesity reported among US children and adolescents (2) has contributed to a corresponding increase in those who will predictably become overweight or obese as adults. These increases in the predicted probability of adult overweight or obesity are also affected by a change in the definition of adult overweight from a BMI ≥ 26 for women and ≥ 28 for men to a BMI ≥ 25 for both sexes.

The prevalence of overweight and obesity among children, adolescents, and adults is a health problem in the United States and

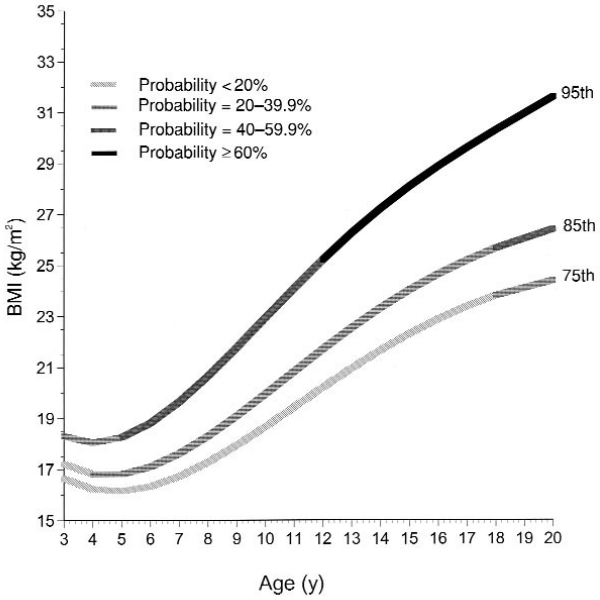

FIGURE 4. The probabilities of adult obesity for young females based on the 75th, 85th, and 95th BMI percentiles in childhood and adolescence from the CDC BMI-for-age growth charts.

around the world (2, 21–23). The probabilities reported here should be useful in clinical and public health assessments of children and adolescents with high BMI values on the new CDC charts. BMI values should be calculated for all children and adolescents, and a child or adolescent with a BMI at the 85th percentile or higher should be evaluated closely at all ages to confirm or rule out excess adiposity. Efforts should be made during childhood and adolescence to reduce high BMI values. This is preferable to waiting until adulthood when the pathophysiologic changes associated with overweight and obesity are likely to be established and when it is difficult to change lifestyles. Because children with high BMI values will be seen at repeated visits, one should also pay close attention to the patterns of change in the BMI values. We have also reported that the pattern of change in BMI with age, such as its velocity, is also a significant predictor of adult values for BMI and body fatness (6). Thus, the utility of BMI to predict overweight and obesity from childhood to adulthood is considerable. This is a very useful index for characterizing and monitoring the onset, development, and degree of overweight and obesity from childhood to adulthood.

Although the data used in this study were from white children and adolescents, the CDC BMI-for-age growth charts were developed from data on white, black, and Mexican American children and adolescents in the United States (6). White and black children and adolescents are represented at all ages, whereas Mexican American children are represented only from 2 to 6 y of age (6). When the probabilities and risk relations in the present study are applied to nonwhite ethnic or racial groups of children and adolescents, the results may be different from those presented. However, ethnic or racial differences in overweight and obesity are affected by nonbiological causes, and there is an increased degree of genetic admixture among children in the United States. Therefore, it is reasonable to assume that similar probabilities and risk relations for BMI between childhood, adolescence, and adulthood could exist in other ethnic or racial groups.

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