Objective: To determine the prevalences of overweight children and adolescents seeking care in 49 Practice Partner Research Network (PPRNet) primary care practices and to compare these rates with national population-based surveys.

Design and Setting: The prevalence of overweight subjects (>95th percentile for age and sex) and subjects at risk for being overweight (>85th percentile for age and sex) was calculated for 30,445 children aged 6 through 19 years visiting PPRNet primary care practices from 1995 through 1997. Prevalences were compared with prevalences from the National Health and Nutrition Examination Surveys. Percentile cutoffs from the National Health Evaluation Survey were used as the baseline standard for the comparisons.

Main Outcome Measure: Obesity prevalences.

Results: Thirty-six percent of boys aged 6 through 11 years and 35% of boys aged 12 through 17 years were either at risk for being overweight or overweight; 20% and 19% were overweight, respectively. Thirty-five percent of girls aged 6 through 11 years and 34% of girls aged 12 through 17 years were either at risk for being overweight or overweight; 20% and 18% were overweight, respectively. Prevalences of overweight subjects and subjects at risk for being overweight were much greater in patients of PPRNet primary care practices compared with the most recent national survey, the National Health and Nutrition Examination Surveys III.

Conclusions: One in 3 children and adolescents visiting PPRNet primary care practices is at risk for being overweight or is overweight. The prevalence of obesity in children and adolescents visiting primary care practices is much greater than that observed in national population-based surveys.

SUBJECTS AND METHODS

SUBJECTS

The participating practices included 49 PPRNet family practice offices. Founded in 1995 by the Medical University of South Carolina Department of Family Medicine, PPRNet is a practice-based research network based in Charleston, SC.6 Research activities of the PPRNet are based on a longitudinal patient database composed of data from electronic patient records. To participate in PPRNet, the clinic must use the Practice Partner Patient Record electronic medical record. The database is updated quarterly and contains demographic information, vital signs, diagnoses, medications, laboratory test results, and other data. As of October 1998, PPRNet practices are located in 24 states. Rural, urban, and suburban areas are represented. Currently, the PPRNet database has information on 479,192 patients, including 2.5 million patient contacts, 5.9 million diagnoses, 2.9 million prescriptions, 0.4 million allergies, 7.4 million vital signs, 10.2 million laboratory test results, and 1.0 million preventive services. From the PPRNet master database, a smaller database was created that included age, sex, height, weight, and date of visit for all 4- to 19-year-old patients visiting the practices from January 1995 through December 1997. We chose a 3-year time frame because most children visit their physician at least once in 3 years, allowing us to capture most of the children enrolled in these practices.

The PPRNet master database for 1995 through 1997 includes 152,032 records of 4- to 19-year-old patients, but many were of multiple visits from the same patient. Records were eliminated from analysis if sex, age, height, or weight was not recorded, or if the height or weight was grossly implausible. (In some cases it appeared that temperature or blood pressure had been recorded as weight.) Of the 152,032 records, 618 had unreliable data for height and/or weight. After eliminating repeated records of the same children, 30,445 records with height and weight remained. There were 15,078 males and 15,367 females. Each patient was included only once in the final database, and we used the most recent visit for which height and weight were recorded. The University Committee on Research Involving Human Subjects of Michigan State University approved this study protocol.

DEFINITION OF OBESITY

There is no internationally accepted measure of obesity in children and adolescents. Methods of classifying obesity include comparison with growth charts (percentile weight for height by age and sex), percentile of triceps skinfold thickness, and calculation of body mass index (BMI), calculated as weight in kilograms divided by the square of height in meters. Body mass index is gaining favor as the preferred measure, and we used this metric value for our comparisons.

The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services7 recommends that children and adolescents with a BMI above the 85th percentile but less than the 95th percentile be classified as at risk for being overweight and those with a BMI above the 95th percentile be classified as overweight. We followed this classification scheme. A new classification for children and adolescents has recently been proposed, which is patterned after the new National Heart, Lung, and Blood Institute, Bethesda, Md, definitions of overweight in adults using percentile cutoffs that correspond to a BMI of 25 to 29.9 for grade 1 overweight and 30 and above for grade 2 overweight.8 This scheme is not yet in use.

COMPARISONS

We compared BMI distributions from the PPRNet children and adolescents with those of NHANES. We followed the method used by Troiano and Flegal.8 For the standard, they used BMI distributions derived from the National Health Examination Surveys (NHES) II (1963-1965) for children aged 6 to 11 years, and NHES III (1966-1970) for adolescents aged 12 to 17 years.8 Using the 85th- and 95th-percentile cutoffs from NHES to define subjects at risk for being overweight and overweight subjects, respectively, they calculated the percentage of children in percentiles above these cutoffs from NHANES I, NHANES II, and NHANES III data. To this analysis we appended the percentage of children and adolescents in the PPRNet practice with BMIs above the 85th and 95th percentiles.

For a more detailed and more contemporary comparison, we compared the distributions of the PPRNet patients’ BMIs by age group and sex with NHANES II data,10 the most recent national survey for which detailed comparison data was available at the time of this analysis.

RESULTS

The percentages of children and adolescents with BMIs above the 85th and 95th percentile cutoffs of the NHES database in the PPRNet and NHANES surveys are presented in the Table. The prevalences of obesity have increased over time, and the highest prevalences are in the PPRNet practices in all age and sex groups.

Figure 1 shows the percentage of boys in the PPRNet sample who have BMIs above the 85th and 95th percentiles according to NHANES II percentile cutoffs. The 13- to 15-year-old males have the highest prevalence above the 85th percentile (37%) and the highest prevalence above the 95th percentile (22%). Overall, 32% of males are above the 85th percentile and 17% are above the 95th percentile.

Prevalences for the girls are shown in Figure 2. The 10- to 12-year-old girls have the highest prevalence above the 85th percentile (36%), and the 18- to 19-year-old girls have the highest prevalence above the 95th percentile (19%). Overall, 33% of girls have a BMI above the 85th percentile and 16% are above the 95th percentile.
This study confirms our previous finding that many children and adolescents seen in primary care practices are overweight. The percentage of children and adolescents in PPRNet practices with BMIs above the 85th and 95th percentiles is nearly identical with the prevalences we previously described in a group of patients at Michigan primary care practices. One in 3 children seen in PPRNet primary care practices is at risk for being overweight, and 1 in 7 is overweight. Moreover, the prevalence of obesity in US children is rising dramatically, as given in the Table.

There are 3 plausible explanations for these findings: (1) These children are representative of the childhood population, and the prevalence of obesity in children has increased considerably in the past 10 years; (2) these children are more obese than the general population, and they see physicians because they are in poorer health than nonobese children; or (3) obese children visit their physician more frequently specifically because they are overweight. The last explanation seems unlikely because

<table>
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<th>Prevalence* of Overweight Children and Adolescents From 3 National Surveys and the Practice Partner Research Network†</th>
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<tr>
<td><strong>Males</strong></td>
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*Based on sex- and age-specific percentile cutoffs derived from NHANES (National Health and Nutrition Examination Survey) II and III: 1963 to 1965, ages 6 through 11 years for II; 1966 to 1970, ages 12 through 17 years for III. †NHANES indicates National Health and Nutrition Examination Surveys; PPRNet, Practice Partner Research Network. Values are given as percentages.

**Figure 1.** Prevalence of overweight males (aged 4 to 19 years) in the Practice Partner Research Network (percentage above the 85th and 95th percentile cutoffs as defined by the National Health and Nutrition Examination Survey [NHANES] II [1976-1980]).

**Figure 2.** Prevalence of overweight females (aged 4 to 19 years) in the Practice Partner Research Network (percentage above the 85th and 95th percentile cutoffs as defined by the National Health and Nutrition Examination Survey [NHANES] II [1976-1980]).

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cause we included all children visiting during a 3-year time frame, and most children of all sizes visit their physician at least once every 3 years. Moreover, each child was included only once no matter how many physician visits were made. The first explanation seems likely, but the second explanation is most intriguing and, if true, requires further study. Obese children do not yet have long-term diseases that would require frequent physician visits, but these children or their parents may have more health concerns and subtle psychological morbidity compared with healthy children.

Because our sampling was consecutive rather than random and because it was limited to 49 practices, a strict comparison with NHANES data is not valid. The NHANES stratified random sampling methods ensure proportionate representation for the country as a whole. The PPRNet practices may have overrepresentation of children from some minority groups and lower socioeconomic groups. (Data are not available on the socioeconomic status of children from PPRNet practices.) However, unlike in adults, the association between being overweight and socioeconomic status in children and adolescents is weak and not statistically significant.2 Because PPRNet data were gathered 4 to 7 years more recently than the latest national survey, our data may simply reflect the upward trend in obesity in the United States. But the increase in the absolute prevalence of overweight subjects from NHANES II to NHANES III, a 12-year period, was 3% to 6% compared with a 12% increase over 4 to 7 years when comparing PPRNet data with NHANES III data. Perhaps the upward trend in obesity is accelerating.

Moreover, our estimates of the prevalence of obesity in children and adolescents in PPRNet practices are likely to be fairly accurate. Unless there were systematic bias in one direction introduced by inaccurate methods of weighing and measuring in many of the practices, the large sample size is likely to overcome measurement biases.

We have demonstrated that the prevalence of obesity in children and adolescents in PPRNet practices is much higher than prior population-based estimates would have suggested. Therefore, the magnitude of the growing epidemic of childhood obesity takes on even greater importance for primary care physicians. Unfortunately, no effective office interventions for children have been developed. There is urgent need for research in this area. A nonjudgmental approach is essential. The consequences of an overzealous approach to obesity, namely anorexia and bulimia, are certainly even worse. At a minimum, clinicians should encourage all children and adolescents to engage in regular physical activity and develop healthy eating habits.

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