Diagnosis, Evaluation, and Treatment of Childhood Obesity in Pediatric Practice

Karen B. Dorsey, MD; Carolyn Wells, MPH; Harlan M. Krumholz, MD; John C. Concato, MD

Objective: To determine rates of diagnosis and treatment, and types of treatment, among overweight children in clinical practice.

Design: Six hundred randomly selected records were reviewed.

Setting: Two community-based and 2 hospital-based clinics in New Haven.

Participants: Children aged 3 to 17 years with a health maintenance visit from January 1, 1999, to December 31, 2000. Children classified according to body mass index (BMI) (calculated as weight in kilograms divided by the square of height in meters) lower than the 85th percentile were designated as nonoverweight; 85th to 94th percentile, at risk of overweight; and 95th percentile or greater, overweight.

Main Outcome Measures: We examined the text of the encounter note for documentation of BMI, corresponding diagnosis regarding overweight, examination for comorbid disease, and treatment for overweight.

Results: Among 600 patients, 52.6% were male, 34.5% were black, 35.1% were Latin American, 57.2% were in single-parent households, and 84.0% received Medicaid. Overall, 39.8% were at risk of overweight (n=107; range across sites, 14.7%-20.0%) or were overweight (n=132; range across sites, 18.0%-28.0%). The BMI was documented in 0.5% (n=3) of medical records. Among the 239 children at risk of overweight or overweight, 20.5% had a documented diagnosis (range, 12%-37%) and 16.9% had documented treatment (range, 6%-34%). The most common strategies among the 41 subjects with documented treatment (overweight and at risk of overweight patients) were diet (74%) and increased activity (49%). Treatment recommendations were often limited to general advice (eg, “recommended diet” [n=19] or “↑ [increase] exercise” [n=16]).

Conclusion: Despite a high burden of overweight, routine screening with BMI was not documented and few children received a formal diagnosis or treatment.

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vention (Figure 1). Few studies have examined whether practitioners are using this method to screen children to determine if they are overweight, if they are examining overweight children for diabetes mellitus or other co-morbid conditions, or if they are routinely providing counseling regarding diet or physical activity. Our objectives were to determine the rates of diagnosis and treatment of obesity and to describe specific types of treatment among 3- to 17-year-old children seeking routine care in 4 pediatric clinics (2 community health centers and 2 hospital-based clinics) in New Haven. These clinics serve an urban population with many racial and ethnic minorities insured by Medicaid. These characteristics are associated with a higher prevalence of obesity in children and a higher risk for comorbid diseases, in particular, diabetes mellitus.4,5,7,17-26

METHODS

We conducted a medical record review to estimate the prevalence of overweight and describe how often clinicians identify, examine, and treat overweight children. We chose 4 sites with the largest volume of pediatric patients in New Haven. The 2 community health centers employ pediatrics, nurse practitioners, and family practitioners (28 providers). The hospital-based health centers provide care within tertiary care teaching hospitals, and employ pediatricians and nurse practitioners (86 providers). Together, these 4 sites provide care for most children living in New Haven, with significant overlap of communities served by the clinics. We obtained approvals from the Human Investigation Committee at Yale University School of Medicine and each internal review board at the participating sites.

We identified 11,895 patient records using billing data for all patients aged between 3 and 17 years with a scheduled visit between January 1, 1999, and December 31, 2000, at the 4 clinics. We then generated a target random sample of 1,500 patients per site, for a final sample of 600 patient records. For each patient record, we identified an index visit, defined as the most recent visit during the study interval in which height and weight were recorded. A total of 870 medical records were requested to obtain our target sample size of 600. Medical records were excluded (n=270) because of an absence of adequate data to identify an index visit (eg, missing height) or an inability to locate the record. No other exclusions were made.

The prevalence of obesity among children seen for routine care was determined using age, sex, height, and weight from the index visit. The height and weight were converted into BMI. We compared the BMI for each child with national percentile values, using the Centers for Disease Control and Prevention standards for sex and age (in months). Per Centers for Disease Control and Prevention definitions, children with a BMI at or above the age- and sex-appropriate threshold for the 85th percentile were categorized as “at risk of overweight” and those with a BMI at or above the 95th percentile were categorized as “overweight.”

Documentation of BMI, diagnosis, and treatment was determined from the text of the index visit. A diagnosis was considered present if the word obese, overweight, or any text related to excess weight (eg, “↑ [increase] wt” or “↑ [increase] weight gain”) was present in the provider note for the index visit either before (eg, history of present illness) or after (eg, assessment and plan) the physical examination. Evidence of treatment for overweight included documentation of any of the following in the text of the index visit: (1) recommended diet modification (eg, “dietary changes recom-
mended” or “↓ [decrease] snacks”), (2) increase in physical activity (eg, “discussed exercise” or “↑ [increase] activity”), (3) recommended follow-up visits specifically for a weight problem (eg, “RTC [return to clinic] 2 months for wt ↑”), (4) referral to a subspecialist for weight control (nutritionist, endocrinology clinic, weight loss program, or social worker), or (5) testing for comorbidity disease (insulin levels, glucose testing, or lipid levels). The actual number of follow-up visits after the index visit was recorded to determine the actual frequency of follow-up for overweight, at risk of overweight, and nonoverweight patients. In addition, we examined the text from the index visit for any mention (present or absent) of obesity-related morbidity, including obstructive sleep apnea, polycystic ovary syndrome, hypertension, lipid disorders, insulin resistance, and diabetes mellitus.

To examine the relationship between patient characteristics and rates of overweight or at risk of overweight, we collected data from each patient record, including dates of birth, race or ethnic group (data available from 3 of 4 sites), clinic site, family structure, insurance type, duration of enrollment in the clinic, and frequency of visits during the enrollment period. These data were used to determine the rates of diagnosis among various subgroups of children seen in the 4 clinics. All proportions (rates) were calculated first from the actual sample numbers (n=600); adjusted values were then determined to account for sampling from the overall population of children (N=11,895) seen for routine care in all 4 clinic sites.

To test interrater reliability of medical record extraction, we extracted 5.0% of records (n=30) twice for patient and site characteristic variables (site, provider, family structure, insurance type, sex, race, date of birth, dates of first and most recent clinic visit, data of index visit, height, weight, and number of visits). An additional 13.0% of records (n=78) were reviewed to determine interrater reliability for the key outcome variables of diagnosis and treatment. We confirmed categorization of children as nonoverweight (<85th percentile for age and sex), at risk of overweight (≥85th and <95th percentiles for age and sex), and overweight (≥95th percentile for age and sex) for all patients using the publicly available software comparing subjects’ BMI values from this study group with Centers for Disease Control and Prevention BMI z scores. All analyses were performed using SAS statistical software, version 8.0 (SAS Institute Inc, Cary, NC).

RESULTS

Characteristics of the study population (Table 1) are reported as adjusted proportions. Data regarding race or ethnicity were available from 3 sites (n=450). The median number of visits was 3 per year, and the median duration of clinic enrollment was 6 years.

Agreement between data collectors was excellent for all variables presented, as indicated by k values in the range of 0.75 and 1.00 for descriptive variables. k Values for height, weight, and BMI were all 1.00; k values for diagnosis and treatment were 1.00 and 0.87, respectively. Five children were misclassified by medical record extraction as having a BMI of less than the 85th percentile; no data for diagnosis or treatment were collected for these children. Four of these children had a BMI only slightly above the 85th percentile (85.0-85.4), and 1 had a BMI at the 88th percentile.

Overall adjusted proportions of at risk of overweight and overweight were 17.6% (range, 14.7%-20.0%) and 20.2% (range, 18.0%-28.0%), respectively (Table 2).
2 to 20 years: Girls
Body mass index-for-age percentiles

<table>
<thead>
<tr>
<th>Date</th>
<th>Age</th>
<th>Weight</th>
<th>Stature</th>
<th>BMI*</th>
<th>Comments</th>
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*To Calculate BMI: Weight (kg) ÷ Stature (cm) = Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) = Stature (in) x 703

Published May 30, 2000 (modified 10/16/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

Figure 1. An example of growth curves published and distributed by the Centers for Disease Control and Prevention used to estimate a child’s body mass index (BMI) percentile for age and sex. The example shown is for girls.
Slightly more female patients were at risk of overweight and more male patients were overweight, but the total rates of male and female patients at or over the 85th percentile were similar. Among children aged 3 to 4 years, 27.7% were at risk of overweight or were overweight, compared with 46.6% of those aged 13 to 17 years. Rates of overweight among children living with biological parents in single-parent households or 2-parent households were different than those among children living with grandparents, other relatives, or in foster care. Several subgroups of children with distinct patient characteristics had differences in rates of overweight and at risk of overweight. Although statistically significant, the overall magnitude of these differences was small (for Medicaid recipients vs the privately insured; children with <$3 vs ≥$3 visits per year; and those enrolled for <1, 1-5, and ≥5 years).

The BMI was recorded by the provider at the visit in 0.5% (3/600) of the medical records reviewed. Percentages diagnosed within BMI percentile categories are as follows: 85th through 94th percentile, 5.9% (6/102); 95th through 98th percentile, 23.2% (22/95); and 99th percentile or higher, 56.8% (21/37). Rates of diagnosis and treatment among children receiving routine care in the participating clinics were 20.5% (range, 12%-37%) and 16.9% (range, 6%-34%), respectively. Rates for undiagnosed and untreated children were 79.5% (range, 63%-88%) and 83.1% (range, 66%-94%), respectively.

Rates of diagnosis varied slightly according to measured patient characteristics (Figure 2). Whereas patient age has little influence on whether providers documented diagnosis or treatment, male patients were diagnosed and treated more commonly than female patients (20.0% vs 13.5%; P < .001). Fewer Latin American children had documented diagnosis and treatment compared with black children (21.9% vs 29.4%; P < .001). Children with private insurance and those living with 2 parents more often had diagnoses and treatment (29.3% and 21.1%, respectively) compared with those with Medicaid insurance and those living with another guardian (18.8% and 12.4%, respectively) (P < .01 and P = .03, respectively). In addition, children with more frequent visits per year and longer periods of clinic enrollment also more commonly had documented diagnoses and treatment (23.8% and 23.4%, respectively) compared with those with fewer visits and shorter clinical enrollment (16.0% and 10.3%, respectively) (P < .001).

Among overweight children who were treated (n = 41), the most common treatment recommendation (using adjusted percentages) was dietary change (74%). Changes in activity were recommended for 49% of children treated. Only 14% were referred to a nutritionist or obesity management clinic, 3% were tested for comorbid diseases, and 7% had mention of the presence or absence of comorbid disease. (The unadjusted values were 78.0% [32/41] for dietary change, 46.3% [19/41] for changes in activity, 19.5% [8/41] for referral, 2.4% [1/41] for testing, and 4.9% [2/41] for mention of comorbid disease.) The difference in the number of visits after the index visit was small, although statistically significant (P < .001), for nonoverweight children (mean, 2.11; SD, 2.62) and for overweight or at risk of overweight children (mean, 2.23; SD, 2.83). The median number of visits after the index visit was 1 (range, 0-14) for nonoverweight children and 2 (range, 0-21) for overweight or at risk of overweight children.

Recommended changes in diet were most often limited to general advice about dietary change (n = 19) (eg, "discussed weight loss in general" or "recommended diet and exercise"). Less frequently, we found recommendations to avoid particular foods (n = 7) (eg, "↓ soda" or "Δ change to diet soda"). Other strategies included reducing portion size (eg, "eliminate seconds @ meals") (n = 1), including a specific goal to reduce caloric intake (eg, "discussed calorie restriction/food choice") (n = 2), reducing the frequency of meals or snacks (eg, "discussed 3 meals/24 hours/no snacks") (n = 2), and using specific tools to support behavior change (eg, "suggested keeping a journal of food and activities") (n = 1). Advice about activity change was also frequently nonspecific (n = 16), such as "↑ exercise." Other strategies for activity included advising participation in organized sports, joining a health club, and participation in an after school program.

### Table 1. Characteristics of the 600 Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unadjusted</th>
<th>Adjusted</th>
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</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>52.0 (312)</td>
<td>52.6</td>
</tr>
<tr>
<td>Female</td>
<td>48.0 (288)</td>
<td>47.4</td>
</tr>
<tr>
<td>Age, y</td>
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</tr>
<tr>
<td>3-4</td>
<td>19.7 (118)</td>
<td>21.8</td>
</tr>
<tr>
<td>5-12</td>
<td>60.7 (364)</td>
<td>58.5</td>
</tr>
<tr>
<td>13-17</td>
<td>19.5 (117)</td>
<td>19.6</td>
</tr>
<tr>
<td>Race/ethnicity†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>36.2 (163)</td>
<td>34.5</td>
</tr>
<tr>
<td>Latin American</td>
<td>40.7 (183)</td>
<td>35.1</td>
</tr>
<tr>
<td>White</td>
<td>10.0 (45)</td>
<td>6.7</td>
</tr>
<tr>
<td>Family structure</td>
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<td></td>
</tr>
<tr>
<td>1 Parent</td>
<td>56.7 (340)</td>
<td>57.2</td>
</tr>
<tr>
<td>2 Parents</td>
<td>33.2 (199)</td>
<td>31.6</td>
</tr>
<tr>
<td>Nonparent</td>
<td>10.2 (61)</td>
<td>11.3</td>
</tr>
<tr>
<td>Insurance</td>
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</tr>
<tr>
<td>Medicaid</td>
<td>81.7 (490)</td>
<td>84.0</td>
</tr>
<tr>
<td>Private</td>
<td>4.8 (29)</td>
<td>2.7</td>
</tr>
</tbody>
</table>

*Data are given as percentage (number) of the 600 patients. Percentages may not total 100 because of rounding or missing data.
†Data are given as percentages, sampling from the parent population (N = 11 895).
‡The denominator used was 450.

Despite the routine recording of height and weight during health maintenance visits, we found a striking absence of any systematic approach toward identification of overweight children in this population. It is unclear why screening practices for overweight using BMI during routine visits have not been adopted. Although our study was not designed to determine why providers do not adhere to published practice recommendations, our findings suggest that these practices have not been fully integrated into practice among the largest pediatric providers in New Haven. These findings raise questions as to whether implementation of these recommendations...
has been slow because providers perceive them as ineffective and inappropriate or whether systematic barriers rather than providers’ beliefs have prevented their adoption. In recent studies27,28 examining barriers to obesity prevention and treatment in general pediatric settings, clinicians have reported several obstacles, including parental and patient resistance to behavior change, lack of sufficient time, lack of adequate knowledge to provide counseling, poor availability of efficacious interventions, and lack of reimbursement for these services.

Whatever the underlying reasons, our results suggest that the failure to implement routine screening using BMI has several important consequences. First, many children, even those with profound obesity, were not identified as overweight. Consequently, children with a potential health risk were not examined or treated. Second, more extreme overweight children were preferentially identified and treated, making intervention early in the development of obesity unlikely. These visits, at which no attempt has been made to identify overweight children, evaluate their health risk, or provide treatment recommendations, amount to an important missed opportunity. Because documented diagnosis was so rare among patients in this population, we did not have adequate power to measure the mitigating effects of BMI percentile on the relationship between other patient characteristics and presence of diagnosis and treatment. We did observe that several of the patient subgroups who were more frequently diagnosed also had more patients with an extremely high BMI percentile. Thus, with this data set, it is impossible to isolate the individual impact of each patient characteristic on provider behavior. Nevertheless, we found several interesting trends that may indicate that providers may be underdiagnosing female patients, children who are Latin American, those insured through Medicaid, and those living apart from their biological parents. In addition, providers may become more sensitized to elevated BMI the longer or more frequently they encounter children. Whether this is due to having more opportunities to make a diagnosis or having the chance to develop a relationship with families and, thus, becoming more comfortable bringing up the topic of weight control requires further study.

Given the degree of underrecognition of obesity in this study, it is not surprising that few children who were overweight and at risk of overweight had any documented treatment in the clinical encounter. We found a particularly low proportion treated among at-risk children, compared with overweight children, indicating that practitioners tended to document treatment plans for children at the highest BMI percentiles. By focusing on the most extremely overweight children, providers might be selecting those patients who have the most difficulty maintaining or losing weight. Failures in treatment efforts centered on these children might exaggerate the perception of futility in achieving weight management for overweight children in general.

Documented treatment strategies most commonly focused on recommended diet changes and less often included recommendations to increase physical activity. The
focus of diet changes was often general advice to alter dietary practices and rarely specific, such as avoidance of particular foods and reduction of portion sizes or meal frequency. We rarely identified any documented plan to reinforce behavior changes with follow-up visits. Although several treatment strategies that target specific behaviors and use behavior modification methods to support and reinforce behavior change have been successful in achieving weight control, our findings suggest that such approaches have not been translated into clinical practice. The lack of strategies that incorporate even the most basic behavior modification techniques might limit the potential efficacy of interventions delivered in the clinical encounter. In addition, the absence of systematic and standardized treatment strategies limits the ability to measure treatment outcomes across patient populations.

Although not the main focus of this study, our results showed that despite the many children in the study with a BMI that qualified them for examination, few had any mention of or testing for diabetes mellitus or lipid disorders. The lack of examination for comorbid diseases highlights another important gap in care provided to overweight children. The reasons why children with potentially significant risk for comorbidity did not have any documentation of fasting plasma glucose level, oral glucose tolerance testing, or fasting lipid levels (as recommended by experts) were unclear. Whatever the cause, our findings suggest that potentially treatable conditions such as diabetes mellitus, insulin resistance, and dyslipidemias may be undetected, possibly leading to ongoing preventable health risk in affected children.

It is important to recognize several issues to consider in the interpretation of this study. Children in our study population were overrepresentative of Medicaid recipients, ethnic minority groups, and single-parent families. Although this might limit the degree to which our results can be generalized to different patient groups, several reasons explain why we chose to focus on this population. First, this population is profoundly impacted by the obesity epidemic and in need of immediate attention to this problem. Second, although several studies have demonstrated the increased risk of obesity-related comorbid disease in racial and ethnic minority groups, few have examined the quality and content of care delivered to these patients. Third, policy changes informed by this type of research have the potential to improve the quality of health care delivery for the entire Medicaid population. This sample was limited to 4 pediatric clinic sites in a single city, yet these clinics provide care to most children living in New Haven and are, therefore, representative of the care delivered to children in this community.

The most important implications of our findings are that efforts to address obesity in pediatric practice may be greatly enhanced by systems that encourage providers to adopt standardized approaches to diagnosis and treatment of overweight patients. In routine practice without such approaches, it is common for overweight patients to go undiagnosed and for attention to focus on treating the most extremely overweight rather than on early detection and prevention. Our findings also highlight the need for systems and investments that support testing and implementation of potentially effective evaluation and treatment strategies. Most important, studies that examine the impact of systematic intervention strategies on patient outcomes in clinical settings are needed to justify more aggressive implementation of practice recommendations. In New Haven, this study has been used to encourage clinics to adopt and evaluate universal screening strategies, routine evaluation of diabetes mellitus and lipid disorders, and standard treatment recommendations for children overweight or at risk of overweight.

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Correspondence: Karen B. Dorsey, MD, Yale University School of Medicine, 333 Cedar St, Room IE-61 SHM, PO Box 208088, New Haven, CT 06520-8088.

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REFERENCES


