

Primary Care Screening for Childhood Obesity: A Population-Based Analysis

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Abstract

Background: The prevalence of obesity among children and adolescents in the western world has increased dramatically.

Objectives: To assess the efficacy of routine childhood obesity screening by primary physicians in the pediatric population in Israel and the utilization of health services by overweight children.

Methods: The electronic medical records of children aged 60–83 months registered in 39 pediatric primary care centers between January 2001 and October 2004 ($n=21,799$) were reviewed. Those in whom height and weight were documented during a clinic visit (index visit) were classified as overweight, at risk of overweight, or normal weight according to body mass index percentiles. The number of visits to the pediatrician, laboratory tests and health care costs 12 months after the index visit were calculated.

Results: Anthropomorphic measurements were performed in 1556 of the 15,364 children (10.1%) who visited the clinic during the study period. Of these, 398 (25.6%) were overweight, 185 (11.9%) were at risk of overweight, and 973 (62.5%) were normal weight. Children in the first two groups visited the clinic slightly more often than the third group, but the differences were not statistically significant ($P = 0.12$), and they had significantly more laboratory tests than the rest of the children visiting the clinics ($P = 0.053$). Health care costs were 6.6% higher for the overweight than the normal-weight children.

Conclusions: Electronic medical records are a useful tool for population-based health care assessments. Current screening for obesity in children during routine care in Israel is insufficient and additional education of community pediatricians in diagnosis and intervention is urgently needed.

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tions. Reported rates in adults in the United States have jumped from 23% in the late 1980s to 31% in 2002 [1], and in children from 11% (age 6–17 years) [2] to 16% (age 6–19 years) [3]. The consequences of obesity have been well documented in adults [4], and similar evidence is now emerging among children [5].

Primary physicians play a major role in the initial identification of obesity in children. Although the U.S. Preventive Services Task Force has refrained from recommending routine screening for overweight in children and adolescents as a means to prevent adverse health outcomes [6], mainly because of a lack of evidence-based data [7], the American Academy of Pediatrics and the American Academy of Family Physicians endorse universal screening based on body mass index and BMI growth curves. Indeed, most physicians take the BMI into consideration more than weight and height measurements [8]. Studies have shown that primary pediatric practices in which BMI is routinely documented have high rates of referral of children and adolescents for counseling and intervention for overweight [9].

The purpose of the present study was to assess the rate of identification of overweight children in a large health management organization in Israel and to estimate the utilization of health care resources by this patient population compared to normal-weight children.

Subjects and Methods

The study was conducted at the Clalit Health Services, the largest of the four HMOs in Israel, serving 3.75 million people, of whom 1.2 million are under age 17. Clalit Health Services runs over 1300 primary community clinics throughout Israel. We focused

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The last two decades have witnessed an increase in the prevalence of obesity in the western world to almost epidemic propor-

BMI = body mass index

HMO = health management organization

on its 39 primary clinics that offer pediatric care only. The study protocol was approved by the Institutional Review Board.

We reviewed the electronic medical records of all children aged 60–83 months registered at one of the 39 Clalit primary pediatric care clinics from January 2001 to October 2004. We used Clalit's computerized data warehouse that stores demographic as well as medical data. Data are aggregated by inputs from health service providers, physicians documenting patient-physician interactions, laboratory data and pharmaceutical information.

Those for whom height and weight had been documented at any visit during this period (index visit) were defined as the study group, and their BMI was calculated according to the guidelines of the U.S. Centers for Disease Control [10]. Visits for a transient illness were excluded unless height and weight were measured at that time. The children were divided into three subgroups: overweight – BMI at or above the 95th percentile for age and gender; at risk of overweight – BMI between the 85th and 95th percentile for age and gender; and normal weight – BMI below the 85th percentile for age and gender.

The records of the overweight or at-risk patients in the study group whose index visit occurred before October 2003 were reviewed for number of clinic visits and use of additional medical services during the 1 year period following the index visit. These findings were compared to the normal-weight group and to the rest of the clinic visitors in 2004, respectively. The number of laboratory tests performed was compared between the patients at risk of overweight and the general clinic population of similar age, excluding the measured children. We included only laboratory tests normally recommended in cases of suspected obesity [11] as follows: plasma cholesterol, glucose, hemoglobin, alanine aminotransferase, aspartate aminotransferase and thyroid-stimulating hormone. The number of abnormal laboratory tests was compared between the overweight and at-risk-of-overweight groups, as we assumed that in the general population the tests were ordered largely because of a transient illness, so that the results were more likely to fall outside the normal range.

The estimated cost burden of obesity was defined as the total cost incurred by the HMO for health resources used by the overweight and at-risk patients during the year after the index visit. The following services were included: visits to medical specialists, medications, outpatient clinic visits, emergency department visits, hospital admissions, physiotherapy and diagnostic imaging. Primary physician fees were excluded because physicians are remunerated by the HMO according to the number of patients in their care, and not on a fee-for-service basis. Costs of medical services provided by hospitals were calculated according to the actual amount paid to these suppliers by the HMO. Costs of medical services provided by the HMO itself were calculated according to its expense list. Costs of drugs were calculated according to the HMO's expense list less the patient's share, where applicable.

Statistical analysis

Descriptive statistics and frequency distributions were calculated for the study variables. Information from the charts was entered

into a Microsoft Excel (Microsoft Corp., Redmond, WA, USA) database and analyzed with the Microsoft Excel Statistical Analysis ToolPak and SPSS version 12 (SPSS, Chicago, IL). Chi-squared test was used to compare overweight and at-risk children with normal-weight children for number of clinic visits, and analysis of variance (ANOVA) was used to compare overweight and at-risk children with the rest of the clinic population in 2004 for number of laboratory tests. Z-test for proportions was used to compare the number of normal and abnormal blood tests in the overweight and at-risk groups. A two-tailed *P* value of < 0.05 was considered significant.

Results

During the study period 21,799 children aged 60–83 months were registered in the 39 primary pediatric clinics of the Clalit Health Services. Of these, 15,364 (70%) visited the clinic during this period (total 47,067 visits) and their medical records were reviewed. Weight and height measurements were documented in 1556 cases (7.1% of the registered children; 10.1% of the children who visited a clinic) [Figure 1]. According to our BMI calculations, 398 children (25.6%) were overweight (217 boys, 55%), 185 (11.9%) were at risk of overweight (79 boys, 43%), and 973 (62.5%) were of normal weight. Of the overweight children, 148 (37.2%) had a diagnosis of obesity in their medical records (217 boys, 37.3%). Of the at-risk children, only 12 (6.5%) had a diagnosis in their records of being at risk (6 boys, 7.6%).

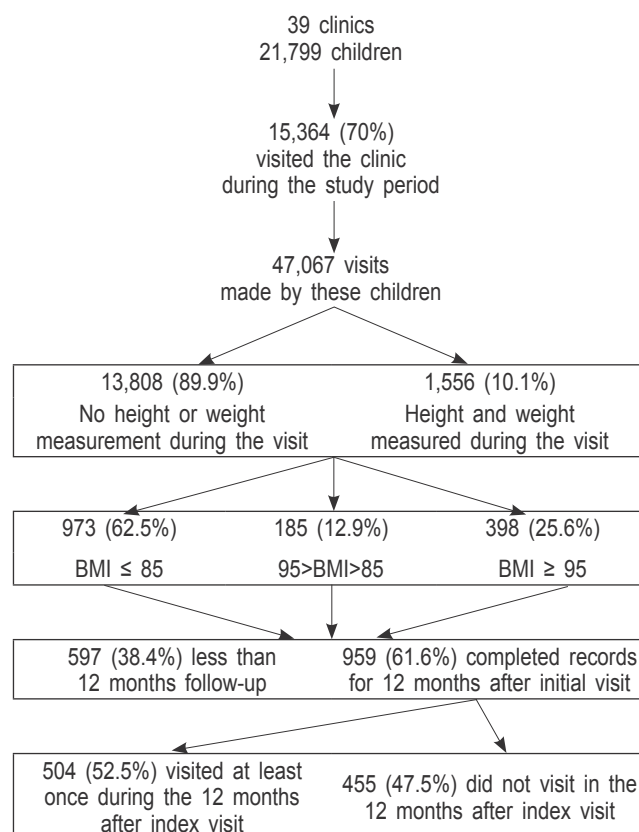


Figure 1. Flow chart of study population

Table 1. Physician visits during the 12 months following the index visit of children with BMI measurements

Group	Children who visited the physician during the 12 months following BMI measurement				All children (including those who did not visit the physician) during the 12 months following BMI measurement			
	No. of children	No. of visits	Average no. of visits per child	Ratio of visits of overweight/ at-risk children to normal-weight children	No. of children	No. of visits	Average no. of visits per child	Ratio of visits of overweight/ at-risk children to normal-weight children
Overweight	132	282	2.14	1.13	232	282	1.22	1.23
At risk of overweight	47	114	2.43	1.29	97	114	1.18	1.19
Normal weight	325	613	1.89	1.00	620	613	0.99	1.00
Total	504	1009	2.00		949	1009	1.06	

Table 2. Total laboratory tests performed in overweight and at-risk groups and rest of clinic population

	Overweight N=398 (%)	At risk of overweight N= 185 (%)	Unmeasured clinic population N=10,138 (%)	P
Cholesterol	73 (18.3)	9 (4.9)		0.00002
		9 (4.9)	455 (4.5)	0.4
Glucose	73 (18.3)		455 (4.5)	< 0.00001
	78 (19.6)	16 (8.6)		0.00034
AST		16 (8.6)	666 (6.6)	0.13
	78 (19.6)		666 (6.6)	< 0.00001
ALT	86 (21.6)	23 (12.9)		0.0042
		23 (12.9)	818 (8.1)	0.017
Hemoglobin	86 (21.6)		818 (8.1)	<0.00001
	84 (21.2)	23 (12.4)		0.059
TSH		23 (12.4)	809 (8.0)	0.012
	84 (21.2)		809 (8.0)	< 0.00001
Cholesterol	118 (29.6)	46 (24.9)		0.117
		46 (24.9)	1941 (19.1)	0.026
Glucose	118 (29.6)		1941 (19.1)	< 0.00001
	76 (19.1)	11 (5.9)		< 0.00002
AST		11 (5.9)	325 (3.2)	0.019
	76 (19.1)		325 (3.2)	< 0.00001

Table 3. Abnormal laboratory tests out of total number of tests in overweight and at-risk groups

	Overweight (%)		At risk of overweight (%)		P
	No. of tests	Abnormal tests (%)	No. of tests	Abnormal tests (%)	
Cholesterol	85	7 (8.2)	9	0	0.19
Glucose	97	7 (7.2)	22	0	0.09
AST	104	13 (12.5)	32	3 (9.4)	0.06
ALT	99	8 (8.1)	32	2 (6.3)	0.37
Hemoglobin	158	18 (11.4)	66	6 (9.1)	0.28
TSH	83	5 (6)	12	0	0.19

For analysis of number of post-index clinic visits, complete records were available for 959 children (61.6%) [Figure 1], of whom 10 were excluded from the analysis because of an excep-

tionally high utilization of health services (25 times the average of the other 949 children) for tests or treatments unrelated to obesity. A total of 504 children (53%) had revisited the clinic at least once, including 132 overweight children, 47 at-risk children, and 325 normal-weight children. The number of clinic visits per patient was higher for the overweight and at-risk children (2.14 and 2.43 respectively) than for the normal-weight children (1.89, $P = 0.053$).

The overweight group had on average 13% more visits than the control group, and the at-risk group 29% more visits [Table 1]. The mean number of visits for the whole sample of 949 children with BMI measurements (including children with and without additional visits after the index visit) was 1.22 for the overweight group, 1.18 for the at-risk group, and 0.99 for the normal-weight group. No statistically significant differences in these values were found between the groups ($P = 0.12$).

Significantly more laboratory tests were performed for the overweight children during the 1 year period after their index visit ($n=398$) compared to the general clinic population of the same age (excluding all measured children) in 2004 ($n=10,138$) [Table 2]. Significant differences were found between the overweight and at-risk group and the unmeasured children in the number of tests ordered for cholesterol, glucose, AST and TSH levels. Comparison of the rate of abnormal tests between the overweight and at-risk-of-overweight children and the unmeasured children visiting the clinics yielded significant differences in AST, ALT, hemoglobin, and TSH. The rate of abnormal laboratory tests was similar in the overweight and at-risk children [Table 3].

The mean health-cost expenditure (U.S. dollars) during the 12 month period after the index visit was \$154.50 for the overweight children ($n=232$), \$155.78 for the at-risk children ($n=97$), and \$145.52 for the normal-weight children ($n=620$). The corresponding cost ratios to normal-weight children were 1.062, 1.072 and 1.000. The cost for the children in the overweight and at-risk groups was 6.6% higher than the cost for the control children.

Discussion

Concern is growing in Israel and worldwide that the diet and sedentary lifestyle of many of today's children, of all ages [12], is leading to an overweight "epidemic." This phenomenon has dire consequences for their health. The initial step in identifying obesity is measuring and documenting height and weight [13]. In the present study anthropomorphic measurements were performed only in 10% of the children who visited the clinics during the study period. Considering that this is the age group in which the

AST = aspartate aminotransferase
TSH = thyroid-stimulating hormone
ALT = alanine aminotransferase

outpatient teams were asked to focus on anthropomorphic documentation, the suggestion is that BMI documentation needs to be improved. In the present study, of the 1566 children measured for height and weight 25% were found to be overweight and another 12% at risk of overweight. Children with a BMI beyond the 85th percentile for age and gender visited their doctor more often during the year after the height/weight measurement than children with a BMI below the 85th percentile. These visits were associated with significantly more laboratory tests and a higher cost of health care.

The World Health Organization described obesity as “one of today’s most bluntly visible, yet most neglected, public health problems” [14]. Accordingly, one of the most important findings of the present study was that height and weight were measured in only about 10% of the 21,799 children attending 39 pediatric clinics over a 4 year period. This low rate indicates an urgent need to educate the public and the medical community regarding the importance of routine BMI measurements in the pediatric age group. In one study of 144 Israeli physicians, 19% reported that they weigh all children examined in their clinic for obesity assessment [15]. However, in practice, this rate is apparently even lower.

Primary pediatricians play a sentinel role in the initial identification of obesity, education of patients and their parents, and referral of patients for further intervention, as necessary. However, many physicians continue to use weight for height instead of BMI to diagnose overweight in children [16]. A lack of familiarity with current recommendations was reported by 78% of physicians in Israel and 81% in Boston [15,16]. Furthermore, a recent report based on the U.S. National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey noted low counseling rates among clinicians during well-child visits [17]. Although multivariate analysis showed that children seen by pediatricians received counseling for diet and exercise more than twice as often as children seen by non-pediatricians, obesity was clearly underdiagnosed in the whole sample (only 1%). When asked about counseling pediatric patients on obesity, 25% of physicians surveyed in the southern New England area thought that they were not at all or only slightly competent, and 20% reported feeling not at all or only slightly comfortable with it [18]. These findings, together with those of the present study, emphasize the importance of alerting clinicians to the current guidelines of diagnosis and management of obesity. This would encourage more widespread measurement of BMI in children and also increase both the clinicians’ capability in counseling obese children and their faith in its overall effectiveness [16]. Additional barriers to proper management of obesity suggested in a 2002 survey of 202 pediatricians, 293 pediatric nurse practitioners, and 444 registered dietitians in the United States were lack of parental involvement, lack of patient motivation, and lack of support services [19]. All three groups questioned viewed child and adolescent obesity with concern, felt that intervention is important, and wanted further education in the field.

Regarding patient use of health care resources, we found that overweight children and children at risk of overweight visited their physician’s office more frequently than children with a normal BMI

for age and gender. Although the difference was of only borderline statistical significance ($P = 0.053$), the trend for more visits was clear. Studies have shown that obesity is associated with a range of illnesses that require medical attention, such as hypertension, dyslipidemia and asthma [20], impaired glucose tolerance, and obstructive sleep apnea [21], which may have accounted for a proportion of these visits. Further studies are needed to measure the reasons for these added visits and their cost-effectiveness.

Interestingly, the children at risk of overweight made on average 29% more visits to the clinic compared to controls, whereas the overweight children made only 13% more visits. It is possible that in the former group, the physician, family and/or children were aware of a potential to “reverse” the obesity process – hence, the more frequent visits. By contrast, the children who were already overweight might have been less compliant and failed to return to the clinic for further evaluation and treatment. This finding underscores the importance of preventive measures

The higher number of clinic visits in the overweight and at-risk group is in line with their higher number of laboratory tests. In recognition of the importance of obesity in children, the Maternal and Child Health Bureau convened an expert committee to formulate guidelines for its evaluation and management. Their findings were published in *Pediatrics* in 1998 [11] and included a recommendation for several screening blood tests. However, our findings show that even among children who were measured for height and weight and found to have a BMI over the 95th percentile, only 18% (cholesterol) to 30% (hemoglobin) underwent laboratory tests in the following year [Table 2]. These rates are significantly higher than those for normal and at-risk children but nevertheless unsatisfactory. This finding may be explained by an earlier report by our group and another from the USA showing that only a small percentage of physicians complied with the entire medical assessment [14,15]. Physicians who reported global adherence to guidelines were more likely to practice according to the expert committee recommendations [16]. Because of the low rate of screening blood tests, it will not be evidence-based to suggest a different screening routine. However, in our study the rate of abnormal results was significantly higher in the overweight and at-risk-of-obesity children compared to the rest of the children visiting the clinics, supporting the current laboratory screening recommendation

The average cost of health care for children with a BMI beyond the 85th percentile was 6.6% higher than for children in the normal-weight group. We suspect this rate is probably lower than the true rate had all children with this level of BMI been evaluated according to the published guidelines, including laboratory tests and follow-up visits. Nevertheless, even this conservative estimate carries weight in a growing population of at-risk or already overweight children. The expenses also rise considerably when these children become overweight adults [22].

A U.S. Institutes of Medicine report suggested that all medical records should be computerized by the year 2000 [23]. Although this goal has not yet been met, it is now recognized that electronic medical records can improve the quality of pediatric primary care [24] and have distinct benefits over paper-based charts

in the outpatient setting [25]. Conducting quality assurance and research with electronic medical records can help decision makers identify areas for improvement in their practice.

Our study has several limitations. First, it is retrospective, and does not preclude the possibility that in some cases, physicians measured height and weight but did not document them in the electronic medical record. Also, we excluded visits of children with a BMI beyond the 85th percentile if they were for a transient illness, although it is possible that some of the pediatricians considered these visits an opportunity for counseling and follow-up of height and weight measurements. Finally, the low rate of anthropometric measurements of children in our clinics limits the generalizability of the results to other health systems; however, the information on resource utilization and cost may be universal.

In summary, primary pediatricians play a paramount role in the diagnosis and management of obesity in children. Our findings suggest that physicians in the 39 pediatric clinics in Israel would benefit from additional training and education regarding intervention strategies, with implementation of published guidelines and efforts to reduce the number of missed opportunities for screening and counseling for overweight/obesity. A set of quality indicators for documentation of pediatric height and weight for the diagnosis of obesity needs to be established and its impact investigated.

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