ASSESSMENT OF CHILDREN

How to Use Repeated Measures of Body Mass Index (BMI) To Assess and Prevent Obesity in Children*

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Body Mass Index (BMI) and Weight Status</td>
<td>4</td>
</tr>
<tr>
<td>Care and Handling of Data</td>
<td>7</td>
</tr>
<tr>
<td>Weight Measurement Protocol</td>
<td>10</td>
</tr>
<tr>
<td>Height Measurement Protocol</td>
<td>10</td>
</tr>
<tr>
<td>BMI Screening Program</td>
<td>12</td>
</tr>
<tr>
<td>BMI Screening Program Sample Cases</td>
<td>13</td>
</tr>
<tr>
<td>1. Normal Growth</td>
<td>14</td>
</tr>
<tr>
<td>2. Increase in BMI and Effects of Intervention</td>
<td>15</td>
</tr>
<tr>
<td>3. Growth Pattern within “Normal Zone” Indicating</td>
<td>16</td>
</tr>
<tr>
<td>4. Decrease in BMI Indicating Failure to Thrive</td>
<td>17</td>
</tr>
<tr>
<td>5. Effect of Medication on Growth and Development</td>
<td>18</td>
</tr>
<tr>
<td>BMI Surveillance Program</td>
<td>19</td>
</tr>
<tr>
<td>School-based BMI Screening? or Surveillance?</td>
<td>20</td>
</tr>
<tr>
<td>Initiating Interventions with Parents</td>
<td>21</td>
</tr>
<tr>
<td>Conclusion</td>
<td>22</td>
</tr>
<tr>
<td>Appendix A: Body Mass Index or BMI</td>
<td>24</td>
</tr>
<tr>
<td>1. How do I calculate BMI?</td>
<td>24</td>
</tr>
<tr>
<td>2. Thinking Metric</td>
<td>24</td>
</tr>
<tr>
<td>3. Manually plot BMI Percentile</td>
<td>24</td>
</tr>
<tr>
<td>4. What is a BMI Z-Score?</td>
<td>25</td>
</tr>
<tr>
<td>5. Definitions of Overweight and Obesity for Adults</td>
<td>25</td>
</tr>
<tr>
<td>Appendix B: Summary Checklist - Height &amp; Weight Protocols</td>
<td>26</td>
</tr>
<tr>
<td>Appendix C: Screening: Sample Letters to Parents</td>
<td>28</td>
</tr>
<tr>
<td>1. Opt-out letter</td>
<td>28</td>
</tr>
<tr>
<td>2. Notification of Obesity Status</td>
<td>28</td>
</tr>
<tr>
<td>3. Notification of Overweight Status</td>
<td>29</td>
</tr>
<tr>
<td>4. Notification of Normal Weight Status</td>
<td>29</td>
</tr>
<tr>
<td>5. Notification of Underweight Status</td>
<td>30</td>
</tr>
<tr>
<td>Appendix D: Surveillance: Sample Letters to Parents</td>
<td>31</td>
</tr>
<tr>
<td>1. Notification of Surveillance</td>
<td>31</td>
</tr>
<tr>
<td>2. Notification of Surveillance plus Active Opt-Out</td>
<td>32</td>
</tr>
<tr>
<td>Appendix E: U.S. Preventive Services Task Force (USPSTF)</td>
<td>33</td>
</tr>
<tr>
<td>January 2010 Recommendation Statement on Screening for Obesity in Children and Adolescents</td>
<td>33</td>
</tr>
</tbody>
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INTRODUCTION

In January 2010 the U.S. Preventive Services Task Force (USPSTF) recommended that all school-aged children be screened for obesity and that obese children identified through screening be referred for treatment (See Appendix E). Making it easier for school districts to voluntarily comply with this recommendation is one of the goals of this document.

We begin by explaining the use of Body Mass Index or BMI in assessing the weight status of children and present several examples of the usefulness of repeated assessments of school-aged children over a multi-year period. We describe the basic elements of a screening program and a surveillance program and the strengths and limitations of each. This information can be used by health care professionals, school administrators, nursing staff, the members of a school wellness committee and other interested individuals who are considering the implementation of an obesity screening program or an obesity surveillance program in a school district. Appendix A offers information on how to calculate BMI and how to manually plot the age- and sex-specific BMI percentile for a child.

Proper measurement of children is a requirement for either program. General descriptions of protocols for measurement of height and weight are provided below and summarized in checklist format in Appendix B.

CHILDREN SHOULD BE MEASURED IN A RESPECTFUL MANNER IN A CONFIDENTIAL AND PRIVATE SETTING. THE DATA SHOULD BE TREATED WITH THE UTMOST CARE TO INSURE CONFIDENTIALITY AND SHOULD BE SHARED ONLY WITH PARENTS/CAREGIVERS AS SPECIFIED BY LOCALLY APPLICABLE LAWS, POLICIES OR REGULATIONS.

This document describes several cases taken from a school-based BMI screening program. These cases provide insight into normal development patterns and illustrate how repeated measures over a period of years can reveal growth patterns that signal problems that merit further evaluation. This document also illustrates the kind of information that can be generated through a BMI surveillance program. This information addresses the difference between screening versus surveillance and should help schools decide which program meets their needs.

Toward the end of this document we offer additional information on school-based programs and the importance of including local health care professionals as you plan your program. We close with some general considerations on how to initiate interventions with parents around the issue of weight management.
BODY MASS INDEX (BMI) AND WEIGHT STATUS

Body Mass Index or BMI is a mathematical way of relating a person’s weight to his or her height. The BMI has been in use for many decades, originally by insurance companies that used BMI to predict the health status of policyholders over the long term. Insurance companies were the first to correlate a higher BMI with subsequent early development of health problems and a shorter life span.

In adults, overweight and obesity can be determined by measurement of body fat content but such measurements are rarely done. More often, overweight and obesity are defined in terms of body mass index or BMI, which is a ratio: BMI is the weight of the individual expressed in kilograms divided by the square of his or her height expressed in meters (see Appendix A). BMI correlates well with body fat in a population which means that in general, the higher the BMI, the higher the body fat content.

For children, BMI changes dramatically with age and the pattern of change differs markedly depending on sex. The graphs below are intended for plotting BMI versus Age. Note the different shape of the percentile lines for girls shown on the left versus boys shown on the right.

The BMI graphs or growth charts shown above were developed by the Centers for Disease Control and Prevention (CDC) in 2000 and are easily downloaded from the CDC website (www.cdc.gov).
Since children are constantly growing, BMI must be based on carefully measured height and weight. These graphs or growth charts are used for the determination of each child’s BMI percentile-for-age (the pink chart for girls; blue for boys). To use a BMI chart, you must know the birth date of the child, so that you can calculate the age (in months) on the date that his or her height and weight were measured. The percentile lines closest to the point of intersection of the child’s age and BMI are used to estimate that child’s age- and sex-specific BMI percentile.

If this sounds complicated, don’t despair. There is an easier way to calculate and plot BMI versus age to determine the BMI percentile of a child or a group of children. If you know the sex, birth date, measurement date and the height and weight data for a child, you can use online programs to calculate and plot the BMI percentile automatically. The Shape Up America! online program was designed for screening programs with repeated measures of the same child year after year. It allows for the entry of up to six sets of data for a single child [http://www.shapeup.org/oap/entry.php]. The data will be graphed automatically for you and you can print out the graph to discuss it with the child’s parent(s). Another nicely designed program that permits multiple entries for a single child is found at KidsHealth. [http://kidshealth.org/parent/nutrition_fit/nutrition/bmi_charts.html]
The CDC offers an Excel Spreadsheet that is very convenient for surveillance programs or for screening programs that choose not to send a graph home to the parent(s). It can handle the data for up to 2000 school children (ages 2 to 19 years old). The spreadsheet is available in two versions (English and metric). The CDC spreadsheet will automatically calculate BMI percentiles for each child and summarize your data by grade level.

Your data will be automatically summarized into weight categories. These weight categories are defined by a BMI percentile range as shown below:

<table>
<thead>
<tr>
<th>WEIGHT CATEGORY</th>
<th>BMI Percentile(s) used to define this category</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 5&lt;sup&gt;th&lt;/sup&gt; Percentile</td>
<td>Any child less than the 5&lt;sup&gt;th&lt;/sup&gt; percentile is categorized as underweight</td>
</tr>
<tr>
<td>Normal weight</td>
<td>≥5&lt;sup&gt;th&lt;/sup&gt; up to &lt;85&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>Any child at the 5&lt;sup&gt;th&lt;/sup&gt; percentile or above, up to but not including the 85&lt;sup&gt;th&lt;/sup&gt; percentile is categorized as normal weight</td>
</tr>
<tr>
<td>Overweight</td>
<td>≥85&lt;sup&gt;th&lt;/sup&gt; up to &lt;95&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>Any child at the 85&lt;sup&gt;th&lt;/sup&gt; percentile or above, up to but not including the 95&lt;sup&gt;th&lt;/sup&gt; percentile is categorized as overweight</td>
</tr>
<tr>
<td>Obese</td>
<td>≥95&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>Any child at the 95&lt;sup&gt;th&lt;/sup&gt; percentile or higher is categorized as obese</td>
</tr>
<tr>
<td>Overweight or Obese</td>
<td>≥85&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>Any child at the 85&lt;sup&gt;th&lt;/sup&gt; percentile or higher is categorized as overweight or obese</td>
</tr>
</tbody>
</table>

To give you an idea of what the spreadsheet and summary information looks like, see the example below. The CDC Excel spreadsheet can be accessed at the following link:

Example of Measurements Tab for a single grade level (e.g. 3rd grade):

```
<table>
<thead>
<tr>
<th>ID (optional)</th>
<th>Name (optional)</th>
<th>Sex</th>
<th>Date of birth</th>
<th>Date of measurement</th>
<th>Height (centimeters)</th>
<th>Weight (kilograms)</th>
<th>BMI</th>
<th>BMI %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Carlos Rodriguez</td>
<td>M</td>
<td>3/7/1996</td>
<td>10/1/2007</td>
<td>146.7</td>
<td>57.7</td>
<td>25.1</td>
<td>99.2</td>
</tr>
<tr>
<td>3</td>
<td>John Smith</td>
<td>M</td>
<td>6/22/1998</td>
<td>10/1/2007</td>
<td>154.6</td>
<td>57.7</td>
<td>25</td>
<td>99.2</td>
</tr>
<tr>
<td>4</td>
<td>John Smith</td>
<td>M</td>
<td>6/22/1998</td>
<td>10/1/2007</td>
<td>143.2</td>
<td>39.7</td>
<td>16.6</td>
<td>59.9</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>F</td>
<td>6/11/1998</td>
<td>10/1/2007</td>
<td>130.2</td>
<td>34.9</td>
<td>17.2</td>
<td>64.7</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>F</td>
<td>9/6/1997</td>
<td>10/1/2007</td>
<td>146.4</td>
<td>36.3</td>
<td>17.2</td>
<td>64.7</td>
</tr>
<tr>
<td>7</td>
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<td>6/23/1996</td>
<td>10/1/2007</td>
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<td>16.2</td>
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</tr>
<tr>
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<td>4/24/1996</td>
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</tr>
<tr>
<td>9</td>
<td>M</td>
<td>M</td>
<td>8/16/1996</td>
<td>10/1/2007</td>
<td>156.1</td>
<td>29.3</td>
<td>15.4</td>
<td>50.3</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td>F</td>
<td>5/14/1997</td>
<td>10/1/2007</td>
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<td>35.9</td>
<td>17.1</td>
<td>54.0</td>
</tr>
<tr>
<td>11</td>
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<td>M</td>
<td>11/7/1997</td>
<td>10/1/2007</td>
<td>145.7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
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<td>10/2/2007</td>
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<td>61.6</td>
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<tr>
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<td>1/10/1999</td>
<td>10/2/2007</td>
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<tr>
<td>14</td>
<td>F</td>
<td>F</td>
<td>11/22/1997</td>
<td>10/2/2007</td>
<td>145.1</td>
<td>48.4</td>
<td>23.0</td>
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<tr>
<td>15</td>
<td>F</td>
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<td></td>
</tr>
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<td>10/2/2007</td>
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<td>10/2/2007</td>
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<td>31.6</td>
<td>13.6</td>
<td>5.2</td>
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<td>20</td>
<td>M</td>
<td>M</td>
<td>7/13/1997</td>
<td>10/2/2007</td>
<td>157.6</td>
<td>46.3</td>
<td>18.7</td>
<td>78.0</td>
</tr>
<tr>
<td>21</td>
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<td>11/12/1996</td>
<td>10/2/2007</td>
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<td>51.6</td>
<td>24.3</td>
<td>95.4</td>
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<td>12/12/1996</td>
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<td>96.4</td>
</tr>
<tr>
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<td>M</td>
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<td>1/10/2007</td>
<td>10/3/2007</td>
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<td>29.6</td>
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<td>Age err</td>
</tr>
<tr>
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<td>10/3/2007</td>
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<td>34.0</td>
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<td>10/3/2007</td>
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<td>22.6</td>
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<td>1/23/1997</td>
<td>10/3/2007</td>
<td>153</td>
<td>52.5</td>
<td>22.4</td>
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</tr>
<tr>
<td>33</td>
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<td>34.4</td>
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</tr>
<tr>
<td>34</td>
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<td>4/26/1997</td>
<td>10/4/2007</td>
<td>155.3</td>
<td>43.1</td>
<td>17.9</td>
<td>69.8</td>
</tr>
</tbody>
</table>

CARE AND HANDLING OF DATA

The data collected on children should be treated with great care as you would data on IQ or other clinical data on hearing or vision. Under most circumstances, the complete dataset would be accessible only to the school nurse or other qualified health care professional who can interpret the data and answer any questions parents may have about what it signifies for the health of the child. The data for as many as 2000 students can be entered into the spreadsheet as illustrated above. Note that the program flags data entry errors such as biologically implausible heights or weights. It will also note missing data such as a missing birth date. Once you have corrected all the errors and supplied any missing data, the software associated with the spreadsheet analyzes all of the data you enter and summarizes it automatically as shown below:
Example of Group Summary Tab for the above data:

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of children assessed:</td>
<td>51</td>
<td>45</td>
<td>96</td>
</tr>
<tr>
<td>Underweight (≤ 5th %ile)</td>
<td>2%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Normal BMI (5th - 85th %ile)</td>
<td>57%</td>
<td>76%</td>
<td>65%</td>
</tr>
<tr>
<td>Overweight and obese (≥ 85th %ile)*</td>
<td>41%</td>
<td>24%</td>
<td>34%</td>
</tr>
<tr>
<td>Obese (≥ 95th %ile)</td>
<td>25%</td>
<td>10%</td>
<td>19%</td>
</tr>
</tbody>
</table>


Note that in the above illustration, the data for the overweight children and the obese children are combined. It is possible for the user to alter the way in which the data are summarized so that all five weight categories are summarized individually if you prefer. The program then goes on to graphically present a summary of your data as illustrated below:

Example of Graphs on Summary Tab for the above data:
The data for a specific child should be shared only with that child's parent(s) or legal guardian(s). Parents should be counseled that the BMI data is for their information and guidance only, and should not be disclosed to the child. Providing the data directly to the child is not recommended.

Care should be taken to discourage children from seeing their own numbers or comparing their own numbers to those of other children. Children are usually unfamiliar with metric values. For this reason, taking the measurements in METRIC UNITS (weight to the closest tenth of a kilogram and height to the closest tenth of a centimeter) is encouraged. This will also facilitate data entry into the metric spreadsheet. If they are conducting a screening program, schools will have to maintain confidential records on each child that can be updated from year to year (or periodically as they decide) as shown in the cases that are described below on pages 14 - 18.

Before taking height and weight measurements, professional or clinical quality equipment must be in place and the necessary staff must be fully trained and tested for precision of measurements.
WEIGHT MEASUREMENT PROTOCOL

Weigh the child in a PRIVATE setting AFTER voiding and BEFORE a meal using a beam balance with nondetachable weights or a clinical quality electronic scale [e.g. see www.Tanita.com (425) 222-7873 or The Competitive Edge in Preston WA 425-222-7853 ]. An electronic scale with a detached readout (the base and the readout are connected by a wire as shown below) allows you to place the readout in a position so as to prevent the child from seeing the numbers.

![Beam balance with readout](image)

Place the measuring device on a hard flat surface and zero the balance before each measurement. The child should be wearing only light clothing. Shoes and socks should not be worn although for practical reasons, socks may have to be left on. Pockets should be completely emptied of keys, coins, cell phones, etc. The child should stand unassisted and care should be taken to check correct foot placement on the platform of the measuring instrument. Ask the child to look straight ahead, standing relaxed but still. Scales should be calibrated properly to insure accuracy of the data collected. Check the calibration of the balance or electronic scale with a set of known weights regularly throughout the year, or as specified by the scale manufacturer.

HEIGHT MEASUREMENT PROTOCOL

Because the calculation of BMI involves squaring the height (see Appendix A), any error in the measurement of height will lead to an incorrect assessment of BMI. Consequently, special care should be taken to obtain an accurate measurement of height.
Children should be measured in the standing position using a wall-mounted stadiometer – a device mounted on the wall for the purpose of measuring height accurately. [e.g. QuickMedical.com model 31-420 – estimated cost - $435] The wall should be perfectly flat with no molding to interfere with the placement of the stadiometer. Clothing should be minimal when measuring height so that the posture of the child can clearly be seen. Take care that braids, buns or other hair styles do not interfere with the measurement. Shoes and socks should not be worn. Measuring students during gym class promotes accurate measurements of both height and weight and can speed up measurements as the children are eager to return to class.

The child should stand with the back and head straight so that the Frankfurt plane (an imaginary plane formed by the two eyes) is horizontal and parallel to the floor.
Except as noted below, feet, knees, buttocks and shoulder blades should be in contact with the vertical surface of the stadiometer. Arms should be hanging loosely at the sides with palms facing the thighs; the head is not necessarily in contact with the wall (see below). Subjects are asked to take a deep breath, exhale and stand tall to aid in straightening of the spine. Shoulders should be relaxed. The moveable headboard should be gently lowered until it touches the crown of the head. If large amounts of adipose or fat tissue prevent the heels, buttocks, and shoulders from touching the wall simultaneously, the child should simply be asked to stand erect.¹

**BMI SCREENING PROGRAM**

The following section provides graphs and tables of data based on actual cases from a BMI screening program conducted by school nurses over a period of several years in a school district with more than 7000 children in Pennsylvania. The program was developed in 1998 by the school nursing staff and implemented for the first time in 1999. In subsequent years, the program continued to be implemented successfully, but communication with parents was improved under the guidance of the School Wellness Committee in collaboration with primary care physicians and other health care professionals living and

working in the community. As a consequence of this collaborative effort, all health care professionals in the community were prepared for the referral of parents whose children were identified to be at risk through this BMI screening program.

As you examine each of the five cases below, note how uninformative a single measurement of the BMI of a child is when compared to the information you can obtain through repeated measures of that child over a period of years. The ability to detect patterns of growth in individual children is the most important advantage of a BMI screening program over a surveillance program that only examines the prevalence of overweight and obesity in a population of children. On the other hand, if funds are limited, it may be difficult to establish a screening program and maintain records for the BMI and other health-related data for children over a period of years. To do so requires organizational skills and the ability to maintain the integrity and confidentiality of such sensitive data. For a limited budget, a BMI surveillance program may be the only approach possible. BMI surveillance is discussed in further detail on page 19.

**BMI SCREENING PROGRAM SAMPLE CASES**

The first case described below reflects normal development while subsequent cases reflect growth patterns that may signal problems that merit further evaluation.
This graph represents repeated measures of BMI versus Age and reflects a "normal" or expected growth pattern. The child’s BMI “tracks” or remains reasonably close to a percentile channel. This example is not meant to infer that a percentile ranking at the 50th percentile is the ideal. Any percentile between the 5th and the 85th is considered within the normal range. **What is important to note is NOT the percentile per se, but the fact that this child is tracking consistently over several years.** The table shows all of the data that were needed to develop this graph. The column on the far right of the table shows the BMI percentile for each measurement.
CASE 2     Significant Change in BMI and Effects of Intervention

This child's graph (and table) indicates a BMI increase of 2.43 units between the ages of about 7 years (81.11 mo) and 8 years (93.13 mo) with a resulting increase from the 87th percentile to the 94th percentile (see lines 2 and 3 of table). An increase of more than 2 BMI units over the course of a single year indicates a need for further assessment by the family health care provider.² This child was identified at age 9 through a school district screening program and was referred for further assessment and intervention. On the graph (and far right column of the table), note that at age 9, BMI percentile reached a maximum. Intervention was successful and subsequent measurements demonstrate a decreasing BMI percentile due to a decrease in rate of weight gain while still maintaining a growth in height of 2 to 3 inches per year.

CASE 3  Growth Pattern within “Normal Zone” Indicating Risk of Obesity

This child demonstrates a sharp upward trend in BMI percentile (see graph and also far right hand column of table) that will place her at risk of obesity if the trajectory of the increase continues unchanged. She is progressively increasing her rate of weight gain while maintaining a growth in height of approximately 2 inches per year. As of the fall of 2003, her BMI percentile still falls within the accepted or “normal” percentile range for her age and sex. Despite remaining in the “normal” zone, the overall growth trend is accelerating upward and clearly indicates that a referral is indicated to prevent future risk of overweight or obesity.
CASE 4  Decrease in BMI Indicating Failure to Thrive

This graph (and table) depicts a gradual decrease in BMI over the course of 4 years resulting in a BMI percentile below the 5th percentile. The data indicate abnormal growth and development due to minimal weight gain that does not keep up with her increase in height. There currently is no research regarding the use of the 5th percentile as a cut off for underweight. The CDC accepted the recommendation of the World Health Organization in choosing this percentile classification. These results would merit a referral to a qualified health care provider for further assessment to determine why this child is failing to thrive.

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CASE 5  Effect of Medication on Growth and Development

This child was diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and prescribed Ritalin, which she took periodically between ages 5 and 9. At age 9, she was started on Risperdal, which resulted in a 3-point jump in BMI and moved her from the 68th percentile to the 87th percentile. The following year she was diagnosed with bipolar disorder and prescribed Seroquel, which lead to a 7-point increase in BMI and a jump to the 98th percentile. This graph (and table) demonstrates that the use of certain medications can be associated with significant weight gain, indicating a need for intervention by a qualified health care professional4 including a possible change in medication.

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BMI SURVEILLANCE PROGRAM

As mentioned earlier, a BMI surveillance program also depends on the accurate determination of BMI and the age- and sex-specific BMI percentile. The data are collected and aggregated in a manner that is useful to the school health care professional (usually the school nurse) or School Wellness Committee who is interested in the aggregate data – usually as a health indicator. The following illustrates the type of information that can be collected through a BMI surveillance program. Assume that you have measured 100 first graders (56 girls and 44 boys), 102 fifth graders (54 girls and 48 boys) and 96 9th graders (45 girls and 51 boys) and categorized them into five groups (for each grade level) as shown below:

<table>
<thead>
<tr>
<th>Weight Category→</th>
<th>Underweight</th>
<th>Normal Weight</th>
<th>Overweight</th>
<th>Obesity</th>
<th>Overweight &amp; Obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentile Definition→</td>
<td>≤5th</td>
<td>&gt;5th - &lt;85th</td>
<td>85th - ≤95th</td>
<td>≥95th</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>Boys (44)</td>
<td>1</td>
<td>2.2</td>
<td>32</td>
<td>73</td>
<td>6</td>
</tr>
<tr>
<td>Girls (56)</td>
<td>0</td>
<td>-</td>
<td>40</td>
<td>71</td>
<td>7</td>
</tr>
<tr>
<td>All 1st graders (100)</td>
<td>1</td>
<td>1</td>
<td>72</td>
<td>72</td>
<td>13</td>
</tr>
<tr>
<td>Boys (48)</td>
<td>0</td>
<td>-</td>
<td>35</td>
<td>73</td>
<td>8</td>
</tr>
<tr>
<td>Girls (54)</td>
<td>0</td>
<td>-</td>
<td>39</td>
<td>72</td>
<td>7</td>
</tr>
<tr>
<td>All 5th graders (102)</td>
<td>0</td>
<td>-</td>
<td>74</td>
<td>72.5</td>
<td>15</td>
</tr>
<tr>
<td>Boys (51)</td>
<td>0</td>
<td>-</td>
<td>35</td>
<td>69</td>
<td>7</td>
</tr>
<tr>
<td>Girls (45)</td>
<td>2</td>
<td>4</td>
<td>30</td>
<td>67</td>
<td>7</td>
</tr>
<tr>
<td>All 9th Graders (96)</td>
<td>2</td>
<td>2</td>
<td>65</td>
<td>68</td>
<td>14</td>
</tr>
</tbody>
</table>

The aggregated data tells you the prevalence of each weight category at each grade level by each sex separately and for all children in each grade. BMI Z-scores can also be calculated for each grade level. This can easily be done using Excel. The Z-score will tell you how your three populations of children (first, fifth and ninth graders) differ from the reference populations on which the CDC BMI growth charts are based. For more information on the BMI Z-score, see Appendix A on BMI and also the CDC website [www.cdc.gov].
SCHOOL-BASED BMI SCREENING? or SURVEILLANCE?

Schools receiving federally supported meal programs are required by law to have a written SCHOOL WELLNESS POLICY that is posted and accessible to all students and faculty. Such a policy has usually been developed by the School Wellness Committee. Ideally, the committee would include:

- School nurses
- School administrators
- School food service personnel
- Teachers (physical education teacher)
- Students
- Parents
- Health Care Professionals (doctors, nurses)

The School Wellness Committee can decide if they wish to conduct an obesity screening program or an obesity surveillance program. A screening program involves identifying the status of each child based on his or her BMI percentile and informing parents (usually by mail in order to maintain confidentiality) of the results. Sample letters are provided in Appendix C for screening and in Appendix D for surveillance.

A screening program involves storing the BMI data from year to year in order to build a historical record on each child to document growth patterns and identify potential problems before they become severe. A screening program may also include other health assessments such as hearing and vision assessments.

A screening program may be conducted on a regular basis (such as every other year or every three years) as the budget permits. Depending on the budget available, a screening program can be conducted in one or more specific grade levels (such as 1st, 3rd, 5th and 10th grades), or in all grade levels.

A surveillance program collects and summarizes the data on children by grade level, but does not involve sending the results home to parents or storing the data on each child in order to build historical data on his or her growth over time. The data are usually summarized by grade level and by sex.

A surveillance program involves measuring all children and aggregating the data to determine the prevalence of underweight, normal weight, overweight and obesity in boys and girls at each grade level. A surveillance program does not entail notification of parents and is thus less expensive and easier to conduct. On the other hand, a screening program can help to stem the prevalence of overweight and obesity as it enlists the support of parents via the letter informing them of the results. Parents can be encouraged to consult qualified local health care professionals who can intervene appropriately with the families of children.
who are found to be at risk for serious health problems associated with obesity. For this reason, a screening program is considered to be a component of an overall childhood obesity prevention and/or treatment strategy. On the other hand, a surveillance program may be a useful first step in convincing the leadership of a school system or a community that a screening program is needed to improve the health of school-aged children.

INITIATING INTERVENTIONS WITH PARENTS

Parents and children have separate concerns about overweight. Major barriers make it challenging for parents to initiate meaningful interventions with their children:

- Parents often demonstrate an inability to recognize overweight and obesity in their own child.5,6,7
- The majority of family health care providers fail to track BMI percentile and hesitate to address the problem with the parents of overweight or obese children so parents are skeptical that a problem exists.8
- Parents may mistakenly believe that their children are simply “big boned” or that they will “out-grow” their “chubbiness.”
- Parents lack knowledge of the deleterious physiological and emotional consequences of obesity in children. An appreciation of the problem as a serious health issue may be absent.
- There may be a lack of resources available to parents when they are ready to address issues related to their child’s weight.
- Parents may intuitively understand that weight is a sensitive issue and may not know how to broach the subject without alienating their child.

Parents need support to overcome these barriers, so they can be enlisted to intervene on behalf of their overweight children. Even if they are aware a problem exists, parents are often hesitant to initiate change due to concerns about causing unintended harm to their child’s emotional and physical well-being. Readiness to change must be assessed and respected.1,9 Once parents realize

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the importance of addressing overweight within their family and are ready to change, they want suggestions on how to make this a positive experience in their child’s life rather than a judgmental one. They seek out practical suggestions on healthful meals and snacks, fun activities for the whole family, and how to sustain the changes they are making.

Overweight or obese children are mostly concerned with acceptance from peers, their appearance, and their ability to perform in sports, on the playground and in gym class. Children typically want direct messages, small attainable goals, and parental support and acceptance.\textsuperscript{10}

To help their overweight children, parents are advised to:

- Communicate that their child is loved and accepted AS THEY ARE TODAY.
- Make FAMILY changes in lifestyle rather than impose individual changes on the child.
- Consult with the family health care provider before initiating dietary changes.

\textbf{CONCLUSION}

In this document we have presented the basic information needed to conduct a BMI Screening Program or a BMI Surveillance Program and discussed the merits of each. For school systems that can afford to conduct a complete screening program, that is the ideal situation since you will be able to build a growth history on each of your students which can be used to help parents understand how their child is developing. If you choose to conduct a screening program you can easily assess the prevalence of underweight, normal weight, overweight and obesity each year for each grade level by using the CDC Excel spreadsheet discussed above. In that sense, a screening program includes surveillance but a screening program goes one important step further to notify parents of the status of their child and when appropriate, encourages further evaluation by a health care professional if a child is underweight, overweight, obese or at risk for any of these conditions.

The most complete (and most expensive) screening programs will retain the data from year to year in order to document the growth history on each student. But if record-keeping on each student is too challenging or too expensive, this component of the screening program can be omitted. This weakens the

prevention component of a screening program since it is the historical pattern of growth of a child that permits you to identify students whose growth trends are accelerating either upward or downward.

One major advantage of a surveillance program is that it is less expensive. The results of a surveillance program can also be used to convince community leaders, parents, or school administrators that the health of school children in the community is at risk and this, in turn, may pave the way toward establishing a screening program.

Many communities are concerned about preventing childhood obesity and are launching various programs to promote healthier eating habits and investing in facilities such as walking trails, parks, community gardens or fitness centers to address the problem on a community-wide basis. Data collected through either a screening or a surveillance program can be invaluable for assessing the effectiveness of broader community-wide childhood prevention programs.
APPENDIX A: Body Mass Index or BMI

How do I calculate BMI?
To calculate BMI, you must measure height and weight and you must use the proper units in the calculation in order to obtain the correct answer. If you know your weight in pounds and your height in inches, you can calculate your BMI using the equation below:

\[ \text{BMI} = 703 \times \frac{\text{weight(lb)}}{\text{height(in)}^2} \]

So BMI = 703 \times \frac{\text{(weight in pounds)}}{\text{(height in inches X height in inches)}}

If you know your weight in pounds and your height in feet or in feet and inches, you must convert your height to inches before using the above equation. So a height measurement of 5 feet two inches tall must be converted to 62 inches before you use the equation.

Thinking Metric
If you know your weight in kilograms and your height in centimeters, first convert your height from centimeters to meters, then calculate BMI by using the following equation:

\[ \text{BMI} = \frac{\text{weight(kg)}}{\text{height(m)}^2} \]

So in the metric system, BMI = \frac{\text{(weight in kilograms)}}{\text{(height in meters X height in meters)}}

How do I MANUALLY PLOT the Age- and Sex-specific BMI Percentile?
In addition to the BMI of the child, you will need to calculate the child’s age (in months) on the date the child’s height and weight were measured. Based on the sex of the child, choose the correct BMI growth chart. Sample charts can be downloaded from the CDC website (www.cdc.gov). On the correct chart (based on the sex of the child) find the child’s AGE (in months) on the X-axis and the child’s BMI on the Y-axis. Use a ruler or straight edge to determine the point of intersection between the two values. The BMI percentile line closest to that point of intersection is the child’s sex- and age-specific BMI percentile.
What is a BMI Z-Score?
A BMI Z-score is a quantitative measure of the deviation of a specific BMI percentile from the mean of that population. So a positive Z-score tells you the child is heavier than the mean and a negative Z-score tell you the child is lighter than the mean. The number part of the z-score represents the number of standard deviations from the mean. So a z-score of +1.0 is one standard deviation above the mean and a z-score of -1.5 is one and a half standard deviations below the mean. So a Z-score allows you to compare the BMI of a given child to the BMI distribution for a population of children of the same age and gender.

What is the definition of "overweight" and “obesity” in ADULTS based on BMI?
The following are the Body Mass Index or BMI definitions used in ADULTS:

- “Overweight” is defined as a body mass index (BMI) that falls between 25.0 to 29.9
- “Obesity” is defined as a BMI of 30.0 or higher
- Underweight is a BMI of LESS THAN 18.5
- The “normal” zone for BMI is 18.5 to 25.9

NOTE: The above definitions are for adults only. Although useful in the general healthy adult population, BMI should NOT be used to assess overweight or obesity in body builders or certain other elite athletes, nor should it be used in the frail elderly.
APPENDIX B: Summary Checklist -- Height and Weight Protocols

To accurately weigh and measure students, the following procedures should be followed:

**Weight**
- Make sure that the scale is on a firm surface, preferably an uncarpeted floor.
- Set the scale at zero reading.
- Have student remove shoes, heavy jewelry, empty all pockets of keys, money, cell phones, etc.
- Have student remove heavy outer clothing, such as sweater, jacket, or vest.
- Have the student step on scale platform, facing you, with both feet on platform, and remain still.
- Read weight value to nearest 1/10 kilogram (or ¼ pound)
- Have recorder enter weight immediately on the data form or spreadsheet before student gets off scale.
- If using balance beam scale, return weights to zero position.

**Height**
- Have student remove shoes and hat.
- Have student remove hair ornaments, buns, braids to extent possible (note on chart or spreadsheet “unable to measure” if unable to obtain an accurate measurement; don’t “guesstimate” height of hairdo).
- Have student stand on footplate portion with back against stadiometer rule.
- Have student bring legs together, contact at some point (whatever touches first).
- Make sure that the knees are not bent, arms are at sides, and shoulders are relaxed.
- Make sure that the back of the student’s body touches/has contact with stadiometer at some point.
- Make sure that the body is in a straight line (mid-axillary line parallel to stadiometer). Check to see if the student’s head is in appropriate position. You should be able to draw a straight (perpendicular) line from the back of the board, past the ear opening and the top of the cheek bone. You can use a pencil or ruler to help check the line. This is called the Frankfort plane.
- Lower headpiece snugly to crown of head with sufficient pressure to flatten hair.
- Read value at eye level; read in an upward direction (from lowest to higher number).
- Measure height to nearest 1/10 cm (or 1/8 inch) and record value.
- Repeat measurement, having the child line up again, and record appropriate value immediately on data form.
- Repeat measurements should agree within ½ cm or ¼ inch, if they do not, repeat measurement a third time.
Reading Height Measurements
• Read at eye level
• Count visible lines
• If the arrow points at a line, count that line
• If the arrow points between lines, read to nearest line
• Use 0.5 (1/2) line as guide
• Read in upward direction (from lower to higher number)

Source: Comprehensive Growth Screening Program for Schools from the Massachusetts Department of Public Health, June 2007
APPENDIX C: Sample Text for Letters to Parents – BMI Screening Program

For those seeking to implement a school-based obesity screening program, we offer the following sample letters with text that can be adapted by you (placed on your school’s letterhead) to send to parents. We start with a parental “opt-out” letter because experience has shown that the first two or three years of a program, permitting parents to opt-out has increased acceptance of the program over the long run:

SAMPLE OPT-OUT LETTER REQUIRING PARENTAL ACTION BY A CERTAIN DATE

Dear Parent or Guardian:

The Centers for Disease Control have established growth charts with percentile ranges that identify which children may be at risk for specific health problems based on weight. By participating in our health screening program, you will be able to track your child’s growth as he/she progresses through the developmental years. You are encouraged to share the information we provide with your health care provider. This information will not be discussed with your child and will be treated as strictly confidential. Results will be provided to you by mail.

You may choose NOT to participate in this program. If you choose NOT to have your child participate, and NOT to be notified of your child’s results, please sign below and return this document to your child’s school no later than ____ (insert response date here)_____.

If you wish your child to participate, you do not need to do anything further. You will receive the results of the school screening by mail once they are available.

[Signed by the school nurse.]

LETTER NOTIFYING PARENT OF OBESITY STATUS

Dear Parent or Guardian:

The Centers for Disease Control have established growth charts with percentile ranges that identify which children may be at risk for specific health problems based on weight. By participating in our health screening program, you can track your child’s growth as he/she progresses through the developmental years.

Your child had his/her height and weight measured as part of a health screening program for all enrolled students. Based on these measurements, your child’s Body Mass Index (BMI) is equal to or above the 95th percentile for his/her age and sex. [Please refer to the attached graph showing the results for your child.] This means that your child is heavier than 95% of the children of the same age and sex and he/she faces a higher risk of health problems. Obese children are at increased risk for diabetes, heart disease, high blood pressure, and joint problems. They can also suffer from social isolation, depression, bullying and other emotional problems.

The following is a statement from the American Academy of Pediatrics,
“We recommend that children and adolescents with a BMI greater than or equal to the 95% for age and sex should undergo an in-depth medical assessment.”

You may wish to share this information with your family health care provider and arrange for a further evaluation of your child.

This information is treated with the strictest confidentiality and has not been discussed with your child. Please contact us should you wish to be referred to a qualified health care professional.

[Signed by the school nurse.]

**LETTER NOTIFYING PARENT OF OVERWEIGHT STATUS**

Dear Parent or Guardian:

The Centers for Disease Control have established growth charts with percentile ranges that identify which children may be at risk for specific health problems based on weight. By participating in our health screening program, you can track your child’s growth as he/she progresses through the developmental years.

Your child had his/her height and weight measured as part of a health screening program for all enrolled students. Based on these measurements, your child’s Body Mass Index (BMI) is equal to or above the 85th percentile for his/her age and sex. [Please refer to the attached graph showing the results for your child.] This means that your child is heavier than 85% of children of the same age and sex. Although some overweight children are perfectly normal and healthy, others may be at increased risk for health problems. You may wish to share this information with your family health care provider for a careful assessment of the weight and health of your child.

This information is treated with the strictest confidentiality and has not been discussed with your child. Please contact us should you wish to be referred to a qualified health care professional.

[Signed by the school nurse.]

**LETTER NOTIFYING PARENT OF NORMAL WEIGHT STATUS**

Dear Parent or Guardian:

The Centers for Disease Control have established growth charts with percentile ranges that identify which children may be at risk for specific health problems based on weight. By participating in our health screening program, you can track your child’s growth as he/she progresses through the developmental years.

Your child had his/her height and weight measured as part of a health screening program for all enrolled students. Based on these measurements, your child’s Body Mass Index (BMI) is equal to or above the 5th percentile (and below the 85th percentile) for his/her age and sex. [Please refer to the attached graph showing the results for your child.] This means that your child’s BMI falls in a range similar to the majority of children of the same age and sex. You may wish to share this information with your family health care provider.

This information is treated with the strictest confidentiality and has not been discussed with your child. Please contact us should you wish to be referred to a qualified health care professional.
LETTER NOTIFYING PARENT OF UNDERWEIGHT STATUS

Dear Parent or Guardian:

The Centers for Disease Control have established growth charts with percentile ranges that identify which children may be at risk for specific health problems based on weight. By participating in our health screening program, you can track your child’s growth as he/she progresses through the developmental years.

Your child had his/her height and weight measured as part of a health screening program for all enrolled students. Based on these measurements, your child’s Body Mass Index (BMI) is equal to or below the 5th percentile for his/her age and sex. [Please refer to the attached graph showing the results for your child.] This categorization suggests that your child is underweight – i.e., weighs less that 95% of all children of the same age and sex. Although some small children are normal and healthy, some underweight children may need to be examined by a qualified health care professional to rule out the possibility of a medical problem. We suggest that you share this information with your family health care provider and arrange for further evaluation of your child.

This information is treated with the strictest confidentiality and has not been discussed with your child. Please contact us should you wish to be referred to a qualified health care professional.

[Signed by the school nurse]

NOTE: Brackets indicate optional text or text that should be modified based on local school capabilities or policies or legislation that may apply in local communities.
APPENDIX D: Sample Text for Notification Letters to Parents  – BMI Surveillance Program

For those seeking to implement a school-based obesity surveillance program, we offer the following sample letters developed in Missoula MT with text that can be adapted by you (placed on your school’s letterhead) to send to parents. The first sample letter simply notifies the parent of the program. It does not provide an opt-out form for the parent to sign and send back to school by a certain date. The second sample is an active opt-out letter that requires a parental signature on a form to be sent back to the school by a specific date should the parent wish to opt out of the program.

Sample Letter to Parent Notifying of BMI Surveillance Program:

Dear Parent:

I am excited about ________________ participating in a county-wide study involving third graders. This school year the Missoula City-County Health Department will be measuring the heights and weights of as many third grade students as possible throughout the county.

Nationally there has been a trend for the last 20 years of people becoming heavier and less active and increasing their health risks. This concern has gotten a lot of attention in the news media. The Health Department would like to see how Missoula County compares to other places and monitor this over time. These measurements will provide a powerful community health indicator similar to measuring air quality, traffic crashes or tobacco use. It will also allow us to measure our progress in contending with this public health challenge.

The heights and weights will be used to determine something called the Body Mass Index (BMI). The BMIs will not be recorded on your child’s school record; it will NOT be shared with you or your child; it will not be used in any way that identifies your child. Your child will not be able to see what their weight is or compare their results with other children. It is completely anonymous.

The Health Department will take all the BMIs from Missoula third graders and average them together to create our indicator. A team of MSU nursing students and a representative from the Health Department will be collecting the data on October 1st of this school year. We will complete the measurements during regular school hours and your child will not need to wear special clothes.

If you have any questions or concerns about these measurements and how the information will be handled, please contact __________________ at the Health Department. She can be reached at XXX-XXXX.

Montana Nutrition and Physical Activity Program [www.montananapa.org]  
Page 31
Sample Letter Requiring Parental Action to Opt Out of Surveillance Program:

Dear Parent:

I am excited about ______________ participating in a county-wide study involving third graders. This school year the Missoula City-County Health Department will be measuring the heights and weights of as many third grade students as possible throughout the county.

Nationally there has been a trend for the last 20 years of people becoming heavier and less active and increasing their health risks. This concern has gotten a lot of attention in the news media. The Health Department would like to see how Missoula County compares to other places and monitor this over time. These measurements will provide a powerful community health indicator similar to measuring air quality, traffic crashes or tobacco use. It will also allow us to measure our progress in contending with this public health challenge.

The heights and weights will be used to determine something called the Body Mass Index (BMI). The BMIs will not be recorded on your child’s school record; it will NOT be shared with you or your child; it will not be used in any way that identifies your child. Your child will not be able to see what their weight is or compare their results with other children. It is completely anonymous.

The Health Department will take all the BMIs from Missoula third graders and average them together to create our indicator. A team of MSU nursing students and a representative from the Health Department will be collecting the data on ___________ of this school year. We will complete the measurements during regular school hours and your child will not need to wear special clothes.

If you have any questions or concerns about these measurements and how the information will be handled, please contact ___________ at the Health Department. She can be reached at XXX-XXXX.

I think this is a great opportunity to help understand the overall health of the Missoula community and I am happy ______________ is participating.

If you do not want your child to participate in this data collection please sign the attached form and return to your child’s teacher by ____________.

I do not want my child, ____________________________, to participate in the Body Mass Index data collection project.

_________________________                     _______________
Parent/Guardian Signature                                                                 Date
APPENDIX E: U.S. Preventive Services Task Force (USPSTF) January 2010 Recommendation Statement on Screening for Obesity in Children and Adolescents

Summary of Recommendation and Evidence

- The USPSTF recommends that clinicians screen children aged 6 years and older for obesity and offer them or refer them to comprehensive, intensive behavioral interventions to promote improvement in weight status. Grade: B recommendation.


Importance

Since the 1970s, childhood and adolescent obesity has increased three- to sixfold. Approximately 12% to 18% of 2- to 19-year-old children and adolescents are obese (defined as having an age- and gender-specific BMI at ≥95th percentile). BMI values are used to determine a percentile score on the basis of population-based references such as those developed by the Centers for Disease Control and Prevention (CDC). The 2000 CDC growth charts that are used to calculate BMI were developed with data from 5 national health examination surveys that occurred from 1963 to 1994 and supplemental data from surveys that occurred from 1960 to 1995.1

Detection

Previously, the USPSTF found adequate evidence that BMI was an acceptable measure for identifying children and adolescents with excess weight.

Benefits of Detection and Early Intervention/Treatment

The USPSTF found adequate evidence that multicomponent, moderate- to high-intensity behavioral interventions for obese children and adolescents aged 6 years and older can effectively yield short-term (up to 12 months) improvements in weight status. Inadequate evidence was found regarding the effectiveness of low-intensity interventions.

Harms of Detection and Early Intervention/Treatment

There is adequate evidence that the harms of behavioral interventions are no greater than small.

USPSTF Assessment

The USPSTF concludes that there is moderate certainty that the net benefit is moderate for screening for obesity in children aged 6 years and older and for offering or referring children to moderate- to high-intensity interventions to improve weight status.

Clinical Considerations
Patient Population Under Consideration

This recommendation applies to children and adolescents aged 6 to 18 years. The USPSTF is using the following terms to define categories of increased BMI: overweight is defined as an age- and gender-specific BMI between the 85th and 95th percentiles, and obesity is defined as an age- and gender-specific BMI at ≥95th percentile. The USPSTF did not find sufficient evidence for screening children younger than 6 years.

Screening Tests

In 2005, the USPSTF found adequate evidence that BMI was an acceptable measure for identifying children and adolescents with excess weight. BMI is calculated from the measured weight and height of an individual.

Treatment

The USPSTF found that effective comprehensive weight-management programs incorporated counseling and other interventions that targeted diet and physical activity. Interventions also included behavioral management techniques to assist in behavior change. Interventions that focused on younger children incorporated parental involvement as a component.

Moderate- to high-intensity programs involved >25 hours of contact with the child and/or the family over a 6-month period and showed results including improved weight status, defined as an absolute and/or relative decrease in the BMI 12 months after the beginning of the intervention. Most participants were obese, and it is not known whether these results can be applied to children who are overweight but not obese. In addition, evidence was limited on the long-term sustainability of BMI changes achieved through behavioral interventions and on the trajectory of weight gain in children and adolescents. Interventions generally took place in referral settings, and the results can only be generalized to children who follow through on treatment. Low-intensity interventions, defined as ≤25 contact hours over a 6-month period, did not result in significant improvement in weight status.

Interventions that combined pharmacologic agents (sibutramine or orlistat) with behavioral interventions resulted in modest short-term improvement in weight status in children aged 12 years and older. There were no long-term data on the maintenance of improvement after discontinuation of medications. The magnitude of the harms of these drugs in children could not be estimated with certainty. Adverse effects included elevated heart rate, elevated blood pressure, and adverse gastrointestinal effects. Sibutramine, a centrally acting appetite suppressant, has been approved by the US Food and Drug Administration (FDA) for use in adolescents aged 16 years and older. Orlistat, a lipase inhibitor, has been approved by the FDA for use in adolescents aged 12 years and older. Neither sibutramine nor orlistat has been approved for use in pediatric populations younger than 12 years.

Screening Intervals

No evidence was found regarding appropriate intervals for screening. Height and weight, from which BMI is calculated, are routinely measured during health maintenance visits.

Other Considerations

Implementation
BMI percentile can be plotted on a chart or calculated by using readily available online calculators. Although moderate- to high-intensity interventions will rarely be practical in the primary care setting, children can be referred from primary care to these programs.

Research Needs and Gaps

Areas for further research include investigations to determine the specific effective components of behavioral interventions. Longer-term follow-up of participants in behavioral or multicomponent trials is needed to confirm maintenance of treatment effect and to assess longer-term risks and harms. Investigation is needed of more efficient, primary care-feasible interventions that use allied health professionals. More studies are needed that address weight management in minority children and adolescents, behavioral interventions in younger children (aged ≤5 years), and behavioral interventions in children who are overweight but not obese.

Discussion

Burden of Disease

During the past 3 decades, childhood and adolescent obesity (defined as age- and gender-specific BMI at ≥95th percentile) has increased three- to sixfold, with the rate of increase dependent on age, gender, and ethnicity. Recent prevalence figures (2003-2006) have indicated that ~12% to 18% of 2- to 19-year-old children and adolescents are obese. The prevalence of obesity varies with age and is more likely to be higher in older children, in males, and in racial and ethnic minorities. Evidence suggests that childhood and adolescent obesity can have a sizeable health impact. Obese children and adolescents have an increased risk of type 2 diabetes mellitus, asthma, and nonalcoholic fatty liver disease; are more likely to have cardiovascular risk factors; and have greater anesthesia risk. They may also experience more mental health and psychological issues such as depression and low self-esteem compared with nonobese children.

Scope of Review

The USPSTF examined the evidence for interventions intended to improve weight status in overweight and obese adolescents, evaluating both the effectiveness and harms of these interventions. Multicomponent behavioral interventions and interventions that combined behavioral and pharmacologic treatments were considered. Surgical treatments, which are reserved for morbidly obese patients who are identified without the need for screening, were considered to be outside the scope of this review, as was obesity prevention.

Accuracy of Screening Tests

In 2005, the USPSTF found that BMI (calculated as weight in kilograms divided by height in meters squared) percentile for age and gender is the preferred measure for detecting overweight in children and adolescents, because it is feasible and reliable and because it tracks with adult obesity measures. The definitions used by the USPSTF have changed since the 2005 report. Overweight is now defined as having a BMI between the 85th and 94th percentiles for the individual's age- and gender, and obesity is defined as having a BMI at ≥95th percentile for age and gender. BMI-for-age percentile is not a direct measure of adiposity, but it correlates fairly well with percentile rankings of directly measured percent body fat (with correlations generally between 0.78 and 0.88) in children. Because BMI changes with age, percentile scores based on age- and gender-specific norms are used to monitor growth.

Effectiveness of Treatment

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**Behavioral Interventions**

Thirteen behavioral intervention trials conducted with 1258 overweight or obese (primarily obese) children and adolescents aged 4 to 18 years were included in the USPSTF review. No studies targeted those younger than 4 years.

Hours of contact were used as a proxy for treatment intensity and categorized as very low (<10 hours), low (10-25 hours), moderate (26-75 hours), or high (>75 hours). Weight outcomes were defined as short-term (6-12 months since the beginning of the intervention) or maintenance (between 1 and 4 years after the beginning of the intervention and at least 12 months after the end of the intervention).

The comprehensiveness of interventions was also assessed. Interventions were deemed comprehensive if they included all of the following elements: (1) counseling for weight loss or healthy diet; (2) counseling for physical activity or a physical activity program; and (3) instruction in and support for the use of behavioral management techniques to help make and sustain changes in diet and physical activity. Behavioral management techniques included self-monitoring, stimulus control, eating management, contingency management, and cognitive-behavioral techniques.

Moderate- to high-intensity interventions were conducted in specialty health care facilities such as pediatric obesity referral clinics or similar settings. Such interventions would not be feasible for implementation in a primary care setting; however, they would be feasible for referral. The amount of absolute or relative weight change associated with 3 fair-quality comprehensive moderate- to high-intensity behavioral interventions was modest (1.9-3.3 kg/m² difference in mean BMI 6-12 months after starting treatment, compared with controls). For an 8-year-old boy or girl, the largest BMI difference (3.3 kg/m²) would be equivalent to ~13 lb (based on 50th percentile for height for ages 8 and 9, assuming ~2 in of growth). For girls aged 16 years this BMI difference would be equivalent to ~19 lb, whereas for boys aged 16 years the difference would be between 22 and 23 lb. Limited evidence suggests that these improvements can be maintained over 12 months after treatment. Lower-intensity interventions that are possibly feasible for primary care did not demonstrate a significant, consistent benefit with regard to BMI. Limited evidence suggests that reductions in insulin-resistance measures are possible with moderate- to high-intensity comprehensive interventions. However, decreases in cardiovascular risk factors (e.g., blood pressure, lipid levels, blood glucose levels, or insulin resistance) were not consistent.

**Combined Pharmacologic and Behavioral Interventions**

Seven trials combined pharmacologic treatments (sibutramine or orlistat) with behavioral interventions in 1294 obese adolescents aged 12 to 18 years. In 691 obese adolescents aged 12 to 18 years, between-group BMI differences were 1.6 to 2.7 kg/m² greater among those treated with 6 to 12 months of sibutramine plus behavioral intervention, compared with those who received placebo plus behavioral intervention. In 539 obese adolescents aged 12 to 18 years, 12 months of orlistat plus behavioral intervention compared with behavioral intervention alone resulted in a small but statistically significant between-group BMI difference (0.85 kg/m²). Two very small studies showed no significant differences between groups. There are no long-term data on the maintenance of improvement after discontinuation of sibutramine or orlistat. As noted, sibutramine has not been approved by the FDA for use in pediatric populations, whereas orlistat is currently approved for prescription use in children aged 12 years and older.

**Potential Harms of Treatment**

An examination of the literature on the harms of weight-management programs found no evidence of adverse effects on growth, eating disorder pathology, or mental health. Other harms, such as risk of exercise-induced injuries, were considered minimal. Serious adverse events were reported for 2.7% of the patients who were taking sibutramine and <1% of the patients who were taking the placebo. Adverse events...
occurred in 3% of the patients who received orlistat compared with 2% of the patients who received placebo. Adolescent sibutramine users were more likely to develop small increases in heart rate or blood pressure. They also commonly experienced mild-to-moderate adverse gastrointestinal effects, with 20% to 30% reporting oily spotting, oily evacuation, abdominal pain, fecal urgency, or flatus with discharge and 9% reporting fecal incontinence. Neither medication seems to adversely affect short-term (6–12 months) growth and maturation. Orlistat does not adversely impact fat-soluble vitamin levels.\textsuperscript{15,16}

**Estimate of Magnitude of Net Benefit**

The USPSTF found adequate evidence that multicomponent, moderate- to high-intensity behavioral interventions for obese children and adolescents aged 6 years and older can effectively yield short-term (up to 12 months) improvements in weight status. Inadequate evidence was found regarding the effectiveness of low-intensity interventions. There is adequate evidence that the harms of behavioral interventions are no greater than small. Harms of screening were judged to be minimal. Therefore, the net benefit of screening was judged to be at least moderate.

**Update of Previous USPSTF Recommendation**

This recommendation replaces the 2005 recommendation on screening and interventions for overweight in children and adolescents.\textsuperscript{12} At that time, the USPSTF found that overweight children can be identified by using BMI measurement but that the evidence for effective interventions for weight management in childhood was inadequate. The major change in the current recommendation is that the USPSTF has determined that comprehensive moderate- to high-intensity programs that include dietary, physical activity, and behavioral counseling components can result in improvement in weight status among obese children aged 6 and older who complete the programs.

**Recommendations of Others**

In 2007, an American Medical Association (AMA) expert committee of 15 individuals representing 15 professional medical organizations revised 1998 recommendations on how clinicians should approach the prevention, assessment, and treatment of childhood obesity.\textsuperscript{11,18} In the updated recommendations, the AMA advised that a clinician’s assessment should include a BMI calculation as well as medical and behavioral risks for obesity.\textsuperscript{11} For overweight and obese patients, the expert committee proposed using a stepwise approach that divides treatment into several stages including counseling, providing a structured weight-management plan, and using a comprehensive multidisciplinary intervention/tertiary care intervention delivered by multidisciplinary teams with expertise in childhood obesity. The American Academy of Pediatrics endorsed the 2007 AMA expert committee recommendations and has also recommended the annual plotting of BMI for all patients aged 2 years and older.\textsuperscript{11,19}

**Members of the U.S. Preventive Services Task Force**

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