Promoting Healthier Weight
in Pediatrics
Acknowledgements
This toolkit was originally developed in 2008, through collaboration between the Vermont Child Health Improvement Program, the Vermont Department of Health, and the University of Vermont College of Medicine, and with extensive input from the primary care community. In 2014, this toolkit was updated to reflect current standards of practice, guidelines, and best practices. We would like to thank all of those whose collaboration went into the first edition.

Vermont Child Health Improvement Program
UHC Campus, St. Joseph's 7, 1 South Prospect Street, Burlington, VT 05401
(802) 656-8210

Vermont Department of Health
108 Cherry Street, PO Box 70, Burlington, Vermont 05402
(802) 863-7330
# Table of Contents

## Introduction
4
- Overview & Office Visit Goals
- Algorithm: Guidelines for the Prevention & Management of Overweight Children

## Assessment
8
- Dietary & Physical Activity Habits
- Body Mass Index (BMI)
  - Steps to Calculate, Plot, and Interpret BMI
  - Measurement Technique Checklist
  - Example of How to Interpret BMI
- Physical Exam & Medical History
- Laboratory Tests & Referrals

## Counseling
11
- Goals for Treatment
- Behavior Change Counseling 101
- Steps for Interacting with Patients and Families

## Community Resources
14

## Reimbursement Strategies
16

## Resources & References
18

## Tools
20

## Adult BMI Charts
33

## National Guidelines


Introduction

Promoting a healthy weight, good nutrition, and physical activity provides health care practitioners the opportunity to reduce the rates of overweight and obesity in children and youth. Counseling children and families allows clinicians a chance to establish long term health benefits and prevent lifestyle related chronic conditions. In Vermont, 12% of low income children between two and five years of age are obese and according to the recent Vermont Youth Risk Behavior Survey, three in ten youths in grades 9 through 12 are overweight or obese.

This toolkit was designed to help health care practitioners develop their own approach to reach these goals, and to achieve the following office visit goals recommended by the American Academy of Pediatrics (AAP) guidelines for the prevention of overweight and obesity in children and adolescents. Although we acknowledge the important issues around being underweight (BMI < 5 %ile), these very different issues are not addressed in this toolkit.

Office visit goals for all children & adolescents

- Calculate and plot BMI once a year
- Document current weight status
- Assess current nutrition and physical activity
- Counsel families to develop healthy nutrition and physical activity behaviors

Vermonters look to their health care practitioners for health information. Vermont data shows that adults who are counseled by their health care practitioners are more likely to try healthier behaviors than patients not counseled. Pediatric providers can focus on prevention right from the start by helping families adopt healthy behaviors.

Helping families change health-related behaviors can be difficult, however. The information included here will introduce you to basic concepts. You may want to pursue additional training or reading. References and additional resources are included at the end.

All aspects of the toolkit should be used in combination with clinical judgment and sensitivity for this often challenging topic. Use the tools that will help you meet the office goals listed above.
Guidelines for the Prevention & Management of Overweight Children Ages 2-18 Years*

All Patients Annually
Assess Lifestyle: nutrition behaviors, physical activity behaviors, and attitudes towards change
Assess Medical Risks: physical exam (BMI, blood pressure), family history, review of systems
Calculate & Plot BMI
Classify by BMI

Healthy Weight
BMI = 5%-84% for age/gender

Overweight
BMI 85% - 94% for age/gender

Obese
BMI≥95% for age/gender

Review systems for overweight comorbidities & complications, including depression
Determine if there has been large change in BMI
Obtain family & patient history of risk factors:
Diabetes / Obesity / Cardiovascular Disease / High Blood Pressure / Hyperlipidemia

Obtain labs (see separate algorithm below)

Make referrals if needed for:
severe overweight (above 99th percentile)
severe overweight in children younger than 2 years
pseudotumor cerebri
sleep apnea
obesity hypoventilation syndrome
Blount’s disease
slipped capital femoral epiphysis

If the family is ready to discuss change, the items at left should ideally be covered at a second visit.
If a second visit is not feasible, try to discuss during current visit.

Ask family if they are willing to discuss behavior change
If not ready

Reinforce healthy habits of patient & family
If change is indicated and family is willing to discuss, work with patient/family to set an achievable goal for nutrition or activity (may be indicated even if healthy weight)
Re-evaluate at next visit (date of visit to be determined by behavior change plan)

Indicate respect for a family’s choice
Let them know you are a resource and that you will ask again in the future

### Pediatric Lipid Screening Guidelines*

<table>
<thead>
<tr>
<th>Age</th>
<th>Population</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-8 years</td>
<td><strong>Child Condition:</strong> BMI &gt; 95%ile OR diabetes, hypertension, cigarette smoker&lt;br&gt;<strong>FHx:</strong> MI, angina, CABG/stent/angioplasty at &lt;55 in males or &lt;65 in females, parent with TC&gt;240, parent with dyslipidemia</td>
<td>Fasting lipid profile x2 (2 weeks-3 months apart, average the results)*&lt;br&gt;*see tables B &amp; C for values</td>
</tr>
<tr>
<td>9-11 years</td>
<td><strong>ALL Children:</strong> SCREEN ONCE</td>
<td>Non-HDL cholesterol (non-fasting) or FLP</td>
</tr>
<tr>
<td>12-21 years</td>
<td>BMI &gt;85%ile or Child Condition or FHx to include above indications</td>
<td>Fasting lipid profile x2 (average results)</td>
</tr>
<tr>
<td>17-21 years</td>
<td><strong>ALL adolescents/young adults:</strong> SCREEN ONCE</td>
<td>Non-HDL cholesterol (non-fasting) or FLP</td>
</tr>
<tr>
<td>Anytime</td>
<td><strong>High risk medical condition</strong>**&lt;br&gt;**see table A</td>
<td>Fasting lipid profile x2</td>
</tr>
</tbody>
</table>

#### Table A: High Risk Medical Conditions

<table>
<thead>
<tr>
<th>High Risk</th>
<th>Moderate Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 DM&lt;br&gt;Type 2 DM&lt;br&gt;Chronic kidney disease/end stage renal disease/ post renal transplant&lt;br&gt;post heart transplant Kawasaki disease with current aneurysms</td>
<td>Kawasaki disease with regressed coronary aneurysms&lt;br&gt;Chronic inflammatory disease (systemic lupus erythematosus, juvenile rheumatoid arthritis)&lt;br&gt;HIV infection&lt;br&gt;Nephrotic syndrome</td>
</tr>
</tbody>
</table>

---

Table B: Acceptable, Borderline-High, and High Plasma Lipid, Lipoprotein, and Apolipoprotein Concentrations for Children and Adolescents**

<table>
<thead>
<tr>
<th>Category</th>
<th>Low, mg/dL</th>
<th>Acceptable, mg/dL</th>
<th>Borderline-High, mg/dL</th>
<th>High, mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>--</td>
<td>&lt;170</td>
<td>170-199</td>
<td>&gt;200</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>--</td>
<td>&lt;110</td>
<td>110-129</td>
<td>&gt;130</td>
</tr>
<tr>
<td>Non-HDL Cholesterol</td>
<td>--</td>
<td>&lt;120</td>
<td>120-144</td>
<td>&gt;145</td>
</tr>
<tr>
<td>Apolipoprotein B</td>
<td>--</td>
<td>&lt;90</td>
<td>90-109</td>
<td>&gt;110</td>
</tr>
<tr>
<td>Triglycerides</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-9 y</td>
<td>--</td>
<td>&lt;75</td>
<td>75-99</td>
<td>&gt;100</td>
</tr>
<tr>
<td>10-19 y</td>
<td>--</td>
<td>&lt;90</td>
<td>90-129</td>
<td>&gt;130</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>&lt;40</td>
<td>&gt;45</td>
<td>40-45</td>
<td>--</td>
</tr>
<tr>
<td>Apolipoprotein A-1</td>
<td>&lt;115</td>
<td>&gt;120</td>
<td>115-120</td>
<td>--</td>
</tr>
</tbody>
</table>

Recommended Cut Points for Lipid and Lipoprotein Levels in Young Adults**

<table>
<thead>
<tr>
<th>Category</th>
<th>Low, mg/dL</th>
<th>Borderline-Low, mg/dL</th>
<th>Acceptable, mg/dL</th>
<th>Borderline-High, mg/dL</th>
<th>High, mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>--</td>
<td>--</td>
<td>&lt;190</td>
<td>190-224</td>
<td>&gt;225</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>--</td>
<td>--</td>
<td>&lt;120</td>
<td>120-159</td>
<td>&gt;160</td>
</tr>
<tr>
<td>Non-HDL Cholesterol</td>
<td>--</td>
<td>--</td>
<td>&lt;150</td>
<td>150-189</td>
<td>&gt;190</td>
</tr>
<tr>
<td>Triglycerides</td>
<td></td>
<td></td>
<td>&lt;115</td>
<td>115-149</td>
<td>&gt;150</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>&lt;40</td>
<td>40-44</td>
<td>&gt;45</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>


Table C: Fasting Plasma Glucose and Liver Function Tests

<table>
<thead>
<tr>
<th>Fasting Plasma Glucose</th>
<th>Liver Function Tests (screening for Non-Alcoholic Fatty Liver Disease)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Children &gt; 10 years old (or at onset of puberty, if younger than 10)</td>
<td>For children &gt; 10 years old and BMI &gt; 95% (or BMI &gt; 85% with other risk factors)</td>
</tr>
<tr>
<td>• AND BMI &gt; 85%ile PLUS any 2 of the following:</td>
<td>• Obtain LFTs (ALT and AST)</td>
</tr>
<tr>
<td>• FHx Type 2 DM in first or second degree relative</td>
<td></td>
</tr>
<tr>
<td>• Race/ethnicity: Native American, African American, Latino, Asian American, Pacific Islander</td>
<td></td>
</tr>
<tr>
<td>• Signs of insulin resistance (acanthosis nigricans, hypertension dyslipidemia, PCOS)</td>
<td></td>
</tr>
</tbody>
</table>

Frequency: Check every two years

*Evidence is not yet available, but expert recommendation is as follows, until better evidence is available
**Assessment**

**Prevention**

**Breastfeeding**
Promoting healthier weight begins with feeding decisions made before and at the time of the infant’s birth. Explore with parents the benefits of exclusive and continued breastfeeding. Initiation and duration of breastfeeding are associated with reducing pediatric overweight.¹

**Behaviors**

**Nutrition & physical activity habits**
Incorporate assessment of nutrition and physical activity behaviors into routine clinical practice. A careful history will uncover opportunities to make improvements. Asking about nutrition and physical activity also raises awareness in the patient and the family of their importance for good health.²

Refer to Healthy Habits Questionnaire to assess activity and nutrition behaviors (pages 27-30).

**Attitudes**

**Self-perception & motivation**
Access perception or concern about weight with patient and family. Establish patient’s readiness for change and determine barriers, challenges, and successes.³ Refer to national guidelines and Healthy Weight Change Plan (pages 31-33) for more detailed guidance.

**Family History**
The guideline’s algorithm summarizes aspects of the patient and family risk factors that are important for the assessment of overweight.

**Review of Symptoms**
Take a focused review of systems using the table at right and refer to national guidelines in toolkit (page 35).

**Medical Risks**

**Physical exam**
Signs to look for while conducting the physical exam are included in the table at the right. Assess annually blood pressure and body mass index (BMI).

**Blood pressure**
When measuring blood pressure be sure to use a cuff large enough to cover 80% of the arm and refer to Table 2 (page 39) in the Implementation Guide when diagnosing hypertension.³

**SYMPTOMS & SIGNS OF CONDITIONS ASSOCIATED WITH OBESITY**

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>SIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety, school avoidance, social isolation, sleepiness or wakefulness (Depression)</td>
<td>Poor linear growth (Hypothyroidism, Cushing’s, Prader-Willi syndrome)</td>
</tr>
<tr>
<td>Tobacco use (Weight control technique)</td>
<td>Dysmorphic features (Genetic disorders, including Prader-Willi syndrome)</td>
</tr>
<tr>
<td>Polyuria, polydipsia, unexpected weight loss (Type 2 diabetes mellitus)</td>
<td>Acanthosis nigricans (Insulin resistance)</td>
</tr>
<tr>
<td>Severe recurrent headaches (Pseudotumor cerebri)</td>
<td>Hirsutism and excessive acne (Polycystic ovary syndrome)</td>
</tr>
<tr>
<td>Breathing difficulties (Shortness of breath, exercise intolerance, asthma, sleep apnea, hyperventilation syndrome, daytime sleepiness, nocturnal enuresis)</td>
<td>Violaceous striae (Cushing’s syndrome)</td>
</tr>
<tr>
<td>Abdominal pain (Gastroesophageal reflux, gallbladder disease, constipation)</td>
<td>Papilledema, cranial nerve VI paralysis (Pseudotumor cerebri)</td>
</tr>
<tr>
<td>Hip, knee, or foot pain (Slipped capital femoral epiphysis, musculoskeletal stress from weight)</td>
<td>Tonsillar hypertrophy (Sleep apnea)</td>
</tr>
<tr>
<td>Oligomenorrhea or amenorrhea (Polycystic ovary disease)</td>
<td>Adominal tenderness (Gall bladder disease, GERD, NAFLD)</td>
</tr>
<tr>
<td>Hepatomegaly (Nonalcoholic fatty liver disease [NAFLD])</td>
<td>Undescended testicle (Prader-Willi syndrome)</td>
</tr>
<tr>
<td>Limited hip range of motion (Slipped capital femoral epiphysis)</td>
<td>Lower leg bowing (Blount’s disease)</td>
</tr>
</tbody>
</table>


Mental Health
Depressed children and children with eating disorders also require psychological evaluation and treatment. Without treatment, a weight-control program may be ineffective. *Bright Futures in Practice: Mental Health* (see the Resources section for more information) provides information on early recognition and intervention for specific mental health problems.

Laboratory Tests & Referrals
Laboratory tests and referrals should be determined by the degree of overweight, family history, and the results of the physical exam. Clinicians should recognize and monitor changes in obesity-related risk factors for adult chronic disease, including hypertension, dyslipidemia, hyperinsulinemia, impaired glucose tolerance, and symptoms of obstructive sleep apnea syndrome. Universal screening is now recommended for all children aged 9-11 and 17-21. (Refer to page 6)

Body Mass Index (BMI)
Calculate and plot BMI periodically. BMI is the ratio of weight in kilograms to the square of height in meters. It is used to define overweight because it correlates well with more accurate measures of body fatness and is derived from commonly available data.

It is helpful for several members of the office team to know how to calculate patient BMI and to assign this role specifically for well-child visits.

Once BMI is calculated for patients, it is critical to assess and track the child’s BMI over time. You will also find an online BMI calculator at [http://apps.nccd.cdc.gov/dnpabmi/](http://apps.nccd.cdc.gov/dnpabmi/). If your practice has an Electronic Health Record that automatically calculates BMI percentile, it is important to document the weight category and discuss with patient and family.

A child with BMI between the 85th and 94th percentile for age and sex is considered overweight. BMI at or above the 95th percentile is considered obese. Newly-issued recommendations replace the phrase “at risk of overweight” with “overweight” and suggest the term “obese” rather than “overweight” for patients with a BMI ≥95th percentile. The negative impact of the term "obese"
The CDC recommends measuring stature for children 2 years and older who are able to stand on their own, calculating BMI and plotting it on the BMI-for-age chart. However, clinicians may choose to measure recumbent length and use the weight-for-length charts for children 2 to 3 years of age. Alternatively, the weight-for-stature charts can be used to plot stature from 77 to 121 centimeters. Whether the child’s length or stature is measured determines which growth chart will be used. It is inappropriate to use a length measurement to calculate BMI-for-age. It is also inappropriate to use a stature measurement with either the length-for-age chart or the weight-for-length chart.

**Measurement Technique Checklist**

**Stature**
- Use a calibrated vertical stadiometer with a right-angle headpiece
- Measure stature (height, not length) for children 2 years and older who are able to stand on their own*
- Child or adolescent is measured without shoes, outer clothing, or hair ornaments on calibrated stadiometer.
- The child is measured standing with heels, buttocks, and shoulders touching a flat upright surface
- Child or adolescent should stand on the stadiometer footplate with heels together, legs straight, arms at sides, shoulders relaxed
- Child looks straight ahead
- Bring the perpendicular headboard down to touch the crown of the head
- Measurer’s eyes should be parallel with the headboard
- Read the measurement to the nearest 0.1 cm or 1/8 inch and record it on the chart
- Reposition and remeasure the individual
- Measures should agree within 1 cm or 1/4 inch

**Weight**
- Use a beam balance or electronic scale.
- A child older than 36 months is weighed standing on a scale
- Child must stand without assistance
- Child or adolescent is wearing lightweight undergarments, gown, or negligible outer clothing
- Child or adolescent stands on center of scale platform
- Read the measurement to the nearest 0.01 kg, 10 gm, or 1/2 oz. and record it on the chart
- Reposition and repeat measure
- Measures should agree within 0.1 kg, 100 gm, or 1/4 lb

**BMI 99 PERCENTILE CUT POINTS (KG/M²)**

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>BOYS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>20.1</td>
<td>21.5</td>
</tr>
<tr>
<td>6</td>
<td>21.6</td>
<td>23.0</td>
</tr>
<tr>
<td>7</td>
<td>23.6</td>
<td>24.6</td>
</tr>
<tr>
<td>8</td>
<td>25.6</td>
<td>26.4</td>
</tr>
<tr>
<td>9</td>
<td>27.6</td>
<td>28.2</td>
</tr>
<tr>
<td>10</td>
<td>29.3</td>
<td>29.9</td>
</tr>
<tr>
<td>11</td>
<td>30.7</td>
<td>31.5</td>
</tr>
<tr>
<td>12</td>
<td>31.8</td>
<td>33.1</td>
</tr>
<tr>
<td>13</td>
<td>32.6</td>
<td>34.6</td>
</tr>
<tr>
<td>14</td>
<td>33.2</td>
<td>36.0</td>
</tr>
<tr>
<td>15</td>
<td>33.6</td>
<td>37.5</td>
</tr>
<tr>
<td>16</td>
<td>33.9</td>
<td>39.1</td>
</tr>
<tr>
<td>17</td>
<td>34.4</td>
<td>40.8</td>
</tr>
</tbody>
</table>

* The CDC recommends measuring stature for children 2 years and older who are able to stand on their own, calculating BMI and plotting it on the BMI-for-age chart. However, clinicians may choose to measure recumbent length and use the weight-for-length charts for children 2 to 3 years of age. Alternatively, the weight-for-stature charts can be used to plot stature from 77 to 121 centimeters. Whether the child’s length or stature is measured determines which growth chart will be used. It is inappropriate to use a length measurement to calculate BMI-for-age. It is also inappropriate to use a stature measurement with either the length-for-age chart or the weight-for-length chart.

**Significant changes in BMI should also be recognized and addressed. Refer to page 8 for symptoms and signs of conditions associated with obesity.**

Until the BMI 99 percentile is added to the growth charts, the Expert Committee recommends use of the following table to determine the 99 percentile cut points.²
Helping families adopt healthy behaviors is a major challenge for primary care clinicians. Most clinicians have received little training in the communication skills needed to engage families in making behavioral changes. This overview will introduce you to basic concepts, but you may want to pursue additional training or reading. Consult the Community Resources and Resources & References to get started.

Counseling for change and shared decision-making can be time-consuming. Explore a family’s willingness for a second, follow-up visit to give adequate time for counseling. While families are usually always involved, if you are working with an adolescent, it is important to acknowledge their independence.

**Goals for Treatment**

The primary goals of managing uncomplicated childhood overweight in still growing children should be **healthy eating and physical activity habits to maintain weight**, not weight loss.

Weight loss may be beneficial for children with secondary complications or a BMI greater than the 95th percentile, but this should be secondary to developing healthy habits. Refer to weight loss targets below.

Once families demonstrate they can maintain the child’s weight, recommend additional changes in eating and activity to achieve weight loss of approximately 1 pound per month.

**WEIGHT LOSS TARGETS**

<table>
<thead>
<tr>
<th>Age 2-5 Years</th>
<th>BMI 85-94 PERCENTILE</th>
<th>BMI 85-94 PERCENTILE WITH RISKS</th>
<th>BMI 95-98 PERCENTILE</th>
<th>BMI &gt;= 99 PERCENTILE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain weight velocity</td>
<td>Decrease weight velocity or weight maintenance</td>
<td>Weight maintenance</td>
<td>Gradual weight loss of up to 1 pound a month if BMI is very high (&gt;21 or 22 kg/m²)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 6-11 Years</th>
<th>Maintain weight velocity</th>
<th>Decrease weight velocity or weight maintenance</th>
<th>Weight maintenance or gradual weight loss (1 pound per month)</th>
<th>Weight loss (average is 2 pounds per week)*</th>
</tr>
</thead>
</table>

| Age 12-18 Years | Maintain weight velocity After linear growth is complete, maintain weight | Decrease weight velocity or weight maintenance | Weight loss (average is 2 pounds per week)* | Weight loss (average is 2 pounds per week)* |

---

*Excessive weight loss should be evaluated for high risk behaviors*
All children and families have strengths. Children with a weight concern may have some things they and their families need to change, but they also have assets or strengths that have helped them develop. A child’s strengths (things like a supportive friend or family member; discipline in practicing an instrument; or independence in preparing their own meals at home) will help a child stick with any recommended behavior changes. Similarly, a parent’s and family’s strengths will help them make changes together with their child.

Avoid offering unsolicited advice. A highly directive or confrontational counseling style often proves counterproductive. Clinician comments like “She really needs to stop watching so much TV” or “Your family needs to give up the sugary beverages and drink more water,” are not only unlikely to work, they may promote resistance to change.

Use reflective listening. When a parent responds negatively to a request to discuss weight, saying (for example) “I’m sick and tired of people getting on my case about Amber’s weight,” it is tempting to respond with, “Well, you know she’s at high risk for diabetes and heart disease when she gets older.” Instead, try something like, “You’re feeling frustrated with people blaming you for Amber’s being big.” Reflective listening helps parents and patients open up. It takes lots of practice – a course in motivational interviewing that includes role playing is a great way to learn.

Don’t assume that families should want to change, need to change, or must change health behaviors simply because their child’s long term health is at risk.

Avoid trying to do too much. Set no more than one or two goals for change in one visit.

Offer encouragement. Making changes requires courage. Remind families they have tackled tough issues in the past, and have strengths that will support them once they are ready to change.

Asking one or two questions can help identify strengths and lets patients know these are important aspects of their lives.

You may want to give interested parents “A Strength-Based Approach to Healthy Weight” (page 23) so they can help their child maintain a positive attitude.

Ask children: What are you good at?
What responsibilities do you have at home? At school?
Who are the important adults in your life?

Ask parents: Tell me about the things your child does well. What are some of the things you do together as a family? What makes you most proud of your son/daughter? Of your family?

Some Simple (and not so simple) Rules for Talking About Change

Begin with the positive. Pave the way by first identifying and praising the personal assets and other resources the patient and family may have: It’s great that you are doing so well in school. That tells me you know how to work hard to achieve goals for yourself.

Ask permission when preparing to discuss a sensitive topic like a child’s weight. I think it would be a good idea for us to talk about Amber’s healthy growth and development. Would that be OK?
### Examples of Interactions with Patients and Families

#### IF A PATIENT IS AT HEALTHY WEIGHT

Offer praise and encouragement. Then ask for any questions the patient or family might have about nutrition or physical activity issues.

| Amber, it looks like you are making some healthy eating choices. And we’ve talked today about continuing to walk to school. Your decision to stay active is a very healthy choice! Do you have any questions about food choices at school? Any questions about being active at home? |

#### IF A PATIENT IS OVERWEIGHT OR OBESE

Offer praise and encouragement to the patient and parent. Then ask for any questions the patient or family might have about nutrition or physical activity issues.

| Jacob, it is wonderful that you are such a big help to your mom. You are learning how to take on responsibility. That is a good example of your healthy development. And, Mrs. Peterson, it sounds like you are all making some healthy eating choices at home. Jacob, do you have any questions about food choices at school? Any questions about being active at home? |

| Jacob, Mrs. Peterson, I think it would be a good idea for us to talk about Jacob’s growth and development. Would that be OK? |

Then ask permission to discuss the patient’s weight. Depending on the age of the child, you may want to ask permission from the parent or the patient or both.

Use reflective listening and determine how ready the patient is for change. You may want to ask the patient and his/her family member to indicate where they are on a 1-10 scale of readiness. See the Healthy Weight Change Plan in the Tools section for an example.

#### IF THE PATIENT AND FAMILY APPEAR READY TO CHANGE

If the patient and family appear ready to change, explore the possibility of setting up a follow-up visit to give enough time for discussion of a change plan. At that visit, (or in the same initial visit if a second visit is not feasible) let the patient choose an achievable goal and make a plan for follow-up. The Healthy Weight Change Plan can help you talk through the patient’s readiness and level of commitment.

#### IF A PATIENT IS NOT READY FOR CHANGE

If the patient and family do not want to discuss the issue or are not ready for change, ask one of these questions:

You could also provide families with a copy of the Healthy Weight Change Plan. Ask them to think about making a change in the future.

| What might need to be different for you to consider making a change in the future? What does your family define as “healthy?” and/or Could I give you some information about the effects of overweight to help you think about this? |

Some additional pointers
- It is appropriate to express concern for unhealthy behaviors, especially if a child is above the 95th percentile.
- Complete any indicated health assessment.
- Note the readiness to change in the chart.
- Schedule an appointment for follow up.
- Ask again at the next visit.
Community Resources

You may want to identify a champion in your office who can research local resources and have the information readily available for patients and families.

One way to begin gathering information is to call Vermont 2-1-1, a free, statewide service that informs callers about community services available in their area.

2-1-1 staff is available:
Monday-Thursday: 8:00am-8:00pm
Friday: 8:00am-4:30pm
Dial 2-1-1, a local call from anywhere in Vermont
1-866-652-4636, toll free in Vermont
1-802-652-4636, from outside of Vermont

Statewide Resources

The Learning Kitchen empowers limited-resource parents and at-risk youth to prepare healthy, affordable meals for their families by increasing their nutrition, budgeting, shopping, and cooking skills. The program is a collaboration of the Vermont Campaign to End Childhood Hunger and the University of Vermont Extension’s Expanded Food and Nutrition Education Program. Cooking for Life offers the program across the state. For more information, contact 865-0255 or visit www.hungerfreevt.org/what/the-learning-kitchen

The Vermont Children’s Hospital at Fletcher Allen offers a Healthy Living Clinic once a week in Burlington. The referral based clinic provides consultations, nutrition assessment and education to children and adolescents who are overweight or obese and addresses nutrition and physical activity, as well as the medical and psychosocial/emotional aspects of overweight and obesity. For more information call 802-847-4488.

Fletcher Allen’s patient centered medical homes include Community Health Teams - nurses, social workers, dietitians, and health educators who work together to help patients manage conditions, including overweight and obesity, and provide patients with the tools and support to reach their goals.
The Vermont Department of Health operates 12 Local Health Offices throughout the state. All Local Offices are committed to strengthening relationships with their local medical community and collaborating to provide the following services and resources:

- Nutrition education and WIC food
- Breastfeeding support and promotion
- Tobacco prevention and cessation services
- Alcohol and drug abuse prevention
- Healthy school environments
- Disease prevention
- Immunization

Some local offices also offer expanded services such as breastfeeding peer counseling and WIC services co-located in the pediatric home.

**The Vermont Department of Health Local Offices**

- **Barre**
  - McFarland Office Building
  - 5 Perry Street, Suite 250
  - Barre, VT 05641-4272
  - 802-479-4200

- **Bennington**
  - 324 Main Street, Suite 2
  - Bennington, VT 05201
  - 802-447-3531

- **Brattleboro**
  - 232 Main Street, Suite 3
  - Brattleboro, VT 05301-2881
  - 802-257-2880

- **Burlington**
  - 108 Cherry Street, Suite 102
  - Burlington, VT 05401-9962
  - 802-863-7323

- **Middlebury**
  - 156 So. Village Green, Suite 102
  - Middlebury, VT 05753-1529
  - 802-388-4644

- **Morrisville**
  - 63 Professional Drive, Suite 1
  - Morrisville, VT 05661
  - 802-888-7447

- **Newport**
  - 100 Main Street, Suite 220
  - Newport, VT 05401-9962
  - 802-334-6707

- **Rutland**
  - 300 Asa Bloomer State Office Building
  - Rutland, VT 05701
  - 802-786-5811

- **St. Albans**
  - 20 Houghton Street, Suite 312
  - St. Albans, VT 05478-2248
  - 802-524-7970

- **St. Johnsbury**
  - 107 Eastern Avenue, Suite 9
  - St. Johnsbury, VT 05819-2638
  - 802-748-5151

- **Springfield**
  - 100 Mineral Street, Suite 104
  - Springfield, VT 05156
  - 802-885-5778

- **White River Junction**
  - 226 Holiday Drive, Suite 22
  - White River Junction, VT 05001
  - 802-295-8820
Proper Coding and Reimbursement Strategies

At all health supervision visits from age 3 and up, always use the proper ICD-9-CM Diagnosis code to document BMI percentile, counseling for nutrition and counseling for physical activity. The combination of these three codes makes up the Healthcare Effectiveness Data and Information Set (HEDIS) measure that document quality. Also add the appropriate ICD-9-CM Diagnosis code if the patient is overweight or obese.

Using the appropriate code, however, is important for tracking the incidence of obesity. The American Academy of Pediatrics has a fact sheet about appropriate coding and can answer coding questions (see the Resources).

The American Academy of Family Physicians, Americans in Motion (AIM) initiative offers the following strategies for reimbursement of preventive services:

- Schedule a separate visit to address chronic illness (e.g., diabetes management) so there is enough time in wellness visits for counseling and guidance.
- Bill for treatment of co-morbidities such as diabetes and metabolic syndrome.
- Consult with the health plans. Some may be willing to pay for fitness conversations.
- Negotiate for reimbursement with self-insured companies.
- Ask families about using Flexible Spending Accounts to pay for additional visits.
- Group visits for billable conditions like hypertension may be an opportunity for group conversations about making lifestyle changes.
## Pediatric Obesity Coding

<table>
<thead>
<tr>
<th>At Health Supervision Visits:</th>
<th>At Follow up visits:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Always Add V Codes:</strong></td>
<td>Consider coding for time if &gt; 50% of time spent counseling:</td>
</tr>
<tr>
<td>• V85.51 BMI, less than 5th percentile for age</td>
<td>• 99213 – 15 minutes</td>
</tr>
<tr>
<td>• V85.52 BMI, 5th to less than 85th percentile for age</td>
<td>• 99214 – 25 minutes</td>
</tr>
<tr>
<td>• V85.53 BMI, 85th to 95th percentile for age</td>
<td>• 99215 – 40 minutes</td>
</tr>
<tr>
<td>• V85.54 BMI, greater than or equal to 95th percentile for age</td>
<td><strong>Use ICD 9 Codes:</strong></td>
</tr>
<tr>
<td></td>
<td>• 278.00 - Obesity NOS</td>
</tr>
<tr>
<td></td>
<td>• 278.01 – Morbid Obesity</td>
</tr>
<tr>
<td></td>
<td>• 278.02 – Overweight</td>
</tr>
<tr>
<td><strong>Add V Codes:</strong></td>
<td><strong>Add V Codes:</strong></td>
</tr>
<tr>
<td>• V85.53 BMI, 55th to 95th percentile for age</td>
<td>• V85.53 BMI, 55th to 95th percentile for age</td>
</tr>
<tr>
<td>• V85.54 BMI, greater than or equal to 95th percentile for age</td>
<td>• V85.54 BMI, greater than or equal to 95th percentile for age</td>
</tr>
<tr>
<td></td>
<td><strong>Counseling codes:</strong></td>
</tr>
<tr>
<td></td>
<td>• V65.3 – Counseling on Nutrition</td>
</tr>
<tr>
<td></td>
<td>• V65.41 – Counseling on Physical Activity</td>
</tr>
<tr>
<td><strong>Add codes for all existing co-morbidities:</strong></td>
<td><strong>Mental Health:</strong></td>
</tr>
<tr>
<td><strong>Cardiovascular</strong></td>
<td>• 311 Depression</td>
</tr>
<tr>
<td>• 796.2 Elevated Blood Pressure (BP)</td>
<td>• 300.4 Dysthymic Disorder</td>
</tr>
<tr>
<td>• 401.9 Hypertension (HTN)</td>
<td><strong>Neurologic:</strong></td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>• 348.2 Pseudotumor Cerebri</td>
</tr>
<tr>
<td>• 626.0 Amenorrhea</td>
<td><strong>Conditions Diagnosed with Lab Tests:</strong></td>
</tr>
<tr>
<td>• 626.1 Infrequent Menses</td>
<td>• 272.0 (Pure) Hypercholesterolemia</td>
</tr>
<tr>
<td>• 626.4 Irregular Menses</td>
<td>• 772.2 Mixed Lipidemia</td>
</tr>
<tr>
<td>• 704.1 Hirsutism</td>
<td>• 790.29 Insulin Resistance- other abnormal glucose (pre-diabetes not otherwise specified; hyperglycemia)</td>
</tr>
<tr>
<td>• 259.1 Sexual Precocity</td>
<td>• 277.7 (Dys)metabolic Syndrome (X)</td>
</tr>
<tr>
<td>• 256.4 Polycystic (Ovaries) Syndrome</td>
<td>• 794.8 Abnormal LFT’s</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>• 571.8 Fatty Liver- Other Chronic Non-Alcoholic Liver Disease</td>
</tr>
<tr>
<td>• 706.1 Acne</td>
<td>• 250.00 Diabetes Mellitus without mention of complication, Type II or unspecified type, not stated as uncontrolled</td>
</tr>
<tr>
<td>• 701.2 Acquired Acanthosis Nigricans</td>
<td></td>
</tr>
<tr>
<td>• 701.3 Striae</td>
<td></td>
</tr>
<tr>
<td><strong>Sleep</strong></td>
<td><strong>GI</strong></td>
</tr>
<tr>
<td>• 780.57 Unspecified Sleep Apnea</td>
<td>• 530.81 GERD/ Esophageal Reflux</td>
</tr>
<tr>
<td>• 786.09 Snoring</td>
<td>• 574.1 Cholecystitis</td>
</tr>
<tr>
<td><strong>Ortho</strong></td>
<td>• 574.2 Cholelithias</td>
</tr>
<tr>
<td>• 736.41 Genu Valgum</td>
<td></td>
</tr>
</tbody>
</table>
Resources & References

Resource List

Assessment

CDC Training Module: Growth Chart Training
www.cdc.gov/nccdphp/dnpa/growthcharts/training/modules.htm

CDC BMI Calculator
www.cdc.gov/nccdphp/dnpa/bmi/index.htm

CDC Growth Charts
http://www.cdc.gov/growthcharts/cdc_charts.htm

http://brightfutures.aap.org/pdfs/guidelines_pdf/1-bf-introduction.pdf


American Academy of Pediatrics: Clinical and professional resources related to pediatric nutrition and weight management available for purchase through the online bookstore
www.aap.org

Counseling


Reimbursement

AAP Obesity and Related Co-Morbidities Coding Fact Sheet for Primary Care Pediatricians

AAP Coding Questions
http://www.aap.org/en-us/professional-resources/practice-support/financing-and-payment/Pages/Coding-Concerns.aspx
**Patient-Friendly Materials**

Nemours Foundation, “Kid’s Health for Parents”
www.kidshhealth.org/parent/nutrition_fit/nutrition/overweight_obesity.html

**We Can! (Ways to Enhance Children’s Activity & Nutrition)** is a national movement designed to give parents, caregivers, and communities a way to help children stay at a healthy weight by providing tools, fun activities, and more. Sponsored by the National Heart, Lung, and Blood Institute, National Institute of Diabetes and Digestive and Kidney Diseases, and the Eunice kennedy Shriver National Institute of Child Health and Human Development, and the National Cancer Institute.

**Let’s Move!** is a initiative launched by First Lady Michelle Obama, dedicated to solving the challenge of childhood obesity. The website provides parents, caregivers, and communities strategies, tools, and information to foster environments that support healthy choices.
http://www.letsmove.gov/

**MyPlate** is a nutrition guide endorsed by the US Department of Agriculture which highlights the Dietary Guidelines and visually depicts how to make healthy food choices when planning our meals. MyPlate provides guidance, tools, games, as well as healthy recipes and a food tracker tool.
http://www.choosemyplate.gov/

**Kids Eat Right** is a joint initiative from the Academy of Nutrition and Dietetics and Academy of Nutrition and Dietetics Foundation whose goal is to educate families, communities, and policy makers about the importance of quality nutrition. Resources are available for all stages of childhood and adolescents and promote healthy shopping, cooking, and eating.
http://www.eatright.org/kids/

**BAM! Body and Mind** is an interactive online resource from the Centers for Disease Control and Prevention, designed to give kids 9-13 years old information they need to make healthy lifestyle choices.
http://www.cdc.gov/bam

**Fit WIC** is an online resource that encourages parents and caregivers to be active with children and increase the amount of time children actively play.
http://healthvermont.gov/wic/parents.aspx

**References**

Healthy Habits: Ideas for Families with Young Children
Make 5-2-1-0 your goal; here are some activities to get you started.

EAT MORE COLORS
Goal: Aim for 5 fruits and vegetables a day
☐ Try one new vegetable or fruit each week
☐ Add fruit to your child’s cereal
☐ Make a rainbow of vegetables and fruits on your child’s plate
☐ Try veggies right out of the can or freezer bag for a quick and healthy snack

TURN IT OFF!
Goal: Aim for less than 2 hours of screen time a day (no screen time for children under age 2)
☐ Read a story (and then act it out)
☐ Visit the library—walk there if you can!
☐ Turn up the volume and dance to your favorite music
☐ Plan for TV time, pick the programs, set and stick to your limits.

MOVE MORE
Goal: Aim for at least 1 hour of activity each day
☐ Toddlers love to follow the leader—especially when you’re the leader! Hop like a bunny, jump like a frog, stomp your feet, clap your hands. If you are active, your child will be too.
☐ Play outside! Go on a bear hunt, take teddy bear on a picnic, visit a barnyard.
☐ Preschoolers like activities that use large and small muscles—and expand their minds. Play with your child. You’ll enjoy spending time together. Skip along a sidewalk, somersault down a hill, dribble a ball with feet or hands bat a ball, balance on a low beam, climb a jungle gym, or toss a Frisbee
☐ Take the dog for a walk—borrow your neighbor’s if you need to

CHOOSE YOUR DRINK
Goal: Aim for 0 sugar-sweetened drinks
☐ Offer water when your child is thirsty
☐ Limit juice consumption (use 100% juice in a child size cup)
☐ Drink non-fat or low-fat milk (for children over age 2)

MORE IDEAS!
☐ Eat family meals as often as possible
☐ Involve children in choosing vegetables, preparing meals, and setting the table
☐ You decide what, when and where meals and snacks are eaten—let your child decide how much
☐ Limit eating out at fast food places and pack your own “grab and go” food
Healthy Habits: Ideas for Families with School Age Children

Make 5-2-1-0 your goal; here are some activities to get you started.

Choose an activity that will help you move toward one or more of the goals listed below

**EAT MORE COLORS**

*Goal: Aim for 5 fruits and vegetables a day*

☐ Try one new vegetable or fruit each week
☐ Add fruit to your cereal
☐ Eat vegetables and fruits that are different colors
☐ Try cut up veggies and dip for a healthy snack

**TURN IT OFF!**

*Goal: Aim for less than 2 hours of screen time a day*

☐ Take the TV out of the bedroom
☐ Pick one day a week for game night instead of watching TV
☐ Plan TV, computer, and game time each day

**MOVE MORE**

*Goal: Aim for at least 1 hour of activity each day*

☐ Play your favorite sport or choose a favorite physical activity (ride bikes, play tag)
☐ Walk or bike to school if you can
☐ Take the dog for a walk
☐ Use the stairs

**CHOOSE YOUR DRINK**

*Goal: Aim for 0 sugar-sweetened drinks*

☐ Switch from soda to water or seltzer
☐ Limit juice consumption (use the tiny glasses!)
☐ Drink non-fat or low-fat milk

**MORE IDEAS!**

☐ Eat meals together at least once a week
☐ Learn about portion sizes
☐ Get everyone involved in preparing meals
☐ Take the farthest spot in the parking lot
☐ Eat breakfast daily
☐ Limit eating out at restaurants, especially fast food places
Staying Active As a Family

Keep a family log and set a goal to achieve a set number of hours of activity. When you reach your goal, celebrate your success with a family movie night or go bowling.

- Visit your elementary school’s playground or local park for unstructured fun; walk if possible
- Take a bike ride together around the neighborhood or visit a bike path; don’t forget the helmets
- Build a fort inside using chairs, blankets, boxes, and watch your child’s imagination take off
- Plan a scavenger hunt and roam your yard looking for common things found in your house or yard
- Set up the sprinkler on a hot day and take turns running around the yard and through the cooling mist
- Wash the family car
- Grab some old pillow cases and have sack races outside
- Play organized school yard games – tag, kickball, dodgeball or four square
- Explore the natural surroundings by taking a hike or walk through woods; take your time and see what animals, birds, or insects you can find
- In the fall, rake leaves together; if you don’t have any leaves in your yard, head to the woods to collect interesting leaves
- Start a family garden and plant your favorite flowers or vegetables; be sure to tend to it weekly
- Plan a treasure hunt
- Participate in an open gym at a local fitness center or school gymnasium
- Have a dance party – turn on your favorite music and see who has the best moves
- Look at your local parks and rec department to find free or low cost recreation programs or sports leagues
- Get the family involved in cleaning the house – think of chores that require physical effort
- Take a family walk after dinner
- Make a Saturday morning walk a weekly habit
- Celebrate special occasions and holidays with activities
- Have a jump rope or hula hoop competition
- For more ideas of kid-friendly fun happening in your area, check out Find and Go Seek Vermont @ www.findandgoseek.net
You are the expert on your child. The ideas below are meant to help you support your child’s healthy growth and development. Consider whether these suggestions are right for your family. If they aren’t, we hope you will see the spirit of a strength-based approach and will come up with your own ways to encourage your child’s healthy development. (And please share your ideas with us!)

**Recognize Your Child’s Strengths**

All children have strengths. Your love and support, and your child’s developing strengths, will help your child make healthy choices and become a healthy adult. Look for the following strengths in your child:

- **Independence**: Is your child learning to do things on his or her own? Making decisions independently? Problem-solving? Growing independence can help a child “own” a decision to increase their physical activity, or improve their eating habits.

- **Mastery**: Does your child know she is good at certain tasks like reading, caring for a pet, or sports? Are there healthy activities he or she participates in with enthusiasm? Has she/he made progress in choosing healthy behavior, like good hygiene, exercising, controlling anger, or following family rules? Praise this progress and let them know healthy eating and activity choices can be mastered, too.

- **Belonging**: Is your child making connections with friends and family? A child’s best friends and family, and knowing they have people who support them, can help a child stick with healthy behaviors.
**Simple Things You Can Do To Support Your Child’s Strengths and Healthy Behavior**

**Offer Guidance:** Actively guide your child toward the values and skills you want for them.
- Remind your child of their strengths and that they can accomplish great things.
- Regularly discuss what you expect from them.
- Discuss your values; what you believe, and don’t believe.
- Suggest ways they can pursue their interests and enhance their strengths.
- Model positive behavior. Let your kids see you learning, working, and trying new things. And show them you are making healthy physical activity and eating choices.
- Be present and supportive when things go wrong.

**Make a safe space:** It’s hard to control the outside environment, but you can make your home a safe space where healthy decisions are easier.
- Serve healthy meals for everyone, not just for the child who is trying to improve their eating habits.
- Keep healthy snacks like apples in easy reach and don’t buy tempting, high-calorie, low nutrition foods like chips and cookies.
- Put the TV and video games in a room that is not welcoming, or where a glare hits the screen.
- If you designate TV time, try giving equal (or more) time for exercise.

**Get Involved:** Let your child know what they think and do matters to someone.
- Talk together often. Ask them how things are going.
- Play together and eat meals together.
- Attend their school and sporting events.
- Meet your child’s friends and their parents.

**Acknowledge and Reward:** Show your child you appreciate them and enjoy being around them.
- Ask their opinion.
- Include them in conversations.
- Encourage them to share their talents with others.
- Listen to their stories.
- Go places together.
- Share their excitement.
- Tell them how proud of them you are.
- Follow them when they lead.
- Do what they like to do.
- Marvel at what they can do.
- Cheer their accomplishments.
- Believe what they say.
- Help them take a stand, and stand with them.
- Join in their adventures.
- Introduce them to people of excellence.

When things seem to be going wrong, remember… you have a great kid! No child is perfect. When things start get off track, make a list of your child’s strengths to help you refocus. When you finish the list, review the strengths present or lacking and make a plan for moving forward.

And don’t forget, you have strengths as a parent:
- You are the expert on your child.
- You have experiences and guidance that can help your child.
- Your child needs YOU.

*Your doctor cares about you and your child. Talk to your doctor about your questions and concerns.*

---

Healthy Habits Questionnaire
Ages 2-9 (parent/caregiver)

DEMOGRAPHICS

Last Name: ___________________  First Name: ___________________
DOB: ___________________
Gender: □ M □ F
Parent/caregiver name: ___________________  Preferred Phone: ___________________
□ Home  □ Cell  □ Work

HEALTHY BEHAVIORS ASSESSMENT

How many servings of fruits or vegetables does your child eat a day? _______________
How many times a week does your child eat dinner at the table together with the family? _______________
How many times a week does your child eat breakfast? _______________
How many times a week does your child eat takeout or fast food? _______________
How many hours a day does your child watch TV/movies or sit and play video/computer games? _______________
Does your child have a TV in the room where he/she sleeps? □ Yes  □ No
Does your child have a computer in the room where he/she sleeps? □ Yes  □ No
How many hours of sleep does your child get per night? _______________
How much time a day does your child spend in active play (faster breathing/heart rate or sweating)? _______________
How many 8-ounce servings of the following does your child drink a day? (A 12-oz serving is the size of a can of soda or pop)

100% juice __________  Fruit drinks or sports drinks __________  Soda or punch __________
Water __________  Whole milk __________  Nonfat or reduced fat milk __________

Are you concerned about any of your child’s nutrition or activity habits? ______________________________
_________________________________________________________________________________________
Have you recently made any changes to your child’s nutrition or activity habits? ________________________
_________________________________________________________________________________________
Have you thought about making any changes to your child’s nutrition or activity habits? ______________________
_________________________________________________________________________________________

Please rate the level of stress in your family (select a number)

0 1 2 3 4 5 6 7 8 9 10
Little or no stress  A great deal of stress

NOTES

** Modified from Let’s Go Healthy Habits Survey (Ages 2-9) www.letsgo.org
Healthy Habits Questionnaire
Ages 2-9 (parent/caregiver)

DEMOGRAPHICS

Last Name ___________________ First Name ___________________

DOB ___________________ Gender □ M □ F

Parent/caregiver name: ___________________ Preferred Phone ___________________ □ Home □ Cell □ Work

HEALTHY BEHAVIORS ASSESSMENT**

Does your child eat at least five or more servings of fruits and vegetables daily? □ Yes □ No

Does your family eat meals together at home 5-6 times a week? □ Yes □ No

Does your child eat breakfast every day? □ Yes □ No

Does your child eat fast food or takeout more than 2 times a week? □ Yes □ No

Does your child watch TV, play video games, or spend time on a computer for more than two hours per day? □ Yes □ No

Does your child have a TV in the room where he/she sleeps? □ Yes □ No

Does your child have a computer in the room where he/she sleeps? □ Yes □ No

Does your child get at least 7-8 hours of sleep every night? □ Yes □ No

Does your child participate in active play (faster breathing/heart rate or sweating) for a total of one hour a day? □ Yes □ No

Does your child drink more than one 8oz sugar sweetened beverage (soda, juice, sports drink) each day? □ Yes □ No

Based on your answers, is there one thing you would like to change? □ Yes □ No

** Modified from Let’s Go Healthy Habits Survey (Ages 2-9) www.letsgo.org
## DEMOGRAPHICS

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Gender</th>
<th>Dob</th>
<th>Parent/caregiver name: ___________________</th>
<th>Preferred Phone: ___________________</th>
<th>Home</th>
<th>Cell</th>
<th>Work</th>
</tr>
</thead>
</table>

## HEALTHY BEHAVIORS ASSESSMENT**

- How many servings of fruits or vegetables does your child eat a day? _____________
- How many times a week does your child eat dinner at the table together with the family? _______________
- How many times a week does your child eat breakfast? _______________
- How many times a week does your child eat takeout or fast food? _______________
- How many hours a day does your child watch TV/movies or sit and play video/computer games? _______________
- Does your child have a TV in the room where he/she sleeps? □ Yes □ No
- Does your child have a computer in the room where he/she sleeps? □ Yes □ No
- How many hours of sleep does your child get per night? _______________
- How much time a day does your child spend in active play (faster breathing/heart rate or sweating)? ____________
- How many 8-ounce servings of the following does your child drink a day? (A 12-oz serving is the size of a can of soda or pop)
  - 100% juice __________
  - Fruit drinks or sports drinks __________
  - Soda or punch __________
  - Water __________
  - Whole milk __________
  - Nonfat or reduced fat milk __________

Are you concerned about any of your child’s nutrition or activity habits? ______________________________
________________________________________________________________________________________
Have you recently made any changes to your child’s nutrition or activity habits? ________________________
________________________________________________________________________________________
Have you thought about making any changes to your child’s nutrition or activity habits? __________________
________________________________________________________________________________________

Please rate the level of stress in your family (select a number)

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or no stress</td>
<td>A great deal of stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Modified from Let’s Go Healthy Habits Survey (Ages 2-9) www.letsgo.org
VCHIP

Healthy Habits Questionnaire
Ages 2-9 (parent/caregiver)

DEMOGRAPHICS

Last Name ___________________ First Name ___________________

DOB __________ Gender □ M □ F

Parent/caregiver name: ___________________ Preferred Phone ___________________

□ Home □ Cell □ Work

HEALTHY BEHAVIORS ASSESSMENT**

Does your child eat at least five or more servings of fruits and vegetables daily? □ Yes □ No

Does your family eat meals together at home 5-6 times a week? □ Yes □ No

Does your child eat breakfast every day? □ Yes □ No

Does your child eat fast food or takeout more than 2 times a week? □ Yes □ No

Does your child watch TV, play video games, or spend time on the computer for more than two hours per day? □ Yes □ No

Does your child have a TV in the room where he/she sleeps? □ Yes □ No

Does your child have a computer in the room where he/she sleeps? □ Yes □ No

Does your child get at least 7-8 hours of sleep every night? □ Yes □ No

Does your child participate in active play (faster breathing/heart rate or sweating) for a total of one hour a day? □ Yes □ No

Does your child drink more than one 8oz sugar sweetened beverage (soda, juice, sports drink) each day? □ Yes □ No

Based on your answers, is there one thing you would like to change? □ Yes □ No

** Modified from Let’s Go Healthy Habits Survey (Ages 2-9) www.letsgo.org
Healthy Habits Questionnaire
Ages 10-18

DEMOGRAPHICS

Last Name ___________________________ First Name ___________________________
DOB ___________________________ Gender □ M □ F
Parent/caregiver name: ___________________________ Preferred Phone ___________________________
□ Home □ Cell □ Work

HEALTHY BEHAVIORS ASSESSMENT**

How many servings of fruits or vegetables do you eat a day? _____________
How many times a week do you eat dinner at the table together with the family? _____________
How many times a week do you eat breakfast? _____________
How many times a week do you eat takeout or fast food? _____________
How many hours a day do you watch TV/movies or sit and play video/computer games? _____________
Do you have a TV in your bedroom? □ Yes □ No
Do you have a computer in your bedroom? □ Yes □ No
How many hours of sleep do you get per night? _____________
How much time a day do you spend in active play (faster breathing/heart rate or sweating)? _____________
How many 8-ounce servings of the following do you drink a day? (A 12-oz serving is the size of a can of soda or pop)

100% juice ___________ Fruit drinks or sports drinks ___________ Soda or punch ___________
Water ___________ Whole milk ___________ Nonfat or reduced fat milk ___________

Are you concerned about any of your nutrition or activity habits? ___________________________
Have you recently made any changes to your nutrition or activity habits? ___________________________
Have you thought about making any changes to your nutrition or activity habits? ___________________________
Please rate the level of stress in your life (select a number)

0 1 2 3 4 5 6 7 8 9 10
Little or no stress A great deal of stress

NOTES

** Modified from Let’s Go Healthy Habits Survey (Ages 10-18) www.letsgo.org
## DEMOGRAPHICS

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOB</th>
<th>Gender</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>M</strong></td>
<td><strong>F</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parent/caregiver name:</th>
<th>Preferred Phone</th>
<th>Home</th>
<th>Cell</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## HEALTHY BEHAVIORS ASSESSMENT**

Do you eat at least five or more servings of fruits and vegetables daily?  □ Yes □ No

Does your family eat meals together at home 5-6 times a week?  □ Yes □ No

Do you eat breakfast every day?  □ Yes □ No

Do you eat fast food or takeout more than 2 times a week?  □ Yes □ No

Do you watch TV, play video games, or spend time on the computer for more than two hours per day  □ Yes □ No

Do you have a TV in your bedroom?  □ Yes □ No

Do you have a computer in your bedroom?  □ Yes □ No

Do you get at least 7-8 hours of sleep every night?  □ Yes □ No

Do you participate in active play (faster breathing/heart rate or sweating) for a total of one hour a day?  □ Yes □ No

Do you drink more than one 8oz sugar sweetened beverage (soda, juice, sports drink) each day?  □ Yes □ No

Based on your answers, is there one thing you would like to change?  □ Yes □ No

** Modified from Let’s Go Healthy Habits Survey (Ages 10-18) www.letsgo.org
Healthy Weight Change Plan

Name ____________________________________________

SETTING A GOAL
Here are some things other people have decided to do for their health. I would like to set my goal to:

☐ Eat at least 5 servings of fruits/vegetables a day
☐ Reduce sugar-sweetened beverages
☐ Get at least 60 minutes of physical activity every day
☐ Manage my stress
☐ Get at least 60 minutes of physical activity every day
☐ Get enough sleep
☐ Limit screen time (especially TV)
☐ Other ____________________________

ACHIEVING MY GOAL

1. How ready am I to make this change? (select a number)

0 1 2 3 4 5 6 7 8 9 10
Not at all ready Ready to start today

2. What might make it difficult for me to achieve my goal (what are the barriers)?
________________________________________________________________________________________

3. Steps I will take to make this change (for example: what, when, how and with whom):

a. _____________________________________________

b. _________________________________________________________________________________

c. _________________________________________________________________________________

d. _________________________________________________________________________________

4. How confident am I that I can carry out this plan? (select a number)

0 1 2 3 4 5 6 7 8 9 10
Not at all confident Very confident

5. Information or support I might need in accomplishing my goal:
_________________________________________________________________________________________

6. I will know my plan is working when:
_______________________________________________________________________________________

7. I will celebrate my success by:
_______________________________________________________________________________________

8. I agree to this plan of action and will review my plan and progress on ___________ with _______________ by _____________ (Date) ________________________________ (Name)

REFERRALS AND FOLLOW UP

I need more information about how to improve my health! I want to:

☐ Follow up with my primary care doctor, ______________________________ (Date)

☐ See a dietitian to talk about healthy eating

☐ Be referred to community agencies where I can exercise

I give my permission to forward the information about my health assessment and my plan to the health professional I want to see.

Signature of individual __________________________ Date __________________________
Healthy Weight Change Plan

Name ________________________________________________

SETTING A GOAL

Here are some things other people have decided to do for their health. I would like to set goal(s) to:

☐ Eat at least 5 servings of fruits/vegetables a day
☐ Eat breakfast everyday
☐ Reduce sugar-sweetened beverages
☐ Manage my stress
☐ Get at least 60 minutes of physical activity every day
☐ Get enough sleep
☐ Limit screen time (especially TV)
☐ Other ________________________________

ACHIEVING MY GOAL

1. How ready am I to make this change? (select a number)

   0     1     2     3     4     5     6     7     8     9     10

   Not at all ready  Ready to start today

2. What might make it difficult for me to achieve my goal (what are the barriers)?

   __________________________________________________________________________________

3. Steps I will take to make this change (for example: what, when, how and with whom):

   a. __________________________________________________________________________________
   b. __________________________________________________________________________________
   c. __________________________________________________________________________________
   d. __________________________________________________________________________________

4. How confident am I that I can carry out this plan? (select a number)

   0     1     2     3     4     5     6     7     8     9     10

   Not at all confident  Very confident

5. Information or support I might need in accomplishing my goal:

   __________________________________________________________________________________

6. I will know my plan is working when:

   __________________________________________________________________________________

7. I will celebrate my success by:

   __________________________________________________________________________________

8. I agree to this plan of action and will review my plan and progress on ___________ with ________________
   by ______________ (Date) ______________________________ (Name)

REFERRALS AND FOLLOW UP

I need more information about how to improve my health! I want to:

☐ Follow up with my primary care doctor, ______________________________ (Name) by ____________ (date)

☐ See a dietitian to talk about healthy eating

☐ Be referred to community agencies where I can exercise

I give my permission to forward the information about my health assessment and my plan to the health professional I want to see.

Signature of individual __________________________ Date __________________________
**Annotated Healthy Weight Change Plan**

Photocopy the plan on the next page and work through it with patients and families when behavior change is needed. You can begin by asking patients and families if they agree it is important to make a change.

The questions should be answered by the patients and family, not the clinician.

One copy of the plan can go home with the family; another can be kept in the patient's chart for follow-up.

If a family is not ready to discuss or commit to a change, let them take the plan home to help them think about making a change.

Note that healthy weight children may also benefit from improving their habits.

### Activities About Activity and Eating?

<table>
<thead>
<tr>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Ready</td>
<td>Very Ready</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Nutrition**

**Change:**

Explore the reasons for their choices here. “I see you chose X. Why not something lower/higher?” Once they give their barriers and concerns, follow up with “But on the other hand, X isn’t 0. Can you tell me more about your choice?”

**What will help me make this change?**

**Who or what can help me?**

My strengths:

My family’s strengths:

**What can get in the way?**

**Physical Activity**

**Change:**

It is preferable to only set one goal. Two goals should be the maximum.

**What will help me make this change?**

**Who or what can help me?**

My strengths:

My family’s strengths:

**What can get in the way?**

### How Confident Am I That I Can Make This Change?

<table>
<thead>
<tr>
<th>Not Confident</th>
<th>Very Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Explore the reasons for their choice.

Parent signature might not be necessary for adolescents.

Date ________________________________

PATIENT SIGNATURE | PARENT SIGNATURE | CLINICIAN SIGNATURE
## Healthy Weight Change Plan

Date: ________________________________

### HOW READY AM I TO MAKE SOME HEALTHY CHOICES ABOUT ACTIVITY AND EATING?

<table>
<thead>
<tr>
<th>Not Ready</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Very Ready</th>
</tr>
</thead>
</table>

### NUTRITION

**Change:**

**What will help me make this change?**

**Who or what can help me?**

- My strengths:
- My family’s strengths:

**What can get in the way?**

### PHYSICAL ACTIVITY

**Change:**

**What will help me make this change?**

**Who or what can help me?**

- My strengths:
- My family’s strengths:

**What can get in the way?**

### HOW CONFIDENT AM I THAT I CAN MAKE THIS CHANGE?

<table>
<thead>
<tr>
<th>Not Confident</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Very Confident</th>
</tr>
</thead>
</table>

PATIENT SIGNATURE

PARENT SIGNATURE

CLINICIAN SIGNATURE
**Weight Loss Recommendations**

- **For people with a BMI ≥30**, weight loss is recommended.
- **For people with a BMI between 25 and 29.9, or who have a waist circumference greater than 40” in men and 35” in women, and who have additional risk factors**, weight loss is recommended.
- **For people with a BMI between 25 and 29.9 who have no risk factors and do not want to lose weight, prevention of further weight gain is recommended.**

**BMI is calculated by weight in pounds multiplied by 703 and divided by height in inches squared.**

---

**Risk Factors**

**Disease conditions:**
- Established CHD, other atherosclerotic diseases
- Type 2 diabetes
- Sleep apnea
- Gynecological abnormalities
- Osteoarthritis
- Gallstones & their complications
- Stress incontinence

**Cardiovascular risk factors:**
- Cigarette smoking
- Hypertension
- High LDL cholesterol (≥160 mg/dl)
- Low HDL cholesterol: Men <40 mg/dl; Women <50 mg/dl
- Impaired fasting glucose (110–125 mg/dl)
- Family history of premature CHD
- Men ≥45 years; Women ≥55 years (or postmenopausal)

**Other risk factors:**
- High serum triglycerides (>150 mg/dl)
- Physical inactivity
BMI is calculated by weight in pounds multiplied by 703 and divided by height in inches squared.

### Adult Body Mass Index (BMI) Chart

#### V Codes for Billing by Body Mass Index (BMI) Category

<table>
<thead>
<tr>
<th>Category</th>
<th>BMI</th>
<th>V Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Healthy Weight</td>
<td>&lt;19</td>
<td>V85.0</td>
</tr>
<tr>
<td>Healthy Weight</td>
<td>19-24</td>
<td>V85.1</td>
</tr>
<tr>
<td>Overweight</td>
<td>25</td>
<td>V85.21</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>V85.22</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>V85.23</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>V85.24</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>V85.25</td>
</tr>
<tr>
<td>Obese I</td>
<td>30</td>
<td>V85.30</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>V85.31</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>V85.32</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>V85.33</td>
</tr>
<tr>
<td></td>
<td>34</td>
<td>V85.34</td>
</tr>
<tr>
<td>Obese II &amp; III</td>
<td>35</td>
<td>V85.35</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>V85.36</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>V85.37</td>
</tr>
<tr>
<td></td>
<td>38</td>
<td>V85.38</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>V85.39</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>V85.40</td>
</tr>
</tbody>
</table>

**BMI** is calculated by weight in pounds multiplied by 703 and divided by height in inches squared.
Expert Committee Recommendations on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity - 2007

- An Implementation Guide from the Childhood Obesity Action Network -

Overview:
In 2005, the AMA, HRSA and CDC convened an Expert Committee to revise the 1997 childhood obesity recommendations. Representatives from 15 healthcare organizations submitted nominations for the experts who would compose the three writing groups (assessment, prevention, treatment). The initial recommendations were released on June 6, 2007 in a document titled “Appendix: Expert Committee Recommendations on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity” (www.ama-assn.org/ama/pub/category/11759.html)

In 2006, the National Initiative for Children’s Healthcare Quality (NICHQ) launched the Childhood Obesity Action Network (COAN). With more than 40 healthcare organizations and 600 health professionals, the network is aimed at rapidly sharing knowledge, successful practices and innovation. This Implementation Guide is the first of a series of products designed for healthcare professionals by COAN to accelerate improvement in the prevention and treatment of childhood obesity.

The Implementation Guide combines key aspects of the Expert Committee Recommendations summary released on June 6, 2007 and practice tools identified in 2006 by NICHQ from primary care groups that have successfully developed obesity care strategies (www.NICHQ.org). These tools were developed before the 2007 Expert Recommendations and there may be some inconsistencies such as the term overweight instead of obesity for BMI ≥ 95th. The tools are intended as a source of ideas and to facilitate implementation. As tools are updated or new tools developed based on the Expert Recommendations, the Implementation Guide will be updated. The Implementation Guide defines 3 key steps to the implementation of the 2007 Expert Committee Recommendations:

- **Step 1 – Obesity Prevention at Well Care Visits** (Assessment & Prevention)
- **Step 2 – Prevention Plus Visits** (Treatment)
- **Step 3 – Going Beyond Your Practice** (Prevention & Treatment)

### Step 1 – Obesity Prevention at Well Care Visits (Assessment & Prevention)

<table>
<thead>
<tr>
<th>Action Steps</th>
<th>Expert Recommendations</th>
<th>Action Network Tips and Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assess all children for obesity at all well care visits 2-18 years</td>
<td>Physicians and allied health professional should perform, at a minimum, a yearly assessment.</td>
<td>A presentation for your staff and colleagues can help implement obesity prevention in your practice.</td>
</tr>
</tbody>
</table>
| Use Body Mass Index (BMI) to screen for obesity | **Accurately measure height and weight**  
**Calculate BMI**  
(Metric): weight (kg) / height (cm)²  
(English): weight (lb) / [height (in) / 36]²  
**Plot BMI on BMI growth chart**  
**Not recommended: skinfold thickness, waist circumference** | BMI is very sensitive to measurement errors, particularly height. Having a standard measurement protocol as well as training can improve accuracy. BMI calculation tools are also helpful. Use the CDC BMI %ile-for-age growth charts. |
| Make a weight category diagnosis using BMI percentile | < 5th %ile Underweight  
5-84th %ile Healthy Weight  
85-94th %ile Overweight  
95-98th %ile Obesity  
≥ 99th %ile | Until the BMI 99th %ile is added to the growth charts, Table 1 can be used to determine the 99th %ile cut-points. Physicians should exercise judgement when choosing how to inform the family. Using more neutral terms such as weight, excess weight, body mass index, BMI, or risk for diabetes and heart disease can reduce the risk of stigmatization or harm to self-esteem. |
| Measure blood pressure | Use a cuff large enough to cover 80% of the upper arm  
Measure pulse in the standard manner | Diagnose hypertension using NHLBI tables. An abbreviated table is shown below (Table 2). |
| Take a focused family history | Obesity  
Type 2 diabetes  
Cardiovascular disease (hypertension, cholesterol)  
Early deaths from heart disease or stroke | A child with one obese parent has a 3 fold increased risk of becoming obese. This risk increases to 13 fold with 2 obese parents. Using a clinical documentation tool can be helpful. |

**Childhood Obesity Action Network**  
The Healthcare Campaign to Stop the Epidemic

[Logo: National Initiative for Children's Healthcare Quality]
<table>
<thead>
<tr>
<th>Take a focused review of systems</th>
<th>Take a focused review of systems</th>
<th>See Table 3. Using a clinical documentation tool can be helpful.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assess behaviors and attitudes</strong></td>
<td><strong>Diet Behaviors</strong>&lt;br&gt;- Sweetened-beverage consumption&lt;br&gt;- Fruit and vegetable consumption&lt;br&gt;- Frequency of eating out and family meals&lt;br&gt;- Consumption of excessive portion sizes&lt;br&gt;- Daily breakfast consumption <strong>Physical Activity Behaviors</strong>&lt;br&gt;- Amount of moderate physical activity&lt;br&gt;- Level of screen time and other sedentary activities <strong>Attitudes</strong>&lt;br&gt;- Self-perception or concern about weight&lt;br&gt;- Readiness to change&lt;br&gt;- Successes, barriers and challenges</td>
<td>Using behavioral risk assessment tools can facilitate history taking and save clinician time.</td>
</tr>
<tr>
<td><strong>Perform a thorough physical examination</strong></td>
<td><strong>Perform a thorough physical examination</strong></td>
<td>See Table 3. Using a clinical documentation tool can be helpful.</td>
</tr>
<tr>
<td><strong>Order the appropriate laboratory tests</strong></td>
<td><strong>BMI 85-94%ile Without Risk Factors</strong>&lt;br&gt;- Fasting Lipid Profile</td>
<td>Consider ordering ALT, AST and glucose tests beginning at 10 years of age and then periodically (every 2 years). Provider decision support tools can be helpful when choosing assessment and treatment options. Delivering lab results can be one way to open the conversation about weight and health with a family.</td>
</tr>
<tr>
<td><strong>BMI 85-94%ile Age 10 Years &amp; Older With Risk Factors</strong>&lt;br&gt;- Fasting Lipid Profile&lt;br&gt;- ALT and AST&lt;br&gt;- Fasting Glucose</td>
<td><strong>BMI ≥ 95%ile Age 10 Years &amp; Older</strong>&lt;br&gt;- Fasting Lipid Profile&lt;br&gt;- ALT and AST&lt;br&gt;- Fasting Glucose&lt;br&gt;- Other tests as indicated by health risks</td>
<td></td>
</tr>
<tr>
<td><strong>Give consistent evidence-based messages for all children regardless of weight</strong>&lt;br&gt;- Limit sugar-sweetened beverages&lt;br&gt;- Eat at least 5 servings of fruits and vegetables&lt;br&gt;- Moderate to vigorous physical activity for at least 60 minutes a day&lt;br&gt;- Limit screen time to no more than 2 hours/day&lt;br&gt;- Remove television from children’s bedrooms&lt;br&gt;- Eat breakfast every day&lt;br&gt;- Limit eating out, especially at fast food&lt;br&gt;- Have regular family meals&lt;br&gt;- Limit portion sizes</td>
<td>An example from the Maine Collaborative:&lt;br&gt;- 5 fruits and vegetables&lt;br&gt;- 2 hours or less of TV per day&lt;br&gt;- 1 hour or more physical activity&lt;br&gt;- 0 servings of sweetened beverages</td>
<td>Exam and waiting room posters and family education materials can help deliver these messages and facilitate dialogue. Encourage an authoritative parenting style in support of increased physical activity and reduced TV viewing. Discourage a restrictive parenting style regarding child eating. Encourage parents to be good role models and address as a family issue rather than the child’s problem.</td>
</tr>
<tr>
<td><strong>Use Empathize/Elicit - Provide - Elicit to improve the effectiveness of your counseling</strong></td>
<td><strong>Assess self-efficacy and readiness to change. Use Empathize/Elicit - Provide - Elicit to improve the effectiveness of your counseling.</strong>&lt;br&gt;<strong>Empathize/Elicit</strong>&lt;br&gt;- Reflect&lt;br&gt;- What is your understanding?&lt;br&gt;- What do you want to know?&lt;br&gt;- How ready are you to make a change (1-10 scale)? <strong>Provide</strong>&lt;br&gt;- Advice or information&lt;br&gt;- Choices or options <strong>Elicit</strong>&lt;br&gt;- What do you make of that?&lt;br&gt;- Where does that leave you?</td>
<td>A possible dialogue: <strong>Empathize/Elicit</strong>&lt;br&gt;“Yours child’s height and weight may put him/her at increased risk for developing diabetes and heart disease at a very early age.”&lt;br&gt;“What do make of this?”&lt;br&gt;“Would you be interested in talking more about ways to reduce your child’s risk?” <strong>Provide</strong>&lt;br&gt;“Some different ways to reduce your child’s risk are...”&lt;br&gt;“Do any of these seem like something your family could work on or do you have other ideas?” <strong>Elicit</strong>&lt;br&gt;“Where does that leave you?”&lt;br&gt;“What might you need to be successful?” Communication guidelines can help when developing communication skills.</td>
</tr>
</tbody>
</table>
## Step 2 – Prevention Plus Visits (Treatment)

<table>
<thead>
<tr>
<th>Action Steps</th>
<th>Expert Recommendations</th>
<th>Action Network Tips and Tools</th>
</tr>
</thead>
</table>
| Develop an office based approach for follow up of overweight and obese children | A staged approach to treatment is recommended for ages 2-19 whose BMI is 85-94thile with risk factors and all whose BMI is ≥ 95thile. In general, treatment begins with Stage 1 Prevention Plus (Table 4) and progresses to the next stage if there has been no improvement in weight/BMI or velocity after 3-6 months and the family is willing/ready. The recommended weight loss targets are shown in Table 5. **Stage 1 - Prevention Plus**  
- Family visits with physician or health professional who has had some training in pediatric weight management/behavioral counseling.  
- Can be individual or group visits.  
- Frequency - individualized to family needs and risk factors, consider monthly.  
- Behavioral Goals –  
  - Decrease screen time to 2 hr/day or fewer  
  - No sugar-sweetened beverages  
  - Consume at least 5 servings of fruits and vegetables daily  
  - Be physically active 1 hour or more daily  
  - Prepare more meals at home as a family (the goal is 5-6 times a week)  
  - Limit meals outside the home  
  - Eat a healthy breakfast daily  
  - Involve the whole family in lifestyle changes  
  - More focused attention to lifestyle changes and more frequent follow-up distinguishes Prevention Plus from Prevention Counseling  
- Weight Goal – weight maintenance or a decrease in BMI velocity. The long term BMI goal is <85thile although some children can be healthy with a BMI 85-94thile.  
- Advance to Stage 2 (Structured Weight Management) if no improvement in weight/BMI or velocity in 3-6 months and family willing/ready to make changes. | Prevention Plus visits may include:  
- Health education materials  
- Behavioral risk assessment and self-monitoring tools  
- Action planning and goal setting tools  
- Clinical documentation tools  
- Counseling protocols  
- Other health professionals such as dietitians, psychologists and health educators  
Besides behavioral and weight goals, improving self-esteem and self-efficacy (confidence) are important outcomes. Although weight maintenance is a good goal, more commonly, a slower weight gain reflected in a decreased BMI velocity is the outcome seen in lower intensity behavioral interventions such as Prevention Plus. Measuring and plotting BMI after 3-6 months is an important step to determine the effectiveness of obesity treatment. |

| Use motivational interviewing at Prevention Plus visits for ambivalent families and to improve the success of action planning | Use patient-centered counseling – motivational interviewing | Research suggests that motivational interviewing may be an effective approach to address childhood obesity prevention and treatment. Motivational interviewing is particularly effective for ambivalent families but can also be used for action planning.  
Instead of telling patients what changes to make, you elicit “change talk” from them, taking their ideas, strengths, and barriers into account. Communication guidelines and communication training can be helpful with skill development. |

| Develop a reimbursement strategy for Prevention Plus visits | Coding strategies can help with reimbursement for Prevention Plus visits. Advocacy through professional organizations to address reimbursement policies is another strategy. |  |
# Step 3 – Going Beyond Your Practice (Prevention & Treatment)

<table>
<thead>
<tr>
<th>Action Steps</th>
<th>Expert Recommendations</th>
<th>Action Network Tips and Tools</th>
</tr>
</thead>
</table>
| Advocate for improved access to fresh fruits and vegetables and safe physical activity in your community and schools | The Expert Committee recommends that physicians, allied healthcare professionals, and professional organizations advocate for:  
- The federal government to increase physical activity at school through intervention programs as early as grade 1 through the end of high school and college, and through creating school environments that support physical activity in general.  
- Supporting efforts to preserve and enhance parks as areas for physical activity, informing local development initiatives regarding the inclusion of walking and bicycle paths, and promoting families’ use of local physical activity options by making information and suggestions about physical activity alternatives available in doctors’ offices. | Physicians and health professionals can play a key role in advocating for policy and built environment changes to support healthy eating and physical activity in communities, child care settings, and schools (including after-school programs). **Advocacy tools and resources** can be helpful in advocacy efforts. Partnering with others and using evidence-based strategies are also critical to the success of **multi-faceted community interventions**. |
| Identify and promote community services which encourage healthy eating and physical activity | Promote physical activity at school and in child care settings (including after school programs), by asking children and parents about activity in these settings during routine office visits.                                                                                       | Public Health Departments and Parks and Recreation are good places to start looking for community programs and resources.  
You can work on developing your own partnerships with community organizations (Physical Activity Directory template and/or referral forms). |
| Identify or develop more intensive weight management interventions for your families who do not respond to Prevention Plus | The Expert Committee recommends the following staged approach for children between the ages of 2 and 19 years whose BMI is 85–94th and with risk factors and all whose BMI is ≥ 95th:  
- **Stage 2 - Structured Weight Management**  
(Family visits with physician or health professional specifically trained in weight management. Monthly visits can be individual or group.)  
- **Stage 3 - Comprehensive, Multidisciplinary Intervention**  
(Multidisciplinary team with experience in childhood obesity. Frequency is often weekly for 8-12 weeks with follow up.)  
- **Stage 4 - Tertiary Care Intervention**  
(Medications - sibutramine, orlistat, Very-low-calorie diets, weight control surgery - gastric bypass or banding.) Recommended for select patients only when provided by experienced programs with established clinical or research protocols. Gastric banding is in clinical trials and not currently FDA approved. | Stage 2 could be done without a tertiary care center if community professionals from different disciplines collaborated. For example, if a physician provided the medical assessment, a dietitian provided classes, and the local YMCA provided an exercise program.  
Partnering with your community tertiary care center can be an effective strategy to develop or link to more intensive weight management interventions (Stages 3 and 4) as well as referral protocols to care for families who do not respond to Prevention Plus visits. **Provider decision support tools** can be helpful when choosing appropriate treatment and referral options. **Weight management protocols and curriculum** can also be helpful when getting started. |

---

**Implementation Guide Authors:** Scott Gee, MD, Victoria Rogers, MD, Lenna Liu, MD, MPH, Jane McGrath, MD  
**Implementation Guide Contact:** obesity@nicho.org

**Childhood Obesity Action Network**  
*The Healthcare Campaign to Stop the Epidemic*  

---

[Link to Childhood Obesity Action Network](www.nicho.org)
### Table 1 – BMI 99th Percentile Cut-Points (kg/m²)

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>20.1</td>
<td>21.5</td>
</tr>
<tr>
<td>3</td>
<td>21.6</td>
<td>23.0</td>
</tr>
<tr>
<td>4</td>
<td>23.6</td>
<td>24.6</td>
</tr>
<tr>
<td>5</td>
<td>25.6</td>
<td>26.4</td>
</tr>
<tr>
<td>6</td>
<td>27.6</td>
<td>28.2</td>
</tr>
<tr>
<td>7</td>
<td>29.3</td>
<td>29.9</td>
</tr>
<tr>
<td>8</td>
<td>30.7</td>
<td>31.5</td>
</tr>
<tr>
<td>9</td>
<td>31.8</td>
<td>33.1</td>
</tr>
<tr>
<td>10</td>
<td>32.6</td>
<td>34.6</td>
</tr>
<tr>
<td>11</td>
<td>33.2</td>
<td>36.0</td>
</tr>
<tr>
<td>12</td>
<td>33.6</td>
<td>37.5</td>
</tr>
<tr>
<td>13</td>
<td>33.9</td>
<td>39.1</td>
</tr>
<tr>
<td>14</td>
<td>34.4</td>
<td>40.8</td>
</tr>
</tbody>
</table>

### Table 2 – Abbreviated NHLBI Blood Pressure Table

<table>
<thead>
<tr>
<th>Age</th>
<th>Boys Height %</th>
<th>Girls Height %</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>102/61</td>
<td>109/63</td>
</tr>
<tr>
<td>90%</td>
<td>115/72</td>
<td>115/74</td>
</tr>
<tr>
<td>5%</td>
<td>112/72</td>
<td>112/73</td>
</tr>
<tr>
<td>5 Yr</td>
<td>116/78</td>
<td>115/76</td>
</tr>
<tr>
<td>8 Yr</td>
<td>116/78</td>
<td>115/76</td>
</tr>
<tr>
<td>11 Yr</td>
<td>121/80</td>
<td>121/79</td>
</tr>
<tr>
<td>14 Yr</td>
<td>128/82</td>
<td>126/82</td>
</tr>
<tr>
<td>17 Yr</td>
<td>136/87</td>
<td>129/84</td>
</tr>
</tbody>
</table>

### Table 3 – Symptoms and Signs of Conditions Associated with Obesity

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety, school avoidance, social isolation (Depression)</td>
<td>Poor linear growth (Hypothyroidism, Cushing’s, Prader-Willi syndrome)</td>
</tr>
<tr>
<td>Polyuria, polydipsia, weight loss (Type 2 diabetes mellitus)</td>
<td>Dysmorphic features (Genetic disorders, including Prader-Willi syndrome)</td>
</tr>
<tr>
<td>Headaches (Pseudotumor cerebri)</td>
<td>Acanthosis nigricans (NIDDM, insulin resistance)</td>
</tr>
<tr>
<td>Night breathing difficulties (Sleep apnea, hypoventilation syndrome, asthma)</td>
<td>Hirsutism and Excessive Acne (Polycystic ovary syndrome)</td>
</tr>
<tr>
<td>Daytime sleepiness (Sleep apnea, hypoventilation syndrome, depression)</td>
<td>Violaceous striae (Cushing’s syndrome)</td>
</tr>
<tr>
<td>Abdominal pain (Gastroesophageal reflux, Gall bladder disease, Constipation)</td>
<td>Papilledema, cranial nerve VI paralysis (Pseudotumor cerebri)</td>
</tr>
<tr>
<td>Hip or knee pain (Slipped capital femoral epiphysis)</td>
<td>Tonsillar hypertrophy (Sleep apnea)</td>
</tr>
<tr>
<td>Oligomenorrhea or amenorrhea (Polycystic ovary syndrome)</td>
<td>Abdominal tenderness (Gall bladder disease, GERD, NAFLD)</td>
</tr>
<tr>
<td></td>
<td>Hepatomegaly (Nonalcoholic fatty liver disease (NAFLD))</td>
</tr>
<tr>
<td></td>
<td>Undescended testicle (Prader-Willi syndrome)</td>
</tr>
<tr>
<td></td>
<td>Limited hip range of motion (Slipped capital femoral epiphysis)</td>
</tr>
<tr>
<td></td>
<td>Lower leg bowing (Blount’s disease)</td>
</tr>
</tbody>
</table>

### Table 4 – A Staged Approach to Obesity Treatment

<table>
<thead>
<tr>
<th>BMI 85.94th to 95th</th>
<th>BMI 95-96th</th>
<th>BMI &gt;= 98th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 2-5 Years</td>
<td>Prevention Counseling</td>
<td>Initial: Stage 1</td>
</tr>
<tr>
<td></td>
<td>Initial: Stage 2</td>
<td>Initial: Stage 2</td>
</tr>
<tr>
<td>Age 6-11 Years</td>
<td>Prevention Counseling</td>
<td>Initial: Stage 1</td>
</tr>
<tr>
<td></td>
<td>Highest: Stage 2</td>
<td>Highest: Stage 2</td>
</tr>
<tr>
<td>Age 12-18 Years</td>
<td>Prevention Counseling</td>
<td>Highest: Stage 1</td>
</tr>
<tr>
<td></td>
<td>Highest: Stage 3</td>
<td>Highest: Stage 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Prevention Plus</th>
<th>Primary Care Office</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 2</td>
<td>Structured Weight Management</td>
<td>Primary Care Office with Support</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Comprehensive, Multidisciplinary Intervention</td>
<td>Public Health Management Center</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Tertiary Care Intervention</td>
<td>Tertiary Care Center</td>
</tr>
</tbody>
</table>

### Table 5 – Weight Loss Targets

<table>
<thead>
<tr>
<th>BMI 85.94th to 95th</th>
<th>BMI 95-96th</th>
<th>BMI &gt;= 98th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 2-5 Years</td>
<td>Maintain weight velocity</td>
<td>Decrease weight velocity or weight maintenance</td>
</tr>
<tr>
<td></td>
<td>Gradual weight loss of up to 1 pound a month if BMI is very high (&gt;20 or 22 kg/m²)</td>
<td></td>
</tr>
<tr>
<td>Age 6-11 Years</td>
<td>Maintain weight velocity</td>
<td>Decrease weight velocity or weight maintenance</td>
</tr>
<tr>
<td></td>
<td>Weight loss (average is 2 pounds per week)*</td>
<td></td>
</tr>
<tr>
<td>Age 12-18 Years</td>
<td>Maintain weight velocity</td>
<td>Decrease weight velocity or weight maintenance</td>
</tr>
</tbody>
</table>

* Excessive weight loss should be evaluated for high risk behaviors

---

**Childhood Obesity Action Network**  
*The Healthcare Campaign to Stop the Epidemic*  

**National Initiative for Children’s Healthcare Quality**
A SUPPLEMENT TO PEDIATRICS


Rae-Ellen W. Kavey, MD, MPH, Denise G. Simons-Morton, MD, MH, PhD, and Janet M. de Jesus, MS, RD, Supplement Editors

Sponsored by the National Heart, Lung, and Blood Institute,
National Institutes of Health

These guidelines have been endorsed by the American Academy of Pediatrics. Statements and opinions expressed in this supplement are those of the authors and not necessarily those of Pediatrics or the Editor or Editorial Board of Pediatrics.
## CONTENTS

1. Introduction
2. State of the Science: Cardiovascular Risk Factors and the Development of Atherosclerosis in Childhood
3. Integrated Cardiovascular Health Schedule
4. Family History of Early Atherosclerotic CVD
5. Nutrition and Diet
6. Physical Activity
7. Tobacco Exposure
8. High BP
9. Lipids and Lipoproteins
10. Overweight and Obesity
11. DM and Other Conditions Predisposing to the Development of Accelerated Atherosclerosis
12. Risk-Factor Clustering and the Metabolic Syndrome
13. Perinatal Factors

**doi:**10.1542/peds.2009-2107A
Expert Panel Members
Stephen R. Daniels, MD, PhD, Panel Chair
University of Colorado School of Medicine
Denver, CO

Irwin Benuck, MD, PhD
Northwestern University Feinberg School of Medicine
Chicago, IL

Dimitri A. Christakis, MD, MPH
University of Washington
Seattle, WA

Barbara A. Dennison, MD
New York State Department of Health
Albany, NY

Samuel S. Gidding, MD
Alfred I du Pont Hospital for Children
Wilmington, DE

Matthew W. Gillman, MD, MS
Harvard Pilgrim Health Care
Boston, MA

Mary Margaret Gottesman, PhD, RN, CPNP
Ohio State University-College of Nursing
Columbus, OH

Peter O. Kwiterovich, MD
Johns Hopkins University School of Medicine
Baltimore, MD

Patrick E. McBride, MD, MPH
University of Wisconsin School of Medicine and Public Health
Madison, WI

Brian W. McCrindle, MD, MPH
Hospital for Sick Children
Toronto, Ontario, Canada

Albert P. Rocchini, MD
C. S. Mott Children’s Hospital
Ann Arbor, MI

Elaine M. Urbina, MD
Cincinnati Children’s Hospital Medical Center
Cincinnati, OH

Linda V. Van Horn, PhD, RD
Northwestern University-Feinberg School of Medicine
Chicago, IL

Reginald L. Washington, MD
Rocky Mountain Hospital for Children
Denver, CO

NHLBI Staff
Rae-Ellen W. Kavey, MD, MPH
Panel Coordinator
National Heart, Lung, and Blood Institute
Bethesda, MD
Christopher J. O'Donnell, MD, MPH
National Heart, Lung, and Blood Institute
Framingham, MA

Karen A. Donato, SM
National Heart, Lung, and Blood Institute
Bethesda, MD

Robinson Fulwood, PhD, MSPH
National Heart, Lung, and Blood Institute
Bethesda, MD

Janet M. de Jesus, MS, RD
National Heart, Lung, and Blood Institute
Bethesda, MD

Denise G. Simons-Morton, MD, MPH, PhD
National Heart, Lung, and Blood Institute
Bethesda, MD

Contract Staff
The Lewin Group, Falls Church, VA
Clifford Goodman, MS, PhD
Christel M. Villarivera, MS
Charlene Chen, MHS
Erin Karnes, MHS
Ayodola Anise, MHS

doi:10.1542/peds.2009-2107B
Atherosclerotic cardiovascular disease (CVD) remains the leading cause of death in North Americans, but manifest disease in childhood and adolescence is rare. By contrast, risk factors and risk behaviors that accelerate the development of atherosclerosis begin in childhood, and there is increasing evidence that risk reduction delays progression toward clinical disease. In response, the former director of the National Heart, Lung, and Blood Institute (NHLBI), Dr Elizabeth Nabel, initiated development of cardiovascular health guidelines for pediatric care providers based on a formal evidence review of the science with an integrated format addressing all the major cardiovascular risk factors simultaneously. An expert panel was appointed to develop the guidelines in the fall of 2006.

The goal of the expert panel was to develop comprehensive evidence-based guidelines that address the known risk factors for CVD (Table 1-1) to assist all primary pediatric care providers in both the promotion of cardiovascular health and the identification and management of specific risk factors from infancy into young adult life. An innovative approach was needed, because a focus on cardiovascular risk reduction in children and adolescents addresses a disease process (atherosclerosis) in which the clinical end point of manifest CVD is remote. The recommendations, therefore, need to address 2 different goals: the prevention of risk-factor development (primordial prevention) and the prevention of future CVD by effective management of identified risk factors (primary prevention).

The evidence review also required an innovative approach. Most systematic evidence reviews include 1 or, at most, a small number of finite questions that address the impact of specific interventions on specific health outcomes, and a rigorous literature review often results in only a handful of in-scope articles for inclusion. Typically, evidence is limited to randomized controlled trials (RCTs), systematic reviews, and meta-analyses published over a defined time period. The results of the review lead to the conclusions, independent of interpretation.

By contrast, given the scope of the charge to the expert panel, this evidence review needed to address a broad array of questions concerning the development, progression, and management of multiple risk factors extending from birth through 21 years of age, including studies with follow-up into later adult life. The time frame extended back to 1985, ~5 years before the review for the last NHLBI guideline addressing lipids in children published in 1992.1 This evidence is largely available in the form of epidemiologic observational studies...
Atherosclerosis begins in youth, and this process, from its earliest phases, is related to the presence and intensity of the known cardiovascular risk factors shown in Table 1-1. Clinical events such as myocardial infarction, stroke, peripheral arterial disease, and ruptured aortic aneurysm are the culmination of the lifelong vascular process of atherosclerosis. Pathologically, the process begins with the accumulation of abnormal lipids in the vascular intima, a reversible stage, progresses to an advanced stage in which a core of extracellular lipid is covered by a fibromuscular cap, and culminates in thrombosis, vascular rupture, or acute ischemic syndromes.

**Evidence Linking Risk Factors in Childhood to Atherosclerosis at Autopsy**

Atherosclerosis at a young age was first identified in Korean and Vietnam

---

**TABLE 1-1 Evaluated Risk Factors**

<table>
<thead>
<tr>
<th>Family history</th>
<th>Age</th>
<th>Gender</th>
<th>Nutrition/diet</th>
<th>Physical inactivity</th>
<th>Tobacco exposure</th>
<th>BP</th>
<th>Lipid levels</th>
<th>Overweight/obesity</th>
<th>Diabetes mellitus</th>
<th>Predisposing conditions</th>
<th>Metabolic syndrome</th>
<th>Inflammatory markers</th>
<th>Perinatal factors</th>
</tr>
</thead>
</table>

---

**TABLE 1-2 Evidence Grading System: Quality Grades**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Well-designed RCTs or diagnostic studies performed on a population similar to the guideline’s target population</td>
</tr>
<tr>
<td>B</td>
<td>RCTs or diagnostic studies with minor limitations; genetic natural history studies; overwhelmingly consistent evidence from observational studies</td>
</tr>
<tr>
<td>C</td>
<td>Observational studies (case-control and cohort design)</td>
</tr>
<tr>
<td>D</td>
<td>Expert opinion, case reports, or reasoning from first principles (bench research or animal studies)</td>
</tr>
</tbody>
</table>

---

War casualties. Two major contemporary studies, the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study\(^2\) and the Bogalusa Heart Study,\(^3\) subsequently evaluated the extent of atherosclerosis in children, adolescents, and young adults who died accidentally. The Bogalusa study\(^2\) measured cardiovascular risk factors (lipid levels, blood pressure [BP], BMI, and tobacco use) as part of a comprehensive school-based epidemiologic study in a biracial community. These results were related to atherosclerosis measured at autopsy after accidental death. Strong correlations were shown between the presence and intensity of risk factors and the extent and severity of atherosclerosis. In the PDAY study,\(^2\) risk factors and surrogate measures of risk factors were measured after death in 15- to 34-year-olds who died accidentally of external causes. Strong relationships were found between atherosclerotic severity and extent, and age, non–high-density lipoprotein (HDL) cholesterol, HDL cholesterol, hypertension (determined by renal artery thickness), tobacco use (thiocyanate concentration), diabetes mellitus (DM) (glycohemoglobin), and (in men) obesity. There was a striking increase in both severity and extent as age and the number of risk factors increased. By contrast, the absence of risk factors was shown to be associated with a virtual absence of advanced atherosclerotic lesions, even in the oldest subjects in the study.

### Evidence Linking Risk Factors in Childhood to Atherosclerosis Assessed Noninvasively

Over the last decade, measures of sub-clinical atherosclerosis have developed, including the demonstration of coronary calcium on electron beam computed tomography imaging, increased carotid intima-media thickness (CIMT) assessed with ultrasound, endothelial dysfunction (reduced arterial dilation) with brachial ultrasound imaging, and increased left ventricular mass with cardiac ultrasound. These measures have been assessed in young people with severe abnormalities of individual risk factors:

- In adolescents with a marked elevation of low-density lipoprotein (LDL) cholesterol level caused by familial heterozygous hypercholesterolemia, abnormal levels of coronary calcium, increased CIMT, and impaired endothelial function have been found.
- Children with hypertension have been shown to have increased CIMT, increased left ventricular mass, and eccentric left ventricular geometry.
- Children with type 1 DM (T1DM) have significantly abnormal endothelial function and, in some studies, increased CIMT.
- Children and young adults with a family history of myocardial infarction have increased CIMT, higher prevalence of coronary calcium, and endothelial dysfunction.
- Endothelial dysfunction has been shown by ultrasound and plethysmography in association with ciga
Left ventricular hypertrophy at levels associated with excess mortality in adults has been found in children with severe obesity.

Four longitudinal studies have found relationships of risk factors measured in youth (specifically LDL cholesterol, non-HDL cholesterol and serum apolipoproteins, obesity, hypertension, tobacco use, and DM) with measures of subclinical atherosclerosis in adulthood. In many of these studies, risk factors measured in childhood and adolescence were better predictors of the severity of adult atherosclerosis than were risk factors measured at the time of the subclinical atherosclerosis study.

Evidence Linking Risk Factors in Childhood to Clinical CVD

The most important evidence relating risk in youth to clinical CVD is the observed association of risk factors for atherosclerosis to clinically manifest cardiovascular conditions. Genetic disorders related to high cholesterol are the biological model for risk-factor impact on the atherosclerotic process. With homozygous hypercholesterolemia, in which LDL cholesterol levels exceed 800 mg/dL beginning in infancy, coronary events begin in the first decade of life and life span is severely shortened. With heterozygous hypercholesterolemia, in which LDL cholesterol levels are minimally 160 mg/dL and typically >200 mg/dL and total cholesterol (TC) levels exceed 250 mg/dL beginning in infancy, 50% of men and 25% of women experience clinical coronary events by the age of 50. By contrast, genetic traits associated with low cholesterol are associated with longer life expectancy. In the PDAY study, every 30 mg/dL increase in non-HDL cholesterol level was associated with a visible incremental increase in the extent and severity of atherosclerosis. In natural-history studies of DM, early CVD mortality is so consistently observed that the presence of DM is considered evidence of vascular disease in adults. Consonant with this evidence, in 15- to 19-year-olds in the PDAY study, the presence of hyperglycemia was associated with the demonstration of advanced atherosclerotic lesions of the coronary arteries. In the PDAY study, there was also a strong relationship between abdominal aortic atherosclerosis and tobacco use. Finally, in a 25-year follow-up, the presence of the metabolic syndrome risk-factor cluster in childhood predicted clinical CVD in adult subjects at 30 to 48 years of age.

The Impact of Risk-Factor Clustering in Childhood on the Development of Atherosclerosis

CVD has been observed in diverse geographic areas and all racial and ethnic backgrounds. Cross-sectional research in children has found differences according to race and ethnicity and according to geography for prevalence of cardiovascular risk factors; these differences are often partially explained by differences in socioeconomic status. No group within the United States is without a significant prevalence of risk. Several longitudinal cohort studies referenced extensively in this report (Bogalusa Heart Study, the PDAY study, and the Coronary Artery Risk Development in Young Adults [CARDIA] study) have included racially diverse populations, and other studies have been conducted outside the United States. However, longitudinal data on Hispanic, Native American, and Asian children are lacking. Clinically important differences in prevalence of risk factors exist according to race and gender, particularly with regard to tobacco-use rates, obesity prevalence, hypertension, and dyslipidemia. Low socioeconomic status in and of itself confers substantial risk. However, evidence is not adequate for the recommendations provided in this report to be specific to racial or ethnic groups or socioeconomic status.

The Impact of Racial/Ethnic Background and Socioeconomic Status in Childhood on the Development of Atherosclerosis

From a population standpoint, clustering of multiple risk factors is the most common association with premature atherosclerosis. The pathologic studies reviewed above clearly showed that the presence of multiple risk factors is associated with striking evidence of an accelerated atherosclerotic process. Among the most prevalent multiple-risk combinations are the use of tobacco with 1 other risk factor and the development of obesity, which is often associated with insulin resistance, elevated triglyceride levels, reduced HDL cholesterol levels, and elevated BP, a combination known in adults as the metabolic syndrome. There is ample evidence from both cross-sectional and longitudinal studies that the increasing prevalence of obesity in childhood is associated with the same obesity-related risk-factor clustering seen in adults and that it continues into adult life. This high-risk combination is among the reasons that the current obesity epidemic with its relationship to future CVD and DM is considered one of the most important public health challenges in contemporary society. One other prevalent multiple-risk combination is the association of low cardiorespiratory fitness (identified in 33.6% of adolescents in the National Health and Nutrition Examination Surveys [NHANES] from 1999 to 2002) with overweight and obesity, elevated TC level and systolic BP, and a reduced HDL cholesterol level.
Risk-Factor Tracking From Childhood Into Adult Life

Tracking studies from childhood to adulthood have been performed for all the major risk factors.

- Obesity tracks more strongly than any other risk factor; among many reports from studies that have demonstrated this fact, one of the most recent is from the Bogalusa study, in which >2000 children were followed from initial evaluation at 5 to 14 years of age to adult follow-up at a mean age of 27 years. On the basis of BMI percentiles derived from the study population, 84% of those with a BMI in the 95th to 99th percentile as children were obese as adults, and all of those with a BMI at the >99th percentile were obese in adulthood. Increased correlation is seen with increasing age at which the elevated BMI occurs.

- For cholesterol and BP, tracking correlation coefficients in the range of 0.4 have been reported consistently from many studies, correlating these measures in children 5 to 10 years of age with results 20 to 30 years later. These data suggest that having cholesterol or BP levels in the upper portion of the pediatric distribution makes having them as adult risk factors likely but not certain. Those who develop obesity have been shown to be more likely to develop hypertension or dyslipidemia as adults.

- Tracking data on physical fitness are more limited. Physical activity levels do track but not as strongly as other risk factors.

- By its addictive nature, tobacco use persists into adulthood, although ~50% of those who have ever smoked eventually quit.

- T1DM is a lifelong condition.

- The insulin resistance of T2DM can be alleviated by exercise, weight loss, and bariatric surgery, but the long-term outcome of those with T2DM diagnosed in childhood is not known.

- As already discussed, risk-factor clusters such as those seen with obesity and the metabolic syndrome have been shown to track from childhood into adulthood.

CVD Prevention Beginning in Youth

The rationale for these guidelines comes from the following evidence.

- Atherosclerosis, the pathologic basis for clinical CVD, originates in childhood.

- Risk factors for the development of atherosclerosis can be identified in childhood.

- Development and progression of atherosclerosis clearly relates to the number and intensity of cardiovascular risk factors, which begin in childhood.

- Risk factors track from childhood into adult life.

- Interventions exist for the management of identified risk factors.

The evidence for the first 4 bullet points is reviewed in this section, and the evidence surrounding interventions for identified risk factors is addressed in the risk-factor–specific sections of the guideline to follow.

It is important to distinguish between the goals of prevention at a young age and those at older ages in which atherosclerosis is well established, morbidity may already exist, and the process is only minimally reversible. At a young age, there have historically been 2 goals of prevention: (1) prevent the development of risk factors (primordial prevention); and (2) recognize and manage those children and adolescents who are at increased risk as a result of the presence of identified risk factors (primary prevention). It is well established that a population that enters adulthood with lower risk will have less atherosclerosis and will collectively have lower CVD rates. This concept is supported by research that has found that (1) societies with low levels of cardiovascular risk factors have low CVD rates and that changes in risk in those societies are associated with a change in CVD rates, (2) in adults, control of risk factors leads to a decline in morbidity and mortality from CVD, and (3) those without childhood risk have minimal atherosclerosis at 30 to 34 years of age, absence of subclinical atherosclerosis as young adults, extended life expectancy, and a better quality of life free from CVD.

The Pathway to Recommending Clinical Practice-Based Prevention

The most direct means of establishing evidence for active CVD prevention beginning at a young age would be to randomly assign young people with defined risks to treatment of cardiovascular risk factors or to no treatment and follow both groups over sufficient time to determine if cardiovascular events are prevented without undue increase in morbidity arising from treatment. This direct approach is intellectually attractive, because atherosclerosis prevention would begin at the earliest stage of the disease process and thereby maximize the benefit. However, this approach is as unachievable as it is attractive, primarily because such studies would be extremely expensive and would be several decades in duration, a time period in which changes in environment and medical practice would diminish the relevance of the results.

The recognition that evidence from this direct pathway is unlikely to be achieved requires an alternative stepwise approach in which segments of an evidence chain are linked in a manner that serves as a sufficiently rigorous proxy for the causal inference of a...
This document provides recommendations for preventing the development of risk factors and optimizing cardiovascular health, beginning in infancy, that are based on the results of the evidence review. Pediatric care providers (pediatricians, family practitioners, nurses, nurse practitioners, physician assistants, registered dietitians) are ideally positioned to reinforce cardiovascular health behaviors as part of routine care. The guideline also offers specific guidance on primary prevention with age-specific, evidence-based recommendations for individual risk-factor detection. Management algorithms provide staged care recommendations for risk reduction within the pediatric care setting and identify risk-factor levels that require specialist referral. The guidelines also identify specific medical conditions such as DM and chronic kidney disease that are associated with increased risk for accelerated atherosclerosis. Recommendations for ongoing cardiovascular health management for children and adolescents with these diagnoses are provided.

A cornerstone of pediatric care is the provision of health education. In the US health care system, physicians and nurses are perceived as credible messengers for health information. The childhood health maintenance visit provides an ideal context for effective delivery of the cardiovascular health message. Pediatric care providers provide an effective team educated to initiate behavior change to diminish risk of CVD and promote lifelong cardiovascular health in their patients from infancy into young adult life.

4. FAMILY HISTORY OF EARLY ATHEROSCLEROTIC CVD

A family history of CVD represents the net effect of shared genetic, biochemical, behavioral, and environmental components. In adults, epidemiologic studies have found that a family history of premature coronary heart disease in a first-degree relative (heart attack, treated angina, percutaneous coronary catheter interventional procedure, coronary artery bypass surgery, stroke, or sudden cardiac death in a male parent or sibling before the age of 55 years or a female parent or sibling before the age of 65 years) is an important independent risk factor for future CVD. The process of atherosclerosis is complex and involves many genetic loci and multiple environmental and personal risk factors. Nonetheless, the presence of a positive parental history has been consistently found to significantly increase baseline risk for CVD. The risk for CVD in offspring is strongly inversely related to the age of the parent at the time of the index event. The association of a positive family history with increased cardiovascular risk has been confirmed for men, women, and siblings and in different racial and ethnic groups. The evidence review identified all RCTs, systematic reviews, meta-analyses, and observational studies that addressed family history of premature atherosclerotic disease and the development and progression of atherosclerosis from childhood into young adult life.

Conclusions and Grading of the Evidence Review for the Role of Family History in Cardiovascular Health

- Evidence from observational studies strongly supports inclusion of a positive family history of early coronary heart disease in identifying children at risk for accelerated atherosclerosis and for the presence of an abnormal risk profile (grade B).

- For adults, a positive family history is defined as a parent and/or sibling with a history of treated angina, myocardial infarction, percutaneous coronary catheter interven-
tional procedure, coronary artery bypass grafting, stroke, or sudden cardiac death before 55 years in men or 65 years in women. Because the parents and siblings of children and adolescents are usually young themselves, it was the panel consensus that when evaluating family history of a child, history should also be ascertained for the occurrence of CVD in grandparents, aunts, and uncles, although the evidence supporting this recommendation is insufficient to date (grade D).

- Identification of a positive family history for cardiovascular disease and/or cardiovascular risk factors should lead to evaluation of all family members, especially parents, for cardiovascular risk factors (grade B).

- Family history evolves as a child matures, so regular updates are a necessary part of routine pediatric care (grade D).

- Education about the importance of accurate and complete family health information should be part of routine care for children and adolescents. As genetic sophistication increases, linking family history to specific genetic abnormalities will provide important new knowledge about the atherosclerotic process (grade D).

Recommendations for the use of family history in cardiovascular health promotion are listed in Table 4-1.

5. NUTRITION AND DIET

The 2010 Dietary Guidelines for Americans (DGA)\(^\text{8}\) include important recommendations for the population aged 2 years and older. In 1992, the National Cholesterol Education Program (NCEP) Pediatric Panel report\(^\text{1}\) provided dietary recommendations for all children as part of a population-based approach to reducing cardiovascular risk. Evidence relative to diet and the development of atherosclerosis in childhood and adolescence was identified by the evidence review for this guideline and, collectively, provides the rationale for new dietary prevention efforts initiated early in life.

This new pediatric cardiovascular guideline not only builds on the recommendations for achieving nutrient adequacy in growing children as stated in the 2010 DGA but also adds evidence regarding the efficacy of specific dietary changes in reducing cardiovascular risk from the current evidence review for use by pediatric care providers in the care of their patients. Because the focus of these guidelines is on cardiovascular risk reduction, the evidence review specifically evaluated dietary fatty acid and energy components as major contributors to hypercholesterolemia and obesity, as well as dietary composition and micronutrients as they affect hypertension. New evidence from multiple dietary trials that addressed cardiovascular risk reduction in children has provided important information for these recommendations.

Conclusions and Grading of the Evidence Review for Diet and Nutrition in Cardiovascular Risk Reduction

The expert panel concluded that there is strong and consistent evidence that good nutrition beginning at birth has profound health benefits and the potential to decrease future risk for CVD. The expert panel accepts the 2010 DGA\(^\text{8}\) as containing appropriate recommendations for diet and nutrition in children aged 2 years and older. The recommendations in these guidelines are intended for pediatric care providers to use with their patients to address cardiovascular risk reduction. The conclusions of the expert panel’s review of the entire body of evidence in a specific nutrition area with grades are summarized. Where the evidence is inadequate yet nutrition guidance is needed, recommendations for pediatric care providers are based on a consensus of the expert panel (grade D). The age- and evidence-based recommendations of the expert panel follow.

In accordance with the Surgeon General’s Office, the World Health Organization, the AAP, and the American Academy of Family Physicians, exclusive breastfeeding is recommended for the first 6 months of life. Continued breastfeeding is recommended to at least 12 months of age with the addition of complementary foods. If breastfeeding per se is not possible, feeding human milk by bottle is second best, and formula-feeding is the third choice.

- Long-term follow-up studies have found that subjects who were breastfed have sustained cardiovascular health benefits, including lower cholesterol levels, lower BMI, reduced prevalence of type 2 DM, and lower CIMT in adulthood (grade B).

- Ongoing nutrition counseling has been effective in assisting children and families to adopt and sustain recommended diets for both nutrient adequacy and reducing cardiovascular risk (grade A).

- Within appropriate age- and gender-based requirements for growth and nutrition, in normal children and in children with hypercholesterolemia intake of total fat can be safely limited to 30% of total calories, saturated fat intake limited to 7% to 10% of calories, and dietary cholesterol limited to 300 mg/day. Under the guidance of qualified nutritionists, this dietary composition has been shown to result in lower TC and LDL cholesterol levels, less obesity, and
less insulin resistance (grade A). Under similar conditions and with ongoing follow-up, these levels of fat intake might have similar effects starting in infancy (grade B). Fats are important to infant diets because of their role in brain and cognitive development. Fat intake for infants younger than 12 months should not be restricted without medical indication.

- The remaining 20% of fat intake should comprise a combination of monosaturated and polyunsaturated fats (grade D). Intake of trans fats should be limited as much as possible (grade D).

- For adults, the current NCEP guidelines\(^5\) recommend that adults consume 25% to 35% of calories from fat. The 2010 DGA supports the Institute of Medicine recommendations for 30% to 40% of calories from fat for ages 1 to 3 years, 25% to 35% of calories from fat for ages 4 to 18 years, and 20% to 35% of calories from fat for adults. For growing children, milk provides essential nutrients, including protein, calcium, magnesium, and vitamin D, that are not readily available elsewhere in the diet. Consumption of fat-free milk in childhood after 2 years of age and through adolescence optimizes these benefits without compromising nutrient quality while avoiding excess saturated fat and calorie intake (grade A). Between the ages of 1 and 2 years, as children transition from breast milk or formula, reduced-fat milk (ranging from 2% milk to fat-free milk) can be used on the basis of the child’s growth, appetite, intake of other nutrient-dense foods, intake of other sources of fat, and risk for obesity and CVD. Milk with reduced fat should be used only in the context of an overall diet that supplies 30% of calories from fat. Dietary intervention should be tailored to each specific child’s needs.

- Optimal intakes of total protein and total carbohydrate in children were not specifically addressed, but with a recommended total fat intake of 30% of energy, the expert panel recommends that the remaining 70% of calories include 15% to 20% from protein and 50% to 55% from carbohydrate sources (no grade). These recommended ranges fall within the acceptable macronutrient distribution range specified by the 2010 DGA: 10% to 30% of calories from protein and 45% to 65% of calories from carbohydrate for children aged 4 to 18 years.

- Sodium intake was not addressed by the evidence review for this section on nutrition and diet. From the evidence review for the “High BP” section, lower sodium intake is associated with lower systolic and diastolic BP in infants, children, and adolescents.

- Plant-based foods are important low-calorie sources of nutrients including vitamins and fiber in the diets of children; increasing access to fruits and vegetables has been shown to increase their intake (grade A). However, increasing fruit and vegetable intake is an ongoing challenge.

- Reduced intake of sugar-sweetened beverages is associated with decreased obesity measures (grade B). Specific information about fruit juice intake is too limited for an evidence-based recommendation. Recommendations for intake of 100% fruit juice by infants was made by a consensus of the expert panel (grade D) and are in agreement with those of the AAP.

- Per the 2010 DGA, energy intake should not exceed energy needed for adequate growth and physical activity. Calorie intake needs to match growth demands and physical activity needs (grade A). Estimated calorie requirements according to gender and age group at 3 levels of physical activity from the dietary guidelines are shown in Table 5-2. For children of normal weight whose activity is minimal, most calories are needed to meet nutritional requirements, which leaves only ~5% to 15% of calorie intake from extra calories. These calories can be derived from fat or sugar added to nutrient-dense foods to allow their consumption as sweets, desserts, or snack foods (grade D).

- Dietary fiber intake is inversely associated with energy density and increased levels of body fat and is positively associated with nutrient density (grade B); a daily total dietary fiber intake from food sources of at least age plus 5 g for young children up to 14 g/1000 kcal for older children and adolescents is recommended (grade D).

- The expert panel supports the 2008 AAP recommendation for vitamin D supplementation with 400 IU/day for all infants and children.\(^9\) No other vitamin, mineral, or dietary supplements are recommended (grade D). The new recommended daily allowance for vitamin D for those aged 1 to 70 years is 600 IU/day.

- Use of dietary patterns modeled on those shown to be beneficial for adults (eg, Dietary Approaches to Stop Hypertension [DASH] pattern) is a promising approach to improving nutrition and decreasing cardiovascular risk (grade B).

- All diet recommendations must be interpreted for each child and family to address individual diet patterns and patient sensitivities such as lactose intolerance and food allergies (grade D).
## 3. INTEGRATED CARDIOVASCULAR HEALTH SCHEDULE

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Birth to 12 mo</th>
<th>1-4 y</th>
<th>5-9 y</th>
<th>9-11 y</th>
<th>12-17 y</th>
<th>18-21 y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family history of early CVD</strong></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>Tobacco exposure</strong></td>
<td>Advise smoke-free home; offer smoking-cessation assistance or referral to parents</td>
<td>Continue active antismoking advice with parents; offer smoking-cessation assistance and referral as needed</td>
<td>Obtain smoke exposure history from child; begin active antismoking advice with child</td>
<td>Assess smoking status of child; active antismoking counseling or referral as needed</td>
<td>Continue active antismoking counseling with patient; offer smoking-cessation assistance or referral as needed</td>
<td>Reinforce strong antismoking message; offer smoking-cessation assistance or referral as needed</td>
</tr>
<tr>
<td><strong>Nutrition/diet</strong></td>
<td>Support breastfeeding as optimal to 12 mo of age if possible; add formula if breastfeeding decreases or stops before 12 mo of age; at age 12-24 mo, may change to cow’s milk with 2% percentage of fat decided by family and pediatric care provider; after 2 y of age, fat-free milk for all; juice ≤4 oz/d; transition to CHLD-1 diet by the age of 2 y</td>
<td>Reinforce CHLD-1 diet messages</td>
<td>Reinforce CHLD-1 diet messages as needed</td>
<td>Obtain diet information from child and use to reinforce healthy diet and limitations and provide counseling as needed</td>
<td>Review healthy diet with patient</td>
<td></td>
</tr>
<tr>
<td><strong>Growth, overweight/obesity</strong></td>
<td>Review family history for obesity; discuss weight-for-height tracking, growth chart, and healthy diet</td>
<td>Chart height/weight/BMI; classify weight by BMI from age 2 y; review with parent</td>
<td>Chart height/weight/BMI and review with parent; BMI ≥ 85th percentile, crossing percentiles; intensify diet/activity focus for 6 mo; if no change: RD referral, manage per obesity algorithms; BMI ≥ 95th percentile, manage per obesity algorithms</td>
<td>Chart height/weight/BMI and review with parent and child; BMI ≥ 85th percentile, crossing percentiles; intensify diet/activity focus for 6 mo; if no change: RD referral, manage per obesity algorithms; BMI ≥ 95th percentile, manage per obesity algorithms</td>
<td>Chart height/weight/BMI and review with child and parent; BMI ≥ 85th percentile, crossing percentiles; intensify diet/activity focus for 6 mo; if no change: RD referral, manage per obesity algorithms; BMI ≥ 95th percentile, manage per obesity algorithms</td>
<td>Review height/weight/BMI and norms for health with patient; BMI ≥ 85th percentile; crossing percentiles; intensity diet/activity focus for 6 mo; if no change: RD referral, manage per obesity algorithms; BMI ≥ 95th percentile; manage per obesity algorithms</td>
</tr>
<tr>
<td><strong>Lipids</strong></td>
<td>No routine lipid screening</td>
<td>Obtain FLP only if family history for CVD is positive, parent has dyslipidemia, child has any other RFs or high-risk condition</td>
<td>Obtain RLP only if family history for CVD is positive, parent has dyslipidemia, child has any other RFs or high-risk condition</td>
<td>Obtain universal lipid screen with nonfasting non-HDL ≤ TC – HDL, or RLP; manage per lipid algorithms as needed</td>
<td>Obtain FLP if family history newly positive, parent has dyslipidemia, child has any other RFs or high-risk condition</td>
<td>Measure 1 nonfasting non-HDL or FLP in all; review with patient; manage with lipid algorithms per ATP as needed</td>
</tr>
<tr>
<td><strong>BP</strong></td>
<td>Measure BP in infants with renal/urologic/cardiac diagnosis or history of neonatal ICU; Measure BP annually in all from the age of 3 y; chart for age/sex/weight percentile and review with parent; Check BP annually and chart for age/sex/weight percentile and review with parent; workup and/or management per BP algorithm as needed</td>
<td>Measure BP annually and chart for age/sex/weight percentile and review with parent; workup and/or management per BP algorithm as needed</td>
<td>Check BP annually and chart for age/sex/weight percentile and review with parent; workup and/or management per BP algorithm as needed</td>
<td>Check BP annually and chart for age/sex/weight percentile and review with parent; workup and/or management per BP algorithm as needed</td>
<td>Measure BP; review with patient; evaluate and treat per JNC guidelines</td>
<td></td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td>Encourage parents to model routine activity; no screen time before the age of 2 y</td>
<td>Encourage active play; limit sedentary/screen time to ≤2 h/d; no TV in bedroom</td>
<td>Recommend MVPA of ≥1 h/d; limit screen/sedentary time to ≤2 h/d</td>
<td>Obtain activity history from child; recommend MVPA of ≥1 h/d and screen/sedentary time of ≤2 h/d</td>
<td>Use activity history with adolescent to reinforce MVPA of ≥1 h/d and leisure screen time of ≤2 h/d</td>
<td>Discuss lifelong activity, sedentary time limits with parent</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Obtain fasting glucose level if indicated; refer to endocrinologist as needed</td>
</tr>
</tbody>
</table>

Graded, age-specific recommendations for pediatric care providers to use in optimizing cardiovascular health in their patients are summarized in Table 5-1. The Cardiovascular Health Integrated Lifestyle Diet (CHILD-1) is the first stage in dietary change for children with identified dyslipidemia, overweight and obesity, risk-factor clustering, and high-risk medical conditions that might ultimately require more intensive dietary change. CHILD-1 is also the recommended diet for children with a positive family history of early cardiovascular disease, dyslipidemia, obesity, primary hypertension, DM, or exposure to smoking in the home. Any dietary modification must provide nutrients and calories needed for optimal growth and development (Table 5-2). Recommended intakes are adequately met by a DASH-style eating plan, which emphasizes fat-free/low-fat dairy and increased intake of fruits and vegetables. This diet has been modified for use in children aged 4 years and older on the basis of daily energy needs according to food group and is shown in Table 5-3 as an example of a heart-healthy eating plan using CHILD-1 recommendations.

6. PHYSICAL ACTIVITY

Physical activity is any bodily movement produced by contraction of skeletal muscle that increases energy expenditure above a basal level. Physical activity can be focused on strengthening muscles, bones, and joints, but because these guidelines address cardiovascular health, the evidence review concentrated on aerobic activity and on the opposite of activity: sedentary behavior. There is strong evidence for beneficial effects of physical activity and disadvantageous effects of a sedentary lifestyle on the overall health of children and adolescents across a broad array of domains. Our review focused on the effects of activity on cardiovascular health, because physical inactivity has been identified as an independent risk factor for coronary heart disease in adults. Over the last several decades, there has been a steady decrease in the amount of time that children spend being physically active and an accompanying increase in time spent in sedentary activities. The evidence review identified many studies in youth ranging in age from 4 to 21 years that strongly linked increased time spent in sedentary activities with reduced overall activity levels, disadvantageous lipid profiles, higher systolic BP, higher levels of obesity, and higher levels of all the obesity-related cardiovascular risk factors including hypertension, insulin resistance, and type 2 DM.

Conclusions and Grading of the Evidence Review for Physical Activity

The expert panel felt that the evidence strongly supports the role of physical activity in optimizing cardiovascular health in children and adolescents.

- There is reasonably good evidence that physical activity patterns established in childhood are carried forward into adulthood (grade C).
- There is strong evidence that increases in moderate-to-vigorous physical activity are associated with lower systolic and diastolic BP, decreased measures of body fat, decreased BMI, improved fitness measures, lower TC level, lower LDL cholesterol level, lower triglyceride level, higher HDL cholesterol level, and decreased insulin resistance in childhood and adolescence (grade A).
- There is limited but strong and consistent evidence that physical exercise interventions improve subclinical measures of atherosclerosis (grade B).
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Recommendation Details</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to 6 mo</td>
<td>Infants should be exclusively breastfed (no supplemental formula or other foods) until the age of 6 mo.</td>
<td>Grade B, Strongly recommend</td>
</tr>
<tr>
<td>6 to 12 mo</td>
<td>Continue breastfeeding until at least 12 mo of age while gradually adding solids; transition to iron-fortified formula until 12 mo if reducing breastfeeding. Fat intake in infants &lt;12 mo of age should not be restricted without medical indication. Limit other drinks to 100% fruit juice (≤4 oz/d); no sweetened beverages; encourage water.</td>
<td>Grade B, Strongly recommend, Grade D, Recommend</td>
</tr>
<tr>
<td>12 to 24 mo</td>
<td>Transition to reduced-fat (2% to fat-free) unflavored cow’s milk (see supportive actions). Limit/avoid sugar-sweetened beverage intake; encourage water. Transition to table food with: Total fat 30% of daily kcal/EER, Saturated fat 8%-10% of daily kcal/EER, Avoid trans fats as much as possible, Monounsaturated and polyunsaturated fat up to 20% of daily kcal/EER, Cholesterol &lt; 300 mg/d.</td>
<td>Grade B, Recommend, Grade B, Strongly recommend, Grade D, Recommend, Grade D, Strongly recommend, Grade B, Strongly recommend</td>
</tr>
<tr>
<td>2 to 10 y</td>
<td>Primary beverage: fat-free unflavored milk. Limit/avoid sugar-sweetened beverages; encourage water. Fat content: Total fat 25%-30% of daily kcal/EER, Saturated fat 8%-10% of daily kcal/EER, Avoid trans fats as much as possible, Monounsaturated and polyunsaturated fat up to 20% of daily kcal/EER, Cholesterol &lt; 300 mg/d. Encourage high dietary fiber intake from foods.</td>
<td>Grade A, Strongly recommend, Grade B, Recommend, Grade A, Strongly recommend, Grade A, Strongly recommend, Grade D, recommend, Grade D, Recommend, Grade A, Strongly recommend, Grade B, recommend</td>
</tr>
<tr>
<td>11 to 21 y</td>
<td>Primary beverage: fat-free unflavored milk. Limit/avoid sugar-sweetened beverages; encourage water.</td>
<td>Grade A, Strongly recommend, Grade B, Recommend, Grade A, Strongly recommend</td>
</tr>
</tbody>
</table>

Supportive actions:
- Teach portions based on EER for age/gender/age (Table 5-2).
- Encourage moderately increased energy intake during periods of rapid growth and/or regular moderate-to-vigorous physical activity.
- Encourage dietary fiber from foods: age + 5 g/d.
- Limit naturally sweetened juice (no added sugar) to 4 oz/d.
- Limit sodium intake.
- Support DASH-style eating plan (Table 5-3).

Notes:
- * indicates additional considerations for specific populations or circumstances.
- EER = Estimated Energy Requirement.
TABLE 5-1 Continued

Fat content:
- Total fat 25%–30% of daily kcal/EER
- Saturated fat 8%–10% of daily kcal/EER
- Avoid trans fat as much as possible
- Monounsaturated and polyunsaturated fat up to 20% of daily kcal/EER

Cholesterol < 300 mg/d

Encourage high dietary fiber intake from foods

Supportive actions:
- Teach portions based on EER for age/gender/activity (Table 5-2)
- Encourage moderately increased energy intake during periods of rapid growth and/or regular moderate-to-vigorous physical activity
- Advocate dietary fiber: goal of 14 g/1000 kcal
- Limit naturally sweetened juice (no added sugar) to 4–6 oz/d
- Limit sodium intake
- Encourage healthy eating habits: breakfast every day, eating meals as a family, limiting fast-food meals

Support DASH-style eating plan (Table 5-3)

Grades reflect the findings of the evidence review; recommendation levels reflect the consensus opinion of the expert panel. Supportive actions represent expert consensus suggestions from the expert panel provided to support implementation of the recommendations; they are not graded. EER indicates estimated energy requirement.

- Infants who cannot be fed directly at the breast should be fed expressed milk. Infants for whom expressed milk is not available should be fed iron-fortified infant formula.
- For toddlers 12 to 24 mo of age with a family history of obesity, heart disease, or high cholesterol, parents should discuss transition to reduced-fat milk with pediatric care provider after 12 months of age.
- Continued breastfeeding is still appropriate and nutritionally superior to cow’s milk. Reduced-fat milk should be used only in the context of an overall diet that supplies 30% of calories from fat.
- Estimated energy requirements per day for age/gender (Table 5-2).
- Naturally fiber-rich foods are recommended (fruits, vegetables, whole grains); fiber supplements are not advised. Limit refined carbohydrates (sugars, white rice, and white bread).

TABLE 5-2 Estimated Calorie Needs per Day by Age, Gender, and Physical Activity Level

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age (Years)</th>
<th>Sedentary</th>
<th>Moderately Active</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>2–3</td>
<td>1000–1200</td>
<td>1000–1400&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1000–1400&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Female</td>
<td>4–6</td>
<td>1200–1400</td>
<td>1400–1600</td>
<td>1400–1800</td>
</tr>
<tr>
<td></td>
<td>9–13</td>
<td>1400–1600</td>
<td>1600–2000</td>
<td>1800–2200</td>
</tr>
<tr>
<td></td>
<td>14–18</td>
<td>1800–2000</td>
<td>2000</td>
<td>2400</td>
</tr>
<tr>
<td>Male</td>
<td>4–8</td>
<td>1200–1400</td>
<td>1400–1600</td>
<td>1600–2000</td>
</tr>
<tr>
<td></td>
<td>14–18</td>
<td>2000–2400</td>
<td>2400–2800</td>
<td>2800–3200</td>
</tr>
<tr>
<td></td>
<td>19–30</td>
<td>2400–2600</td>
<td>2600–2800</td>
<td>3000</td>
</tr>
</tbody>
</table>

Estimated amounts of calories needed to maintain caloric balance for various gender and age groups at three different levels of physical activity. The estimates are rounded to the nearest 200 calories. An individual’s calorie needs may be higher or lower than these average estimates.

- Based on Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (health) for each age/gender group. For children and adolescents, reference height and weight vary. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and weighs 126 pounds. EER equations are from the Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.
- Sedentary means a lifestyle that includes physical activity equivalent to walking 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life. Active means a lifestyle that includes physical activity equivalent to walking 3 to 5 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.
- The calorie ranges shown are to accommodate needs of different ages within the group. For children and adolescents, more calories are needed at older ages. For adults, fewer calories are needed at older ages.
- Estimates for females do not include women who are pregnant or breastfeeding.

- Physical activity patterns, dietary choices, and smoking behaviors cluster together (grade C).
- There is no evidence of harm associated with increased physical activity or limitation of sedentary activity in healthy children (grade A).
- There is strong evidence that physical activity should be promoted in schools (grade A).
- There is less specific information on the type and amount of physical exercise required for optimum cardiovascular health. Reported activity interventions ranged from 20 to 60 minutes, 2 to 5 times per week in children aged 3 to 17 years and included a wide variety of dynamic and isometric exercises. Extrapolating from these interventions, which occurred in supervised settings, to the real world of childhood and adolescence, the expert panel recommends at least 1 hour of moderate-to-vigorous activity every day of the week for children.

<table>
<thead>
<tr>
<th>Food Group</th>
<th>No. of Servings</th>
<th>Serving Size</th>
<th>Examples and Notes</th>
<th>Significance of Each Food Group to the DASH Eating Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grains</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grains a</td>
<td>4–5/d</td>
<td>1 slice bread; 1 oz dry cereal; ½ cup cooked rice, pasta, or cereal b</td>
<td>Whole-wheat bread and rolls, white-wheat pasta, English muffin, pita bread, bagel,</td>
<td>Major sources of energy and fiber</td>
</tr>
<tr>
<td></td>
<td>5–6/d</td>
<td></td>
<td>cereals, grits, oatmeal, brown rice, unsalted pretzels and popcorn</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6–8/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10–11/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vegetables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>3–4/d</td>
<td>1 cup raw leafy vegetable; ½ cup cut-up raw or cooked vegetable; ½ cup</td>
<td>Broccoli, carrots, collards, green beans, green peas, kale, lima beans, potatoes,</td>
<td>Rich sources of potassium, magnesium, and fiber</td>
</tr>
<tr>
<td></td>
<td>3–4/d</td>
<td>vegetable juice</td>
<td>spinach, squash, sweet potatoes, tomatoes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4–5/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4–5/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5–6/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fruits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>3–4/d</td>
<td>1 medium fruit; ¼ cup dried fruit; ½ cup fresh, frozen, or canned fruit;</td>
<td>Apples, apricots, bananas, dates, grapes, oranges, grapefruit, grapefruit juice,</td>
<td>Important sources of potassium, magnesium, and fiber</td>
</tr>
<tr>
<td></td>
<td>4/d</td>
<td>½ cup fruit juice</td>
<td>mangoes, melons, peaches, pineapples, raisins, strawberries, tangerines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4–5/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4–5/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5–6/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**Fat-free or low-fat milk and</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>milk products**</td>
<td>2–3/d</td>
<td>1 cup milk or yogurt; ½ oz cheese</td>
<td>Fat-free milk or buttermilk, fat-free, low-fat, or reduced-fat cheese, fat-free/low-fat regular or frozen yogurt</td>
<td>Major sources of calcium and protein</td>
</tr>
<tr>
<td></td>
<td>2–3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2–3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2–3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lean meats, poultry, and fish</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lean meats, poultry, and fish</td>
<td>≤3/d</td>
<td>1 oz cooked meats, poultry, or fish; 1 egg c</td>
<td>Select only lean; trim away visible fats; broil, roast, or poach; remove skin from</td>
<td>Rich sources of protein and magnesium</td>
</tr>
<tr>
<td></td>
<td>≤3–4/d</td>
<td></td>
<td>poultry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤3–4/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤6/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤6/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nuts, seeds, and legumes</strong></td>
<td>3/wk</td>
<td>½ cup or 1 ½ oz nuts; 2 tbsp peanut butter; 2 tbsp or ½ oz seeds; ½ cup</td>
<td>Almonds, filberts, mixed nuts, peanuts, walnuts, sunflower seeds, peanut butter,</td>
<td>Rich sources of energy, magnesium, protein, and fiber</td>
</tr>
<tr>
<td></td>
<td>3–4/wk</td>
<td>cooked legumes (dry beans and peas)</td>
<td>kidney beans, lentils, split peas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4–5/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fats and oils</strong></td>
<td>1/d</td>
<td>1 tsp soft margarine; 1 tsp vegetable oil; 1 tbsp mayonnaise; 2 tbsp salad</td>
<td>Soft margarine, vegetable oil (such as canola, corn, olive, or safflower), low-fat</td>
<td>The DASH study had 27% of calories as fat, including fat in or added to foods</td>
</tr>
<tr>
<td></td>
<td>1/d</td>
<td>dressing</td>
<td>mayonnaise, light salad dressing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2–3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2–3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3/d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sweets and added sugars</strong></td>
<td>≤3/wk</td>
<td>1 tsp sugar; 1 tbsp sorbet, gelatin; 1 cup lemonade</td>
<td>Fruit-flavored gelatin, fruit punch, hard candy, jelly, maple syrup, sorbet and</td>
<td>Sweets should be low in fat</td>
</tr>
<tr>
<td></td>
<td>≤3/wk</td>
<td></td>
<td>ices, sugar</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤3/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤5/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤5/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤2/d</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-2 provides estimated energy requirements according to age, gender, and activity level for use with this table. The FDA and the Environmental Protection Agency advise women of childbearing age who may become pregnant, pregnant women, nursing mothers, and young children to avoid some types of fish and shellfish and eat fish and shellfish that are low in mercury. For more information, call the FDA’s food information line toll free at 1[hypen]888-SAFEFOOD or visit www.cfsan.fda.gov/~dms/admehg3.html.

a Whole grains are recommended for most grain servings as a good source of fiber and nutrients.

b Serving sizes vary between a ½ and 1 ½ cups, depending on cereal type. Check the product’s nutrition-facts label.

c Because eggs are high in cholesterol, limit egg yolk intake to no more than 4 per week; 2 egg whites have the same protein content as 1 oz of meat.

d Fat content changes serving amount for fats and oils. For example, 1 tbsp of regular salad dressing — 1 serving; 1 tbsp of low-fat dressing — ½ serving; 1 tbsp fat-free dressing — 0 servings.
older than 5 years (Table 6-1). In agreement with the “Physical Activity Guidelines Advisory Committee Report, 2008” from the Department of Health and Human Services, the expert panel recommends that activity be vigorous on 3 days/week (www.health.gov/paguidelines). In working with children and families, the expert panel suggested that moderate-to-vigorous activity could be compared with jogging or playing baseball and that vigorous physical activity could be compared with running, playing singles tennis, or playing soccer. Similarly, reducing sedentary time is convincingly associated with a favorable cardiovascular profile, and the expert panel agreed with the AAP recommendation for limiting leisure screen time to <2 hours/day.

7. TOBACCO EXPOSURE

Tobacco dependence is responsible for ~4 million deaths worldwide annually, and in utero exposure to tobacco products, involuntary tobacco smoke exposure (secondhand smoke), and tobacco use directly impair health in fetuses, infants, children, and adolescents. On the basis of an analysis of published causes of death, tobacco use is the leading actual cause of death in the United States. The evidence that cigarette use is harmful and addictive is unequivocal. In childhood, nicotine is highly addicting; symptoms of tobacco dependence have been found after brief intermittent use. Cigarette use among high school students declined from 1997 to 2003. Rates were stable from 2003 to 2007 with >20% of high school students reporting daily smoking. From a public health standpoint, the need to reduce tobacco exposure is compelling, and a role for pediatric health care providers is essential.

A clinical practice guideline update from the US Public Health Service published in May 2008 systematically reviewed almost 9000 publications and concluded that smoking prevention and cessation interventions are effective in adults. These same methods should be safely applicable in childhood and adolescence, because behavioral interventions to alter smoking behaviors have little if any morbidity and because morbidity with pharmacologic treatment is limited. Physicians who care for children are well positioned to provide prevention and treatment interventions for their patients. Youth interventions must target parents as well as children, because parental smoking is both a risk factor for child smoking and provides secondhand smoke exposure to fetuses and children. The evidence review assessed prevention and treatment interventions in each of these areas.

Conclusions and Grading of the Evidence on Preventing Tobacco Exposure

Among all the known risk factors for CVD, the dichotomy between known benefits of risk elimination and the paucity of evidence for effective interventions to achieve risk reduction in pediatric care provider settings is greatest for tobacco exposure. The quality of the evidence regarding the harm of smoking and the benefits of avoiding passive smoke exposure, smoking prevention, and smoking cessation is uniformly grade A. That evidence grades in the recommendations are less than grade A reflects the lack of existing evidence on interventions that impact smoking behaviors in specific pediatric age groups as opposed to the collective evidence.

- Good-quality interventions in pediatric care settings to decrease children’s environmental smoke exposure have had mixed results (grade B).
- Intervention studies to prevent smoking initiation have had moderate success, although long-term results are limited (grade B).
- Practice-based interventions to achieve smoking cessation in adolescents have had moderate success with limited long-term follow-up (grade B).
- School-based smoking-prevention programs have been moderately successful with limited long-term follow-up (grade B).

Although the evidence base for effective office-based approaches to tobacco interventions is moderate and mixed, the evidence that cigarette use is harmful and addictive is unequivocal. The need to reduce tobacco exposure is so compelling that a role for pediatric health care providers is essential. The lack of harm associated with such interventions and the importance of communicating the message of risk associated with tobacco provides the rationale for “strongly recommend” despite the lack of conclusive evidence that office-based interventions reliably reduce tobacco initiation or smoking cessation. Physicians and nurses who care for children are well positioned to provide intervention to patients who smoke. The expert panel feels that such providers should routinely identify patients who smoke by using the medical history (Table 7-1). Patients should be explicitly informed about the addictive and adverse health effects of tobacco use. By using the 5 A’s (ask, advise, assess, assist, and arrange), providers can assess readiness to quit and assist in providing resources to support smoking-cessation efforts. Information about telephone quit lines (eg, 1-800-QUIT-NOW), community cessation programs, and pharmacotherapy should also be made available.

As described, practice-based interventions to decrease environmental smoke exposure have had mixed results. Nonetheless, the expert panel believes that pediatric care providers
**TABLE 6-1  Evidence-Based Activity Recommendations for Cardiovascular Health**

<table>
<thead>
<tr>
<th>Age</th>
<th>Activity Recommendations</th>
<th>Grade</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn to 12 mo</td>
<td>Parents should create an environment that promotes and models physical activity and limits sedentary time</td>
<td>Grade D</td>
<td>Recommend</td>
</tr>
<tr>
<td>1 to 4 y</td>
<td>Allow unlimited active playtime in safe, supportive environments</td>
<td>Grade D</td>
<td>Recommend</td>
</tr>
</tbody>
</table>
| 5 to 10 y | Moderate-to-vigorous physical activity every day  
Supportive actions:  
- Discourage TV viewing altogether  
- Limit sedentary time, especially TV/video  
- Allow unlimited active playtime in safe, supportive environments | Grade A | Strongly recommend |
| 11 to 17 y | Moderate-to-vigorous physical activity every day  
Supportive actions:  
- Prescribe moderate-to-vigorous activity 1 h/d with vigorous-intensity physical activity 3 d/wk  
- Limit total media time to no more than 1–2 hours of quality programming per day  
- No TV in child’s bedroom  
- Take activity and screen-time history from child once per year  
- Match physical activity recommendations with energy intake  
- Recommend appropriate safety equipment relative to each sport  
- Support recommendations for daily physical education in schools | Grade A | Strongly recommend |
| 18 to 21 y | Moderate-to-vigorous physical activity every day  
Supportive actions:  
- Prescribe moderate-to-vigorous activity 1 h/d with vigorous-intensity physical activity 3 d/wk  
- Recommend that combined leisure screen time not exceed 2 h/d  
- Take activity and screen-time history from adolescent at health supervision visits  
- Endorse appropriate safety equipment relative to each sport  
- Support recommendations for daily physical education in schools | Grade A | Strongly recommend |

Grades reflect the findings of the evidence review; recommendation levels reflect the consensus opinion of the expert panel; and supportive actions represent expert consensus suggestions from the expert panel provided to support implementation of the recommendations (they are not graded).

* Examples of moderate-to-vigorous physical activities are jogging and playing baseball.
* Examples of vigorous physical activities are running, playing singles tennis, and playing soccer.

---

**8. HIGH BP**

In 2004, an NHLBI task force published “The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents.” This report included a complete review of the current evidence on this subject and detailed recommendations for managing BP throughout childhood. These recommendations were used as the basis for these guidelines, considered complete until 2003 when the review for the report ended. Therefore, this evidence review for BP for these guidelines was limited to studies published between January 1, 2003, and June 30, 2007, with the addition of selected studies through June 30, 2008, identified by the expert panel as having met all the criteria for inclusion. Repeating the review performed by the task force was not felt to be necessary, given the short time since publication of that report, or a judicious use of the resources available for development of these guidelines. Recommendations regarding BP are all graded as expert opinion (grade D), because they are based on the expert consensus conclusions of this NHLBI task force.

**Conclusions of the Evidence-Review Update for High BP (2003–2008)**

- The evidence review for the defined time period resulted in no major changes in the approach to BP evaluation and management.
- According to epidemiologic surveys of children and adolescents over...
the past 20 years, BP levels have been increasing, and the prevalence of hypertension and prehypertension are also increasing, explained partially by the rise in obesity rates.

- Prehypertension progresses to hypertension at a rate of ~7% per year; hypertension persists in almost one-third of boys and one-fourth of girls on 2-year longitudinal follow-up.

- Breastfeeding and supplementation of formula with polyunsaturated fatty acids in infancy are both associated with lower BP at follow-up.

- A DASH-style diet, which is rich in fruits, vegetables, low-fat or fat-free dairy products, whole grains, fish, poultry, beans, seeds, and nuts and lower in sweets and added sugars, fats, and red meats than the typical American diet, is associated with lower BP. The CHILD-1 combined with the DASH eating plan described in “Diet and Nutrition” is an appropriate diet for children that meets the DASH study and 2010 DGA nutrient goals.

- Lower dietary sodium intake is associated with lower BP levels in infants, children, and adolescents.

- Losartan, amlopidine, felodipine, fosinopril, lisinopril, metoprolol, and valsartan can be added to the list of medications that are tolerated over short periods and can reduce BP in children from ages 6 to 17 years but are predominantly effective in adolescents. For black children, greater doses of fosinopril might be needed for effective BP control. Medications are shown in Table 8-5.

- In a study of small-for-gestational-age infants, a nutrient-enriched diet that promoted rapid weight gain was associated with higher BP on follow-up in late childhood. This potential risk should be considered when such diets are selected in the clinical setting.

- In another study, transcendental meditation effectively lowered BP in nonhypertensive adolescents.

**Recommendations**

In “The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents,” an NHLBI task force provided an algorithm and flow diagram to assist clinicians in identifying hypertension in children. For these guidelines, the task force’s recommendations are stratified here to provide an age-appropriate approach congruent with other risk-factor recommendations in other sections, and this is also reflected in a series of revised algorithms (Table 8-1 and Figs 8-1 and 8-2). Conditions under which children

---

**TABLE 7-1 Evidence-Based Recommendations to Prevent Tobacco Exposure**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Recommendation</th>
<th>Supportive actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal</td>
<td>Obtain smoking history from mothers; provide explicit smoking-cessation message before and during pregnancy</td>
<td>Grade A</td>
</tr>
<tr>
<td></td>
<td><strong>Supportive actions:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify resources to support maternal smoking-cessation efforts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advocate for school and community-based smoke-free interventions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>See “Perinatal Factors” section</td>
<td></td>
</tr>
<tr>
<td>0 to 4 y</td>
<td>Smoke-free home environment</td>
<td>Grade B</td>
</tr>
<tr>
<td></td>
<td>Reinforce this message at every encounter, including urgent visits for respiratory problems</td>
<td>Grade C</td>
</tr>
<tr>
<td>5 to 10 y</td>
<td>Obtain smoke-exposure history from child, including personal history of tobacco use</td>
<td>Grade C</td>
</tr>
<tr>
<td></td>
<td>Counsel patients strongly about not smoking, including providing explicit information about the addictive and adverse health effects of smoking</td>
<td>Grade B</td>
</tr>
<tr>
<td>11 to 21 y</td>
<td>Obtain personal smoking history at every nonurgent health encounter</td>
<td>Grade B</td>
</tr>
<tr>
<td></td>
<td>Explicitly recommend against smoking</td>
<td>Grade B</td>
</tr>
<tr>
<td></td>
<td>Provide specific smoking-cessation guidance</td>
<td>Grade B</td>
</tr>
<tr>
<td></td>
<td><strong>Supportive actions:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use 5 A questions to assess readiness to quit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establish your health care practice as a resource for smoking cessation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide quit-line phone number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify community cessation resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide information about pharmacotherapy for cessation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advocate for school and community-based smoke-free interventions</td>
<td></td>
</tr>
</tbody>
</table>

Grades reflect the findings of the evidence review; recommendation levels reflect the consensus opinion of the expert panel; and supportive actions represent expert consensus suggestions from the expert panel provided to support implementation of the recommendations (they are not graded).
TABLE 8-1  Age-Specific Recommendations for BP Measurement and Diagnosis of Hypertension

<table>
<thead>
<tr>
<th>Age Group</th>
<th>BP Measurement Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to 3 y</td>
<td>No routine BP measurement. Measure BP if history (+) for neonatal complications, congenital heart disease, urinary/renal abnormality, solid-organ transplant, malignancy, drug prescription, or condition known to raise BP or increase intracranial pressure. If BProse to 90th percentile by oscillometry, confirm by auscultation. If BP confirmed ≥90th percentile, initiate evaluation for etiology and treatment per algorithm (Figure 9-2).</td>
</tr>
<tr>
<td>3 to 11 y</td>
<td>Annual BP measurement in all, interpreted for age/gender/height per Tables 8-3 and 8-4. If BP &lt;90th percentile, repeat in 1 y. If BP ≥90th percentile: Repeat BP ×2 by auscultation. Average replicate measurements and reevaluate BP category (Fig 8-1). If BP confirmed &gt;90th percentile, &lt;95th percentile: Refer to pediatric HTN expert within 1 wk or Begin BP treatment and initiate basic work-up, per Fig 8-2.</td>
</tr>
<tr>
<td>12 to 17 y</td>
<td>Annual BP measurement in all, interpreted for age/gender/height per Tables 8-3 and 8-4. If BP &lt;90th percentile, counsel on CHILD-1 diet, activity recommendations, and repeat BP in 1 y. If BP ≥90th percentile or ≥120/80 mm Hg: Repeat BP ×2 by auscultation. Average replicate measurements and reevaluate BP category (Fig 8-1). If BP confirmed &gt;90th percentile, &lt;95th percentile or ≥120/80: Refer to pediatric HTN expert within 1 wk or Begin BP treatment and initiate basic work-up, per Fig 8-2.</td>
</tr>
<tr>
<td>18 to 21 y</td>
<td>Measure BP at all health care visits. BP ≥120/80 to 139/89 = pre-HTN; BP ≥140/90 to 159/99 = stage 1 HTN; BP ≥160/100 = stage 2 HTN.</td>
</tr>
</tbody>
</table>

BP recommendations are based on the NHLBI’s “The Fourth Report on the Diagnosis, Evaluation and Treatment of High Blood Pressure in Children and Adolescents” with the evidence review updated from 2003. Recommendations are all graded as expert opinion (grade D) because they are based on the expert consensus conclusions of the Fourth Report.

Younger than 3 years should have BP measured are shown in Table 8-2. The BP norms for age, gender, and height are shown in Tables 8-3 and 8-4. The BP values were taken directly from the NHLBI task force’s report. Age-specific percentiles of BP measurements from birth to 12 months are provided in the “Report of the Fourth Task Force on Blood Pressure Control in Children.” For all age groups the assessment of left ventricular mass by echocardiography is recommended as the best method of assessing hypertensive target organ disease. Tests for left ventricular mass by echocardiography should be performed for patients with stage 2 hypertension and those with persistent stage 1 hypertension. Elevated left ventricular mass might be useful in establishing the need for pharmacologic treatment of hypertension. In Table 8-5, the medications used to achieve BP control in children and adolescents are listed. At present, there are no data to support the use of specific antihypertensive agents for specific age groups.

9. LIPIDS AND LIPOPROTEINS

Since the last NHLBI guidelines for lipid management in children and adolescents were published in 1992, both the knowledge base surrounding dyslipidemia in childhood and the clinical picture have changed. A series of critical observational studies have found a clear correlation between lipoprotein disorders and the onset and severity of atherosclerosis in children, adolescents, and young adults. A major increase in the prevalence of obesity has led to a much larger population of children with dyslipidemia. At the time of the original guidelines, the focus was almost exclusively on identification of children with an elevated LDL cholesterol level. Since then, the predominant dyslipidemic pattern in childhood is a combined pattern associated with obesity, moderate-to-severe elevation in triglyceride level, normal-to-mild elevation in LDL cholesterol level, and a reduced HDL cholesterol level. Both dyslipidemic patterns have been shown to be associated with initiation and progression of atherosclerotic lesions in children and adolescents as demonstrated by pathology and imaging studies. Identification of children with dyslipidemias, which place them at increased risk for accelerated early atherosclerosis, must include a comprehensive assessment of serum lipid and lipoprotein levels.
The evidence review for lipids and lipoproteins addressed the association between dyslipidemia and atherosclerosis in childhood, lipid assessment in childhood and adolescence with tables of normative results provided, the dyslipidemias, dietary treatment of dyslipidemia, and medication therapy.

Conclusions and Grading of the Evidence Review for Lipid Assessment in Childhood and Adolescence

- Combined evidence from autopsy studies, vascular studies, and cohort studies strongly indicates that abnormal lipid levels in childhood are associated with increased evidence of atherosclerosis (grade B).
- The evidence review supports the concept that early identification and control of dyslipidemia throughout youth and into adulthood will substantially reduce clinical CVD risk beginning in young adult life. Preliminary evidence in children with heterozygous familial hypercholesterolemia with markedly elevated LDL cholesterol levels indicates that earlier treatment is associated with reduced subclinical evidence of atherosclerosis (grade B).
- Multiple prospective screening cohort studies have demonstrated the normal lipid and lipoprotein distributions in childhood, adolescence, and young adult life (Tables 9-1 and 9-2) (grade B). Cohort studies have also demonstrated significant tracking of elevated lipid levels from childhood into adulthood. Lipid and lipoprotein results in childhood are predictive of future adult lipoprotein profiles; the strongest statistical correlation occurs between results in late childhood and in the third and fourth decades of life (grade B).
- TC and LDL cholesterol levels decrease as much as 10% to 20% or more during puberty (grade B). On the basis of this normal pattern of change in lipid and lipoprotein levels with growth and maturation, 10 years of age (range: 9–11 years) is a stable time for lipid assessment in children (grade D). For most children, this age range will precede the onset of puberty.
- Significant evidence exists to indicate that using family history of premature CVD or cholesterol disorders as the primary factor in determining lipid screening for children misses ~30% to 60% of children with dyslipidemias, and accurate and reliable measures of family history are not available (grade B). In the absence of a clinical or historic marker, identification of children with lipid disorders that predispose them to accelerated atherosclerosis requires universal lipid assessment (grade B).
- Non-HDL cholesterol level has been identified as a significant predictor of the presence of atherosclerosis, as powerful as any other lipoprotein cholesterol measure in children and adolescents. For both children and adults, non-HDL cholesterol level seems to be more predictive of persistent dyslipidemia and, therefore, atherosclerosis and future events than TC, LDL cholesterol, or HDL cholesterol levels alone. A major advantage of non-HDL cholesterol is that it can be accurately calculated in a nonfasting state and is therefore practical to obtain in clinical practice. The expert panel felt that non-HDL cholesterol should be added as a screening tool for identification of a dyslipidemic state in childhood (grade B).
- In terms of other lipid measurements, (1) most but not all studies have found that measurement of apolipoprotein B and apolipoprotein A-1 for universal screening provides no additional advantage over measuring non-HDL cholesterol, LDL cholesterol, and HDL cholesterol levels, (2) measurement of lipoprotein(a) is useful in the assessment of children with both hemorrhagic and ischemic stroke, (3) in offspring of a parent with premature CVD and no other identifiable risk factors, elevations of apolipoprotein B, apolipoprotein A-1, and lipoprotein(a) have been noted, and (4) measurement of lipoprotein subclasses and their sizes by advanced lipoprotein testing has not been found to have sufficient clinical utility in children at this time (grade B).
- Obesity is commonly associated with a combined dyslipidemia pattern with mild elevation in TC and LDL cholesterol levels, moderate-to-severe elevation in triglyceride level, and a low HDL cholesterol level. This is the most common dyslipidemic pattern seen in childhood, and lipid assessment in overweight

| TABLE 8-2 Conditions Under Which Children <3 Years Old Should Have BP Measured |
| History of prematurity, very low birth weight, or other neonatal complication requiring intensive care |
| Congenital heart disease (repaired or un repaired) |
| Recurrent urinary tract infections, hematuria, or proteinuria |
| Known renal disease or urologic malformations |
| Family history of congenital renal disease |
| Solid-organ transplant |
| Malignancy or bone marrow transplant |
| Treatment with drugs known to raise BP |
| Other systemic illnesses associated with hypertension (neurofibromatosis, tuberous sclerosis, etc) |
| Evidence of increased intracranial pressure |

The 90th percentile is 1.28 SD, the 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.

TABLE 8-3 BP Norms for Boys by Age and Height Percentile

<table>
<thead>
<tr>
<th>Age, Year</th>
<th>5th</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
<th>95th</th>
</tr>
</thead>
<tbody>
<tr>
<td>10th</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>90th</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>95th</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>99th</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>90th</td>
<td>106</td>
<td>106</td>
<td>106</td>
<td>106</td>
<td>106</td>
<td>106</td>
<td>106</td>
</tr>
<tr>
<td>95th</td>
<td>111</td>
<td>111</td>
<td>111</td>
<td>111</td>
<td>111</td>
<td>111</td>
<td>111</td>
</tr>
<tr>
<td>99th</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
<td>115</td>
</tr>
<tr>
<td>90th</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>95th</td>
<td>126</td>
<td>126</td>
<td>126</td>
<td>126</td>
<td>126</td>
<td>126</td>
<td>126</td>
</tr>
<tr>
<td>99th</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
<td>132</td>
</tr>
<tr>
<td>90th</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
<tr>
<td>95th</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>99th</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

BP %ile SBP, mm Hg DBP, mm Hg

90th 127 128 130 132 134 135 137 80 80 81 82 83 84 85
95th 129 130 132 134 135 137 137 82 83 84 85 86 87 88
99th 135 136 138 140 142 142 142 88 89 90 91 92 93 93

*TABLE 8-3 BP Norms for Boys by Age and Height Percentile*
The 90th percentile is 1.28 SD, the 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.

### TABLE 8-4BP Norms for Girls by Age and Height Percentile

<table>
<thead>
<tr>
<th>Age, y</th>
<th>5th</th>
<th>10th</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
<th>90th</th>
<th>95th</th>
<th>99th</th>
<th>99th</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>75</td>
<td>76</td>
<td>77</td>
<td>78</td>
<td>79</td>
<td>80</td>
<td>81</td>
<td>82</td>
<td>83</td>
</tr>
<tr>
<td>6</td>
<td>80</td>
<td>81</td>
<td>82</td>
<td>83</td>
<td>84</td>
<td>85</td>
<td>86</td>
<td>87</td>
<td>88</td>
</tr>
<tr>
<td>7</td>
<td>83</td>
<td>84</td>
<td>85</td>
<td>86</td>
<td>87</td>
<td>88</td>
<td>89</td>
<td>90</td>
<td>91</td>
</tr>
<tr>
<td>8</td>
<td>86</td>
<td>87</td>
<td>88</td>
<td>89</td>
<td>90</td>
<td>91</td>
<td>92</td>
<td>93</td>
<td>94</td>
</tr>
<tr>
<td>9</td>
<td>89</td>
<td>90</td>
<td>91</td>
<td>92</td>
<td>93</td>
<td>94</td>
<td>95</td>
<td>96</td>
<td>97</td>
</tr>
<tr>
<td>10</td>
<td>92</td>
<td>93</td>
<td>94</td>
<td>95</td>
<td>96</td>
<td>97</td>
<td>98</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>11</td>
<td>95</td>
<td>96</td>
<td>97</td>
<td>98</td>
<td>99</td>
<td>100</td>
<td>101</td>
<td>102</td>
<td>103</td>
</tr>
</tbody>
</table>

### Conclusions and Grading of the Evidence Review for Dietary Management of Dyslipidemia

- A diet with total fat at 25% to 30% of calories, saturated fat at <10% of calories, and cholesterol intake at <300 mg/day, as recommended by the original NCEP Pediatric Panel, has been shown to safely and effectively reduce the levels of TC and LDL cholesterol in healthy children (grade A). There is some evidence that this is also the case when the diet begins in infancy and is sustained throughout childhood and into adolescence (grade B). The CHILD-1, described in “Nutrition and Diet,” has this composition.

- In children with identified hypercholesterolemia and an elevated LDL cholesterol level, a more stringent diet with saturated fat at ≤7% of calories and dietary cholesterol limited to 200 mg/day has been shown to be safe and modestly effective in lowering the LDL cholesterol level (grade A) (CHILD-2–LDL; Table 9-8).

- The use of dietary adjuncts such as plant sterol or stanol esters up to 20 g/day can safely enhance LDL cholesterol-lowering effects short-term in children with familial hypercholesterolemia (grade A). However, long-term studies on the safety and effectiveness of plant sterol and stanol esters have not been completed. Their use, therefore, is usually reserved for children with primary elevations of their LDL cholesterol level who do not achieve LDL cholesterol goals with dietary treatment alone. Such an approach.
<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Initial Dosea</th>
<th>Maximal Dose</th>
<th>Dosing Interval</th>
<th>Evidenceb</th>
<th>FDAc</th>
<th>Commentsd</th>
</tr>
</thead>
</table>
| ACE inhibitors        | Benazepril           | 0.2 mg/kg per d up to 10 mg/d | 0.6 mg/kg per d up to 40 mg/d | QD          | RCT      | Yes 1. All ACE inhibitors are contraindicated in pregnancy; women of childbearing age should use reliable contraception.  
2. Check serum potassium and creatinine periodically to monitor for hyperkalemia and azotemia.  
3. Cough and angioedema are reportedly less common with newer members of this class than with captopril.  
4. Benazepril, enalapril, and lisinopril labels contain information on the preparation of a suspension; captopril may also be compounded into a suspension. |
|                       | Captopril            | 0.3–0.5 mg/kg per dose (>12 mo) | 6 mg/kg per d | TID         | RCT, CS  | No 2. Check serum potassium and creatinine periodically to monitor for hyperkalemia and azotemia.  
3. Cough and angioedema are reportedly less common with newer members of this class than with captopril.  
4. Cough and angioedema are reportedly less common with newer members of this class than with captopril. |
|                       | Fosinopril           | Children >50 kg; 5–10 mg/d | 40 mg/d | QD          | RCT      | Yes 4. Benazepril, enalapril, and lisinopril labels contain information on the preparation of a suspension; captopril may also be compounded into a suspension. |
|                       | Lisinopril           | 0.07 mg/kg per d up to 5 mg/d | 0.6 mg/kg per d up to 40 mg/d | QD          | RCT      | Yes 5. FDA approval for ACE inhibitors with pediatric labeling is limited to children ≥6 y of age and to children with creatinine clearance rate of ≥30 mL/min per 1.73 m². |
|                       | Quinapril            | 5–10 mg/d | 80 mg/d | QD          | RCT, EO  | No 6. Initial dose of fosinopril of 0.1 mg/kg per d may be effective, although black patients might require a higher dose. |
| ARBs                  | Irbesartan           | 6–12 y: 75–150 mg/d; ≥13 y: 150–500 mg/d | 300 mg/d | QD          | CS       | Yes 1. All ARBs are contraindicated in pregnancy; women of childbearing age should use reliable contraception.  
2. Check serum potassium and creatinine levels periodically to monitor for hyperkalemia and azotemia.  
3. Losartan label contains information on the preparation of a suspension.  
4. FDA approval for ARBs is limited to children ≥6 y of age and to children with creatinine clearance rate of ≥30 mL/min per 1.73 m². |
|                       | Losartan             | 0.7 mg/kg per d up to 50 mg/d | 1.4 mg/kg per d up to 100 mg/d | QD–BID      | RCT      | Yes 3. Losartan label contains information on the preparation of a suspension.  
4. FDA approval for ARBs is limited to children ≥6 y of age and to children with creatinine clearance rate of ≥30 mL/min per 1.73 m². |
|                       | Valsartan            | 5–10 mg/d; 0.4 mg/kg per d | 40–80 mg/d; 3.4 mg/kg per d | QD          | RCT      | No  |
| α- and β-antagonist   | Labetalol            | 1–3 mg/kg per d | 10–12 mg/kg per d up to 1200 mg/d | BID         | CS, EO   | No 1. Asthma and overt heart failure are relative contraindications.  
2. Heart rate is dose-limiting.  
4. Should not be used in insulin-dependent diabetic patients. |
| β-antagonists         | Atenolol             | 0.5–1 mg/kg per d | 2 mg/kg per d up to 100 mg/d | QD–BID      | CS       | No 1. Noncardioselective agents (propranolol) are contraindicated in asthma and heart failure.  
2. Heart rate is dose-limiting.  
4. Should not be used in insulin-dependent diabetic patients.  
5. A sustained-release, once-daily formulation of propranolol is available. |
|                       | Bisoprolol/          | 2.5–6.25 mg/d | 10/6.25 mg/d | QD          | RCT      | No 2. Heart rate is dose-limiting. |
|                       | hydrochlorothiazide  |               |             |             |          |      |
|                       | Metoprolol           | Children >6 y: 1 mg/kg per d (12.5–50 mg/d) | 2 mg/kg per d up to 200 mg/d | BID         | CS       | Yes 3. May impair athletic performance in athletes. |
|                       | Propranolol          | 1–2 mg/kg per d | 4 mg/kg per d up to 640 mg/d | BID–TID     | RCT, EO  | Yes 4. Should not be used in insulin-dependent diabetic patients.  
5. A sustained-release, once-daily formulation of propranolol is available. |
| Calcium-channel       | Amlodipine           | Children 6–17 y: 2.5 mg/d | 5 mg/d | QD          | RCT      | Yes 1. Amlodipine and isradipine can be compounded into stable extemporaneous suspensions.  
2. Felodipine and extended-release nifedipine tablets must be swallowed whole. |
<p>| blockers              | Felodipine           | 2.5 mg/d | 10 mg/d | QD          | RCT, EO  | No     |</p>
<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Initial Dose&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Maximal Dose</th>
<th>Dosing Interval</th>
<th>Evidence&lt;sup&gt;b&lt;/sup&gt;</th>
<th>FDA&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Comments&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central α-agonist</td>
<td>Clonidine</td>
<td>Children ≥ 12 y: 0.2 mg/d</td>
<td>2.4 mg/d</td>
<td>BID</td>
<td>EO</td>
<td>Yes</td>
<td>1. May cause dry mouth and/or sedation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Transdermal preparation is available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Sudden cessation of therapy can lead to severe rebound hypertension</td>
</tr>
<tr>
<td>Diuretics</td>
<td>Hydrochlorothiazide</td>
<td>1 mg/kg per d</td>
<td>3 mg/kg per d up to 50 mg/d</td>
<td>QD</td>
<td>EO</td>
<td>Yes</td>
<td>1. All patients treated with diuretics should have their electrolytes monitored shortly after initiating therapy and periodically thereafter</td>
</tr>
<tr>
<td></td>
<td>Chlorthalidone</td>
<td>0.3 mg/kg per d</td>
<td>2 mg/kg per d up to 50 mg/d</td>
<td>QD</td>
<td>EO</td>
<td>No</td>
<td>2. Useful as add-on therapy in patients being treated with drugs from other drug classes</td>
</tr>
<tr>
<td></td>
<td>Furosemide</td>
<td>0.5–2.0 mg/kg per dose</td>
<td>6 mg/kg per d</td>
<td>QO–BID</td>
<td>EO</td>
<td>No</td>
<td>3. Potassium-sparing diuretics (spironolactone, triamterene, amiloride) may cause severe hyperkalemia, especially if given with an ACE inhibitor or ARB</td>
</tr>
<tr>
<td></td>
<td>Spironolactone</td>
<td>1 mg/kg per d</td>
<td>3.3 mg/kg per d up to 100 mg/d</td>
<td>QO–BID</td>
<td>EO</td>
<td>No</td>
<td>4. Furosemide is labeled only for treatment of edema but may be useful as add-on therapy in children with resistant hypertension, particularly in children with renal disease</td>
</tr>
<tr>
<td></td>
<td>Triamterene</td>
<td>1–2 mg/kg per d</td>
<td>3–4 mg/kg per d up to 300 mg/d</td>
<td>BID</td>
<td>EO</td>
<td>No</td>
<td>5. Chlorthalidone may precipitate azotemia in patients with renal diseases and should be used with caution in those with severe renal impairment</td>
</tr>
<tr>
<td></td>
<td>Amiloride</td>
<td>0.4–0.825 mg/kg per d</td>
<td>20 mg/d</td>
<td>QD</td>
<td>EO</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Peripheral α-antagonists</td>
<td>Doxazosin</td>
<td>1 mg/d</td>
<td>4 mg/d</td>
<td>QD</td>
<td>EO</td>
<td>No</td>
<td>1. May cause first-dose hypotension</td>
</tr>
<tr>
<td></td>
<td>Prazosin</td>
<td>0.05–0.1 mg/kg per day</td>
<td>0.5 mg/kg per d</td>
<td>TID</td>
<td>EO</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terazosin</td>
<td>1 mg/d</td>
<td>20 mg/d</td>
<td>QD</td>
<td>EO</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Vasodilators</td>
<td>Hydralazine</td>
<td>0.75 mg/kg per d</td>
<td>7.5 mg/kg per d up to 200 mg/d</td>
<td>QID</td>
<td>EO</td>
<td>Yes</td>
<td>1. Tachycardia and fluid retention are common adverse effects</td>
</tr>
<tr>
<td></td>
<td>Minoxidil</td>
<td>Children &lt;12 y: 0.2 mg/kg per d; children &gt;12 y: 5 mg/d</td>
<td>7.5 mg/kg per d up to 200 mg/d</td>
<td>QO–TID</td>
<td>CS, EO</td>
<td>Yes</td>
<td>2. Hydralazine can cause a lupus-like syndrome in slow acetylators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Children &lt;12 y: 50 mg/d; children ≥ 12 y: 100 mg/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Prolonged use of minoxidil can cause hypertrichosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Minoxidil is usually reserved for patients with hypertension that is resistant to multiple drugs</td>
</tr>
</tbody>
</table>

ACE indicates angiotensin-converting enzyme; QD, every day; BID, 2 times daily; TID, 3 times daily; QD, 4 times daily; CS, case series; EO, expert opinion; ARB, angiotensin-receptor blocker.

<sup>a</sup> The maximal recommended adult dose should not be exceeded in routine clinical practice.

<sup>b</sup> Level of evidence on which recommendations are based.

<sup>c</sup> FDA-approved pediatric labeling information is available for treatment of hypertension. Recommended doses for agents with FDA-approved pediatric labels contained in this table are the doses contained in the approved labels. Even when pediatric labeling information is not available, the FDA-approved label should be consulted for additional safety information.

<sup>d</sup> Comments apply to all members of each drug class except where otherwise stated.


<sup>f</sup> Study did not reach the primary end point (dose response for reduction in systolic BP). Some prespecified secondary end points demonstrated effectiveness.

might lower the LDL cholesterol level sufficiently to avoid the necessity of drug treatment. Food products that contain plant stanols esters, such as some margarines, are marketed directly to the general public. In 2 short-term trials, they have been shown to be safe and have minimal LDL-lowering effects in healthy children (grade B).

- Evidence for the use of other dietary supplements is insufficient for any recommendation (no grade).
- In children with an elevated triglyceride level, reduction of simple carbohydrate intake and weight loss are associated with decreased triglyceride levels (grade B). Reduction of simple carbohydrate intake needs to be associated with increased intake of complex carbohydrates and reduced saturated-fat intake. When triglyceride elevation is associated with obesity, decreased calorie intake and increased activity levels are of paramount importance. The CHILD-2–TG (shown in Table 9-8) is recommended as the primary diet therapy in this setting.

A behavioral approach that engages the child and family delivered by a registered dietitian has been shown to be the most consistently effective approach for achieving dietary change (grade B).

The approach to management of dyslipidemias is staged, as in the original NCEP Pediatric Panel recommendations. For all children with identified dyslipidemia in whom the response to a low-fat/low-saturated-fat/low-cholesterol diet has not been evaluated, the CHILD-1 (described in “Nutrition and Diet”) is recommended as the first step; implementation should be guided by a registered dietitian. For obese children with identified dyslipidemia, additional age- and BMI-specific recommendations that

### TABLE 9-1 Acceptable, Borderline-High, and High Plasma Lipid, Lipoprotein, and Apolipoprotein Concentrations for Children and Adolescents

<table>
<thead>
<tr>
<th>Category</th>
<th>Low, mg/dL</th>
<th>Acceptable, mg/dL</th>
<th>Borderline-High, mg/dL</th>
<th>High, mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>—</td>
<td>&lt;170</td>
<td>170–199</td>
<td>≥200</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>—</td>
<td>&lt;110</td>
<td>110–129</td>
<td>≥130</td>
</tr>
<tr>
<td>Non-HDL cholesterol</td>
<td>—</td>
<td>&lt;120</td>
<td>120–144</td>
<td>≥145</td>
</tr>
<tr>
<td>Apolipoprotein B</td>
<td>—</td>
<td>&lt;90</td>
<td>90–109</td>
<td>≥110</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>0–9 y</td>
<td>&lt;75</td>
<td>75–89</td>
<td>≥100</td>
</tr>
<tr>
<td>10–18 y</td>
<td>—</td>
<td>&lt;90</td>
<td>90–129</td>
<td>≥130</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>&lt;40</td>
<td>&gt;45</td>
<td>40–45</td>
<td>—</td>
</tr>
<tr>
<td>Apolipoprotein A-1</td>
<td>&lt;115</td>
<td>&gt;120</td>
<td>115–120</td>
<td>—</td>
</tr>
</tbody>
</table>

Values for plasma lipid and lipoprotein levels are from the NCEP Expert Panel on Cholesterol Levels in Children. Non-HDL cholesterol values from the Bogalusa Heart Study are equivalent to the NCEP Pediatric Panel cut points for LDL cholesterol. Values for plasma apolipoprotein B and apolipoprotein A-1 are from the National Health and Nutrition Examination Survey III. Note that values shown are in mg/dL; to convert to SI units, divide the results for TC, LDL cholesterol, HDL cholesterol, and non-HDL cholesterol by 38.6; for triglycerides, divide by 88.6.

a Low cut points for HDL cholesterol and apolipoprotein A-1 represent approximately the 10th percentile. The cut points for non-HDL cholesterol by 38.6; for triglycerides, divide by 88.6.

### TABLE 9-2 Recommended Cut Points for Lipid and Lipoprotein Levels in Young Adults

<table>
<thead>
<tr>
<th>Category</th>
<th>Low, mg/dL</th>
<th>Borderline-Low, mg/dL</th>
<th>Acceptable, mg/dL</th>
<th>Borderline-High, mg/dL</th>
<th>High, mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>—</td>
<td>—</td>
<td>&lt;190</td>
<td>190–224</td>
<td>≥225</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>—</td>
<td>—</td>
<td>&lt;120</td>
<td>120–159</td>
<td>≥160</td>
</tr>
<tr>
<td>Non-HDL cholesterol</td>
<td>—</td>
<td>—</td>
<td>&lt;150</td>
<td>150–189</td>
<td>≥190</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>—</td>
<td>—</td>
<td>&lt;115</td>
<td>115–149</td>
<td>≥150</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>&lt;40</td>
<td>40–44</td>
<td>&gt;45</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Values provided are from the Lipid Research Clinics Prevalence Study. The cut points for TC, LDL cholesterol, and non-HDL cholesterol represent the 95th percentile for 20- to 24-year-old subjects and are not identical with the cut points used in the most recent NHLBI adult guidelines, Adult Treatment Panel III (“Third Report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults”), which are derived from combined data on adults of all ages. The age-specific cut points given here are provided for pediatric care providers to use in managing this young adult age group. For TC, LDL cholesterol, and non-HDL cholesterol, borderline-high values are between the 75th and 94th percentiles, whereas acceptable values are at the 25th percentile; borderline-low values are between the 26th and 39th percentiles, and acceptable values are at the >50th percentile.
address calorie restriction and increased activity appear in “Overweight and Obesity.” If, after a 3-month trial of the CHILD-1/lifestyle management, fasting-lipid-profile (FLP) findings exceed the therapeutic goals listed in Tables 9-1 and 9-2, then the lipid parameter-specific diet changes outlined in Table 9-8 are recommended. Dyslipidemia management is also outlined in the algorithms in Figs 9-1 and 9-2.

Conclusions and Grading of the Evidence Review for Use of Medication to Treat Dyslipidemia

When medication is recommended, it should always be in the context of the complete cardiovascular risk profile of the patient and in consultation with the patient and the family. Note that, in the following section, values given are in mg/dL; to convert to SI units, divide the results for TC, LDL cholesterol, HDL cholesterol, and non-HDL cholesterol by 38.6; for triglycerides, divide by 88.6.

- Decisions regarding the need for medication therapy should be based on the average of results from at least 2 FLPs obtained at least 2 weeks but no more than 3 months apart (grade C) (Fig 9-1).
- The cut points used to define the level at which drug therapy should be considered from the 1992 NCEP pediatric guidelines have been used as the basis for multiple drug safety and efficacy trials in dyslipidemic children (grade B):
  - LDL cholesterol ≥ 190 mg/dL after a 6-month trial of lifestyle management (CHILD-1 → CHILD-2–LDL) for children aged 10 years or older.
  - LDL cholesterol 160 to 189 mg/dL after a 6-month trial of lifestyle/diet management (CHILD-1 → CHILD-2–LDL) in a child aged 10 years or older with a positive family history of premature CVD/events in first-degree relatives (Table 9-6) or at least 1 high-level risk factor or risk condition or at least 2 moderate-level risk factors or risk conditions (Tables 9-6, 9-7, and 9-12; Fig 9-1).
  - LDL cholesterol 130 to 190 mg/dL in a child aged 10 years or older with a negative family history of premature CVD in first-degree relatives.
relatives and no high- or moderate-level risk factor or risk condition: management should continue to focus on lifestyle changes (CHILD-1 → CHILD-2–LDL) based on lipid-profile findings (Fig 9-1) plus weight management if the BMI is at the ≥85th percentile.

- The goal of LDL-lowering therapy in childhood and adolescence is to decrease the LDL cholesterol level to the <95th percentile (≤130 mg/dL).
- Children with homozygous familial hypercholesterolemia and extremely elevated LDL cholesterol levels (>500 mg/dL) have undergone effective LDL-lowering therapy with biweekly LDL apheresis under the care of lipid specialists in academic medical centers (grade C).
- Multiple cohort studies have found that the benefits of LDL-lowering therapy in children at high risk for accelerated atherosclerosis (such as those with chronic kidney disease, T1DM or T2DM, Kawasaki disease with coronary aneurysms, or post–cardiac transplantation) should be considered for initiation of medication therapy (grade C) (see “DM and Other Conditions Pre-disposing to the Development of Accelerated Atherosclerosis”).
- Bile acid sequestrants are medications that bind bile salts within the intestinal lumen and prevent their enterohepatic reuptake in the terminal ileum, which results in a depletion of bile salts in the liver and signals for increased production. Because bile salts are synthesized from intracellular cholesterol in the liver, the intracellular pool of cholesterol becomes depleted, which signals increased production of LDL receptors and increased clearance of circulating LDL cholesterol to replenish the intracellular cholesterol levels.
Familial hypercholesterolemia most often manifests with obesity. Dysbetalipoproteinemia (TC: 250–500 mg/dL; HDL cholesterol < 35 mg/dL) and Familial hypoalphalipoproteinemia (TC: 1100–1500 mg/dL) may result in severe hypertriglyceridemia (triglycerides > 1500 mg/dL). Polygenic hypercholesterolemia indicates increased; LDL cholesterol, ↑ LDL cholesterol; IDL cholesterol, ↓ LDL cholesterol; VLDL cholesterol, ↑ triglycerides; HDL cholesterol, ↓ HDL cholesterol (often). Medication therapy is rarely needed for children, with the exception of a small proportion of children with familial hypercholesterolemia who require treatment with statins and other lipid-lowering drugs.

**TABLE 9-4 Summary of Major Lipid Disorders in Children and Adolescents**

<table>
<thead>
<tr>
<th>Primary Lipid Disorders</th>
<th>Lipid/Lipoprotein Abnormality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familial hypercholesterolemia</td>
<td>↑ ↑ LDL cholesterol</td>
</tr>
<tr>
<td>Homozygous</td>
<td>↑ LDL cholesterol*</td>
</tr>
<tr>
<td>Heterozygous</td>
<td>↑ LDL cholesterol</td>
</tr>
<tr>
<td>Familial defective apolipoprotein B</td>
<td>↑ LDL cholesterol</td>
</tr>
<tr>
<td>Familial combined hyperlipidemiaa</td>
<td>↑ LDL cholesterol</td>
</tr>
<tr>
<td>Type IIa</td>
<td>↑ VLDL cholesterol, ↑ triglycerides</td>
</tr>
<tr>
<td>Type IV</td>
<td>↑ LDL cholesterol, ↑ VLDL cholesterol, ↑ triglycerides</td>
</tr>
<tr>
<td>Type IIb</td>
<td>↓ HDL cholesterol (often)</td>
</tr>
<tr>
<td>Types IIb and IV</td>
<td>↑ LDL cholesterol</td>
</tr>
<tr>
<td>Polygenic hypercholesterolemia</td>
<td>↑ VLDL cholesterol, ↑ triglycerides</td>
</tr>
<tr>
<td>Familial hypertriglyceridemia (200–1000 mg/dL)</td>
<td>↑ chylomicrons, ↑ VLDL cholesterol, ↑ ↑ triglycerides</td>
</tr>
<tr>
<td>Severe hypertriglyceridemia (≥1000 mg/dL)</td>
<td>↑ HDL cholesterol</td>
</tr>
<tr>
<td>Familial hypoalphalipoproteinemia</td>
<td>↑ IDL cholesterol, ↑ chylomicron remnants</td>
</tr>
<tr>
<td>DysbetaIipoproteinemia (TC: 250–500 mg/dL; triglycerides: 250–800 mg/dL)</td>
<td>↑ ↑ LDL cholesterol</td>
</tr>
</tbody>
</table>

* These are the 2 lipid and lipoprotein disorders seen most frequently in childhood and adolescence; familial combined hyperlipidemia most often manifests with obesity.

Statin medications inhibit hydroxymethylglutaryl coenzyme A reductase, which is a rate-limiting enzyme in the endogenous cholesterol-synthesis pathway. This inhibition results in a decrease in the intracellular pool of cholesterol, which signals upregulation of LDL receptors and increased clearance of circulating LDL cholesterol. As a group, statins have been shown to reduce LDL cholesterol in children and adolescents with marked LDL cholesterol elevation or familial hypercholesterolemia (defined as elevated LDL cholesterol in the child in conjunction with a family history of elevated LDL cholesterol and/or atherosclerosis or CAD) when used from 8 weeks to 2 years for children aged 8 to 18 years. The lower LDL cholesterol level for eligibility into the statin trials was ≥190 or ≥160 mg/dL with ≥2 additional risk factors after a trial period on diet. Trial subjects were monitored carefully throughout treatment; adverse effects on growth, development, or sexual maturation were not seen, and adverse-event profiles and efficacy were similar to those in studies of adults.

- **Bile acid–binding sequestrants** may be used in combination with a statin for patients who fail to meet LDL cholesterol target levels with either medication alone. One pediatric study assessed this combination and found no increase in adverse effects. The efficacy of the 2 agents together seems to be additive.

- **There is limited published experience in children of use of niacin and fibrates, which have been useful in treating adult patients with combined dyslipidemias. Efficacy and safety data are limited, and no data are available regarding newer formulations. In adults, cholesterol absorption inhibitors have been advocated as an adjunct to statin therapy for patients who do not reach LDL cholesterol therapeutic targets. Because their action is independent of and complementary to that of statins, the LDL cholesterol-lowering effect is additive. No pediatric studies of monotherapy with cholesterol absorption inhibitors had been published during the time period for this evidence review. The use of niacin, fibrates, and cholesterol absorption inhibitors should be instituted only in consultation with a lipid specialist.

- **Medication therapy is rarely needed for children with elevated triglyceride levels that respond well to weight loss and lifestyle changes.** When triglyceride levels exceed 500 mg/
TABLE 9-5 Evidence-Based Recommendations for Lipid Assessment

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to 2 y</td>
<td>No lipid screening Grade C</td>
</tr>
</tbody>
</table>
| 2 to 8 y | No routine lipid screening Grade B  
Measure fasting lipid profile twice, a average results if:  
- Parent, grandparent, aunt/uncle, or sibling with MI, angina, stroke, CABG/stent/angioplasty at <55 y in males, <65 y in females  
- Parent with TC ≥ 240 mg/dL or known dyslipidemia  
- Parent with TC ≥ 240 mg/dL or known dyslipidemia  
- Child has diabetes, hypertension, BMI ≥ 95th percentile or smokes cigarettes  
- Child has a moderate- or high-risk medical condition (Table 5-2) |
| 9 to 11 y | Universal screening Grade B  
Non-FLP: Calculate non–HDL cholesterol:  
Non–HDL cholesterol = TC − HDL cholesterol  
If non–HDL ≥ 145 mg/dL ≤ HDL < 40 mg/dL:  
Obtain FLP twice, a average results  
OR  
FLP:  
If LDL cholesterol ≥ 130 mg/dL ≤ non-HDL cholesterol ≥ 145 mg/dL ≤ HDL cholesterol < 40 mg/dL ≤ triglycerides ≥ 100 mg/dL:  
if <10 y, ≥150 mg/dL, if ≥10 y:  
Repeat FLP, average results  
Use Table 9-1 for interpretation of results, algorithms in Figs 9-1 and 9-2 for management. |
| 12 to 16 y | No routine screening Grade B  
Measure FLP twice, a average results, if new knowledge of:  
- Parent, grandparent with MI, angina, stroke, CABG/stent/angioplasty, sudden death at <55 y in male, <65 y in female  
- Parent with TC ≥ 240 mg/dL or known dyslipidemia  
- Patient has diabetes, hypertension, BMI ≥ 85th percentile or smokes cigarettes  
- Patient has a moderate- or high-risk medical condition (Table 5-2)  
Use Table 9-1 for interpretation of results, algorithms in Figs 9-1 and 9-2 for management. |
| 17 to 21 y | Universal screening once in this time period: Grade B  
Non-FLP: Calculate non–HDL cholesterol:  
Non–HDL cholesterol = TC − HDL cholesterol  
17–19 y:  
If non–HDL cholesterol ≥ 145 mg/dL ≤ HDL cholesterol < 40 mg/dL:  
Measure FLP twice, a average results  
OR  
FLP:  
If LDL cholesterol ≥ 130 mg/dL ≤ non-HDL cholesterol ≥ 145 mg/dL ≤ HDL cholesterol < 40 mg/dL ≤ triglycerides ≥ 130 mg/dL:  
Repeat FLP, average results  
Use Table 9-1 for interpretation of results, algorithms in Figs 9-1 and 9-2 for management.  
20–21 y:  
Non–HDL cholesterol ≥ 190 mg/dL ≤ HDL cholesterol < 40 mg/dL  
Measure FLP twice, average results  
OR  
FLP:  
If LDL cholesterol ≥ 160 mg/dL ≤ non-HDL cholesterol ≥ 190 mg/dL ≤ HDL cholesterol < 40 mg/dL ≤ triglycerides ≥ 150 mg/dL:  
Repeat FLP, average results  
Use Table 9-2 for interpretation of results, Adult Treatment Panel (ATP III) algorithm for management. |

Grades reflect the findings of the evidence review, recommendation levels reflect the consensus opinion of the expert panel. Note that the values given are in mg/dL. To convert to SI units, divide the results for TC, LDL cholesterol, HDL cholesterol, and non-HDL cholesterol by 38.6; for triglycerides, divide by 88.6. MI indicates myocardial infarction; CABG, coronary artery bypass graft; ATP III, Adult Treatment Panel III.  

a Interval between FLP measurements: after 2 weeks but within 3 months.  
b Use Table 9-1 for interpretation of results; use lipid algorithms in Figs 9-1 and 9.2 for management of results.  
c Disregard triglyceride and LDL cholesterol levels in nonfasting sample.  
d Lipid screening is not recommended for those aged 12 to 16 years because of significantly decreased sensitivity and specificity for predicting adult LDL cholesterol levels and significantly increased false-negative results in this age group. Selective screening is recommended for those with the clinical indications outlined.  
e Use Table 9-1 for interpretation of results of 7- to 19-year-olds and lipid algorithms in Figs 9-1 and 9.2 for management. Use Table 17 for interpretation of results of 20- to 21-year-olds and ATP III algorithms for management.
High-level RFs
- Hypertension that requires drug therapy (BP ≥ 99th percentile + 5 mm Hg)
- Current cigarette smoker
- BMI at the ≥97th percentile
- Presence of high-risk conditions (Table 9-7)

(OM is also a high-level RF, but it is classified here as a high-risk condition to correspond with Adult Treatment Panel III recommendations for adults that DM be considered a CVD equivalent.)

Moderate-level RFs
- Hypertension that does not require drug therapy
- BMI at the ≥95th percentile, <97th percentile
- HDL cholesterol < 40 mg/dL
- Presence of moderate-risk conditions (Table 9-7)

RF indicates risk factor.

TABLE 9-7 Special Risk Conditions

<table>
<thead>
<tr>
<th>High risk</th>
<th>Moderate risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1DM and T2DM</td>
<td>Kawasaki disease with current aneurysms</td>
</tr>
<tr>
<td>Chronic kidney disease/2nd stage renal disease/post–renal transplant</td>
<td>Kawasaki disease with regressed coronary aneurysms</td>
</tr>
<tr>
<td>Post–orthotopic heart transplant</td>
<td>Chronic inflammatory disease (systemic lupus erythematosus, juvenile rheumatoid arthritis)</td>
</tr>
<tr>
<td>HIV infection</td>
<td>Nephrotic syndrome</td>
</tr>
</tbody>
</table>

Age-Based Recommendations for Medication Therapy of Children with Dyslipidemia

The age-specific recommendations for pharmacologic management of dyslipidemia are summarized in Table 9-9, Children Younger Than 10 Years

- Children younger than 10 years should not be treated with a medication unless they have a severe primary hyperlipidemia or a high-risk condition that is associated with serious medical morbidity (homozygous hypercholesterolemia/LDL cholesterol level of ≥400 mg/dL; primary hypertriglyceridemia with a triglyceride level of ≥500 mg/dL; evident CVD in the first 2 decades of life; post–cardiac transplantation) (grade C).

Children Aged 10 to 21 Years

- Decisions regarding the need for medication therapy should be based on the average of results from at least 2 FLPS obtained at least 2 weeks but no more than 3 months apart (grade C) (Fig 9-1).
- Children with an average LDL cholesterol level of ≥250 mg/dL or average triglyceride level of ≥500 mg/dL should be referred directly to a lipid specialist (grade B).
- Children with lipid abnormalities should have a detailed family history taken and be assessed for causes of hyperlipidemia, additional risk factors, and risk conditions (grade C) (Tables 9-3, 9-6, and 9-7).

- Children with lipid abnormalities (other than an LDL cholesterol level of ≥250 mg/dL or triglyceride level of ≥500 mg/dL) should be managed initially for 3 to 6 months with diet changes (CHILD-1 → CHILD-2–LDL or CHILD-2–TG) (Table 9-8) on the basis of specific lipid profile findings (Figs 9-1 and 9-2); if the BMI is at the ≥85th percentile, add increased physical activity, reduced screen time, and calorie restriction. Assessment for associated secondary causes (Table 9-3), additional risk factors, or high-risk conditions (Tables 9-6 and 9-7) is recommended. Children at high risk who are unlikely to achieve lipid targets with this strategy alone (severe primary dyslipidemia, post–cardiac transplantation) should concomitantly be considered for initiation of medication therapy (grade C) (see “DM and Other Conditions Predisposing to the Development of Accelerated Atherosclerosis”).

Treatment for children with severe elevation of LDL cholesterol is based on assessment of lipid levels and associated risk factors or risk conditions (Tables 9-6 and 9-7; Figs 9-1 and 9-2):

- Children with an average LDL cholesterol level of ≥250 mg/dL should be referred directly to a lipid specialist (grade B).
- If the LDL cholesterol level remains ≥190 mg/dL after a 6-month trial of lifestyle/diet management (CHILD-1 → CHILD-2–LDL) for children aged 10 years and older, statin therapy should be considered (grade A) (Fig 9-1; Table 9-11 and 9-12).
- If the LDL cholesterol level remains ≥130 to <190 mg/dL in a child aged 10 years or older with a negative
Dyslipidemia algorithm: target LDL cholesterol. Values given are in mg/dL. To convert to SI units, divide results for TC, LDL cholesterol, HDL cholesterol, and non-HDL cholesterol by 3.86; for triglycerides, divide by 1.046. TG indicates triglycerides; C, cholesterol; RF, risk factor; FHx, family history; a exclude secondary causes. Evaluate for other RFs. Start CHILD-1 → CHILD-2–LDL (Table 9-8) + lifestyle change x 6 mo. For children aged 8 or 9 years with BMI at the 90th percentile or at least 2 high-level risk factors or risk condition together with at least 1 moderate-level risk factor or risk condition or the presence of at least 1 high-level risk factor or risk condition or the presence of at least 2 moderate-level risk factors or risk conditions (Fig 9-1) (Tables 9-6 and 9-7), statin therapy might be considered (grade B) (Table 9-12).

- If children aged 8 or 9 years with an LDL cholesterol level persistently ≥190 mg/dL after a trial of lifestyle/diet management (CHILD-1 → CHILD-2–LDL), together with multiple first-degree family members with premature CVD/events, or the presence of at least 1 high-level risk factor or risk condition together with at least 2 moderate-level risk factors or risk conditions (Fig 9-1) (Tables 9-6 and 9-7), statin therapy should be considered (grade B) (Table 9-12).

- For children aged 8 or 9 years with an LDL cholesterol level persistently ≥190 mg/dL after a trial of lifestyle/diet management (CHILD-1 → CHILD-2–LDL), together with multiple first-degree family members with premature CVD/events, or the presence of at least 1 high-level risk factor or risk condition together with at least 2 moderate-level risk factors or risk conditions (Fig 9-1) (Tables 9-6 and 9-7), statin therapy might be considered (grade B) (Table 9-12).

- Statin use should begin with the lowest available dose given once daily. If LDL cholesterol target levels are not achieved with at least 3 months of compliant use, then the dose may be increased by 1 increment (usually 10 mg). If LDL cholesterol target levels are still not achieved with at least 3 months of compliant use, then the dose may be further increased by 1 increment. The risk and effectiveness of dose escalation have been explored in several of the clinical trials of statins in children, and no additional safety issues have been identified (grade B). Alternatively, a second agent such as a bile acid sequestrant or cholesterol absorption inhibitor may be added under the direction of a lipid specialist (grade B) (Table 9-12).

- Children taking a statin should have routine clinical monitoring for symptoms of muscle toxicity and assessment of hepatic transaminases and creatine kinase (grade A) (Table 9-12).

- Pediatric care providers should be on the alert for, and children and
FIGURE 9-2

Dyslipidemia algorithm: target triglycerides. Values given are in mg/dL. To convert to SI units, divide results for TG, LDL cholesterol, HDL cholesterol, and non-HDL cholesterol by 38.6; for triglycerides, divide by 88.6. C indicates cholesterol; a Obtain FLPs at least 2 weeks but no more than 3 months apart.

a The FDA and the Environmental Protection Agency advise women of childbearing age who may become pregnant, pregnant women, nursing mothers, and young children to avoid some types of fish and shellfish that are lower in mercury. For more information, call the FDA’s food information line toll-free at 1-888-SAFEFOOD or visit www.cfsan.fda.gov/Barb2Right.html.

Their families should be counseled about potential medication interactions (grade D) (Table 9-12).

- Females taking a statin should be counseled about risks associated with pregnancy and appropriate contraception strategies if indicated. Use of oral contraceptives in combination with statins is not contraindicated (grade D) (Table 9-12).

Children with elevated triglyceride or non-HDL cholesterol after control of LDL cholesterol are managed on the basis of lipid levels (Fig 9-2):

- Children with fasting triglyceride levels of ≥200 to 499 mg/dL after a trial of lifestyle/diet management with CHILD-1 → CHILD-2–TG (Table 9-8) should have non-HDL recalcified and be managed to a goal level of <145 mg/dL (grade D).

- Children with fasting triglyceride levels of ≥200 to 499 mg/dL, non-HDL levels of >145 mg/dL, after a trial of lifestyle/diet management with CHILD-1 → CHILD-2–TG (Table 9-8) and increased fish intake, may be considered for fish-oil supplementation (grade D) (Table 9-10).

- Children aged 10 years or older with non-HDL cholesterol levels of ≥145 mg/dL after the LDL cholesterol goal has been achieved may be considered for further intensification of statin therapy or additional therapy with a fibrate or niacin in conjunction with referral to a lipid specialist (grade D) (Fig 9-1) (Tables 9-10 and 9-11).

- Children with severe or complex mixed dyslipidemias, particularly when multiple medications are being considered, should be referred for consultation with a lipid specialist (grade D) (Figs 9-1 and 9-2).

10. OVERWEIGHT AND OBESITY

The dramatic increases in childhood overweight and obesity in the United States since 1980 are an important public health focus. Despite efforts over the last decade to prevent and control obesity, recent reports from the National Health and Nutrition Examination Survey show sustained high prevalence; 17% of children and adolescents have a BMI at the >95th percentile for age and gender. The presence of obesity in childhood and adolescence is associated with increased evidence of atherosclerosis at autopsy and of subclinical measures of atherosclerosis on vascular imaging. Because of its strong association with many of the other established risk factors for cardiovascular disease, obesity is even more powerfully correlated with atherosclerosis; this association has been shown for BP, dyslipidemia, and insulin resistance in each of the major pediatric epidemiologic studies. Of all the risk factors, obesity tracks most strongly from childhood into adult life. Improvement in weight status and decrease in body fatness have been shown to be associated with improvement in all the obesity-related risk factors and in subclinical vascular changes. Higher BMI during childhood is directly associated with increased coronary heart disease in adult life. Extrapolation
from current data suggests that adolescent obesity will likely increase adult coronary heart disease by 5% to 16% over the next 25 years with >100 000 excess cases of coronary heart disease attributable to increased obesity in childhood. The evidence review included RCTs, systematic reviews, meta-analyses, and observational studies that assessed the prevention and treatment of overweight and obesity in childhood and adolescence.

**Identification of Overweight and Obese Children and Adolescents**

To identify overweight and obesity in children living in the United States, BMI percentile distributions relative to gender and age on the Centers for Disease Control and Prevention (CDC) 2000 growth charts are now the preferred reference. The CDC growth charts were not developed as a health-related standard. Instead, the growth charts present percentiles of the BMI distribution derived from measurements taken during several National Health and Nutrition Examination Surveys as points of reference. Although the charts were published in 2000, they include selected data from the 1963 through 1980 surveys and, thus, are not representative of the US population in 2000. These BMI percentile growth charts provide the best reference data available for describing normal growth in US children. They are, however, a screening tool and not an instrument for the diagnosis of overweight and obesity.

An expert committee jointly convened by the American Medical Association (AMA), the CDC, and the Maternal and Child Health Bureau (MCHB) of the Health Resources and Services Administration (US Department of Health and Human Services) recently recommended that BMI be used to assess weight-for-height relationships in children. This conclusion was reached because BMI can be easily calculated from height and weight, correlates strongly with direct measures of body fat (especially at higher BMI values), associates only weakly with height, and identifies those with the highest body fat correctly with acceptable accuracy, particularly above the 85th BMI percentile. Pediatric care providers need a feasible standard for identifying overweight and obesity in their patients, because parents recognize a child’s overweight status in fewer than half of the cases. The AMA/CDC/MCHB expert committee defined a BMI at the ≥95th percentile as obese and a BMI between the 85th and 94th percentiles as overweight; children in the latter BMI category have a great deal of variation with respect to prediction of future risk.

The expert panel for these guidelines concluded that BMI is a sufficient measure for screening children and adolescents to identify those who need evaluation for cardiovascular risk factors.
TABLE 9-9 Evidence-Based Recommendations for Pharmacologic Treatment of Dyslipidemia

| Birth to 10 y | Pharmacologic treatment is limited to children with severe primary hyperlipidemia (homozygous familial hypercholesterolemia, primary hypertriglyceridemia [triglycerides ≥ 500 mg/dL]), a high-risk condition (Tables 9-6 and 9-7), or evident cardiovascular disease, all under the care of a lipid specialist | Grade C Recommend |
| ≥10 to 21 y | Detailed family history and RF assessment required before initiation of drug therapya (high- to moderate-level RFs and RCs are listed in Tables 9-6 and 9-7) | Grade C Strongly recommend |

**LDL cholesterol**

- If average LDL cholesterol ≥ 250 mg/dL, consult lipid specialist
- If average LDL cholesterol ≥ 130–250 mg/dL, or non-HDL ≥ 145 mg/dL, refer to dietitian for medical nutrition therapy with CHILD-1 → CHILD-2–LDL (Table 9-8) for 6 mo; repeat FLP

**Repeat FLP**

- LDL cholesterol < 130 mg/dL, continue CHILD-2–LDL, reevaluate in 12 mo
- LDL cholesterol ≥ 190 mg/dLb consider initiation of statin therapy per Tables 9-11 and 9-12
- LDL cholesterol ≥ 130–189 mg/dL, negative family history, no other RF or RC, continue CHILD-2–LDL, reevaluate every 6 mo
- LDL cholesterol = 160–189 mg/dL + positive family history or ≥1 high-level RF/RC or ≥2 moderate-level RFs/RCs, consider statin therapy per Tables 9-11 and 9-12
- LDL cholesterol ≥ 130–159 mg/dL + ≥2 high-level RFs/RCs or 1 high-level + 2 moderate-level RFs/RCs, consider statin therapy per Tables 9-11 and 9-12
- Children on statin therapy should be counseled and carefully monitored per Table 9-12

**≥10 to 21 y**

- Detailed family history and RF/RC assessment required before initiation of drug therapya (high- to moderate-level RFs/RCs in Tables 9-6 and 9-7)
- Triglycerides
  - If average triglycerides ≥ 500 mg/dL, consult lipid specialist
  - If average triglycerides ≥ 100 mg/dL in child aged <10 y, ≥130 mg/dL in a child aged 10–19 y, or <500 mg/dL, refer to dietitian for medical nutrition therapy with CHILD-1 → CHILD-2–TG (Table 9-8) for 6 mo
  - Repeat FLP
  - Triglycerides < 100 (130) mg/dL, continue CHILD-2–TG, monitor every 6–12 mo
  - Triglycerides ≥ 100 (130) mg/dL, reconsult dietitian for intensified CHILD-2–TG diet counseling
  - Triglycerides ≥ 200–499 mg/dL, non-HDL ≥ 145 mg/dL, consider fish oil ± consult lipid specialist

**Non-HDL cholesterol**

- Children aged ≥10 y with non-HDL cholesterol ≥ 145 mg/dL after LDL cholesterol goal is achieved may be considered for additional treatment with statins, fibrates, or niacin in conjunction with a lipid specialist consultation

Grades reflect the findings of the evidence review, and recommendation levels reflect the consensus opinion of the expert panel. When medication is recommended, it should always be in the context of the complete cardiovascular risk profile of the patient and in consultation with the patient and the family. Values given are in mg/dL. To convert to SI units, divide the results for TC, LDL cholesterol, HDL cholesterol, and non-HDL cholesterol by 38.6; for triglycerides, divide by 88.6. RF indicates risk factor; RC, risk condition.

- a Consideration of drug therapy is based on the average of ≥2 FLPs, obtained at least 2 weeks but no more than 3 months apart.
- b If average LDL cholesterol ≥ 190 mg/dL after CHILD-2–LDL and child is 8 to 9 years old with a positive family history or ≥1 high-level risk factor/risk condition or ≥2 moderate-level risk factors/risk conditions, statin therapy may be considered.
- c If the child is obese, nutrition therapy should include calorie restriction and increased activity beyond that recommended for all children. See “Overweight and Obesity” for additional age-specific recommendations.

ASSOCIATED WITH BODY ADIPOSITY. The expert panel also concluded that the scientific evidence linking elevated BMI to cardiovascular risk factors and morbidity is strong and well supported.

The expert panel therefore recommends that children and adolescents aged 2 to 18 years with a BMI at the ≥95th percentile be described as “obese” and identified as needing assessment for cardiovascular risk factors. For children with a BMI that falls between the 85th and 95th percentiles, the term “overweight” should be used, and the position of the child’s BMI on the growth chart should be used to express concern regarding weight-for-height disproportion. It is important to follow the pattern of growth over time by using these cut points to identify children who require more frequent follow-up and further assessment rather than to assign a diagnosis. Some might feel that “obese” is an unacceptable term for children and parents, so as with all health conditions, the practitioner is encouraged to use descriptive terminology that is appropriate for each child and family and to provide a thorough explanation and discussion. Each patient and family should be considered on an individual basis in deciding how best to convey the seriousness of this issue and to develop management plans.

**Conclusions of the Evidence Review on Prevention of Overweight and Obesity With Diet or Combined Diet and Physical Activity Interventions**

The expert panel concluded that there is good evidence that the dietary behavior of children can safely be improved with interventions that result in lower saturated fat intake, reduced...
intake of sweetened beverages, and increased fruit and vegetable consumption. In a small number of studies, these changes were associated with lower BMI. No evidence that diets of this kind are harmful was identified. Most studies also had specific interventions aimed at changing physical activity behaviors, so it is difficult to

### TABLE 9-10 Medications for Managing Hyperlipidemia

<table>
<thead>
<tr>
<th>Type of Medication</th>
<th>Mechanism of Action</th>
<th>Major Effects</th>
<th>Examples</th>
<th>Adverse Reactions</th>
<th>FDA Approval in Youths (as of This Writing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMG-CoA reductase inhibitors (statins)</td>
<td>Inhibits cholesterol synthesis in hepatic cells; decreases cholesterol pool, resulting in upregulation of LDL receptors</td>
<td>Mainly lowers LDL cholesterol; some decrease in triglycerides and modest increase in HDL cholesterol</td>
<td>Atorvastatin, fluvastatin, lovastatin, pravastatin, rosuvastatin, simvastatin</td>
<td>Raised hepatic enzymes, raised creatine kinase, myopathy possibly progressing to rhabdomyolysis</td>
<td>All statins listed are approved as an adjunct to diet to lower LDL cholesterol in adolescent boys and postmenarcheal girls aged 10–18 y (≥8 y for pravastatin) with heFH and LDL cholesterol ≥190 mg/dL or ≥190 mg/dL with family history of premature CVD and ≥2 CVD risk factors in the pediatric patient</td>
</tr>
<tr>
<td>Bile acid sequestrants</td>
<td>Binds intestinal bile acids, interrupting enterohepatic recirculation; more cholesterol converted into bile acids; decreases hepatic cholesterol pool; upregulates LDL receptors</td>
<td>Lowers LDL cholesterol; small increase in HDL cholesterol; raises triglycerides</td>
<td>Cholestyramine, colestipol, colesevelam</td>
<td>Limited to gastrointestinal tract: gas, bloating, constipation, cramps</td>
<td>No pediatric indication listed for cholestyramine or colestipol; colesevelam indicated as monotherapy or with statin for LDL cholesterol reduction in boys and postmenarcheal girls aged 10–17 y with family history after diet trial if LDL cholesterol ≥190 mg/dL or if LDL cholesterol ≥160 mg/dL with family history of premature CVD or ≥2 CVD risk factors in the pediatric patient</td>
</tr>
<tr>
<td>Cholesterol absorption inhibitors</td>
<td>Inhibits intestinal absorption of cholesterol and plant sterols; decreases hepatic cholesterol pool; upregulates LDL receptors</td>
<td>Mainly lowers LDL cholesterol; some decrease in triglycerides and small increase in HDL cholesterol</td>
<td>Ezetimibe</td>
<td>Myopathy, gastrointestinal upset, headache</td>
<td>Not approved</td>
</tr>
<tr>
<td>Fibric acid derivatives</td>
<td>Agonist for PPAR-α nuclear receptors that upregulate LPL and downregulate apolipoprotein C-III, both increasing degradation of VLDL cholesterol and triglycerides; hepatic synthesis of VLDL cholesterol may also be decreased</td>
<td>Mainly lowers triglycerides and increases HDL cholesterol; little effect on LDL cholesterol</td>
<td>Fenofibrate, gemfibrozil</td>
<td>Dyspepsia, constipation, myositis, anemia</td>
<td>Not approved</td>
</tr>
<tr>
<td>Nicotinic acid (extended release)</td>
<td>Inhibits release of FFA from adipose tissue; decreases VLDL and LDL cholesterol production and HDL cholesterol degradation</td>
<td>Lowers triglycerides and LDL cholesterol and raises HDL cholesterol; can decrease lipoprotein(a) particle size</td>
<td>Niacin, extended release</td>
<td>Flushing, hepatic toxicity, can increase fasting blood glucose, uric acid, can cause hyperacidity</td>
<td>Use not recommended in children &lt;2 y old</td>
</tr>
<tr>
<td>ω-3 fish oil</td>
<td>Decreases hepatic FA and triglycerides synthesis while enhancing FA degradation/oxidation, with subsequent reduced VLDL cholesterol release</td>
<td>ω-3 acid ethyl esters</td>
<td></td>
<td>Occasional adverse gastrointestinal effects but no adverse effect on glucose levels or muscle or liver enzymes or bleeding</td>
<td>Only 1 fish-oil preparation is FDA-approved for adults, but many generic fish-oil capsules are commercially available</td>
</tr>
</tbody>
</table>

HMG-CoA indicates hydroxymethylglutaryl coenzyme A; heFH, heterozygous hypercholesterolemia; PPAR-α, peroxisome proliferator-activated receptor; LPL, lipoprotein lipase; VLDL, very low density lipoprotein; FFA, free fatty acid; FA, fatty acid.

<table>
<thead>
<tr>
<th>Study Authors, Type, and Duration</th>
<th>Medication</th>
<th>No. of Subjects, Gender, Condition</th>
<th>Daily Dose</th>
<th>Effect on Lipid Profile, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TC LDL HDL Triglycerides</td>
</tr>
<tr>
<td>Bile acid–binding resins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonstad et al, RCT, 1 y</td>
<td>Cholestyramine</td>
<td>72, male and female, FH (LDL = 190 mg/dL without family history of premature CVD or LDL ≥ 160 with family history after 1-y diet; ages 6–11 y)</td>
<td>8 g</td>
<td>−12 −17 8 NA</td>
</tr>
<tr>
<td>McCrindle et al, RCT, 8 wk crossover, 2 × 8 wk</td>
<td>Cholestyramine</td>
<td>40, male and female, FH (1 parent with FH; LDL cholesterol ≥ 151 mg/dL; on diet; ages 10–18 y)</td>
<td>8 g</td>
<td>−7 to −11 −10 to −15 2 to 4 6 to 9</td>
</tr>
<tr>
<td>Tonstad et al, RCT, 8 wk; open label, 44–52 wk</td>
<td>Colestipol</td>
<td>66, male and female, FH (TC ≥ 239 mg/dL and triglycerides ≤ 115 mg/dL; ages 10–18 y)</td>
<td>2–12 g</td>
<td>−17 −20 −7 −13</td>
</tr>
<tr>
<td>McCrindle et al, RCT, 8 wk crossover, 2 × 18 wk</td>
<td>Colestipol</td>
<td>36, male and female, FH (CHD LDL ≥ 160 mg/dL after 6 mo of diet counseling; ages 8–18 y)</td>
<td>10 g</td>
<td>−7 −10 2 12</td>
</tr>
<tr>
<td>Stein et al, RCT, 8 wk; open label, 18 wk</td>
<td>Colesevelam</td>
<td>191, male and female, FH (LDL ≥ 190 mg/dL or LDL ≥ plus 2 additional risk factors after 6 mo of diet counseling; ages 10–17 y)</td>
<td>1.87 g</td>
<td>−3 −6 5 6</td>
</tr>
<tr>
<td>Stein et al, RCT, 8 wk</td>
<td></td>
<td></td>
<td>3.75 g</td>
<td>−7 −13 8 5</td>
</tr>
<tr>
<td>Stein et al, 18 wk; open label, 18 wk</td>
<td>Colesevelam</td>
<td>191, male and female, FH (LDL ≥ 190 mg/dL or LDL ≥ plus 2 additional risk factors after 6 mo of diet counseling; ages 10–17 y)</td>
<td>1.87 g</td>
<td>−3 −6 5 6</td>
</tr>
<tr>
<td>Stein et al, RCT, 8 wk</td>
<td></td>
<td></td>
<td>3.75 g</td>
<td>−7 −13 8 5</td>
</tr>
<tr>
<td>HMG-CoA reductase inhibitors (statins)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McCrindle et al, RCT, open label, 26 wk</td>
<td>Atorvastatin</td>
<td>187, male and female, FH/severe hyperlipidemia (LDL cholesterol ≥ 190 mg/dL or LDL cholesterol ≥ 160 mg/dL with family history; triglycerides &lt; 400 mg/dL; ages 10–17 y)</td>
<td>10–20 mg</td>
<td>−30 −40 6 −13</td>
</tr>
<tr>
<td>Van der Graaf et al, open label, 2 y</td>
<td>Fluvastatin</td>
<td>85, male and female, FH (LDL cholesterol ≥ 190 mg/dL or LDL cholesterol ≥ 160 mg/dL and ≥1 risk factor or LDL receptor mutation; ages 10–16 y)</td>
<td>80 mg</td>
<td>−27 −34 5 −5</td>
</tr>
<tr>
<td>Lambert et al, RCT, 8 wk</td>
<td>Lovastatin</td>
<td>69, male, FH (LDL cholesterol &gt; 95th percentile, family history of atherosclerosis and hyperlipidemia; on diet; mean age: 13 y)</td>
<td>10 mg</td>
<td>−17 −21 9 −18</td>
</tr>
<tr>
<td>Stein et al, RCT, 48 wk</td>
<td>Lovastatin</td>
<td>132, male, FH (LDL 189–503 mg/dL + family history of high LDL; or 220–503 mg/dL + family history of CAD death; AHA diet ≥ 4 mo; ages 10–17 y)</td>
<td>10 mg</td>
<td>−13 −17 4 −9</td>
</tr>
<tr>
<td>Stein et al, RCT, 48 wk</td>
<td>Lovastatin</td>
<td>132, male, FH (LDL 189–503 mg/dL + family history of high LDL; or 220–503 mg/dL + family history of CAD death; AHA diet ≥ 4 mo; ages 10–17 y)</td>
<td>10 mg</td>
<td>−13 −17 4 −9</td>
</tr>
<tr>
<td>Clauss et al, RCT, 24 wk</td>
<td>Lovastatin</td>
<td>54, female, FH (family history of FH; LDL 160–400 mg/dL and triglycerides &lt; 350 mg/dL; 4-wk diet placebo run-in and 20-wk treatment; ages 10–17 y, postmenarcheal)</td>
<td>40 mg</td>
<td>−22 −27 3 −23</td>
</tr>
<tr>
<td>Knipscheer et al, RCT, 12 wk</td>
<td>Pravastatin</td>
<td>72, male and female, FH (family history hypercholesterolemia or premature atherosclerosis; LDL &gt; 95th percentile; diet for 8 wk; ages 8–16 y)</td>
<td>5 mg</td>
<td>−18 −23 4 2</td>
</tr>
<tr>
<td>Wiegman et al, RCT, 2 y</td>
<td>Pravastatin</td>
<td>214, male and female, FH (LDL cholesterol ≥ 155 mg/dL and triglycerides ≤ 350 mg/dL; diet for 3 mo; ages 8–18 y)</td>
<td>20–40 mg</td>
<td>−19 −24 6 −17</td>
</tr>
<tr>
<td>Rodenburg et al, open-label; 2 y RCT; 4.5 y open-label follow-up</td>
<td>Pravastatin</td>
<td>186, male and female, FH (LDL cholesterol ≥ 154 mg/dL and triglycerides &lt; 154 mg/dL; diet for 3 mo; ages 8–18 y)</td>
<td>20 mg (ages &lt; 14 y) or 40 mg (ages ≥ 14 y)</td>
<td>−23 −29 3 −2</td>
</tr>
<tr>
<td>de Jongh et al, RCT, 48 wk</td>
<td>Simvastatin</td>
<td>173, male and female, FH (LDL cholesterol = 158–397 mg/dL; ages 10–17 y)</td>
<td>10–40 mg</td>
<td>−31 −41 3 −9</td>
</tr>
<tr>
<td>de Jongh et al, RCT, 28 wk</td>
<td>Simvastatin</td>
<td>50, male and female, FH (LDL cholesterol &gt; 95th percentile, family history of hyperlipidemia, or LDL receptor mutation; ages 8–19 y)</td>
<td>40 mg</td>
<td>−30 −40 5 −17</td>
</tr>
</tbody>
</table>
Obesity and physical activity interventions often addressed reduction in sedentary behavior rather than attempts to increase physical activity. In a majority of the studies there was no significant difference in body-size measures. Sample sizes were often small, and follow-up was often short (frequency <6 months). It is suggested that gender-specific programs might be more successful in changing activity behavior. Overall, the expert panel concluded that on the basis of evidence review.

**Conclusions of the Evidence Review on Prevention of Overweight and Obesity With Physical Activity**

A moderate number of RCTs have evaluated the effect of interventions that addressed only physical activity and/or sedentary behavior on prevention of overweight and obesity. In a small number of these studies, the intervention was effective. It should be noted that these successful interventions often addressed reduction in sedentary behavior rather than attempts to increase physical activity.

**TABLE 9-11 Continued**

<table>
<thead>
<tr>
<th>Study Authors, Type, and Duration</th>
<th>Medication</th>
<th>No. of Subjects, Gender, Condition</th>
<th>Daily Dose</th>
<th>Effect on Lipid Profile, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TC</td>
<td>LDL Cholesterol</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------------</td>
<td>------------------------------------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Avis et al, RCT, 12 wk; then, 40-wk open-label follow-up</td>
<td>Rosuvastin</td>
<td>177, male and female, FH (LDL cholesterol ≥ 190 mg/dl or LDL cholesterol &gt; 160 mg/dl plus positive family history of early CVD or ≥ 2 other risk factors for CVD)</td>
<td>5 mg</td>
<td>-30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 mg</td>
<td>-34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 mg</td>
<td>-39</td>
</tr>
<tr>
<td>Wheeler et al, RCT, 26 wk</td>
<td>Bezafibrate</td>
<td>14, male and female, FH (TC &gt; 268 mg/dL, normal triglycerides + family history of FH or premature CAD; ages 4–15 y)</td>
<td>10–20 mg</td>
<td>-22</td>
</tr>
<tr>
<td>Colletti et al, open label, 1–19 mo</td>
<td>Niacin</td>
<td>21, male and female, FH (mean LDL = 243 ± 45 mg/dL on low-fat diet; mean triglycerides = 87 ± 39 mg/dL; ages 4–14 y)</td>
<td>500–2200 mg</td>
<td>-13</td>
</tr>
<tr>
<td>McCrindle et al, RCT crossover, 2 × 18 wk</td>
<td>Pravastatin and cholestipol</td>
<td>36, male and female, FH/FCHL (LDL &gt; 160 mg/dl + family history of FH or premature CAD; triglycerides &gt; 177 mg/dl in 10 of the 36; ages 10–18 y)</td>
<td>Pravastatin, 10 mg (with cholestipol, 5g)</td>
<td>-13</td>
</tr>
<tr>
<td>van der Graaf et al, RCT, 6 and 27 wk; open label to 53 wk</td>
<td>Simvastatin and ezetimibe</td>
<td>248, male and female, FH (LDL &gt; 159 mg/dl + genotype-confirmed FH or + parental genotype-confirmed FH or + parental LDL &gt; 210 mg/dl or + tendinous xanthomas or LDL &gt; 189 mg/dl + family history of hypercholesterolemia; ages 10–17 y)</td>
<td>Simvastatin, 10–40 mg (with ezetimibe, 10 mg)</td>
<td>-38</td>
</tr>
<tr>
<td>Goldberg et al, ω-3 fatty acid review in adults; no RCTs in children</td>
<td>ω-3 fish oils (1 g per capsule)*</td>
<td>---</td>
<td>1–4 g/d</td>
<td>NC</td>
</tr>
</tbody>
</table>

FH indicates heterozygous familial hypercholesterolemia; NA, not available; FCHL, familial combined hyperlipidemia; HMG-CoA, hydroxymethylglutaryl coenzyme A; CAD, coronary artery disease; NC, not calculated.

* There is only one FDA-approved fish-oil preparation, but there are many generic forms of fish-oil capsules that are commercially available. The University of Wisconsin maintains a preventive cardiology patient education Web site (www.heartdecision.org). The fish-oil section includes information about the content of various preparations. The Web site is updated every 6 months (www.heartdecision.org/chdrisk/v_hd/patient_edu_docs/Fish_Oil_11-hyphen) 2007.pdf.

the evidence review, increasing activity in isolation is of little benefit in preventing obesity. By contrast, the review suggests that reducing sedentary behavior might be beneficial in preventing the development of obesity. The activity recommendations in the guideline specifically address limiting sedentary behavior and increasing physical activity in all children. Guidance on amounts and intensity of physical activity and limitations on sedentary screen time are provided in the recommendations in “Physical Activity.” On the basis of this evidence review, no additional specific recommendations addressing physical activity in preventing obesity are indicated.

**Summary of the Evidence Review of Children at Increased Risk for Overweight and Obesity**

Certain populations of children who are at greater risk; however, research is lacking regarding an appropriate intervention. Despite that fact, epidemiologic associations suggest that primary care providers should be alert to increasing BMI trends and excessive weight gain beyond what is anticipated for height increase when dealing with these children and consider intervention before the child becomes overweight.

Observational studies have identified sample populations that are at special risk for obesity:

<table>
<thead>
<tr>
<th>TABLE 9-12</th>
<th>Recommendations for Use of 3-Hydroxy-3-Methylglutaryl-Coenzyme A Reductase Inhibitors (Statins) in Children and Adolescents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient selection</strong></td>
<td>1. Use algorithm (Fig 9-1) and risk-factor categories (Tables 9-6 and 9-7) to select statin therapy for patients.</td>
</tr>
<tr>
<td>2. Include preferences of patient and family in decision-making.</td>
<td></td>
</tr>
<tr>
<td>3. In general, do not start treatment with statins before the age of 10 y (patients with high-risk family history, high-risk conditions, or multiple risk factors [Tables 9-6 and 9-7] might be considered for medication initiation at age ( \geq 10 ) y).</td>
<td></td>
</tr>
<tr>
<td>4. Precaution/contraindication with potentially interactive medications (cyclosporine, niacin, fibrac acid derivatives, erythromycin, azole antifungal agents, nefazodone, many HIV protease inhibitors); check for potential interaction with all current medications at baseline.</td>
<td></td>
</tr>
<tr>
<td>5. Conduct baseline hepatic panel and CK before initiating treatment.</td>
<td></td>
</tr>
<tr>
<td><strong>Initiation and titration</strong></td>
<td>1. Choice of particular statin is a matter of preference. Clinicians are encouraged to develop familiarity and experience with one of the statins, including dosage regimen and potential drug-drug interactions.</td>
</tr>
<tr>
<td>2. Start with the lowest dose once daily, usually at bedtime. Atorvastatin and rosuvastatin can be taken in the morning or evening because of their long half-lives.</td>
<td></td>
</tr>
<tr>
<td>3. Measure baseline CK, ALT, and AST.</td>
<td></td>
</tr>
<tr>
<td>4. Instruct the patient to report all potential adverse effects, especially muscle cramps, weakness, asthenia, and more diffuse symptoms suggestive of myopathy.</td>
<td></td>
</tr>
<tr>
<td>5. Advise female patients about concerns with pregnancy and the need for appropriate contraception.</td>
<td></td>
</tr>
<tr>
<td>6. Advise about potential future medication interactions, especially cyclosporine, niacin, fibrac acid derivatives, erythromycin, azole antifungal agents, nefazodone, and HIV protease inhibitors.</td>
<td></td>
</tr>
<tr>
<td><strong>Check for potential interaction whenever any new medication is initiated.</strong></td>
<td></td>
</tr>
<tr>
<td>1. Whenever potential myopathy symptoms are present, stop medication and assess CK; determine relation to recent physical activity. The threshold for worrisome level of CK is 10 times above the upper limit of reported normal, considering the impact of physical activity. Monitor the patient for resolution of myopathy symptoms and any associated increase in CK level. Consideration can be given to restarting the medication once symptoms and laboratory abnormalities have resolved.</td>
<td></td>
</tr>
<tr>
<td>2. After 4 wk, measure FLP, ALT, and AST and compare with laboratory-specific reported normal values. The threshold for worrisome levels of ALT or AST is ( \geq 3 ) times the upper limit of reported normal.</td>
<td></td>
</tr>
<tr>
<td>Target levels for LDL cholesterol: minimal, (&lt; 130 ) mg/dL; ideal, (&lt; 110 ) mg/dL.</td>
<td></td>
</tr>
<tr>
<td>3. If target LDL cholesterol levels are achieved and there are no potential myopathy symptoms or laboratory abnormalities, continue therapy and recheck FLP, ALT, and AST in 8 wk and then in 3 mo.</td>
<td></td>
</tr>
<tr>
<td>4. If laboratory abnormalities are noted or symptoms are reported, temporarily withhold the medication and repeat the blood work in 2 wk. When abnormalities resolve, the medication may be restarted with close monitoring.</td>
<td></td>
</tr>
<tr>
<td>5. If target LDL cholesterol levels are not achieved, increase the dose by 1 increment (usually 10 mg) and repeat the blood work in 4 wk. If target LDL cholesterol levels are still not achieved, dose may be further increased by 1 increment, or another agent (bile acid sequestrant or cholesterol absorption inhibitor) may be added under the direction of a lipid specialist.</td>
<td></td>
</tr>
<tr>
<td><strong>Maintenance monitoring</strong></td>
<td>1. Monitor growth (height, weight, and BMI relative to normal growth charts), sexual maturation, and development.</td>
</tr>
<tr>
<td>2. Whenever potential myopathy symptoms present, stop medication and assess CK.</td>
<td></td>
</tr>
<tr>
<td>3. Monitor FLP, ALT, and AST every 3–4 mo in the first year, every 6 mo in the second year and beyond, and whenever clinically indicated.</td>
<td></td>
</tr>
<tr>
<td>4. Monitor and encourage compliance with lipid-lowering dietary and medication therapy. Serially assess and counsel for other risk factors such as weight gain, smoking, and inactivity.</td>
<td></td>
</tr>
<tr>
<td>5. Counsel adolescent girls about statin contraindications in pregnancy and the need for abstinence or use of appropriate contraceptive measures. Use of oral contraceptives is not contraindicated if medically appropriate. Seek referral to an adolescent medicine or gynecologic specialist as appropriate.</td>
<td></td>
</tr>
</tbody>
</table>

CK indicates creatine kinase; ALT, alanine aminotransferase; AST, aspartate aminotransferase.
• children with a BMI between the 85th and 95th percentiles;
• children in whom there is a positive family history of obesity in 1 or both parents;
• early onset of increasing weight beyond that appropriate for increase in height, which can be identified early (beginning in the first year of life);
• excessive increase in weight during adolescence, particularly in black girls; and
• children who have been very active and then become inactive or adolescents who are inactive in general (an example would be a child who previously participated in organized sports and has stopped, particularly in adolescence).

No RCTs that addressed these populations were identified. Despite this fact, the expert panel believes that lifestyle recommendations with a goal of prevention of excessive weight gain are needed for normal-weight children with characteristics consistent with special risk for development of overweight and obesity. The diet and activity recommendations proposed for children at elevated cardiovascular risk (“Nutrition and Diet”; “Physical Activity”) should be vigorously reinforced in these children. In any child, the development of a BMI between the 85th and 95th percentile should be taken as a sign that increased attention to diet and activity as well as BMI-specific follow-up is indicated.

Conclusions and Grading of the Evidence Review on Treatment of Obesity

• There is good evidence for the effectiveness of combined weight-loss programs that included behavior-change counseling, negative energy balance through diet, and increased physical activity in addressing obesity in children older than 6 years with a BMI at the ≥95th percentile and no comorbidities (grade A). However, such programs have been effective primarily in a comprehensive weight-loss program or in research settings; only a small number have been shown to be effective in primary care settings.
• No data were identified on weight-loss programs for children younger than 6 years.
• No single negative-energy diet plan was identified from the evidence review. Dietary plans should be determined for each child on the basis of baseline body size, energy requirements for growth, and physical activity level (grade D).

Increasing dietary fiber from corn bran, wheat flour, wheat bran, oat flakes, corn germ meal, or glucomannan does not significantly improve weight loss (grade A).

Various diets, including low-glycemic-load diets, low-carbohydrate diets, fiber supplements, and protein-sparing modified fasts, have not been adequately studied as to their effects on obesity in children and adolescents.

For children aged 6 to 12 years:
• Family-based programs in research settings that addressed both diet and activity have been shown to be effective at initiating and sustaining weight loss over a follow-up of 10 years (grade A).
• The greatest weight loss is achieved when parents are the focus of the intervention (grade A).

For adolescents:
• Comprehensive programs in research settings were effective at achieving weight loss in the short-term (grade A).
• The greatest weight change was achieved when the adolescent was the primary focus of the intervention (grade B).

• Behavior-change programs that involved peers resulted in more sustained weight loss (grade B).
• In overweight and obese youth, the combination of diet and a specific physical activity intervention that reduced sedentary activity and/or increased physical activity was universally more effective at achieving decreases in weight and BMI as well as decreases in body fat compared with an isolated diet intervention:

• In both children and adolescents, exercise training improved weight loss and body composition (decreasing fat mass and reducing visceral fat), decreased insulin resistance, reduced BP, normalized dyslipidemia, and normalized subclinical measures of atherosclerosis (grade A).

• In children aged 7 to 12 years, reduction in sedentary activity independent of increasing physical activity produced weight loss (grade B). In this age group, reductions in sedentary activity were effectively accomplished by rewarding children for time spent being physically active with TV-viewing time (grade B).
• Girls did not respond as well as boys to combined treatments that both reduced sedentary behaviors and increased physical activity (grade B).

For adolescents with or without significant comorbidities and a BMI at the >95th percentile and for adolescents with a BMI of >35 who have failed to lose weight in a comprehensive lifestyle weight-loss program, addition of medication under the care of a physician experienced in managing weight loss with medication can be safe and effective in achieving weight loss with follow-up of 4 to 12 months. However, long-
term safety and efficacy data are not available:

- In adolescents with severe obesity and insulin resistance, the addition of metformin to a comprehensive lifestyle weight-loss program improved fasting insulin levels and significantly reduced weight and BMI (grade B). (Metformin is currently approved by the US Food and Drug Administration [FDA] for pediatric patients aged 10 years or older with T2DM but is not approved for weight loss for either children or adults.)
- For obese adolescents older than 12 years, the addition of orlistat to a comprehensive lifestyle weight-loss program improved weight loss and BMI (grade A); however, use of this medication had a high rate of adverse gastrointestinal effects. (Orlistat [under the trade name Xenical (Roche Pharmaceuticals, Nutley, NJ)] is approved by the FDA for weight loss in pediatric patients 12 years of age and older in conjunction with a reduced-calorie diet. In August 2009, the FDA released an early communication about an ongoing safety review regarding reports of liver-related adverse events in some patients taking orlistat. In May 2010, the orlistat labeling was updated to incorporate safety information pertaining to the occurrence of rare postmarketing cases of severe liver injury, including hepatic failure that resulted in liver transplant or death.)
- Dropout rates are substantial for all weight-treatment programs.
- No studies defining an appropriate rate for weight loss in any age group were identified by the guidelines evidence review. The 2010 DGA\(^a\) recommends slowing weight gain while allowing normal growth and development. For those with a BMI at the >95th percentile without comorbidities, both the AMA/CDC/MCHB expert committee and the AAP\(^b\) recommend weight maintenance resulting in decreasing BMI as age increases. With a BMI at the >95th percentile with comorbidities, the AMA/CDC/MCHB expert committee and the AAP\(^b\) recommend gradual weight loss not to exceed 1 lb/month in children aged 2 to 11 years or 2 lb/week in adolescents (no grade).
- For adolescents with a BMI far above 35 and associated comorbidities, bariatric surgery on a research protocol in conjunction with a comprehensive lifestyle weight-loss program improved weight loss, BMI, and other outcomes such as insulin resistance, glucose tolerance, and cardiovascular measures in small case series (grade D).

The recommendations for management of overweight and obesity are listed in Table 10-1.

11. DM AND OTHER CONDITIONS PREDISPOSING TO THE DEVELOPMENT OF ACCELERATED ATHEROSCLEROSIS

DM is an established risk factor for early CVD. Metabolically, DM is characterized by hyperglycemia caused by defects in insulin secretion (T1DM) and insulin function and/or secretion (T2DM). Both T1DM and T2DM are associated with vascular disease. Results of autopsy and noninvasive imaging studies suggest that the extent of vascular involvement reflects the duration of the disease and the severity of the chronic metabolic derangement. The epidemiologies of the 2 types differ significantly. T1DM presents at a younger age; 25% of patients are diagnosed between the ages of 5 and 10 years and another 40% between the ages of 10 and 15 years. If not treated adequately, the degree of hyperglycemia is severe, and patients are highly symptomatic. By contrast, with T2DM, the majority of patients present in adult life, but a small and growing number present in adolescence, and most are relatively asymptomatic with only mild-to-moderate hyperglycemia in combination with obesity. Regardless of these differences, children with DM, type 1 or 2, are at significantly increased risk for accelerated atherosclerosis and early CVD.

In certain other pediatric disease states, the process of atherosclerosis is dramatically accelerated with clinical coronary events occurring in childhood and very early adult life. These conditions were the subject of a recent guideline from the American Heart Association (AHA). The expert panel elected to use the AHA guideline as a template for developing recommendations for children with conditions such as DM that predispose them to very accelerated atherosclerosis, because the evidence review identified only a small number of studies that addressed these conditions in an RCT.

Conclusions of the Evidence Review for DM and Other Predisposing Conditions

Children with DM, T1DM or T2DM, represent the prototype of the child at special risk for accelerated atherosclerosis and early clinical CVD. To maximize identification of T2DM in childhood and adolescence, the screening algorithm from the American Diabetes Association\(^c\) is recommended for screening in all children (Table 11-1).

Limited high-quality studies that addressed cardiovascular risk reduction in children with conditions predisposing them to accelerated atherosclerosis were found, so the expert panel elected to modify the recommenda-
The authors of the AHA statement recommended specific risk identification and management stratified according to risk on the basis of defined other conditions that parallel the recommendations for adults with DM or other CVD equivalents. For those in the high-risk category (Table 11-2), the disease process has been associated with clinical coronary disease before 30 years of age. For those in the moderate-risk category, the disease process has been shown to be associated with pathologic, physiologic, or subclinical evidence of accelerated atherosclerosis.

The expert panel believes that these recommendations should be used for the management of children and adolescents with DM and other predisposing conditions as outlined in the algorithm in Fig 11-1 and in Tables 11-2 and 11-3. With the growing evidence of vascular disease in children with T2DM, the expert panel felt that it was prudent to include both T1DM and T2DM in the high-risk category. With increasing evidence of vascular dysfunction in children with HIV infection and nephrotic syndrome, these 2 conditions have been added to the selected disease settings in the moderate-risk category. Patients in the high-risk category require intensive management with more aggressive goals for therapy than those in the moderate-risk category, as outlined in the algorithm.

### 12. RISK-FACTOR CLUSTERING AND THE METABOLIC SYNDROME

Traditional cardiovascular risk factors such as obesity, hypertension, and dyslipidemia demonstrate clustering in youth. Risk behaviors such as smoking, suboptimal diet, and sedentary behavior also demonstrate clustering, as do advantageous diet and exercise habits. Becoming obese increases the prevalence of the risk-factor cluster in adults called the metabolic syndrome. The metabolic syndrome is defined as ≥3 of the following risk factors: elevated waist circumference, triglyceride levels, BP, and/or fasting glucose level and reduced HDL cholesterol level. In the United States, the metabolic syndrome is said to affect between 34% and 39% of adults, including 7% of men and 6% of women in the 20- to 30-year-old age group. The expert panel reviewed all the RCTs, systematic reviews, meta-analyses, and observational studies that addressed the childhood association between the risk-factor cluster known as the metabolic syndrome and the development of atherosclerosis, and the identification and management of the cluster in children and adolescents.

There is a lack of consensus on how to define metabolic syndrome in youth, which has led to widely varying estimates of its frequency. A recent analysis of National Health and Nutrition Examination Survey data from 1999 to 2002 yielded prevalence estimates for all teens from 2.0% to 9.4% and for obese teens from 12.4% to 44.2%.

### TABLE 11-1 American Diabetes Association (ADA) Screening Recommendations for Type 2 DM in Childhood

<table>
<thead>
<tr>
<th>Criteria:</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Overweight, defined by:</td>
</tr>
<tr>
<td>–BMI ≥ 85th percentile for age and gender, or</td>
</tr>
<tr>
<td>–Weight for height ≥ 85th percentile, or</td>
</tr>
<tr>
<td>–Weight &gt; 120% of ideal for height</td>
</tr>
<tr>
<td>Plus any two of the following risk factors:</td>
</tr>
<tr>
<td>● Family history of type 2 DM in first- or second-degree relative</td>
</tr>
<tr>
<td>● Race/ethnicity (Native American, African-American, Latino, Asian-American, Pacific Islander)</td>
</tr>
<tr>
<td>● Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, or polycystic ovary syndrome)</td>
</tr>
</tbody>
</table>

**Screening procedure:**

- **Age of initiation:** ≥10 y, or at onset of puberty, if puberty occurs at a younger age
- **Frequency:** Every 2 y
- **Test:** Fasting plasma glucose


### TABLE 11-2 Special Risk Pediatric Conditions: Stratification by Risk Category

**High risk**

- Manifest coronary artery disease at ≤30 y of age: clinical evidence
- T1DM or T2DM
- Chronic kidney disease/end-stage renal disease/post–renal transplant
- Post–orthotopic heart transplantation
- Kawasaki disease with current coronary aneurysms

**Moderate risk**

- Accelerated atherosclerosis: pathophysiologic evidence
- Kawasaki disease with regressed coronary aneurysms
- Chronic inflammatory disease (systemic lupus erythematosus, juvenile rheumatoid arthritis)
- HIV infection
- Nephrotic syndrome

is higher in older (12- to 14-year-old) compared with younger (8- to 11-year-old) children. The specific etiology of metabolic syndrome is unknown; however, it is most likely caused by the expression of various genotypes modified by environmental interactions and mediated through abdominal obesity and insulin resistance. Longitudinal studies of cohorts in which the metabolic syndrome cluster was present in childhood identified an increased incidence of both T2DM and clinical cardiovascular events over a follow-up period of 25 years. A strong association between obesity with or without elevated insulin levels and/or hypertension in early childhood and subsequent development of the metabolic syndrome constellation in adulthood has been consistently demonstrated. Treatment of cardiovascular risk-factor clustering in youth has not been thoroughly evaluated, but maintenance of low levels of cardiovascular risk factors starting in
The coexistence of obesity with any other major cardiovascular risk factor should be recognized by clinicians as a setting in which:

- intensive weight reduction should be undertaken per the recommendations in “Overweight and Obesity,” along with management of identified risk factors including initiation of pharmacologic therapy, per the risk-factor–specific sections in these guidelines (“High BP”; “Lipids and Lipoproteins”; “DM and Other Conditions Predisposing to the Development of Accelerated Atherosclerosis”; “Tobacco Exposure”); and
- prompt evaluation for DM, liver-function abnormalities, left ventricular hypertrophy, and sleep apnea should be undertaken.

These recommendations are supported by the knowledge that cardiovascular morbidity has a continuous relationship across the risk-distribution spectrum and that a youth with multiple borderline risk factors might, in fact, have risk equivalent to a person with extreme abnormality of a single major risk factor. A presentation such as this should lead to intense nutrition and exercise management with close follow-up, and if lifestyle intervention is unsuccessful, consideration should be given to endocrine referral. Table 12-1 provides definitions of component risk-factor levels for evaluating children with multiple cardiovascular risk factors.
TABLE 12-1 Metabolic Syndrome Component Levels for Evaluation of Children With Multiple Cardiovascular Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cut Point</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity, percentile</td>
<td>≥85th to &lt;95th</td>
<td>CDC growth charts</td>
</tr>
<tr>
<td>BMI</td>
<td>≥90th to &lt;95th</td>
<td>NHANES</td>
</tr>
<tr>
<td>BP, percentile</td>
<td>≥90th to &lt;95th</td>
<td>See “Lipids and Lipoproteins” for normative values</td>
</tr>
<tr>
<td>Dyslipidemia, mg/dL</td>
<td></td>
<td>NHANES</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>≥40 to ≤45</td>
<td>ADA screening recommendations</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>≥75 to &lt;100</td>
<td>ADA screening recommendations</td>
</tr>
<tr>
<td>0–9 y</td>
<td>≥90 to &lt;130</td>
<td>ADA screening recommendations</td>
</tr>
<tr>
<td>Non-HDL cholesterol</td>
<td>≥120 to &lt;144</td>
<td>ADA screening recommendations</td>
</tr>
<tr>
<td>Fasting glucose</td>
<td>≥100 to &lt;126</td>
<td>ADA screening recommendations</td>
</tr>
<tr>
<td>Fasting insulin</td>
<td>Elevated fasting insulin level, above normal for gender, race, and pubertal status, is considered evidence of insulin resistance</td>
<td>ADA screening recommendations</td>
</tr>
</tbody>
</table>

NHANES indicates National Health and Nutrition Examination Survey; ADA, American Diabetes Association.

TABLE 13-1 Evidence-Based Recommendations for Maternal Smoking Cessation

<table>
<thead>
<tr>
<th>Smoking-cessation guidance during pregnancy is strongly advised</th>
<th>Grade A, strongly recommend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supportive action:</td>
<td></td>
</tr>
<tr>
<td>Pediatric care providers should be provided with appropriate</td>
<td></td>
</tr>
<tr>
<td>training and materials to deliver, or refer to, a smoking-</td>
<td></td>
</tr>
<tr>
<td>cessation program in the postpartum period for all smoking</td>
<td></td>
</tr>
<tr>
<td>women of childbearing age</td>
<td></td>
</tr>
<tr>
<td>This intervention should be directly linked to ongoing smoke-</td>
<td></td>
</tr>
<tr>
<td>free home recommendations directed at all young mothers and</td>
<td></td>
</tr>
<tr>
<td>fathers as described in the “Tobacco Exposure” section</td>
<td></td>
</tr>
</tbody>
</table>

Grades reflect the findings of the evidence review; recommendation levels reflect the consensus opinion of the expert panel; and supportive actions represent expert consensus suggestions from the expert panel provided to support implementation of the recommendations (they are not graded).

13. PERINATAL FACTORS

Increasing evidence links prenatal exposures to adverse health outcomes. Perinatal risk reduction is an area in which pediatric care providers can potentially be effective, because they are often the only physicians whom a mother sees between pregnancies. The expert panel identified 3 potential areas for consideration: maternal obesity; choice of neonatal feeding method; and maternal smoking cessation. Maternal obesity is associated with gestational DM, higher birth weight, childhood obesity measured by increased BMI, and increased risk of the metabolic syndrome and T2DM in offspring. However, the expert panel could not identify any prepregnancy or postpartum studies that addressed maternal obesity in a pediatric care setting, and more general approaches to preventing or treating obesity in women of reproductive age are beyond the scope of this report. A detailed discussion of childhood obesity itself is the subject of “Overweight and Obesity.” With regard to choice of neonatal feeding method, the cardiovascular advantages of breastfeeding as the primary source of nutrition for infants are emphasized in “Nutrition and Diet.” Therefore, the evidence review for this section is focused on maternal smoking cessation.

Conclusions and Grading of the Evidence Review on Maternal Smoking Cessation

- The expert panel found that strong evidence supports a benefit for interventions directed at maternal smoking cessation during pregnancy (grade A). Weaker evidence suggests that these interventions do not prevent relapse after delivery. Trials of cessation in the postpartum period, which would be the most applicable to pediatric providers, have been limited in number and suggest that for maternal smoking cessation to be sustained, specific continued support in the pediatric care setting is required.
- No smoking-cessation interventions have resulted in any reported adverse effects related to the interventions (no grade).
- The expert panel believes that pediatric care providers can play a role in helping mothers to remain smoke-free or to quit smoking in the interpregnancy interval. For most women, this interval will extend to the early first trimester of any subsequent pregnancy. The pediatric well-child schedule calls for ~10 visits in the first 2 years of life, and mothers attend most of those visits, so the pediatric care provider usually sees women in this period more than any other health care professional. Pediatric care providers often have a sustained relationship with the mother and her infant, and many already advocate for parental smoking cessation in their efforts to promote a smoke-free environment for children. Pediatric providers and/or their staff need to be trained to either deliver or refer to a long-term maternal smoking-cessation program (no grade).

Recommendations for maternal smoking cessation are listed in Table 13-1.
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth to 24 mo</td>
<td>No weight-for-height-specific recommendations</td>
</tr>
<tr>
<td>2 to 5 y</td>
<td>Identify children at high risk for obesity because of parental obesity and excessive BMI increase</td>
</tr>
<tr>
<td>6 to 11 y</td>
<td>Identify children at increased risk for obesity because of parental obesity, change in physical activity ± excessive gain in BMI for focused CHILD-1 diet/physical activity education</td>
</tr>
<tr>
<td>12 to 21 y</td>
<td>Identify adolescents at increased risk for obesity because of parental obesity, change in physical activity ± excessive gain in BMI for focused CHILD-1 diet/physical activity education</td>
</tr>
</tbody>
</table>

**References**


17. Kavey RE, Allada V, Daniels SR, et al; American Heart Association Expert Panel on Population and Prevention Science; American Heart Association Council on Cardiovascular Disease in the Young; American Heart Association Council on Epidemiology and Prevention; American Heart Association Council on Nutrition, Physical Activity and Metabolism; American Heart Association Council on High Blood Pressure Research; American Heart Association Council on Cardiovascular Nursing; American Heart Association Council on the Kidney in Heart Disease; Interdisciplinary Working Group on Quality of Care and Outcomes Research. Cardiovascular risk reduction in high-risk pediatric patients: a scientific statement from the American Heart Association Expert Panel on Population and Prevention Science; the Councils on Cardiovascular Disease in the Young, Epidemiology and Prevention, Nutrition, Physical Activity and Metabolism, High Blood Pressure Research, Cardiovascular Nursing, and the Kidney in Heart Disease; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research: endorsed by the American Academy of Pediatrics. Circulation. 2006;114(24):2710–2738


(Continued from first page)

Associates for the State of Ohio, Bureau of Early Intervention Services and Help Me Grow program, and has received funding/grant support for research from the NIH; Dr Kwaterovich has served as a consultant or advisory board member for Merck, Schering-Plough, Pfizer, Sankyo, Liposcience, and Astra Zenea, has served on speaker’s bureaus for Merck, Schering-Plough, Pfizer, Sankyo, Kos, and Astra Zenea, and has received funding/grant support for research from Pfizer, Merck, GlaxoSmithKline, Sankyo, and Schering-Plough; Dr McBride has served as a consultant or advisory board member for Bristol-Myers Squibb and Merck and has served on speaker’s bureaus for Kos, Merck, and Pfizer but declares no relevant relationships since July 2007; Dr McCondle has been a consultant for Abbott, Bristol-Myers Squibb, Daichi Sankyo, and Roche, owns stock in CellAgios and reports funding/grant support for research from Astra Zenea, Sankyo, Merck, Schering-Plough, and the NIH; Dr Urbina reports funding/grant support for research from Merck, Schering-Plough, Sankyo, and the NIH; and Dr VanHorn has provided advice to Chartwells School Food Service and has received funding/grant support for research from General Mills and the NIH. Drs Benuck, Christoph, Denson, O’Donnell, Rocchi, and Washington have indicated they have no financial relationships relevant to this article to disclose.

Funded by the National Institutes of Health (NIH).