



# Pediatric Healthy Weight Toolkit

A Toolkit for Health Professionals

**Kids and Teens**  
Weight Management  
Healthy Eating Habits  
Physical Activity



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South Carolina

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## Assessment

At a minimum, health care professionals should perform an annual assessment of weight status in all children under their care. Assessment should include these components:

### Medical and Family History

- Identify familial risks (e.g., overweight/obesity, type 2 diabetes, high blood pressure, heart disease, high cholesterol).
- Identify underlying syndromes or secondary complications of overweight and obesity (e.g., hypothyroidism, polycystic ovarian syndrome, Prader-Willi syndrome, diabetes, sleep apnea).

### BMI Assessment

Measure height and weight, calculate BMI and use the enclosed BMI wheel to document BMI percentile for age. You may also document BMI percentile by plotting the values on the grids found on page 19 and 20 of this toolkit and placing that information in the medical record.\*

\*Adolescents age 16 and older only require documentation of the standard BMI value of kg/m<sup>2</sup>.

### Physical Examination

- Measure blood pressure.
- Inspect and examine body systems to identify underlying syndromes or secondary complications of overweight and obesity (e.g., hirsutism, dysmorphic features, slipped capital femoral epiphysis, leg bowing, acanthosis nigricans).

### Physical Activity and Nutrition Assessment

Document counseling for both nutrition and physical activity. Counseling may include one or more of these:

- Discussion of current nutrition and physical activity behaviors (eating habits, diets, sports, exercise routines, etc.)
- Checklist indicating both nutrition and physical activity was addressed

- Counseling or referral for both nutrition and physical activity education
- Providing educational materials on both nutrition and physical activity
- Anticipatory guidance for both nutrition and physical activity

### Psychosocial Assessment

- Screen for depression, if indicated (e.g., Center for Epidemiological Studies Depression Scale for Children).
- Assess family support and readiness to change.

### Laboratory Testing

Examples include, but are not limited to, fasting lipid profile, liver function tests, fasting plasma glucose and insulin levels, and are based on history or exam findings. If the BMI for age and sex is:

- 85th to 94th percentile (overweight) with no risk factors: Obtain fasting lipid profile.
- 85th to 94th percentile (overweight) with risk factors in history or physical examination: Obtain also aspartate aminotransferase, or AST; alanine aminotransferase, or ALT; and fasting glucose.
- Greater than the 95th percentile (obese), even in the absence of risk factors: Obtain all of the tests listed in second bullet point above, plus blood urea nitrogen, or BUN, creatinine and HbA1C (with presence of other risk factors for diabetes).

### Hyperlipidemia Screening

AHA recommends targeting children over age 2 who meet these criteria:\*

- Family history of dyslipidemia
- Unknown family history along with risk factors
- Premature cardiovascular disease
- Presence of overweight or obesity

\*increased risk if male with HDL <45 or female with HDL <50

## Reference Lab Values

| Glucose testing  | Normal     | Impaired      | Diabetes     |
|--|------------|---------------|--------------|
| Fasting Plasma Glucose   | <100 mg/dl | 100–125 mg/dl | ≥ 126 mg/dl* |
| Two-hour modified OGTT<br>(Perform test using a glucose load containing equivalent of 75g anhydrous glucose dissolved in water.) (OGTT is not recommended for routine clinical use.) | <140 mg/dl | 140–199 mg/dl | ≥ 200 mg/dl* |

*Diabetes Care* 2006; 29 (Suppl.1):S47

**\*In absence of unequivocal hyperglycemia, confirm by repeat testing on a different day.**

| Lipids           | Cholesterol (mg/dl) |            |      | LDL (mg/dl) |            |      | HDL (mg/dl) |
|------------------|---------------------|------------|------|-------------|------------|------|-------------|
|                  | Desirable           | Borderline | High | Desirable   | Borderline | High | Desirable   |
| Child/adolescent | <170                | 170–199    | >200 | <110        | 110–129    | >130 | 45          |

Johns Hopkins: *The Harriet Lane Handbook: A Manual for Pediatric House Officers*, 17th ed., Copyright © 2005 Mosby

| Percentile                  |     |      |      |      |      |  |
|-----------------------------|-----|------|------|------|------|--|
| Total Triglycerides (mg/dl) | 5th | Mean | 75th | 90th | 95th |  |
| <b>1–4 year</b>             |     |      |      |      |      |  |
| Male                        | 29  | 56   | 68   | 85   | 99   |  |
| Female                      | 34  | 64   | 74   | 95   | 112  |  |
| <b>5–9 year</b>             |     |      |      |      |      |  |
| Male                        | 28  | 52   | 58   | 70   | 85   |  |
| Female                      | 32  | 64   | 74   | 103  | 126  |  |
| <b>10–14 year</b>           |     |      |      |      |      |  |
| Male                        | 33  | 63   | 74   | 94   | 111  |  |
| Female                      | 39  | 72   | 85   | 104  | 120  |  |
| <b>15–19 year</b>           |     |      |      |      |      |  |
| Male                        | 38  | 78   | 88   | 125  | 143  |  |
| Female                      | 36  | 73   | 85   | 112  | 126  |  |

## Assessment/Reference Lab Values

## Reference Lab Values

### Reference Lab Values *continued*

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| Aspartate Aminotransferase (AST) | Normal Values |
|----------------------------------|---------------|
| 1–3 yr                           | 20–60 U/L     |
| 4–6 yr                           | 15–50 U/L     |
| 7–9 yr                           | 15–40 U/L     |
| 10–11 yr                         | 10–60 U/L     |
| 12–19 yr                         | 15–45 U/L     |

Johns Hopkins: *The Harriet Lane Handbook: A Manual for Pediatric House Officers*, 17th ed., Copyright © 2005 Mosby

| Creatinine (Serum) | Normal Values |
|--------------------|---------------|
| Child              | 0.3–0.7 mg/dl |
| Adolescent         | 0.5–1.0 mg/dl |

Johns Hopkins: *The Harriet Lane Handbook: A Manual for Pediatric House Officers*, 17th ed., Copyright © 2005 Mosby

| Blood Urea Nitrogen (BUN) | Normal Values |
|---------------------------|---------------|
| Infant/Child              | 5–18 mg/dl    |

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# Strategies to Maintain Healthy Weight in Children

Adapted from the *AMA/CDC Recommendations on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity*. June 2007.

## Recommendations

Physicians and allied health care professionals should provide the following guidance for children ages 2–18 whose BMI is  $\geq$  the 5th percentile and  $\leq$  the 84th percentile:

- Dietary intake:
  - Limit consumption of sugar-sweetened beverages and encourage consumption of diets with recommended quantities of fruits and vegetables.
  - Eat a diet rich in calcium.
  - Eat a diet high in fiber.
  - Eat a diet with balanced macronutrients (calories from fat, carbohydrates, and protein in proportions for age recommended by Dietary Intake References such as USDA Food Pyramid at **USDA.gov**).
- Physical activity:

Children of healthy weight should participate in 60 minutes of moderate to vigorous physical activity daily, unless contraindicated.

  - The 60 minutes can be accumulated throughout the day.
  - Ideally, such activity should be enjoyable to the child.
  - Whereas some health and psychological benefits may be attained by achieving the 60-minute goal, greater duration should yield increased benefit.
- Screen Time:
  - Limit television and other screen time to 1 or 2 hours per day in children as young as age 5, as advised by the American Academy of Pediatrics, and remove television and computer screens from children's primary sleeping areas.



## Strategies to Maintain Healthy Weight in Children

### Strategies to Maintain Healthy Weight in Children *continued*

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- Eating behaviors:
  - Eat breakfast daily.
  - Limit eating out at restaurants, particularly fast-food restaurants.
  - Encourage family meals in which parents and children eat together.
  - Limit portion size.
- Health care professionals who wish to support obesity prevention in clinical, school and community settings should:
  - Actively engage families with parental obesity or maternal diabetes, because these children are at increased risk for developing obesity even if they currently have normal BMI.
  - Encourage an authoritative\* parenting style in support of increased physical activity and reduced sedentary behavior, providing tangible, motivational support for children.
  - Encourage parents to model healthy diets and portion sizes, physical activity and limited television time.
  - 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.

\* Authoritative parents are both demanding and responsive. “They monitor and impart clear standards for their children’s conduct. They are assertive, but not intrusive and restrictive. Their disciplinary methods are supportive, rather than punitive. They want their children to be assertive as well as socially responsible, and self-regulated as well as cooperative.” (Baumrind, 1991, p. 62).



# Treatment Recommendations for Overweight and Obese Children

*(Includes strategies noted previously)*

Adapted from the *AMA/CDC Recommendations on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity*. June 2007.

The treatment of overweight children should be approached in a staged method based upon the child's age, BMI, any related comorbidities, weight status of parents and progress in treatment; and the child's primary caregivers and families should be involved in the process.

Children 2–19 with BMI > 85th percentile:

**Stage 1. Prevention Plus protocol:** These recommendations can be implemented by the primary care physician or allied health care professional who has some training in pediatric weight management or behavioral counseling. Within this category, the goal should be weight maintenance with growth that results in a decreasing BMI as age increases. Stage 1 recommendations include:

- Dietary habits and physical activity:
  - Five or more servings of fruits and vegetables per day
  - Two hours or less of screen time per day, and no television in the room where the child sleeps
  - One hour or more of daily physical activity
  - No sugar-sweetened beverages
- Patients and families of the patient should be counseled to facilitate these eating behaviors:
  - Eating a daily breakfast
  - Limiting meals outside of the home
  - Family eating meals together at least five times per week
  - Allowing the child to self-regulate his or her meals and avoiding overly restrictive behaviors
- Follow-up: After 3–6 months, if there is no improvement in BMI or weight status, advance to Stage 2, based on patient and family readiness to change.



## Treatment Recommendations for Overweight and Obese Children

### Treatment Recommendations for Overweight and Obese Children *continued*

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**Stage 2. Structured Weight Management protocol:** These recommendations can be implemented by a primary care physician or allied health care professional highly trained in weight management. Stage 2 recommendations include:

- Dietary and physical activity behaviors:
  - Development of a plan for using a balanced macronutrient diet emphasizing low amounts of energy-dense foods
  - Increased structured daily meals and snacks
  - Supervised active play of at least 60 minutes per day
  - Screen time of one hour or less per day
  - Increased monitoring (e.g., screen time, physical activity, dietary intake, restaurant logs) by health care professional, patient or family
- Within this category, goal should be weight maintenance that results in a decreasing BMI as age and height increases; however, weight loss should not exceed 1 pound per month in children 2–11 years, or an average of 2 pounds per week in older overweight or obese children and adolescents.
- If no improvement in BMI weight after 3–6 months, patient may be referred to a multidisciplinary obesity care team.



## Effective Communication with Families

Scott Gee, M.D.; Sandra Roberts, R.N.; Amanda Howell. Adapted with permission from copyrighted material by Regional Health Education, Permanente Medical Group, Northern California.

### With whom do you communicate?

Discuss issues with children in a manner appropriate to their developmental capacity and always include a parent or primary caregiver.

### Children of Healthy Weight (BMI <85<sup>th</sup> percentile)

Lifestyle advice for well-child or urgent visit can be less than one minute.

#### Can you ... every day?

- B Eat a healthy BREAKFAST
- 5 Eat at least FIVE or more fruits and vegetables
- 4 Drink FOUR glasses of water
- 3 Have THREE servings of dairy
- 2 Limit screen time (computer, TV, video games) to less than TWO hours
- 1 Be physically active for at least ONE hour
- 0 AVOID sweetened beverages

Source: South Carolina Institute for Childhood Obesity and Related Disorders

### Children Who Are Overweight or Obese (BMI ≥85<sup>th</sup> percentile)

#### 1 Engage the Patient and Parent

- Can we take a few minutes together to discuss your health and weight?
- How do you feel about your health and weight?

#### 2 Share Information

- Your current weight puts you at risk for developing heart disease and diabetes.
- What do you make of this?
- What are your ideas for working toward a healthy weight?

#### 3 Make a Key Advice Statement

##### Can you ... every day?

- B Eat a healthy BREAKFAST
- 5 Eat at least FIVE or more fruits and vegetables
- 4 Drink FOUR glasses of water
- 3 Have THREE servings of dairy
- 2 Limit screen time (computer, TV, video games) to less than TWO hours
- 1 Be physically active for at least ONE hour
- 0 AVOID sweetened beverages

Use patient ideas on working toward a healthy weight from step 2 above.



### Effective Communication with Families *continued*

## 4 Assess Readiness (optional)

- On a scale from 0 to 10, how ready are you to consider taking steps to achieve a healthy weight?  
*To explore answer, consider these types of questions:*
- Straight question: *Why a 5?*
- Backward question: *Why a 5 and not a 3?*
- Forward question: *What would it take to move you from a 5 to a 7?*

|                        |          |          |          |          |          |          |          |          |          |          |           |
|------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| <b>Readiness Scale</b> | <b>0</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> |
|------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|

| Stage of Readiness      | Recommended Approach   | Key Questions  |
|-------------------------|--|--|
| <b>Not Ready</b><br>0–3 | <input type="checkbox"/> Raise awareness<br><input type="checkbox"/> Elicit change talk<br><input type="checkbox"/> Advise and encourage             | <input type="checkbox"/> Would you be interested in knowing more about reaching a healthy weight?<br><input type="checkbox"/> How can I help?<br><input type="checkbox"/> What might need to be different for you to consider a change in the future?  |
| <b>Unsure</b><br>4–6    | <input type="checkbox"/> Evaluate ambivalence<br><input type="checkbox"/> Elicit change talk<br><input type="checkbox"/> Build readiness             | <input type="checkbox"/> Where does that leave you now?<br><input type="checkbox"/> What do you see as your next steps?<br><input type="checkbox"/> What are you thinking and feeling at this point?   |
| <b>Ready</b><br>7–10    | <input type="checkbox"/> Strengthen commitment<br><input type="checkbox"/> Elicit change talk<br><input type="checkbox"/> Facilitate action planning | <input type="checkbox"/> Why is this important to you now?<br><input type="checkbox"/> What are your ideas for making this work?<br><input type="checkbox"/> What might get in the way? How might you work around the barriers?<br><input type="checkbox"/> How might you reward yourself along the way? |

## 5 Explore Ambivalence (if relevant)

*Step 1: Ask a pair of questions to help the patient explore the pros and cons of the issue you are discussing with the patient.*

- What are the things you like about \_\_\_\_? **AND** What are the things you don't like about \_\_\_\_?  
**OR**
- What are the advantages of keeping things the same? **AND** What are the advantages of making a change?

*Step 2: Summarize ambivalence.*

- Let me see if I understand what you've told me so far. (Begin with reasons for maintaining the status quo; end with reasons for making a change.)
- Ask: Did I get it all? Did I get it right?

## 6 Close the Encounter

- Summarize: Our time is almost up. Let's take a look at what you've worked through today.
- Show appreciation, acknowledge willingness to discuss change: Thank you for being willing to discuss your weight.
- Offer advice, emphasize choice, express confidence: I strongly encourage you to be more physically active. The choice to increase your activity, of course, is entirely yours. I am confident that if you decide to be more active you can be successful.
- Confirm next steps and arrange follow up.

## ***Overweight and obese children are at increased risk of developing type 2 diabetes throughout their life span.***

### **Risk Factors and Identification**

- BMI > 85th percentile for age and sex, or weight >120 percent of ideal body weight
- Member of high-risk ethnic groups, such as African-Americans, American Indians, Hispanic or Latino Americans and some Asian or Pacific Islander Americans
- Family member who has type 2 diabetes
- Age > 10 years
- Having signs of insulin resistance, including acanthosis nigricans, high blood pressure and dyslipidemia
- Early-onset puberty

### **Diagnosing Diabetes<sup>1,2</sup>**

- Random glucose level is >200 mg/dl
- Fasting glucose level is >126 mg/dl
- Two-hour postprandial glucose level is >200 mg/dl
- Elevated insulin and C-peptide levels with no autoantibodies to islet cells or insulin also indicates type 2 diabetes

### **At Diagnosis<sup>3,4</sup>**

Diabetes care for children should be provided by a team that can address medical, educational, nutritional and behavioral issues. The team usually consists of a physician, diabetes educator, dietitian and a social worker or psychologist, along with the patient and family.

- Establish treatment regimen and goals.
- Check lipids in children with a significant family history. In children with no significant family history, check lipids at puberty and if normal, repeat profile every five years.
- Diabetes self-management education on:
  - Healthy eating habits
  - Daily physical activity
  - Insulin and medication administration
  - Self-monitoring of blood glucose levels, if appropriate
  - Routine dental care

The individual and family need a solid educational base so that they can become independent in managing their diabetes.

An individual experienced with the nutritional needs of the growing child and the behavioral issues that may impact adolescent diets should provide nutritional therapy.

For adolescents, the **HEADSS** Psychosocial Interview for Adolescents (home/health, education/employment, activities, drugs, depression, safety, sexuality) is recommended.<sup>5</sup>

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<sup>1</sup>Type 2 Diabetes in Children and Adolescents: Screening, Diagnosis, and Management. *Journal of the American Academy of Physician Assistants*, Vol 20 (3), March 2007.

<sup>2</sup>Type 2 Diabetes in Children and Adolescents. *Diabetes Care*, Vol 23(3), March 2000.

<sup>3</sup>Overview of Diabetes in Children and Adolescents. *National Diabetes Education Program*. August 2006.

<sup>4</sup>American Diabetes Association. Clinical Practice Recommendations – Standards of Medical Care in Diabetes. *Diabetes Care* 2005; 28(Suppl. 1): S4-36.

<sup>5</sup>Preventive Health Counseling for Adolescents. *American Family Physician*, 74(7), October 2006.

## Type 2 Diabetes In Children

### Ongoing Evaluation and Monitoring after Diagnosis: Physical Examination<sup>6</sup>

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| Physical Examination Component                                  | Frequency   |
|---|---|
| Weight  | Initially every 3 months*   |
| Height, BMI   | Initially every 3 months*   |
| Blood pressure  | Initially every 3 months*   |
| Injection sites   | Every 3 months  |
| Self-testing blood glucose records                              | Every 3 months  |
| Skin<br>(acanthosis nigricans, hirsutism, tinea, acne)          | Every 12 months   |
| Examine feet<br>(pedal pulses, neurological examination, nails) | Every 12 months but visual foot check every 3 months                                      |
| Refer patient for nutrition therapy                             | At diagnosis; re-evaluate every 12 months   |
| Conduct psychosocial assessment such as HEADDSS                 | At diagnosis and every three months (if needed)   |
| Provide ophthalmologic examination                              | Annually (less often on the advice of an eye care professional) after 5 years of diabetes |
| Administer influenza vaccination                                | Annually  |

\*May decrease to every 6 months if linear growth is complete and glucose is well controlled.

### Ongoing Evaluation and Monitoring After Diagnosis: Laboratory Evaluation<sup>\*7</sup>

| Test   | Frequency   |
|--|---|
| Individualized self monitoring blood glucose                   | Fasting (and preprandial glucose daily)                         |
| Fasting plasma glucose test                                    | Initially and ongoing   |
| HbA1c  | Every 3 months  |
| Urinalysis   | Every 12 months   |
| Microalbuminuria to creatinine ratio                           | At diagnosis and then every 12 months after 5 years of diabetes |
| Creatinine   | At diagnosis  |
| Lipid profile (for children with significant family history)** | At diagnosis and every 1–2 years                                |
| LFTs (liver function test)                                     | At diagnosis (before initiating oral hypoglycemic agents)       |

\* A requirement for more frequent monitoring may be determined at diagnosis, during initiation of new treatment, and during metabolic changes (illness, stress, increased activity, and growth).

\*\* In children with no significant family history, check lipids at puberty and if normal, repeat profile every five years.

<sup>6</sup>Overview of Diabetes in Children and Adolescents. *National Diabetes Education Program*. August 2006.

<sup>7</sup>Prevention and Treatment of Type 2 Diabetes Mellitus in Children, With Special Emphasis on American Indian and Alaska Native Children. *Pediatrics* 2003; 112

## Treatment Strategies and Goals<sup>8</sup>

Treatment for type 2 diabetes in children should include nutrition management, regular physical activity, regular blood glucose checks and taking all medications as prescribed.

**Nutrition plans** may be developed in conjunction with a registered dietitian or diabetes educator. For more information, visit the American Dietetic Association Web site at [eatright.org](http://eatright.org).

Ideally, children with type 2 diabetes should engage in a total of 60 minutes of **physical activity** per day. Physical activity is critical because it helps to lower blood glucose levels and helps children manage their weight.

Young people with diabetes should know the acceptable range for their blood glucose level. Children using insulin should check blood glucose values on a regular basis with a blood glucose meter. In addition, parents, caregivers, and health professionals can help children learn how to take their medications as prescribed.

**Treatment goals** include adequate metabolic control (HbA1c concentration <7%) and prevention of microvascular and macrovascular complications. More specifically, treatment objectives include:

- Avoiding hypoglycemia and eliminating symptoms of hyperglycemia
- Assisting the patient in maintaining a reasonable body weight
- Decreasing cardiovascular risk factors and risk of early kidney disease
- Achieving overall improvement in the child's physical and emotional well-being

All treatment plans should be customized with the child's unique family and social circumstances in mind.

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<sup>8</sup>National Diabetes Education Program. *Overview of Diabetes in Children and Adolescents*. August 2006.



### Blood Glucose Goals

To control diabetes and prevent complications, blood glucose levels must be managed as close to a normal range as is safely possible (70 to 100 mg/dl before eating). Families should work with their health care team to set target blood glucose levels appropriate for the child.

The American Diabetes Association has developed recommendations for blood glucose goals for young people with type 1 diabetes. Although there is no unified national recommendation for children with type 2 diabetes, it may be reasonable to use the values in the following table as a guide.

| Optimal plasma blood glucose and A1C goals for type 1 diabetes by age group <sup>9</sup> |   |                   |               |   |
|--|---|-------------------|---------------|---|
| Values by Age (Years)  | Plasma Blood Glucose Goal Range (mg/dl) |                   | A1C Percent   | Rationale   |
|  | Before Meals                            | Bedtime/Overnight |               |   |
| Toddlers and preschoolers under age 6  | 100–180                                 | 110–200           | ≤8.5 but ≥7.5 | High risk and vulnerability to hypoglycemia                                     |
| Ages 6 to 12   | 90–180                                  | 100–180           | <8            | Risks of hypoglycemia and relatively low risk of complications prior to puberty |
| Adolescents and young adults, ages 13 to 19  | 90–130                                  | 90–150            | <7.5*         | Risk of hypoglycemia<br>Developmental and psychological issues                  |

\* A lower goal (<7.0) is reasonable if it can be achieved without excessive hypoglycemia.

Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on comparing the benefits to the risks.
- Blood glucose goals should be higher than those listed above in children with frequent hypoglycemia or hypoglycemia unawareness.
- Postprandial blood glucose values should be measured when there is a disparity between preprandial blood glucose values and A1C levels.



<sup>9</sup>National Diabetes Education Program. *Overview of Diabetes in Children and Adolescents*. August 2006.

# Hypertension in Children: Definition and Evaluation

## Definition of Hypertension

- Hypertension is defined as average systolic blood pressure or diastolic blood pressure >95th percentile for gender, age and height on  $\geq 3$  occasions.
- Prehypertension in children is defined as average SBP or DBP levels that are  $\geq 90$ th percentile but <95th percentile; as with adults, adolescents with BP level  $\geq 120/80$  mm Hg should also be considered prehypertensive.

## Clinical Evaluation of Confirmed Hypertension

| Study or Procedure  | Purpose   | Target Population  |
|---|---|--|
| <b>Evaluation for identifiable causes</b>   |   |  |
| Physical examination, history including sleep history, family history, risk factors, diet and habits such as smoking and drinking alcohol | History and physical examination help focus subsequent evaluation | All children with persistent BP $\geq 95$ th percentile  |
| BUN, creatinine, electrolytes, urinalysis and urine culture   | R/O renal disease and chronic pyelonephritis                      | All children with persistent BP $\geq 95$ th percentile  |
| CBC   | R/O anemia, consistent with chronic renal disease                 | All children with persistent BP $\geq 95$ th percentile  |
| Renal U/S   | R/O renal scar, congenital anomaly, or disparate renal size       | All children with persistent BP $\geq 95$ th percentile  |
| <b>Evaluation for target-organ damage</b>   |   |  |
| Echocardiogram  | Identify LVH and other indications of cardiac involvement         | Patients with comorbid risk factors* and BP 90th-94th percentile; all patients with BP $\geq 95$ th percentile |
| Retinal Exam  | Identify retinal vascular changes                                 | Patients with comorbid risk factors and BP 90th-94th percentile; all patients with BP $\geq 95$ th percentile  |

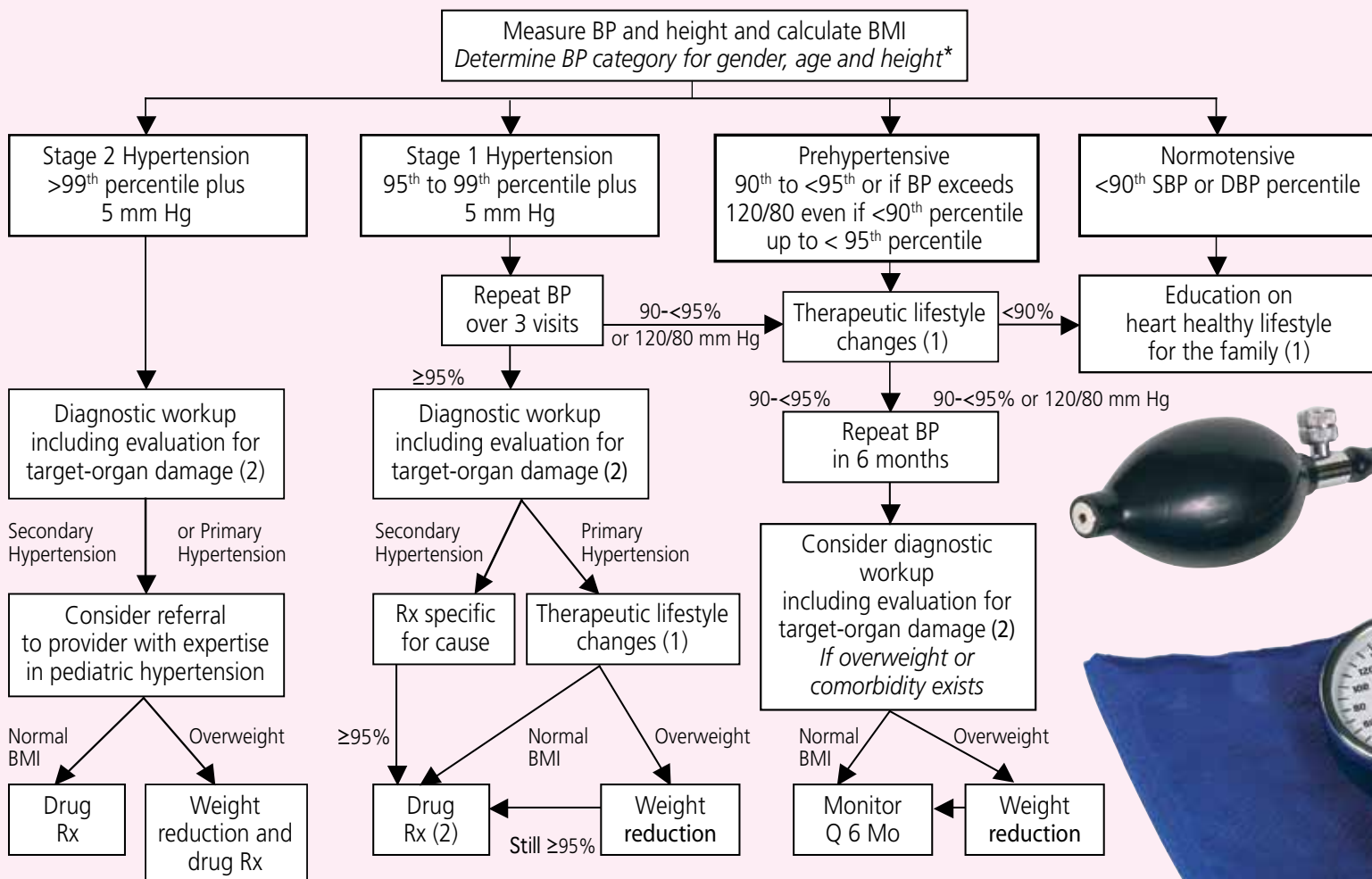
Selected excerpts from "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents," *Pediatrics*, Vol. 114, No. 2, August 2004

BUN, blood urea nitrogen; CBC, complete blood count; LVH, left ventricular hypertrophy; R/O rule out; U/S, ultrasound.

\*Comorbid risk factors also includes diabetes mellitus and kidney disease.

(Hypertension Management Algorithm over)

## Hypertension Management Algorithm



\*See tables titled Blood Pressure Levels for Boys and Girls by Age and Height Percentile  
 (1) Therapeutic Lifestyle Changes (below)  
 (2) Especially if younger, very high BP, little or no family history, diabetic or other risk factors.

### Therapeutic Lifestyle Changes

- Weight reduction is the primary therapy for obesity-related hypertension. Prevention of excess or abnormal weight gain will limit future increases in BP.
- Regular physical activity and restriction of sedentary activity will improve efforts at weight management and may prevent an excess increase in BP over time.
- Dietary modification should be strongly encouraged in children and adolescents who have BP levels in the prehypertensive range as well as those with hypertension.
- Family-based intervention improves success.

### Indication for Antihypertensive Drug Therapy in Children

- Symptomatic hypertension
- Diabetes (types 1 and 2)
- Secondary hypertension
- Persistent hypertension despite nonpharmacologic measures
- Hypertensive target-organ damage

From "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents," *Pediatrics*, Vol. 114, No. 2, August 2004

# Blood Pressure Levels for Girls by Age and Height Percentile

Available online at [http://www.nhlbi.nih.gov/guidelines/hypertension/child\\_tbl.pdf](http://www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.pdf), August 2007.

| Age<br>(Year) | BP<br>Percentile | Systolic BP (mm Hg)  |                  |                  |                  |                  |                  |                  | Diastolic BP (mm Hg) |                  |                  |                  |                  |                  |                  |
|---------------|------------------|----------------------|------------------|------------------|------------------|------------------|------------------|------------------|----------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|               |                  | Percentile of Height |                  |                  |                  |                  |                  |                  | Percentile of Height |                  |                  |                  |                  |                  |                  |
|               |                  | 5 <sup>th</sup>      | 10 <sup>th</sup> | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 90 <sup>th</sup> | 95 <sup>th</sup> | 5 <sup>th</sup>      | 10 <sup>th</sup> | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 90 <sup>th</sup> | 95 <sup>th</sup> |
| 2             | 90 <sup>th</sup> | 98                   | 99               | 100              | 101              | 103              | 104              | 105              | 57                   | 58               | 58               | 59               | 60               | 61               | 61               |
|               | 95 <sup>th</sup> | 102                  | 103              | 104              | 105              | 107              | 108              | 109              | 61                   | 62               | 62               | 63               | 64               | 65               | 65               |
|               | 99 <sup>th</sup> | 109                  | 110              | 111              | 112              | 114              | 115              | 116              | 69                   | 69               | 70               | 70               | 71               | 72               | 72               |
| 3             | 90 <sup>th</sup> | 100                  | 100              | 102              | 103              | 104              | 106              | 106              | 61                   | 62               | 62               | 63               | 64               | 64               | 65               |
|               | 95 <sup>th</sup> | 104                  | 104              | 105              | 107              | 108              | 109              | 110              | 65                   | 66               | 66               | 67               | 68               | 68               | 69               |
|               | 99 <sup>th</sup> | 111                  | 111              | 113              | 114              | 115              | 116              | 117              | 73                   | 73               | 74               | 74               | 75               | 76               | 76               |
| 4             | 90 <sup>th</sup> | 101                  | 102              | 103              | 104              | 106              | 107              | 108              | 64                   | 64               | 65               | 66               | 67               | 67               | 68               |
|               | 95 <sup>th</sup> | 105                  | 106              | 107              | 108              | 110              | 111              | 112              | 68                   | 68               | 69               | 70               | 71               | 71               | 72               |
|               | 99 <sup>th</sup> | 112                  | 113              | 114              | 115              | 117              | 118              | 119              | 76                   | 76               | 76               | 77               | 78               | 79               | 79               |
| 5             | 90 <sup>th</sup> | 103                  | 103              | 105              | 106              | 107              | 109              | 109              | 66                   | 67               | 67               | 68               | 69               | 69               | 70               |
|               | 95 <sup>th</sup> | 107                  | 107              | 108              | 110              | 111              | 112              | 113              | 70                   | 71               | 71               | 72               | 73               | 73               | 74               |
|               | 99 <sup>th</sup> | 114                  | 114              | 116              | 117              | 118              | 120              | 120              | 78                   | 78               | 79               | 79               | 80               | 81               | 81               |
| 6             | 90 <sup>th</sup> | 104                  | 105              | 106              | 108              | 109              | 110              | 111              | 68                   | 68               | 69               | 70               | 70               | 71               | 72               |
|               | 95 <sup>th</sup> | 108                  | 109              | 110              | 111              | 113              | 114              | 115              | 72                   | 72               | 73               | 74               | 74               | 75               | 76               |
|               | 99 <sup>th</sup> | 115                  | 116              | 117              | 119              | 120              | 121              | 122              | 80                   | 80               | 80               | 81               | 82               | 83               | 83               |
| 7             | 90 <sup>th</sup> | 106                  | 107              | 108              | 109              | 111              | 112              | 113              | 69                   | 70               | 70               | 71               | 72               | 72               | 73               |
|               | 95 <sup>th</sup> | 110                  | 111              | 112              | 113              | 115              | 116              | 116              | 73                   | 74               | 74               | 75               | 76               | 76               | 77               |
|               | 99 <sup>th</sup> | 117                  | 118              | 119              | 120              | 122              | 123              | 124              | 81                   | 81               | 82               | 82               | 83               | 84               | 84               |
| 8             | 90 <sup>th</sup> | 108                  | 109              | 110              | 111              | 113              | 114              | 114              | 71                   | 71               | 71               | 72               | 73               | 74               | 74               |
|               | 95 <sup>th</sup> | 112                  | 112              | 114              | 115              | 116              | 118              | 118              | 75                   | 75               | 75               | 76               | 77               | 78               | 78               |
|               | 99 <sup>th</sup> | 119                  | 120              | 121              | 122              | 123              | 125              | 125              | 82                   | 82               | 83               | 83               | 84               | 85               | 86               |
| 9             | 90 <sup>th</sup> | 110                  | 110              | 112              | 113              | 114              | 116              | 116              | 72                   | 72               | 72               | 73               | 74               | 75               | 75               |
|               | 95 <sup>th</sup> | 114                  | 114              | 115              | 117              | 118              | 119              | 120              | 76                   | 76               | 76               | 77               | 78               | 79               | 79               |
|               | 99 <sup>th</sup> | 121                  | 121              | 123              | 124              | 125              | 127              | 127              | 83                   | 83               | 84               | 84               | 85               | 86               | 87               |
| 10            | 90 <sup>th</sup> | 112                  | 112              | 114              | 115              | 116              | 118              | 118              | 73                   | 73               | 73               | 74               | 75               | 76               | 76               |
|               | 95 <sup>th</sup> | 116                  | 116              | 117              | 119              | 120              | 121              | 122              | 77                   | 77               | 77               | 78               | 79               | 80               | 80               |
|               | 99 <sup>th</sup> | 123                  | 123              | 125              | 126              | 127              | 129              | 129              | 84                   | 84               | 85               | 86               | 86               | 87               | 88               |
| 11            | 90 <sup>th</sup> | 114                  | 114              | 116              | 117              | 118              | 119              | 120              | 74                   | 74               | 74               | 75               | 76               | 77               | 77               |
|               | 95 <sup>th</sup> | 118                  | 118              | 119              | 121              | 122              | 123              | 124              | 78                   | 78               | 78               | 79               | 80               | 81               | 81               |
|               | 99 <sup>th</sup> | 125                  | 125              | 126              | 128              | 129              | 130              | 131              | 85                   | 85               | 86               | 87               | 87               | 88               | 89               |
| 12            | 90 <sup>th</sup> | 116                  | 116              | 117              | 119              | 120              | 121              | 122              | 75                   | 75               | 75               | 76               | 77               | 78               | 78               |
|               | 95 <sup>th</sup> | 119                  | 120              | 121              | 123              | 124              | 125              | 126              | 79                   | 79               | 79               | 80               | 81               | 82               | 82               |
|               | 99 <sup>th</sup> | 127                  | 127              | 128              | 130              | 131              | 132              | 133              | 86                   | 86               | 87               | 88               | 88               | 89               | 90               |
| 13            | 90 <sup>th</sup> | 117                  | 118              | 119              | 121              | 122              | 123              | 124              | 76                   | 76               | 76               | 77               | 78               | 79               | 79               |
|               | 95 <sup>th</sup> | 121                  | 122              | 123              | 124              | 126              | 127              | 128              | 80                   | 80               | 80               | 81               | 82               | 83               | 83               |
|               | 99 <sup>th</sup> | 128                  | 129              | 130              | 132              | 133              | 134              | 135              | 87                   | 87               | 88               | 89               | 89               | 90               | 91               |
| 14            | 90 <sup>th</sup> | 119                  | 120              | 121              | 122              | 124              | 125              | 125              | 77                   | 77               | 77               | 78               | 79               | 80               | 80               |
|               | 95 <sup>th</sup> | 123                  | 123              | 125              | 126              | 127              | 129              | 129              | 81                   | 81               | 81               | 82               | 83               | 84               | 84               |
|               | 99 <sup>th</sup> | 130                  | 131              | 132              | 133              | 135              | 136              | 136              | 88                   | 88               | 89               | 90               | 90               | 91               | 92               |
| 15            | 90 <sup>th</sup> | 120                  | 121              | 122              | 123              | 125              | 126              | 127              | 78                   | 78               | 78               | 79               | 80               | 81               | 81               |
|               | 95 <sup>th</sup> | 124                  | 125              | 126              | 127              | 129              | 130              | 131              | 82                   | 82               | 82               | 83               | 84               | 85               | 85               |
|               | 99 <sup>th</sup> | 131                  | 132              | 133              | 134              | 136              | 137              | 138              | 89                   | 89               | 90               | 91               | 91               | 92               | 93               |
| 16            | 90 <sup>th</sup> | 121                  | 122              | 123              | 124              | 126              | 127              | 128              | 78                   | 78               | 79               | 80               | 81               | 81               | 82               |
|               | 95 <sup>th</sup> | 125                  | 126              | 127              | 128              | 130              | 131              | 132              | 82                   | 82               | 83               | 84               | 85               | 85               | 86               |
|               | 99 <sup>th</sup> | 132                  | 133              | 134              | 135              | 137              | 138              | 139              | 90                   | 90               | 90               | 91               | 92               | 93               | 93               |
| 17            | 90 <sup>th</sup> | 122                  | 122              | 123              | 125              | 126              | 127              | 128              | 78                   | 79               | 79               | 80               | 81               | 81               | 82               |
|               | 95 <sup>th</sup> | 125                  | 126              | 127              | 129              | 130              | 131              | 132              | 82                   | 83               | 83               | 84               | 85               | 85               | 86               |
|               | 99 <sup>th</sup> | 133                  | 133              | 134              | 136              | 137              | 138              | 139              | 90                   | 90               | 91               | 91               | 92               | 93               | 93               |

## Blood Pressure Reference

### Blood Pressure Levels for Boys by Age and Height Percentile

17

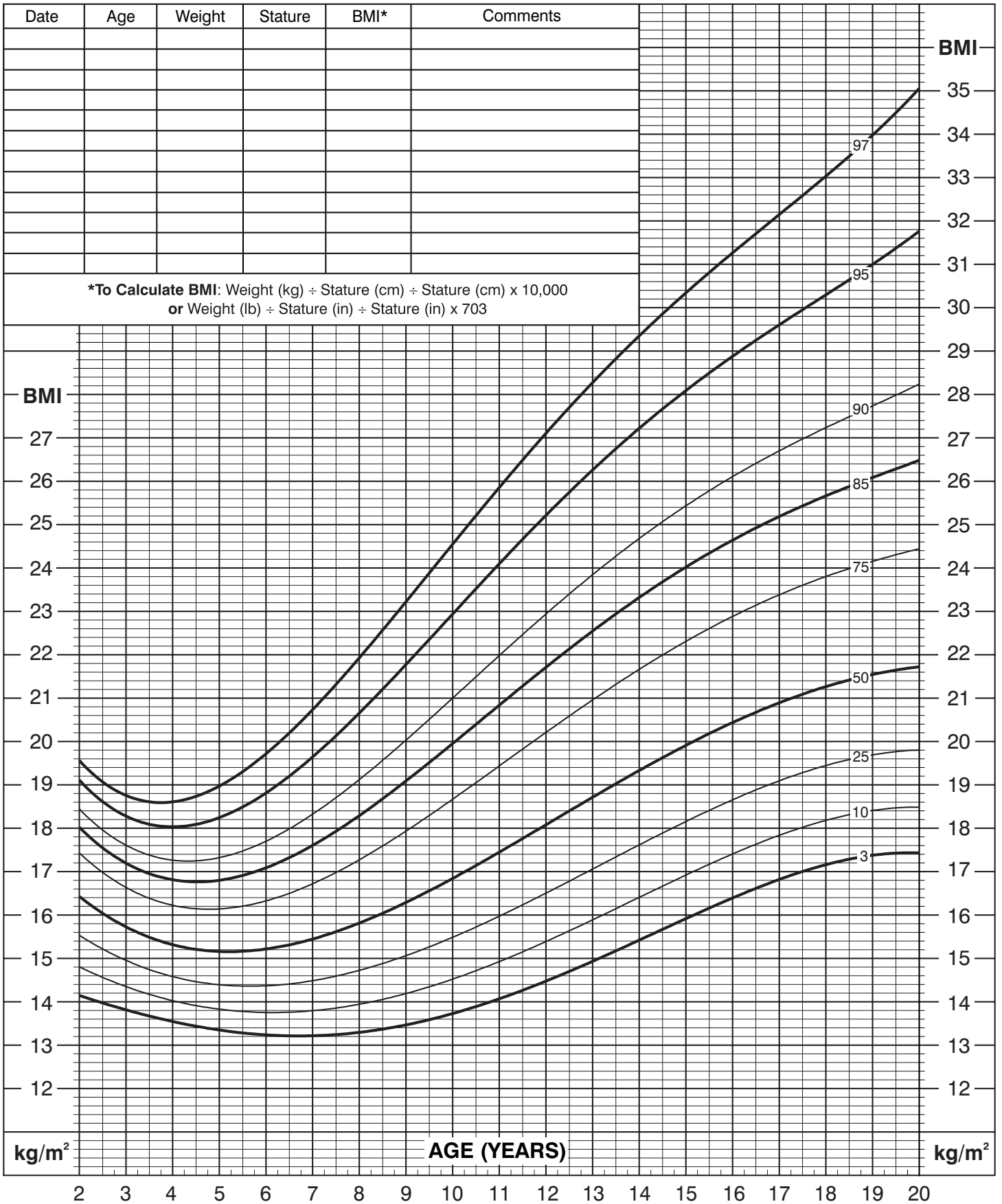
Available online at [http://www.nhlbi.nih.gov/guidelines/hypertension/child\\_tbl.pdf](http://www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.pdf), August 2007.

| Age (Year) | BP Percentile    | Systolic BP (mm Hg)  |                  |                  |                  |                  |                  |                  | Diastolic BP (mm Hg) |                  |                  |                  |                  |                  |                  |
|------------|------------------|----------------------|------------------|------------------|------------------|------------------|------------------|------------------|----------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|            |                  | Percentile of Height |                  |                  |                  |                  |                  |                  | Percentile of Height |                  |                  |                  |                  |                  |                  |
|            |                  | 5 <sup>th</sup>      | 10 <sup>th</sup> | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 90 <sup>th</sup> | 95 <sup>th</sup> | 5 <sup>th</sup>      | 10 <sup>th</sup> | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 90 <sup>th</sup> | 95 <sup>th</sup> |
| 2          | 90 <sup>th</sup> | 97                   | 99               | 100              | 102              | 104              | 105              | 106              | 54                   | 55               | 56               | 57               | 58               | 58               | 59               |
|            | 95 <sup>th</sup> | 101                  | 102              | 104              | 106              | 108              | 109              | 110              | 59                   | 59               | 60               | 61               | 62               | 63               | 63               |
|            | 99 <sup>th</sup> | 109                  | 110              | 111              | 113              | 115              | 117              | 117              | 66                   | 67               | 68               | 69               | 70               | 71               | 71               |
| 3          | 90 <sup>th</sup> | 100                  | 101              | 103              | 105              | 107              | 108              | 109              | 59                   | 59               | 60               | 61               | 62               | 63               | 63               |
|            | 95 <sup>th</sup> | 104                  | 105              | 107              | 109              | 110              | 112              | 113              | 63                   | 63               | 64               | 65               | 66               | 67               | 67               |
|            | 99 <sup>th</sup> | 111                  | 112              | 114              | 116              | 118              | 119              | 120              | 71                   | 71               | 72               | 73               | 74               | 75               | 75               |
| 4          | 90 <sup>th</sup> | 102                  | 103              | 105              | 107              | 109              | 110              | 111              | 62                   | 63               | 64               | 65               | 66               | 66               | 67               |
|            | 95 <sup>th</sup> | 106                  | 107              | 109              | 111              | 112              | 114              | 115              | 66                   | 67               | 68               | 69               | 70               | 71               | 71               |
|            | 99 <sup>th</sup> | 113                  | 114              | 116              | 118              | 120              | 121              | 122              | 74                   | 75               | 76               | 77               | 78               | 78               | 79               |
| 5          | 90 <sup>th</sup> | 104                  | 105              | 106              | 108              | 110              | 111              | 112              | 65                   | 66               | 67               | 68               | 69               | 69               | 70               |
|            | 95 <sup>th</sup> | 108                  | 109              | 110              | 112              | 114              | 115              | 116              | 69                   | 70               | 71               | 72               | 73               | 74               | 74               |
|            | 99 <sup>th</sup> | 115                  | 116              | 118              | 120              | 121              | 123              | 123              | 77                   | 78               | 79               | 80               | 81               | 81               | 82               |
| 6          | 90 <sup>th</sup> | 105                  | 106              | 108              | 110              | 111              | 113              | 113              | 68                   | 68               | 69               | 70               | 71               | 72               | 72               |
|            | 95 <sup>th</sup> | 109                  | 110              | 112              | 114              | 115              | 117              | 117              | 72                   | 72               | 73               | 74               | 75               | 76               | 76               |
|            | 99 <sup>th</sup> | 116                  | 117              | 119              | 121              | 123              | 124              | 125              | 80                   | 80               | 81               | 82               | 83               | 84               | 84               |
| 7          | 90 <sup>th</sup> | 106                  | 107              | 109              | 111              | 113              | 114              | 115              | 70                   | 70               | 71               | 72               | 73               | 74               | 74               |
|            | 95 <sup>th</sup> | 110                  | 111              | 113              | 115              | 117              | 118              | 119              | 74                   | 74               | 75               | 76               | 77               | 78               | 78               |
|            | 99 <sup>th</sup> | 117                  | 118              | 120              | 122              | 124              | 125              | 126              | 82                   | 82               | 83               | 84               | 85               | 86               | 86               |
| 8          | 90 <sup>th</sup> | 107                  | 109              | 110              | 112              | 114              | 115              | 116              | 71                   | 72               | 72               | 73               | 74               | 75               | 76               |
|            | 95 <sup>th</sup> | 111                  | 112              | 114              | 116              | 118              | 119              | 120              | 75                   | 76               | 77               | 78               | 79               | 79               | 80               |
|            | 99 <sup>th</sup> | 119                  | 120              | 122              | 123              | 125              | 127              | 127              | 83                   | 84               | 85               | 86               | 87               | 87               | 88               |
| 9          | 90 <sup>th</sup> | 109                  | 110              | 112              | 114              | 115              | 117              | 118              | 72                   | 73               | 74               | 75               | 76               | 76               | 77               |
|            | 95 <sup>th</sup> | 113                  | 114              | 116              | 118              | 119              | 121              | 121              | 76                   | 77               | 78               | 79               | 80               | 81               | 81               |
|            | 99 <sup>th</sup> | 120                  | 121              | 123              | 125              | 127              | 128              | 129              | 84                   | 85               | 86               | 87               | 88               | 88               | 89               |
| 10         | 90 <sup>th</sup> | 111                  | 112              | 114              | 115              | 117              | 119              | 119              | 73                   | 73               | 74               | 75               | 76               | 77               | 78               |
|            | 95 <sup>th</sup> | 115                  | 116              | 117              | 119              | 121              | 122              | 123              | 77                   | 78               | 79               | 80               | 81               | 81               | 82               |
|            | 99 <sup>th</sup> | 122                  | 123              | 125              | 127              | 128              | 130              | 130              | 85                   | 86               | 86               | 88               | 88               | 89               | 90               |
| 11         | 90 <sup>th</sup> | 113                  | 114              | 115              | 117              | 119              | 120              | 121              | 74                   | 74               | 75               | 76               | 77               | 78               | 78               |
|            | 95 <sup>th</sup> | 117                  | 118              | 119              | 121              | 123              | 124              | 125              | 78                   | 78               | 79               | 80               | 81               | 82               | 82               |
|            | 99 <sup>th</sup> | 124                  | 125              | 127              | 129              | 130              | 132              | 132              | 86                   | 86               | 87               | 88               | 89               | 90               | 90               |
| 12         | 90 <sup>th</sup> | 115                  | 116              | 118              | 120              | 121              | 123              | 123              | 74                   | 75               | 75               | 76               | 77               | 78               | 79               |
|            | 95 <sup>th</sup> | 119                  | 120              | 122              | 123              | 125              | 127              | 127              | 78                   | 79               | 80               | 81               | 82               | 82               | 83               |
|            | 99 <sup>th</sup> | 126                  | 127              | 129              | 131              | 133              | 134              | 135              | 86                   | 87               | 88               | 89               | 90               | 90               | 91               |
| 13         | 90 <sup>th</sup> | 117                  | 118              | 120              | 122              | 124              | 125              | 126              | 75                   | 75               | 76               | 77               | 78               | 79               | 79               |
|            | 95 <sup>th</sup> | 121                  | 122              | 124              | 126              | 128              | 129              | 130              | 79                   | 79               | 80               | 81               | 82               | 83               | 83               |
|            | 99 <sup>th</sup> | 128                  | 130              | 131              | 133              | 135              | 136              | 137              | 87                   | 87               | 88               | 89               | 90               | 91               | 91               |
| 14         | 90 <sup>th</sup> | 120                  | 121              | 123              | 125              | 126              | 128              | 128              | 75                   | 76               | 77               | 78               | 79               | 79               | 80               |
|            | 95 <sup>th</sup> | 124                  | 125              | 127              | 128              | 130              | 132              | 132              | 80                   | 80               | 81               | 82               | 83               | 84               | 84               |
|            | 99 <sup>th</sup> | 131                  | 132              | 134              | 136              | 138              | 139              | 140              | 87                   | 88               | 89               | 90               | 91               | 92               | 92               |
| 15         | 90 <sup>th</sup> | 122                  | 124              | 125              | 127              | 129              | 130              | 131              | 76                   | 77               | 78               | 79               | 80               | 80               | 81               |
|            | 95 <sup>th</sup> | 126                  | 127              | 129              | 131              | 133              | 134              | 135              | 81                   | 81               | 82               | 83               | 84               | 85               | 85               |
|            | 99 <sup>th</sup> | 134                  | 135              | 136              | 138              | 140              | 142              | 142              | 88                   | 89               | 90               | 91               | 92               | 93               | 93               |
| 16         | 90 <sup>th</sup> | 125                  | 126              | 128              | 130              | 131              | 133              | 134              | 78                   | 78               | 79               | 80               | 81               | 82               | 82               |
|            | 95 <sup>th</sup> | 129                  | 130              | 132              | 134              | 135              | 137              | 137              | 82                   | 83               | 83               | 84               | 85               | 86               | 87               |
|            | 99 <sup>th</sup> | 136                  | 137              | 139              | 141              | 143              | 144              | 145              | 90                   | 90               | 91               | 92               | 93               | 94               | 94               |
| 17         | 90 <sup>th</sup> | 127                  | 128              | 130              | 132              | 134              | 135              | 136              | 80                   | 80               | 81               | 82               | 83               | 84               | 84               |
|            | 95 <sup>th</sup> | 131                  | 132              | 134              | 136              | 138              | 139              | 140              | 84                   | 85               | 86               | 87               | 87               | 88               | 89               |
|            | 99 <sup>th</sup> | 139                  | 140              | 141              | 143              | 145              | 146              | 147              | 92                   | 93               | 93               | 94               | 95               | 96               | 97               |

# 2 to 20 Years: Girls Body Mass Index for Age Percentiles

NAME \_\_\_\_\_

RECORD # \_\_\_\_\_



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







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