A complete physical examination is included as part of every Bright Futures visit. The examination must be comprehensive and also focus on specific assessments that are appropriate for the child’s or adolescent’s age, developmental phase, and needs. This portion of the visit builds on the history gathered earlier. The physical examination also provides opportunities to identify silent or subtle illnesses or conditions and time for the health care professional to educate children and their parents about the body and its growth and development.

The chapters in this section of the book focus on topics that emerge during the examination. Assessing Growth and Nutrition; Sexual Maturity Stages; In-toeing and Out-toeing; and Spine, Hip, and Knee discuss critical aspects of healthy development that must be assessed with regularity. Blood Pressure and Early Childhood Caries examine issues of vital public health importance and provide updated guidelines. Sports Participation provides useful guidance for health care professionals at a time when increased physical activity among children and adolescents is a priority.

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Why Is It Important to Assess Growth and Nutrition During the Physical Examination?

Growth measurements correlate directly to nutritional status and can indicate whether a child's health and well-being are at risk. Deviations from normal growth patterns may be familial patterns but may indicate medical problems. For example, abnormal linear growth or poor weight gain could indicate a variety of medical problems, including malnutrition, chronic illness, psychosocial deprivation, hormonal disorders, or syndromes with dwarfism. Similarly, growth trajectories that deviate above the norm (increased weight for height [or increased BMI]) can also indicate medical problems with adverse consequences. Monitoring growth and deviations from normal patterns can help detect and allow intervention for many medical conditions and abnormalities.

Calculating and tracking BMI provides vital information about weight status and risk of overweight and obesity. Body mass index is a clinically useful weight-for-height index that reflects excess body fat as well as nutritional status.

Obesity in childhood is associated with immediate and long-term adverse health and psychosocial outcomes, leading to health problems in as many as 50% of US children. Obesity in children has been associated with increased blood pressure, total cholesterol, low-density lipoprotein cholesterol, and triglycerides and low levels of high-density lipoprotein cholesterol.


Measuring head circumference, especially within the first 3 years, may identify neurologic abnormalities as well as malnutrition. Identification of abnormal growth patterns can lead to early diagnosis of treatable conditions, such as hydrocephalus, or identification of disorders associated with slowed head growth, such as Rett syndrome.

How Should You Take These Measurements?

General Considerations

The measurement process has 2 steps—measure and record. Accurate weighing and measuring have 3 critical components—technique, equipment, and trained measurers. You must use the appropriate techniques for each measurement.

Your choice of whether to use English or metric units for measurements and plotting can depend on a variety of circumstances. If the available equipment is accurately calibrated and the measurers follow standard procedures,
then you can record data in either English or metric units. The use of metric measures is encouraged when weighing infants, children, and adolescents in a clinical setting. To convert from kilograms to pounds, multiply the kilogram amount by 2.2 (eg, 50 kg x 2.2 = 110 lb).

Consistent procedures must be used. If measures are in error, then the foundation of the growth assessment is also in error. It is important to record the date, age, and actual measurements so the data can be used by others or at a later time.

**Measure Stature (Length or Height)**

**Infancy and Early Childhood (0–2 years)**
- Until they can stand securely (age 2 years), measure infants lying down in a supine position on a measuring frame or an examining table.
- Align the infant’s head snugly against the top bar of the frame and ask an assistant to secure it there. Parents can help restrain infants for length measurements, as it is a painless procedure.
- Straighten the infant’s body, hips, and knees.
- Hold the infant’s feet in a vertical position (long axis of foot perpendicular to long axis of leg). Bring the foot board snugly against the bottom of the foot. Some authorities suggest measuring twice and taking an average.
- If an examining table is used, mark the spots at the top of the child’s head and bottom of feet and then measure between the marks. (Note that this is not ideal as it is difficult to get an accurate length using this technique.)
- Plot length measurements on a standard growth chart for age and gender, or one appropriate for the child (eg, low birth weight infant, infant with trisomy 21, infant with Turner syndrome).

**Child (2 years and older)**
- Have the child remove his or her shoes.
- Have the child stand up with the bottom of the heels on floor and back of foot touching the wall, knees straight, scapula and occiput also on the wall, looking straight ahead with head held level.
- Align the measuring bar perpendicular to the wall and parallel to the floor (on a stadiometer or other measuring rod) with the top of the head.
- If a scale with a measuring bar is not available, place a flat object such as a clipboard on the child’s head in a horizontal position and read the height at the point at which the object touches a measuring tape on the back of the scale or a flat wall surface.
- Plot height measurements on a standardized growth chart for age and gender, or one appropriate for the child.

**Measure Weight**

**Infancy and Early Childhood**
- Weigh younger infants nude or in a clean diaper on a calibrated beam or electronic scale. Weigh older infants in a clean, disposable diaper.
- Position the infant in the center of the scale tray.
- It is desirable for 2 people to be involved when weighing an infant. One measurer weighs the infant and protects him or her from harm (such as falling) and reads the weight as it is obtained. The other measurer immediately notes the measurement in the infant’s chart.
- Weigh the infant to the nearest 0.01 kg or 1/2 oz.
- Record the weight as soon as it is completed.
- Then reposition the infant and repeat the weight measurement. Note the second measurement in writing. Compare the weights. They should agree within 0.1 kg or 1/4 lb. If the difference exceeds this, reweigh the infant a third time. Record the average of the 2 closest weights.

If an infant is too active or too distressed for an accurate weight measurement, try the following options:
- Postpone the measurement until later in the visit when the infant may be more comfortable with the setting.
- If you have an electronic scale, use this alternative measurement technique: Have the parent stand on the scale and reset the scale to zero. Then have the parent hold the infant and read the infant’s weight.
Child

- A child older than 36 months who can stand without assistance should be weighed standing on a scale using a calibrated beam balance or electronic scale.
- Have the child or adolescent wear only lightweight undergarments or a gown.
- Have the child or adolescent stand on the center of the platform of the scale.
- Record the weight of the individual to the nearest 0.01 kg or 1/2 oz. (If the scale is not digital, record to the nearest half-kilo or pound). Record the weight on the chart.
- Reposition the individual and repeat the weight measure.
- Compare the measures. They should agree within 0.1 kg or 1/4 lb. (If the scale is not digital, compare to the nearest half-kilo or pound.) If the difference between the measures exceeds the tolerance limit, reposition the child and measure a third time. Record the average of the 2 measures in closest agreement.

In the standardized scale for children, all weights between the 5th and 85th percentiles are considered normal. As important as the fact that a child’s weight falls between these percentiles on a growth chart is that over time the weight follows one of the percentile curves. In other words, a child who is at the 80th percentile the first time he or she is weighed and at the 40th percentile a month later is cause for concern. A child is defined as having a failure to thrive syndrome (a medical diagnosis) if height or weight drops below the third percentile on a standardized growth chart.

Calculate BMI

- Choose English or metric calculation for BMI.
  - English: (Weight (lb) / [Stature (in) x Stature (in)]) x 703
  - Metric: Weight (kg) / [Stature (m) x Stature (m)]
- Plot the child’s or adolescent’s BMI on a growth chart for age and sex to determine BMI percentile. In the United States, BMI growth charts are available for ages 2 to 20. Alternatively, the Centers for Disease Control and Prevention (CDC) has a Web-based tool to calculate both the BMI and age- and sex-adjusted BMI percentile (http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx). See the Resources section for further details.

Measure Head Circumference

Obtain an accurate head circumference, or occipital frontal circumference, by using a flexible non-stretchable measuring tape. Head circumference is generally measured on infants and children until the age of 3 years.

Measure head circumference over the largest circumference of the head, namely the most prominent part on the back of the head (occiput) and just above the eyebrows (supraorbital ridges).
- Place a tape measure around an infant’s head just above the eyebrows and around the most prominent portion of the back of the head, the occipital prominence.
- Pull the tape snugly to compress the hair and underlying soft tissues. Read the measurement to the nearest 0.1 cm or 1/8 inch and record on the chart.
- Reposition the tape and remeasure the head circumference. The measures should agree within 0.2 cm or 1/4 inch. If the difference between the measures exceeds the tolerance limit, the infant should be repositioned and remeasured a third time. The average of the 2 measures in closest agreement is recorded.
- Plot measurements on a standardized growth chart for age and gender.
- Head circumference should correlate with the child’s length (eg, if length is in the 40th percentile, head circumference should also be 40th percentile).

What Should You Do With an Abnormal Result?

Stature

- Children who fall off their height curves (decline in stature/length percentiles or present with extreme short stature) may need to undergo evaluations for underlying medical problems.
- First, be sure that the measurements are accurate, make sense, and are appropriately plotted.
Calculate mean parental height and plot.

- Mean parental height calculation: Add parental heights and subtract 5 inches for a girl (from Dad’s height) or add 5 inches (to Mom's height) for a boy, and then divide that entire number by 2.

  Example: mother is 5'4" (64"), father is 5'9" (69"); (5'9" + 5'4") +/- 5")/2 = mean parental height. A girl’s mean parental height would be 5'4" and a boy’s would be 5'9". (These are average heights for male and female population.)

- If the child is short, but mean parental height falls in the same percentile, the child may have familial short stature.

- If the parents entered puberty late and the child is short and prepubertal at a time when most children are in puberty, he or she may have constitutional delay.

- These children all need to be followed closely and evaluated or referred to an appropriate specialist.

- Those with short stature may need to be assessed for endocrinopathies, pubertal delay, boney dysplasias, or syndromes. Pubertal delays may be genetic/familial or be due to an underlying medical condition

Weight/BMI

- Drop in weight percentiles by more than one large percentile or presentation with extreme underweight may warrant further investigation.

- First be sure measurements are correct and were plotted correctly.

- A number of medical conditions can present with weight loss or fall off weight growth curves, including malabsorption, renal disease, cardiac disorders, neurologic and pulmonary disorders, food or feeding abnormalities, family or environmental difficulties, and chronic infections. Workup and potential referral should proceed as suggested by history and physical examination.

- Review the “Weight Maintenance and Weight Loss” and “Metabolic Syndrome” chapters in this volume for issues with overweight/obesity.

**Head Circumference**

Consider the following actions for a child with an abnormal head size:

- Accurately measure the head circumference and assess the pattern of head growth. If previous measurements are available, assess the onset of the abnormal head size.

- Inspect and palpate the skull.

- Compare the head circumference with other growth parameters.

- Observe for the presence or absence of dysmorphic features.

- Note the presence or absence of congenital abnormalities involving other organ systems.

- Measure the head sizes of first-degree relatives.

- Conduct neurologic and developmental assessments that may
  - Reveal asymmetries
  - Abnormalities in muscle tone, posture, strength, and reflexes
  - Generalized psychomotor retardation
  - Motor delays
  - Speech or language and cognitive impairments
  - Autistic features

- Assess for signs and symptoms of increased intracranial pressure.
What Results Should You Document?

Plot height, weight, and BMI measurements in the child’s growth charts. It is essential to select the appropriate chart for the age and sex of the child or adolescent. The CDC growth charts are presented as:

<table>
<thead>
<tr>
<th>Sex and Age</th>
<th>Charts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys, birth to 36 mos</td>
<td>Weight-for-length</td>
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<tr>
<td>Boys, birth to 36 mos</td>
<td>Weight-for-age</td>
</tr>
<tr>
<td>Boys, birth to 36 mos</td>
<td>Length-for-age</td>
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<tr>
<td>Boys, birth to 36 mos</td>
<td>Head circumference-for-age</td>
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<tr>
<td>Girls, birth to 36 mos</td>
<td>Weight-for-length</td>
</tr>
<tr>
<td>Girls, birth to 36 mos</td>
<td>Weight-for-age</td>
</tr>
<tr>
<td>Girls, birth to 36 mos</td>
<td>Length-for-age</td>
</tr>
<tr>
<td>Girls, birth to 36 mos</td>
<td>Head circumference-for-age</td>
</tr>
<tr>
<td>Boys, 2 to 20 yrs</td>
<td>BMI-for-age</td>
</tr>
<tr>
<td>Boys, 2 to 20 yrs</td>
<td>Weight-for-age</td>
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<td>Boys, 2 to 20 yrs</td>
<td>Stature-for-age</td>
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<td>Girls, 2 to 20 yrs</td>
<td>BMI-for-age</td>
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<tr>
<td>Girls, 2 to 20 yrs</td>
<td>Weight-for-age</td>
</tr>
<tr>
<td>Girls, 2 to 20 yrs</td>
<td>Stature-for-age</td>
</tr>
<tr>
<td>Boys 2 to 5 yrs</td>
<td>Weight-for-stature (optional)</td>
</tr>
<tr>
<td>Girls 2 to 5 yrs</td>
<td>Weight-for-stature (optional)</td>
</tr>
</tbody>
</table>

For children between ages 2 and 3, the measurement you obtain must match the graph you use (eg, if supine length is measured, use the 0–3 years length-for-age graph, not the 2–20 stature [standing height]-for-age graph).

A straight edge, right angle triangle or commercially available plotting aid is recommended to locate the intersecting point of the axis values. After graphing a set of measurements, check to see if they are consistent with those from previous visits (ie, the child is on roughly the same percentile lines as before). If not, check the measurements, graphing, or both.

When you have made accurate measurements, calculated age correctly, and plotted them on the appropriate growth chart, use the information in the clinical assessment process. Share the information with the family (ie, translate the measurements into a form that is useful to them).

<table>
<thead>
<tr>
<th>ICD-9-CM Codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>259.4</td>
<td>Dwarfism</td>
</tr>
<tr>
<td>253.0</td>
<td>Gigantism (cerebral, hypophyseal, pituitary)</td>
</tr>
<tr>
<td>331.4</td>
<td>Hydrocephalus (acquired, external, internal, malignant, noncommunicating, obstructive, recurrent)</td>
</tr>
<tr>
<td>756.0</td>
<td>Macrocephaly</td>
</tr>
<tr>
<td>742.4</td>
<td>Megalencephaly</td>
</tr>
<tr>
<td>742.1</td>
<td>Microcephaly</td>
</tr>
<tr>
<td>278.00</td>
<td>Obesity (constitutional, exogenous, familial, nutritional, simple)*</td>
</tr>
<tr>
<td>278.01</td>
<td>Obesity, morbid*</td>
</tr>
<tr>
<td>278.01</td>
<td>Obesity, severe*</td>
</tr>
<tr>
<td>278.00</td>
<td>Overweight*</td>
</tr>
<tr>
<td>783.2</td>
<td>Abnormal loss of weight and underweight (use BMI code if known, V85.0)</td>
</tr>
<tr>
<td>783.21</td>
<td>Loss of weight</td>
</tr>
<tr>
<td>783.22</td>
<td>Underweight</td>
</tr>
<tr>
<td>783.41</td>
<td>Failure to thrive, poor weight gain</td>
</tr>
<tr>
<td>783.43</td>
<td>Short stature</td>
</tr>
<tr>
<td>783.3</td>
<td>Feeding problem</td>
</tr>
<tr>
<td>779.3</td>
<td>Newborn feeding problem</td>
</tr>
</tbody>
</table>

*Obesity codes are not reimbursed in all jurisdictions. Practitioners may select additional diagnoses.

The American Academy of Pediatrics publishes a complete line of coding publications, including an annual edition of Coding for Pediatrics. For more information on these excellent resources, visit the American Academy of Pediatrics Online Bookstore at www.aap.org/bookstore/.

Resources

Articles


References


Scales or Tools


National Center for Health Statistics: Clinical Growth Charts: http://www.cdc.gov/growthcharts/
Why Is It Important to Assess Blood Pressure During the Physical Examination?

High blood pressure is a growing health concern for children and adolescents. A large national database shows that the prevalence of high blood pressure (BP) in children and adolescents is increasing. These increases are even larger than would be expected from the increase in obesity prevalence.

Primary hypertension is detectable in children and adolescents. Moreover, it is a common problem.

The long-term health risks of hypertension can be substantial. Target-organ damage is commonly associated with hypertension in children and adolescents. Left ventricular hypertrophy, the most prominent finding, is present in up to 36% of hypertensive children.

In addition, elevated BP in childhood correlates with the presence of hypertension in adulthood.

Obesity and hypertension are linked. The prevalence of children who are overweight is increasing. Children and adolescents with hypertension are frequently overweight, with hypertension present in approximately 30% of overweight children. Given the marked increase in childhood obesity, hypertension is becoming a significant health issue.

How Is Hypertension Defined in Children and Adolescents?

Blood pressure falls into several categories.

- **Prehypertension** is systolic BP and/or diastolic BP ≥90th percentile but <95th percentile for age, sex, and height.

  Adolescents with BP ≥120/80 should be considered **prehypertensive**, even if 120/80 is less than the 90th percentile.

- **White-coat hypertension** is BP at ≥95th percentile in the office, normal outside of the office setting. Ambulatory BP monitoring is often needed to make this diagnosis.

- **Hypertension** is defined as systolic BP and/or diastolic BP ≥95th percentile for age, sex, and height on 3 or more occasions. Hypertensive children are further categorized into 2 stages.
  - Stage 1: BP ≥95th percentile but <5 mm Hg above the 99th percentile (<99th percentile + 5 mm Hg)
  - Stage 2: BP is >5 mm Hg above the 99th percentile (>99th percentile + 5 mm Hg)

See the Resources section of this chapter for National Heart, Lung, and Blood Institute blood pressure tables for children and adolescents.
When and How Should You Measure Blood Pressure?

When to Measure

- Children younger than 3 years should have their BP measured under the following circumstances:
  - History of prematurity, low birth weight, care in the neonatal intensive care unit
  - Congenital heart disease
  - Renal or urologic disease
  - Family history of congenital renal disease
  - Solid-organ or bone marrow transplant
  - History of malignancy
  - Treatment with drugs known to raise BP
  - Any systemic illness associated with hypertension
  - Elevated intracranial pressure
- Children older than 3 years should have their BP routinely measured.

How to Measure

- Position the child.
  - Child should be sitting quietly for 5 minutes prior to taking BP
  - Back supported with feet on floor
  - Right arm supported with cubital fossa at heart level
- Use the appropriate cuff size.
  - Inflatable bladder width should be at least 40% of the arm circumference at the midpoint between the olecranon and acromion.
  - Cuff bladder length should cover 80% to 100% of the arm circumference.
  - If a cuff is too small, use the next largest cuff, even if it appears too large.

- Take the measurement.
  - If possible, use the right arm. This will make the measurement consistent with national norms and will prevent confusion with the effects of potential coarctation.
  - Place stethoscope over brachial artery pulse, proximal and medial to the cubital fossa, below the bottom edge of the cuff.
  - Consider using the bell of the stethoscope; it may allow softer Korotkoff sounds to be heard.
  - Determine the systolic BP by the onset of Korotkoff sounds (K1).
  - Determine the diastolic BP by the disappearance of Korotkoff sounds (K5).
  - In some children, Korotkoff sounds can be heard all the way to 0. In this situation, repeat the BP with less pressure on the stethoscope head.
  - If Korotkoff sounds still go to 0, then record muffling of the Korotkoff sounds (K4) as the diastolic BP.

What Should You Do With an Abnormal Result?

Children and adolescents with persistent prehypertension (>6 months in duration) who are overweight, have diabetes, kidney disease, or Stage 1 hypertension should have the appropriate evaluation for secondary hypertension and target-organ damage as recommended in the “Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents.”

Children and adolescents with persistent Stage 1 hypertension, despite a trial of lifestyle modification, may need antihypertensive medications. Consider referral to a practitioner with expertise in pediatric hypertension.

Consider early referral to a practitioner with expertise in pediatric hypertension for all children and adolescents with Stage 2 hypertension.
What Results Should You Document?

Document routine blood pressures in the medical record with other vital signs. Record prehypertension and stage of hypertension in the problem list.

### ICD-9-CM Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>796.2</td>
<td>Elevation of blood pressure, no diagnosis of hypertension</td>
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<tr>
<td>401.1</td>
<td>Hypertension, benign</td>
</tr>
<tr>
<td>401.0</td>
<td>Hypertension, malignant</td>
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</tbody>
</table>

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### Resources

#### Tools

National Heart, Lung, and Blood Institute


### Article


### Web Sites

American Heart Association: http://www.heart.org/HEARTORG/

High Blood Pressure in Children: http://www. americanheart.org/presenter.jhtml?identifier=4609

International Pediatric Hypertension Association: http://www.pediatrichypertension.org

### Reference

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

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<th>Age (Year)</th>
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Blood Pressure Levels for Boys by Age and Height Percentile (Continued)

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BP, blood pressure

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

For research purposes, the standard deviations in Appendix Table B-1 allow one to compute BP Z-scores and percentiles for boys with height percentiles given in Table 3 (i.e., the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles). These height percentiles must be converted to height Z-scores given by (5% = -1.645; 10% = -1.28; 25% = -0.68; 50% = 0; 75% = 0.68; 90% = 1.28%; 95% = 1.645) and then computed according to the methodology in steps 2–4 described in Appendix B. For children with height percentiles other than these, follow steps 1–4 as described in Appendix B.
## Blood Pressure Levels for Girls by Age and Height Percentile

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### Blood Pressure Levels for Girls by Age and Height Percentile (Continued)

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>BP Percentile</th>
<th>Systolic BP (mmHg)</th>
<th>Diastolic BP (mmHg)</th>
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</tr>
<tr>
<td></td>
<td>99th</td>
<td>133</td>
<td>133</td>
</tr>
</tbody>
</table>

BP, blood pressure

* The 50th percentile is 1.28 SD. 95th percentile is 1.645 SD. and the 99th percentile is 2.326 SD over the mean.

For research purposes, the standard deviations in Appendix Table B–1 allow one to compute BP Z-scores and percentiles for girls with height percentiles given in Table 4 (i.e., the 5th, 10th, 25th, 50th, 75th, 95th percentiles). These height percentiles must be converted to height Z-scores given by (Z = -1.845, 10% = -1.26; 25% = -0.66; 50% = 0; 75% = 0.68, 95% = 1.286, 95% = 1.645) and then computed according to the methodology in steps 2–4 described in Appendix B. For children with height percentiles other than these, follow steps 1–4 as described in Appendix B.

What Is Early Childhood Caries?
The American Academy of Pediatric Dentistry (AAPD) defines early childhood caries (ECC) as one or more decayed, missing, or filled teeth in children younger than 6 years.

Why Is It Important to Assess for ECC During the Physical Examination?
Early childhood caries is highly prevalent and becoming more so. Currently 28% of US children ages 2 to 5 have visible cavities, and 73% of these children are in need of treatment. Caries prevalence in children is 5 times that of asthma. The percentage of children with ECC increased 15% over the past decade.

Early childhood caries has strong social, cultural, biological, dietary, and environmental determinants. These determinants interact at multiple levels and result in inequitable distribution of ECC by income and race.

By income
- Poor children younger than 5 years are 5 times more likely to have cavities than are children from families living at 3 times the poverty level.
- Poor and low-income children have 3.5 times more decayed teeth than higher-income children.

By race
- Hispanic children experience higher rates of ECC (36%) than do black (30%) or white (23%) children.
- Native American and Asian-Pacific Islander children experience the highest rates of ECC.

Certain groups are at high risk of developing ECC. Children at high risk of ECC include
- Children with special health care needs for whom diet and oral hygiene are problematic
- Children of mothers/caregivers with a high caries experience
- Children who do not yet have cavities but have earlier signs of caries activity including heavy plaque accumulation along the gum line or “white spot” demineralizations
- Children with high-frequency sugar consumption, including those who sleep with a bottle or continuously breastfeed throughout the night
- Children in families of low socioeconomic status

Bright Futures recommends that all children establish a dental home by 12 months. In children whose teeth have erupted, the “Knee-to-Knee Oral Exam” represents the basic physical examination required to assess for dental caries. Some children need early referral to a dentist before tooth eruption, and a screening tool for assessing caries risk is included in this chapter.
Children should be referred to a dentist so that a dental home can be established by 1 year of age. For those children at high risk as noted previously, the referral should be made as early as 6 months of age and no later than 6 months after the first tooth erupts or 12 months of age (whichever comes first).

The ECC process becomes established at an early age, with consequences for future dental health. The caries process is typically established before age 2, well before most children obtain their first dental visit. Once established, the intensity of an individual’s caries process tends to be stable over the lifetime. Children with ECC are therefore more susceptible to long-term dental problems.

Early childhood caries also has varied and serious consequences for growth and development. Pain and infection resulting from the rapid progression of ECC into the dental pulp distracts from play and learning; often results in disturbances of eating, sleeping, and behavior; and may disturb growth.

Early childhood caries is preventable. It can be stopped through a combination of

- Delay in acquisition of *Streptococcus mutans* and other cariogenic bacteria, which are typically acquired by infants from their mothers by direct salivary transmission
- Reduced frequency and duration of sugar consumption, including in bottle and sippy cup use
- Exclusion of sugar-laden liquids, including juice, in the bottle or sippy cup when used ad libitum as pacifiers
- Age- and risk-appropriate use of fluorides and exposure to fluoridated water

Unmet needs for dental care among all US children are 3 times greater than unmet needs for medical care. The ECC process typically begins well before most children obtain their first dental visit but long after they have begun medical care visits. Young children are more likely to have a first dental visit for pain relief than for preventive care or anticipatory guidance.

American Academy of Pediatrics and AAPD policies support establishing an early dental home. These policies recommend that children have a dental home at the time of the first tooth or first birthday, particularly for children at risk of ECC or with signs or symptoms of other oral problems.

Infant oral health care provides an opportunity to examine children and counsel families on a range of issues in addition to ECC. These issues include oral and dental development, digit sucking and occlusion, oral soft tissues, home care, use of fluorides, oro-facial injury prevention, feeding behaviors, and age-appropriate engagement of children in their own oral hygiene.

How Should You Perform an Early Childhood Caries Examination (“Knee to Knee Oral Examination”)?

Early signs of ECC are subtle but significant. They include heavy soft plaque accumulation on the maxillary incisors, particularly along the gum line, and “white spot” lesions that indicate early enamel decalcification.

Have Your Supplies and Equipment Ready

- 2 x 2 gauze
- A source of good direct overhead light
- Gloves
- Tongue depressor
- Dental mirror (optional)
- Fluoride varnish (optional)

Position Yourself Correctly

Visualize the infant or toddler’s mouth from above by positioning yourself behind the child’s head with the child lying on the examining table, in a carrying seat, or in your lap as you sit knee-to-knee with the parent.

Conduct the Examination

- Pull down on the lower lip and examine the mucosa.
- Lift the upper lip to examine mucosa and the maxillary anterior teeth. The first signs of ECC occur on the front surfaces of these teeth. Note that the front surface of the lower front teeth are almost never affected by caries in young children. Any visible difference between the integrity, color, or sheen of the lower and upper teeth may indicate early signs of ECC.
Look for soft whitish plaque accumulation. Gently scrape with a tongue blade along the gum line to see if this plaque is present on these upper teeth before wiping them dry.

Look closely at the dry teeth along the gum line for crescent shaped or linear white opacities (white spots).

Check for color and translucency (shininess). Primary teeth should be uniform in these aspects. Any discoloration is cause for concern.

Press gently on the teeth to assess that all are firmly in place and that the child does not react to upward pressure, particularly on obviously decayed teeth.

With gentle pressure, press down on—or in front of (in the mucolabial fold)—the lower teeth to open the child’s mouth. Alternatively place the tongue blade between the child’s molars and turn 90 degrees. Examine the posterior teeth for color, form, and integrity. Any dark fissure in young children is of concern.

Examine the buccal mucosa, palate, tongue, and oropharynx.

Examine the dentition for numbers, color, form, and disturbances that may relate to development, trauma, or caries.

Lean forward while tipping the child’s head back to look closely at the back surface of the maxillary incisors as this is another common place for first cavities to appear. A disposable or sterilized dental mirror is recommended for use.

Grasp the child’s chin gently and guide the mouth closed along the midline until the teeth touch. Examine for bite. Look for normal occlusion. All of the upper teeth should drape closely over all of the lower teeth. Any disturbance from this pattern is cause for concern.

Apply fluoride varnish: After drying the teeth with the gauze, use the brush supplied with the fluoride varnish to apply a thin layer of the material to all surfaces of the teeth, with particular attention to the front and back surfaces of the maxillary incisors.

Counsel and prescribe appropriate topical and systemic fluoride.

Assess systemic fluoride: For children whose water supply is not fluoridated and at caries risk, assess the child’s primary water supply for fluoride content by submitting a water sample to a state or private laboratory. For children with a primary water supply that contains suboptimal fluoride, prescribe a fluoride supplement according to Table 1.

### Table 1. Dietary Fluoride Supplementation Schedule

<table>
<thead>
<tr>
<th>Age</th>
<th>&lt;0.3 ppm F</th>
<th>0.3–0.6 ppm F</th>
<th>&lt;0.6 ppm F</th>
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</thead>
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<td>Birth–6 months</td>
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<td>0</td>
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<tr>
<td>6 months–3 years</td>
<td>0.25 mg</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3–6 years</td>
<td>0.50 mg</td>
<td>0.25 mg</td>
<td>0</td>
</tr>
<tr>
<td>6 years up to at least 16 years</td>
<td>1.00 mg</td>
<td>0.50 mg</td>
<td>0</td>
</tr>
</tbody>
</table>

Fluoride supplementation recommendations by AAPD for children at risk for caries.

Recommend appropriate topical fluoride toothpaste use: AAPD recommends that parents use an age-appropriate toothbrush twice daily to apply a “smear” of fluoridated toothpaste for children younger than 2 years who are at caries risk and a non-fluoride toothpaste for children not at risk. For children ages 2 through 5, a “pea sized” amount of toothpaste is appropriate (Figure 1).

![Comparison of a smear (left) with a pea-sized (right) amount of toothpaste.](image)
Summary: Causes of Concern

- Plaque accumulation
- White opacities
- Discoloration of primary teeth
- Differences in tooth surface appearance
- Any disturbance from normal occlusion

What Should You Do With the Results?

For any findings of concern, refer children for further evaluation by a dentist comfortable with young children.

- Make an urgent dental referral for any young child with oral or dental symptoms, including stimulated or unstimulated pain, particularly if the child awakens at night with apparent dental pain.
- Make an urgent dental referral for a child with any intraoral or extraoral swelling that you suspect is of dental origin.
- Make an immediate dental referral for any young child with dental discoloration, developmental irregularity, soft tissue lesion, malocclusion, or evidence of oral trauma.

For other children, counsel parents to establish a dental home at the time of the first tooth or first birthday. Ensure referral of all children older than age 1 for routine dental care.

Prioritize those children whose parents report a history of problems with tooth decay in themselves or their other children.

What Results Should You Document?

- Document that an intraoral examination was performed and report findings that may indicate hard and soft tissue pathologies, abnormal development, and occlusion.
- Document fluoride varnish application as applicable.
- Use the AAPD Caries Risk Assessment Form to document risk.

Document referral to the dentist, including any specific recommendations to parents facilitating the referral.

ICD-9-CM Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>521.0</td>
<td>Dental caries</td>
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</table>

The American Academy of Pediatrics publishes a complete line of coding publications, including an annual edition of Coding for Pediatrics. For more information on these excellent resources, visit the American Academy of Pediatrics Online Bookstore at www.aap.org/bookstore/.

Resources

Photographs

Normal Primary Dentition

Normal primary dentition shows normal mucosa and white, opalescent teeth with spacing.

Subtle Manifestations of ECC—Early Signs

Note linear “white spot” decalcification along the gum line on these dried, illuminated teeth. This is the first clinical manifestation of tooth damage and typically progresses rapidly.

ICD-9-CM Codes

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Subtle Manifestations of ECC—Early Signs

Note linear “white spot” decalcification along the gum line on these dried, illuminated teeth. This is the first clinical manifestation of tooth damage and typically progresses rapidly.
Overt Manifestations of ECC

- 12-month-old with extreme ECC.
- 18-month-old with extreme ECC and abscessed incisor.
- 22-month-old child with extensive ECC. Note that the lower incisors remain intact.

Crossbite

Note that the posterior upper teeth are inside the lower teeth and the upper and lower midlines do not coincide.

Tools

American Academy of Pediatric Dentistry: http://www.aapd.org/
- Reference manual guidelines on infant oral health care, ECC, dental home, age 1 dental visit, fluoride therapy
- Caries Risk Assessment Tool

American Academy of Pediatrics: http://www.aap.org/oralhealth
- Policy statements: http://aap.org/oralhealth/policy-statements.cfm
- Tools and resources: http://aap.org/oralhealth/links-tools.cfm
- Training and videos: http://aap.org/oralhealth/links-training.cfm

Association of Clinicians for the Underserved: http://www.clinicians.org/
- Pocket cards

Web-based Self-education and Resource Materials

Protecting All Children’s Teeth (PACT): A Pediatric Oral Health Training Program aims to educate pediatricians, pediatricians in training, and others interested in infant, child, and adolescent health about the important role that oral health plays in the overall health of patients. The goal of this curriculum is not to train pediatricians to become dentists, but to become more knowledgeable about child oral health, more competent in providing oral health guidance and preventive care, and more comfortable sharing the responsibility of oral health with dental colleagues.

Oral Health Risk Assessment: Training for Pediatricians and Other Child Health Professionals: http://aap.org/oralhealth/ohra-cme.cfm
The purpose of this free training is to provide a concise overview of how to perform an oral examination and conduct an oral health risk assessment and triage for infants and young children.
This online training program was developed for maternal and child health educators and policymakers to better understand early childhood oral health and to facilitate oral health supervision into pediatric well-child supervision.

Children’s Dental Health Project: http://www.cdhp.org/
The Children’s Dental Health Project is a national nonprofit organization with the vision of achieving equity in children’s oral health. The project designs and advances research-driven policies and innovative solutions by engaging a broad base of partners committed to children and oral health, including professionals, communities, policymakers, and parents.

References
How to Apply Fluoride Varnish

**Supplies needed**
- Gloves
- Wipes
- Light source
- Varnish packets

**Technique**
- Position the patient on the lap of the parent/guardian (facing the parent/guardian) with legs wrapped around parent/guardian’s waist, or on an examination table, or sitting on caregiver’s lap.
- Sit with your knees touching knees of parent/guardian.
- If possible, have a medical assistant, older sibling, or other parent/guardian hold the light source (your otoscope light will work fine) directed toward the mouth; other options include a well-positioned goose neck lamp or head light lamp.
- Have supplies ready to go and gloves on.
- Have the parent/guardian drop the patient’s head back onto your lap and have them hold the child’s hands.
- Open the varnish packet; consider brushing most of the material on the non-dominant glove to retrieve quickly.
- Wipe the teeth with 2 x 2 gauze; do 1 quadrant at a time if applying to more that 12 teeth.
- Quickly brush the varnish on all tooth surfaces. Varnish dries almost instantly on contact with saliva, so there is very low risk of toxicity from swallowing.
- Have the parent/guardian pull the child back up into a sitting position.
- Give the child something cold to drink; it will help set up the varnish.

**THAT’S IT!**

**Instructions after**
No brushing until the following morning.
Depending on the brand of fluoride varnish, there may be a slight temporary discoloration of the teeth; it will go away in 2 to 3 days due to brushing and eating. The teeth will return to their natural color.

After varnish instructions that can be shared with parents are available at: aap.org/ORALHEALTH/fluoride.cfm (in multiple languages).
Billing

Current Dental Terminology (CDT) codes are included as part of the standard procedural code set (along with CPT) under HIPAA. The most common codes that Medicaid will reimburse are D-1203, D-1206, and D-0145. (see Oral Health Reimbursement Table available at: http://www.aap.org/ORALHEALTH/pdf/OH-Reimbursement-Chart.pdf.)

Reimbursement for oral health risk assessment and fluoride varnish application vary from state to state. (See Figure 1.)
### Resources

Suppliers of fluoride varnish

<table>
<thead>
<tr>
<th>Fluoride Name</th>
<th>Manufacturer</th>
<th>Colophonium Resin*</th>
<th>Supply Company</th>
<th>Unit Dose</th>
<th>Multiple Doses in 1 Tube</th>
<th>Fluoride</th>
</tr>
</thead>
<tbody>
<tr>
<td>AllSolutions</td>
<td>Dentsply Professional 800/989-8826 <a href="http://www.dentsply.com">www.dentsply.com</a></td>
<td>Yes</td>
<td>Patterson 800/552-1260</td>
<td>0.25 mL</td>
<td></td>
<td>5% NaF</td>
</tr>
<tr>
<td>Cavity Shield</td>
<td>Omnii/3M ESPE 800/445-3386</td>
<td>Yes</td>
<td>Patterson, RJM, Darby, Sullivan-Schein, others</td>
<td>0.25 mL 0.40 mL</td>
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<td>5% NaF</td>
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<tr>
<td>White Varnish*</td>
<td>3M ESPE 800/445-3386</td>
<td>No</td>
<td>Same as above</td>
<td>0.25 mL 0.4 mL 0.4 mL</td>
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<td>5% NaF</td>
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<tr>
<td>Durafluor</td>
<td>Medicom 800/361-2862</td>
<td>Yes</td>
<td>Patterson 800/552-1260</td>
<td>0.25 mL 0.4 mL</td>
<td>10-mL tube, brushes separate</td>
<td>5% NaF</td>
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<td>Duraphat</td>
<td>Colgate Oral Pharmaceuticals</td>
<td>Yes</td>
<td>Colgate Oral Pharmaceuticals</td>
<td>No</td>
<td>10-mL tube (Purchase brushes separately from Henry Schein: 800/372-4346.)</td>
<td>5% NaF</td>
</tr>
<tr>
<td>Fluo-Protector</td>
<td>Ivoclar North America Vivadent 800/327-4688</td>
<td>No</td>
<td>Patterson</td>
<td>0.4 mL</td>
<td></td>
<td>0.1% difluoro-silane</td>
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<tr>
<td>VarnishAmerica</td>
<td>Medical Product Laboratores 800/523-0191</td>
<td>No</td>
<td>Direct sales</td>
<td>0.25 mL 04 mL</td>
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<td>5% NaF</td>
</tr>
<tr>
<td>Topex DuroShield</td>
<td>Sultan Healthcare 800/238-6739</td>
<td>Yes + xylitol</td>
<td>Patterson or Darby</td>
<td>0.4 mL</td>
<td></td>
<td>5% NaF</td>
</tr>
</tbody>
</table>

*White Varnish from 3M ESPE is available without the colophonium resin. Omni claimed that some people are allergic to colophonium and this offers an alternative. It also has a total of 0.5 mL in each unit dose container, and the practitioner would use a dispensing guide to use the desired amount (eg, 0.25, 0.4, or 0.5 mL). Since it is a unit dose intended for one person, the amount not used is wasted. If you have a child that doesn’t have a full set of primary teeth.

The listing of brand names does not imply endorsement.

### Dental Supply Companies

- Darby 800/645-2310
- Patterson 800/328-5536
- Dental City 800/292-7910
- Sullivan Schein 800/372-4326
Why Is It Important to Assess Orthopedic Issues During the Physical Examination?

Many children who toe in or toe out are normal. Similarly, an appearance of knock knees and bow legs can be normal. It can be of great concern to parents. Our task is to distinguish normal from abnormal. If normal, knowledge of the etiology and the natural history is reassuring to the parents. If the condition is thought to be abnormal, appropriate studies and referrals can be made.

How Should You Perform These Examinations?

The evaluation of the child needs to begin with a history. Including the following questions:

- What do parents see that they are concerned about?
- When did they first notice the problem?
- Has it changed over time? Is it better? Is it worse? Is it just different?
- What is the family history? Did anyone else have the problem as a child or persisting into adulthood?
- What is the child’s birth history?
- Have they reached the appropriate developmental milestones?
- What is the child’s diet?

While taking the history, it is useful to observe the undressed child playing in the examination room. It is also imperative that a long hallway is used to observe the child run or walk and observe their gait. The specific examinations for different conditions are as follows.

Intoeing and Outtoeing

Toeing in or out may come from the hip, tibia or foot. Evaluation for each of these includes observing the child walking or running. Estimate the foot progression angle, which is the degrees that the foot points in (a negative foot progression angle) or points out (a positive foot progression angle) relative to a straight line.

To discover where the toeing in or toeing out is coming from you must assess the hip range of motion, assess the tibial torsion, and examine the feet.

Hip Rotation Evaluation

With young or fearful children, examine them on their parent’s lap. With the child’s hips flexed to a right angle, internally and externally rotate the hips. Lie the child down on the lap and do the same examination with the hips extended. Estimate the degree of internal and external rotation. Ideally, if the child is not apprehensive, turn the child prone to assess the rotation with the hips extended. To do this, place one hand on the pelvis and rotate the hip internally and externally until you feel the pelvis move. Examine each hip individually. Estimate the degree of rotation and record it quickly on the examination paper to prevent confusion when
documenting the examination in the medical record. Do one hip at a time and record the degree of internal and external rotation as you do the exam.

**Tibial Torsion**

Tibial torsion is most accurately evaluated with the patient prone on the examination table. It can be done at the same time as the hip rotation evaluation. However, I reserve this examination for older children, or children who are not fearful. With the child prone, flex the knee 90 degrees and imagine a line down the thigh and a line down the axis of the foot. This is the “thigh-foot-angle” and represents the amount of tibial torsion. For feet that turn inward as a result of twisting between the knee and the ankle (internal tibial torsion) this would be a negative thigh-foot-angle and is measured in degrees. Similarly, for feet that turn outward as a result of twisting of the tibia outward, the thigh-foot-angle would be a positive number.

With younger children, I do the examination on the parent’s lap. Therefore, the degree of twisting of the tibia and the amount of twisting is assessed with the patient in a sitting or supine position. The children will be less fearful in this position, and it is easier to demonstrate to the parents why the child toes in. Show the parents the position of the leg between the knee and the ankle. Point the knee toward you and gently dorsiflex the foot to neutral. Show the parents that while the knee is facing you, the ankle joint is facing inward (internal tibial torsion) or outward (external tibial torsion). For a strong demonstration to the parents about the etiology, place the child in their in-utero position. Usually this will be with the hips externally rotated so the knees are facing outward, and the feet tucked in toward the midline. The tibia has to be twisted for the child to fit in the uterus; there is no in-utero position with the knees and feet straight ahead.

Remember that the child can also be packed in utero with the feet turned outward in the same direction as the knee and will be born with external tibial torsion. Most noticeable is when one leg has external tibial torsion and one has internal tibial torsion, giving a “windswept” appearance. The child can still be placed in this in-utero position to demonstrate to the parents.

**Feet**

Observe the feet separately from the tibia. From the bottom of the foot you will be able to see clearly if there is a “hooking” inward of the forefoot, giving it a bean shape. This is metatarsus adductus, or metatarsus varus. Assess how flexible it is by tickling the child or observing their spontaneous movements. If the child does not straighten it out spontaneously, stretch it and see if it is passively correctable.

**Putting It All Together**

Natural history: Many children when they start to walk have physiologic bow legs (genu varum). This is not a true varus. Confirm this by putting the patellae facing anteriorly and the bowing should be much less evident. They have soft tissue external rotation contractures of their hips from the in-utero positioning combined with internal tibial torsion. As a result, they walk with their knees turned outward and their feet straight ahead, giving an appearance of bow legs. This is one of the reasons toddlers look so cute running up and down your hallway in their diaper—every time they take a step, their knee flexes and looks like it is jutting out laterally.

As the hips loosen up, usually by the age of 2 years, they walk with their knees forward, and now the internal tibial torsion is “uncovered” and they intoe. If you explain the natural history to the parents, they will be reassured, especially as time goes on and they see that the bowing is disappearing and the intoeing in is appearing as predicted. Over time, although it is slow, the tibial torsion and the femoral anteversion also correct. Beware, however, that all children do not fully correct these rotational “deformities.” Family history and examining the parents can be useful in predicting how much the child will correct the intoeing by the time they reach adulthood.

By the time the children are age 3, they will typically have a true knock knee (genu valgum). If they have a combination of internal rotation of the hip (the typical child will sit in the “W” position easily) combined with external tibial torsion the knock knee appearance will be more pronounced. The typical physiologic genu valgum corrects spontaneously and the knees should be straight by about age 6 years.
Young babies who have external tibial torsion from their in-utero position, as typically seen with calcaneovalgus feet, will predictably outtoe when they start to walk. These children have external rotation contractures of their hips, but now combined with external tibial torsion. I describe it to parents as “hips like a baby, legs like an adult.” As the hips loosen up and they walk with their knees straight ahead, their feet will also be straight ahead.

The children who have metatarsus adductus may spontaneously correct without treatment. It is usually detected at birth or shortly after birth. Often simple stretching is sufficient to fully correct the foot deformity. If it is rigid or severe, specific treatment may be needed.

Most intoeing and outtoeing, knock knees, and bowlegs are of concern in toddlers. However, older children may continue to in-toe due to excessive internal rotation of their hips. If this is combined with internal tibial torsion that has persisted, then the intoeing may be very noticeable.

What Do You Do With an Abnormal Result?

First, determine if the history is consistent with a normal condition (“My child was so bow legged when he first started walking, and now he toes in.”). If the examination is also consistent with normal intoeing and outtoeing, reassure the family. Keep a close eye on the child to be sure the condition is correcting and changing the way you expect.

<table>
<thead>
<tr>
<th>ICD-9-CM Codes</th>
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<tbody>
<tr>
<td>736.89 Tibial torsion (internal and external)</td>
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<tr>
<td>736.41 Genu valgum</td>
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<tr>
<td>736.42 Genu varum</td>
</tr>
<tr>
<td>754.53 Metatarsus varus (adductus)</td>
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<tr>
<td>755.60 Unspecified/other congenital anomaly of LE</td>
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Most intoeing and outtoeing is normal. There is no predictable way to change the natural history, so simple examination and observation are indicated. There are exceptions to this, however. There are some children who reach early adolescence and they are unable to get their feet straight ahead due to femoral anteversion, or residual internal tibial torsion. Surgery may be indicated in these children. They should be referred to a pediatric orthopedist.

The adolescent who outoes needs to be evaluated for a slipped capital femoral epiphysis. Do not overlook this diagnosis as the presenting complaints may be outtoeing and a limp. Adolescent children with genu varum should be referred to a pediatric orthopedist for diagnosis and treatment for possible adolescent Blounts.
Why Is It Important to Assess Sexual Maturity Stages During the Physical Examination?

Children with early puberty may have problems coping with the physical and hormonal changes of puberty. Girls may have difficulty coping with early menses and boys may experience excessive libido. Early and rapidly progressive precocious puberty can sometimes result in adult short stature. Most cases of precocious puberty are idiopathic, but occasionally boys or girls with precocious puberty have intracranial abnormalities or adrenal or gonadal conditions that require intervention.

Children with delayed puberty may have conditions that require intervention. These children may be late maturers because of constitutional delayed puberty, for which there is often a positive family history. Other conditions that may need assessment or intervention include acquired gonadal failure, gonadal dysgenesis due to Turner syndrome, isolated gonadotropin deficiency, or decreased body fat due to exercise (particularly swimming, gymnastics, and ballet dancing), or anorexia nervosa.

The age of pubertal onset may be declining. Recent studies suggest that the age of onset of puberty is close to 1 year earlier in US girls than 30 years ago. Evidence as to whether a similar trend is occurring in boys is inconclusive at this time.

Early puberty may be a marker for environmental exposure to estrogen-like chemicals, known as endocrine disrupters, that may affect the reproductive axis. Currently no clear evidence exists that environmental chemicals are the major cause of earlier puberty in girls, but studies are ongoing.

Several studies suggest that earlier onset of puberty may be associated with being overweight in girls, and late onset may be associated with abnormal thinness or a very high sustained level of physical activity. With regard to boys, data on the relationship between overweight and earlier pubertal development are conflicting.

The issue of whether or not early puberty is associated with more frequent emotional problems is complex, and studies are conflicting. Many early-maturing children do well, but others show an increase in behavioral problems. Several papers report an increased incidence of psychopathology in young adults who started puberty at an early age. This suggests that early-maturing children need close monitoring of their physical and mental health.

Given the younger age of appearance of signs of puberty, anticipatory guidance for children and parents is even more important than it was in the past.

Racial and ethnic differences in ages of achieving pubertal milestones vary. Results from the Pediatric Research in Office Settings study of puberty published in 1997 indicate that by the age of 8 to 9, approximately half of African-American girls and 15% of white girls will have some evidence of breast development, pubic hair growth, or both.
Reliable data for American boys are not available for testicular growth. During the fourth grade (age 9), about 21% of African-American boys and 4% of white boys have at least Stage 2 pubic hair.

### What Are the Stages of Sexual Maturity?

The system of sexual maturity rating most commonly used is based on the work of Marshall and Tanner. The stages are commonly referred to as the Tanner stages. This rating system has been widely used for decades in studies worldwide. There is no conventionally accepted scale for axillary hair development.

#### Pubic Hair: Male and Female

**Pubic Hair Stage 1**

Prepubertal. The vellus over the pubis is similar to that on the abdomen. This hair has not yet developed the characteristics of pubic hair.

**Pubic Hair Stage 2**

There is sparse growth of long, slightly pigmented downy hair, straight or only slightly curled, mainly at the base of the penis.

**Pubic Hair Stage 3**

The hair is considerably darker, coarser, and more curled. It is spread sparsely over the pubis.

**Pubic Hair Stage 4**

The hair is adult in type, but the area over which it is present is smaller than in most adults. It has not yet spread to the medial thighs or along the linea alba (in males).

**Pubic Hair Stage 5**

The hair is adult in quality and quantity and has the classical triangular distribution in females. It may spread to the medial surface of the thighs.

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<table>
<thead>
<tr>
<th>Girls: Median Age of Transition to Tanner Stages by Race/Ethnicity</th>
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<td><strong>Stage</strong></td>
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<td><strong>Pubic Hair</strong></td>
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<tr>
<td><strong>Breast Development</strong></td>
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<th>Boys: Median Age of Transition to Tanner Stages by Race/Ethnicity</th>
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<tr>
<td><strong>Pubic Hair</strong></td>
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<tr>
<td><strong>Genital Development</strong></td>
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Breasts: Females

Breast Stage 1
There is no development. Only the nipple is elevated.

Breast Stage 2
The “breast bud” stage, the areola widens, slightly darkens, and elevates from the rest of the breast. A bud of glandular tissue is palpable below the nipple.

Breast Stage 3
The breast and areola further enlarge, presenting a rounded contour. There is no change of contour between the nipple and areola and the rest of the breast. The diameter of breast tissue is still smaller than in a mature breast.

Breast Stage 4
The breast continues to grow. The papilla and areola project to form a secondary mound above the rest of the breast.

Breast Stage 5
The mature adult stage. The secondary mound disappears. Some females never progress to Stage 5.

Genitals: Males

Genital Stage 1
Prepubertal. Penis, testes, and scrotum are about the same size and proportions as in early childhood. It is important to take into account whether the penis is uncircumcised when assessing penile growth, as the uncircumcised penis may appear larger than it really is.

Genital Stage 2
Only the testes and scrotum have begun to enlarge from the early childhood size. The penis is still prepubertal in appearance. The texture of the scrotal skin is beginning to become thinner and the skin appears redder due to increased vascularization.

Genital Stage 3
There is further growth of the testes and scrotum. The penis is also beginning to grow, mainly in length with some increase in breadth. It can be difficult to distinguish between Stages 2 and 3.

Genital Stage 4
The penis enlarges further in length and breadth and the glans becomes more prominent. The testes and scrotum are larger. There is further darkening of the scrotal skin.

Genital Stage 5
The penis, testes, and scrotum are adult in size and shape.

How Should You Perform Sexual Maturity Staging?

Pubic Hair Staging

• Ensure adequate lighting, and examine the genital area with the pants and underwear completely removed or lowered to the knees. This is especially true in girls, where the first pubic hair may initially be only along the labia.

• In assessing pubic hair do not confuse fine, light-colored hair in the genital area with pubic hair if it is similar to the hair found on other parts of the trunk or thighs.

• Familiarity with the pictures in standard texts (such as those shown in this chapter) is helpful but, in some children, the appearance does not match the pictures, as some children may be in between stages.

Breast Staging

• The Tanner method, which involves staging of breast development by inspection alone and comparing it with standard pictures found in many texts, needs to be supplemented by palpation for overweight girls.

• If further assessment is needed

  • Examine breast with patient in supine position. If the consistency under the areola is similar to peripheral tissue, it is likely adipose tissue. Breast tissue is firmer and discoid in shape.

  • In girls, the areola becomes thicker and darker with progressive exposure to estrogens.
Boys stages of genital and pubic hair development.

Girls stages of breast development

Girls stages of pubic hair growth.
Male Genital Measurements

- The examiner should verify that the testes are descended and that the urethral opening is at the tip of the glans (ie, that the boy does not have hypospadias).

- In boys, the earliest and most reliable sign of pubertal development is enlargement of the testes, as it reflects increased secretion of the pituitary gonadotropins.

- Where further assessment is needed
  - Testicular size can be assessed by comparing testes with beads of varying size developed by Prader, known as an orchidometer. The beads correspond to testicular volumes of 1 mL through 25 mL. Other methods of measurement include rulers, calipers, and ultrasound. Ultrasound is the most accurate measurement method.
  - Another widely used method is to measure the greatest diameter by positioning the testis between the thumb, index, and middle finger and lining up a small ruler along the long axis of the testis.
  - Prepubertal boys nearly always have a testicular length of 2.5 cm or less or volume of 4 mL or less. As puberty progresses, the increase in testicular size usually precedes the increase in penis size, and eventually reaches the adult size of 5.0 cm or 25 mL.
  - Increasing penile length occurs later than initial growth of the testes.
  - To measure penile length accurately, use either a ruler or a marked tongue blade pressed at the base of the penis while applying firm stretch to the penis itself.
  - In normal prepubertal boys, the penile length is usually between 5 to 7 cm. A stretched length of 8 cm or greater indicates increased testosterone effect.
  - The physical examination record should note for undescended testicles; penile abnormalities, such as chordee; hypospadias; or anomalous genital development.
    - Adrenal androgens, which cause pubic hair development, do not increase penile length.

What Should You Do With an Abnormal Result?

Precocious Puberty

General Observations

Any child with signs of early puberty should have growth carefully plotted. Pathology is not common but is more likely in those children showing clear acceleration of linear growth.

If the only abnormal finding is appearance of pubic hair (often accompanied by axillary hair and odor), the diagnosis is likely premature adrenarche, a benign normal variant due to an early increase in adrenal androgen secretion. It occurs more often in girls but is not infrequent in boys. The risk of pathology is low, and extensive hormone testing and x-ray evaluation are generally not needed, unless there is rapid progression of pubic hair and/or growth acceleration.

- Labs are of limited use in typical cases in which there is early appearance of pubic hair. Dehydroepiandrosterone sulfate (DHEA-S), 17-hydroxyprogesterone, testosterone, and bone age should be considered in higher-risk cases. Luteinizing hormone (LH), follicle stimulating hormone (FSH), and estradiol are of no value if there is no breast development.

Breast Development

Isolated breast development with normal growth starting before age 3 is most likely due to premature thelarche, another benign normal variant. These girls can be monitored by the primary care physician if there is no progression or referred to a specialist if there is rapid growth or significant increase in breast diameter over time.

Breast development starting between the ages of 3 and 7 should generally be referred if it has persisted for at least 6 months.

In girls ages 7 to 8, early breast development is most often found in normal girls who start to mature at the early end of the normal range. However, girls whose breast enlargement progresses rapidly (eg, already at Tanner 3 when first seen or rapidly increases to Tanner 3) are at higher risk of pathology.
What Results Should You Document?

Record Tanner staging in the chart at all routine health supervision visits. For patients showing signs of early or delayed pubertal maturation, it may be helpful in these cases to see the child every 6 months rather than yearly, before deciding if a referral to an endocrinologist is needed.

Document lab tests and x-rays ordered, and results, as well as the follow-up plan.

If the child is referred to a specialist for further evaluation, be certain to give a copy of the results of any hormone testing or x-rays done as well as the growth chart to the parents to take to the appointment.

Be certain to send full evaluation testing on growth chart to referral source.

ICD-9-CM Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>259.0</td>
<td>Delayed puberty</td>
</tr>
<tr>
<td>259.1</td>
<td>Precocious puberty, premature adrenarche; premature thelarche</td>
</tr>
</tbody>
</table>

The American Academy of Pediatrics publishes a complete line of coding publications, including an annual edition of Coding for Pediatrics. For more information on these excellent resources, visit the American Academy of Pediatrics Online Bookstore at www.aap.org/bookstore/.

Resources

Evidenced-based Guidelines

Kaplowitz PB, Oberfield SE; Drug and Therapeutics and Executive Committee of the Lawson Wilkins Pediatric Endocrine Society. Reexamination of the age limit for defining when puberty is precocious in girls in the United States: implications for evaluation and treatment. Pediatrics. 1999;104:936–941

Books

Herman-Giddens ME, Bourdony CJ. Assessment of Sexual Maturity Stages in Boys. Elk Grove Village, IL: Pediatric Research in Office Settings, American Academy of Pediatrics; 2005

Herman-Giddens ME, Bourdony CJ. Assessment of Sexual Maturity Stages in Girls. Elk Grove Village, IL: Pediatric Research in Office Settings, American Academy of Pediatrics; 1995

**Articles**

**General**


Gafni RI, Chow C, Bryant J, Baron J. Assessment of thelarche by the inspection method of Tanner is less accurate than palpation. *Hormone Res*. 2005;64(suppl 1):205–206


**Pubertal Abnormalities**


Why Is It Important to Assess Spine, Hip, and Knee During the Physical Examination?

An accurate examination is key to appropriate referral. A number of pathologic conditions can arise or present in the spine, hip, and knee during childhood. Specific incidences of each vary with age.

Some of these conditions will require further evaluation and treatment by a specialist in general or pediatric orthopedic surgery. Examination findings are often the key to appropriate referral.

How Should You Perform This Examination?

The examination will vary with the age of the patient and the suspected anatomy involved.

When evaluating any presenting complaint anywhere in the lower extremities or back, it is critical to evaluate the spine, hip, and knee, at a minimum. Specifically, a number of pathologic hip conditions will present with knee symptoms.

Perform an Overview Examination of the Musculoskeletal System

This examination includes the following components:

- Take a careful history of developmental milestones.
- Observe gait and other movements.

- Observation of gait for screening is primarily concerned with symmetry and secondarily with difficulty in basic movements.
- Asymmetry should raise suspicion for underlying pathology.
- Unilateral refusal to bear weight in the very young child or significant exacerbation of pain with weight bearing in the verbal child can be worrisome and requires further evaluation.
- Examine the extremities.
- Assess neurologic function, including, at minimum, light touch sensation in the major dermatomes and peripheral nerve distributions.
- Test muscle strength in the major flexion and extension groups for each joint, deep tendon reflexes, abdominal reflexes, and gag reflex.

Perform a Spine Examination

Observe. A spine examination begins with inspection of the skin overlying the spine. Dimples, hair tufts, or disruption of the skin in the midline raises concern for underlying spina bifida.

Assess. Visually and manually note the symmetry in the height of the shoulders, the scapula, and the iliac crests with the patient in a 2-leg
stance. Although more sensitive radiographic measures of lower limb length discrepancy and truncal imbalance for screening exist, careful observation should reveal any severe asymmetries.

**Palpate.** A single spinous process should be palpable in the midline at all levels from the lower cervical through the lumbar spine. In the coronal plane, these should be vertically well-aligned.

**Conduct a provocative test.**

- The American Academy of Pediatrics and the US Preventive Services Task Force no longer recommend screening for scoliosis; however, when a concern is present regarding spinal curvature, the forward bend test is as follows.
  
  - The patient stands with feet shoulder width apart, facing you.
  
  - With hands together and arms dangling down, the patient slowly bends forward at the hips and lower spine until the hands are near or have touched the floor. The patient then straightens up again, slowly.
  
  - The patient repeats the bending a second time with back facing you.

- Watch for the truncal rotations that consistently result from scoliosis and other spine deformities.

- The scapulae and posterior rib contours should be symmetric. If the scapula or ribs on one side appear rotated upward when the patient is bent forward, the difference in height relative to the lower side or the angle subtended between the horizontal and a line tangential to the rotated section of the trunk should be measured and recorded. A scoliometer can also be used and the angle of rotation measured and recorded.

**Perform a Hip Examination**

Hip examinations will vary significantly with age, but these initial basics can be included for children and adolescents of most ages.

**Observe.** Swelling or erythema around a hip is highly unusual. Typical signs of an intra-articular source of pain and effusion are that the patient with a painful effusion resists or refuses to bear weight. The hip is slightly flexed and externally rotated.

**Palpate.** Although the hip joint capsule may be palpated just lateral to the palpable femoral pulses, best clinical information about the hip joint is gleaned from observing gait and supine resting preferred position as well as examining range of motion (flexion, extension, abduction, adduction, and internal and external rotation) and strength. Both the maximal arc of motion and the presence of pain at the extremes of that arc should be noted.

**Assess**

- **Flexion/extension:** With the child lying supine on an examination table, bring both hips up to maximal flexion and then release one at a time to extend back to the examination table. This permits measurement of both the degree of flexion in the flexed hip and the potential presence of a lack of full extension in the extended hip. Lack of full extension, flexion contracture, is common with long-standing intra-articular hip pathology. It will not generally be noticeable unless the contralateral hip is fully flexed, which usually prevents it from laying flat against the bed.

- **Internal/external rotation:** Assess with the hip flexed to 90 degrees, or perpendicular to the body. Hip internal rotation levers the foot away from body midline and hip external rotation levers the foot toward body midline.

Assess rotation with the hip extended with the child lying prone on the examination table and the knees flexed to 90 degrees. Rotate at hip. When feet are brought toward and past each other, the hips are in external rotation. When the feet are brought away from midline, the hips are in internal rotation.
Abduction/adduction: This maneuver is especially important in toddlers. Developmental dysplasia of the hip (DDH) may have no obvious sign other than limited hip abduction unilaterally and/or bilateral waddling gait.

With the child supine on the examination table, the knees are brought maximally away from midline both at full hip extension and at 90 degrees’ hip flexion. Measure abduction by recording the angle subtended between the midline axis and the femur at the extremes of abduction. Adduction is measured similarly in hip extension but with the knees brought toward and past midline.

Conduct a provocative test

Trendelenburg sign: Intra-articular hip pathology frequently induces weakness in hip abduction. Hip abduction raises the joint reactive forces across the painful hip, and is avoided. Weakness will be evident when the patient stands on the ipsilateral lower limb. A positive Trendelenburg sign is defined as the contralateral pelvis dropping below level, or the patient leaning over the painful hip for balance. Compare side to side. Single-leg stance on the normal hip with normal abductor strength will maintain a level pelvis.

Barlow provocative test: This maneuver is intended to screen an infant (0–3 months of age) for DDH. With the infant supine on a firm surface and sufficiently calm, flex the both hips to 90 degrees (thighs will be perpendicular to the trunk if the knees are also at 90-degree flexion). Hold the infant’s thighs with thumbs medially and fingers laterally. The infant’s knees are nested in the examiners first web space. Apply posterior (downward) pressure. A positive Barlow test will yield a clunk sensation as the femoral head subluxes or dislocates from the acetabulum. A negative test should yield firm, smooth resistance without yield or clunk.

Ortolani test: Also for DDH screening, this test is performed in infants 0 to 3 months of age. Hold hips as in Barlow, grasping knee between thumb and fingers, but place the tip of (second or third digit) finger(s) over the infant’s greater trochanters. Abduct hips with the thumbs and simultaneously apply medial and anterior pressure with the long fingers. A positive test will reduce the femoral heads into the acetabulum during abduction.

Perform a Knee Examination

Observe. With the child standing in a 2-leg stance, observe the overall alignment of the lower limbs. When the ankles are centered under the anterior-superior iliac spines, the patella should be roughly vertically aligned between them. The normal degree of coronal plane angulation across the knee will vary with age. Infants are born with physiologic varus or bow-legged alignment of their lower extremities. This corrects to neutral alignment by 18 to 24 months of age. Maximal valgus, or knock-kneed alignment, is characteristic of 3- to 5-year-olds. Normal adult alignment of 7 degrees of valgus between the tibia and the femur is reached by early school age. Watch the child walk and look for a lateral thrust of the knee, or an opening up of the knee into a more varus position. This may indicate that the bowing is not physiologic.
Palpate. Differentiate effusion from generalized swelling by the presence of a fluid wave or by shifting of the area of maximal swelling with variously applied manual pressure over bulging areas of the joint capsule. Tenderness of the knee just proximal to the tibial plateau, at the joint line (laterally or medially), is suggestive of (lateral or medial) meniscal pathology. Prominence or tenderness of the tibial tubercle suggests a diagnosis of Osgood-Schlatter disease.

Assess. Knee motion ranges from full extension, where the tibia and femur are parallel, to full flexion, where the heel touches the ipsilateral buttocks.

To evaluate genu varum (bow legs) or genu valgum (knock knees), the child should be supine on the examination table with the knees and hips extended and adducted until the limbs touch.

If the knees touch first, measure the distance between the medial malleoli of the ankles (intermalleolar distance). This is a quantitative measure of clinical valgus. If the ankles approximate first, the distance between the medial femoral condyles (intercondylar distance) is the quantification of genu varum.

If the child is apprehensive, the child can be examined in the parent’s lap: Child and parent will be facing examiner with child seated in lap. Hips and knees are flexed 90 degrees with knees facing examiner. If there is internal tibial torsion, feet will cross. If bowing (or valgus) is no longer present, the condition is likely physiologic.

To evaluate Q-angle: With the child lying supine, but with the knee flexed 30 degrees, the angle between a line connecting the anterior superior iliac spine and the center of the patella and a line from the center of the patella to the tibial tubercle (the insertion of the patella tendon). This angle is normally 12 degrees with the apex toward the midline. Increases in this angle may be associated with patellofemoral instability.

Scales or Tools

No specific grades or tools exist for these examinations. Symmetry is more important than meeting a set expected range of motion.

What Should You Do With an Abnormal Result?

For hip abnormalities in an infant, maintain a low threshold. Refer the infant for plain films (generally after 4 months of age) of the hips or for ultrasonography (usually done in the first 2–4 months, if a specialist with experience in this technique is available in your medical care system). Make the referral to the orthopedic surgeon who cares for children’s orthopedic problems in your referral system. This specialist may be a general orthopedic surgeon or a pediatric orthopedic surgeon.

Consider skeletal dysplasia in any child with genu varum or valgus deformities who has poor linear growth. If the child is bow legged, and it is getting worse over time, consider rickets (obtain a dietary history; examine wrists for metaphyseal flaring; examine ribs for beading; and obtain radiographs, calcium, phosphorus, alkaline phosphatase, and 25 OH vitamin D).

Infantile Blount’s disease, or tibia vara, must be considered in children who walk early and have an increasing or persistent varus deformity at 2 1/2 years, especially with lateral thrust on weight bearing. This is a radiographic diagnosis and requires consultation from a pediatric orthopedist.
Adolescent children may develop Blount’s disease. It is often a unilateral disorder in obese children with complaints of knee pain; referral to an orthopedic or pediatric orthopedic surgeon is recommended.

Genu valgum may represent a variety of pathologic conditions. Use laboratory studies to rule out renal osteodystrophy and rickets. Use radiographs to rule out tumors, fractures, and skeletal dysplasias, especially poor linear growth. Refer severe, progressive, or asymmetric genu valgum to an orthopedic surgeon or pediatric orthopedist for evaluation.

What Results Should You Document?

Findings for each of these examination maneuvers can be documented in a typical clinical note by simple description of both normal and abnormal findings. Be certain to perform and document an examination of the knee and hip for any patient with complaints near either joint. It is especially important to examine and document hip findings, as well as knee, thigh, and leg findings, with any knee complaint in children, since hip pathology often presents with knee pain.

Resources

Books


Web Sites


Provides information on various orthopedic screening examinations for children.


Provides information on screening examinations and techniques for the spine, hip, and knee.
How Should You Perform a Sports Physical Examination?

The history is the most important aspect of the evaluation process, with the 3 key systems being the cardiac, musculoskeletal, and neurologic systems. The fourth edition of the preparticipation physical evaluation form is an excellent tool for documenting the history and physical evaluation for athletes as discussed below.

Perform a Cardiac History and Examination

A cardiac history and examination are important because 12 to 36 sudden cardiac deaths occur annually in youth younger than 18 years. The most common causes of sudden cardiac arrest in children and adolescents are hypertrophic cardiomyopathy (HCM), Marfan syndrome, total anomalous pulmonary venous return, and long QT syndrome.

Randomized clinical trials to test screening questions for cardiac sports participation clearance have not yet been conducted, but the American Heart Association and other organizations have published several consensus statements on this topic. These statements can guide your history interview. If an athlete answers yes to any of the following questions, withhold participation clearance until you complete further diagnostic workup.

Based on the latest Preparticipation Physical Evaluation, fourth edition (forms at the end of this chapter), the most important cardiac history questions include:

- Have you fainted/passed out (or nearly fainted) during or after exercise?
- Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?
- Does your heart ever race or skip beats during exercise?
- Do you get lightheaded, feel more short of breath, or feel more fatigued than expected during exercise?
- Has a doctor ever told you that you have any heart problems?
- Has a doctor ever ordered a test for your heart?
- Has any family member or relative died of heart problems or had an unexpected or unexplained sudden death before age 50?
- Does anyone in your family have a heart condition, such as hypertrophic cardiomyopathy or dilated cardiomyopathy, Marfan syndrome, arrhythmias, or long QT syndrome?
- Has anyone in your family had unexplained fainting or drowning?

In the past, health care practitioners performed a specific “sports physical.” Now the American Academy of Pediatrics suggests that adolescents in need of a yearly physical examination to participate in sports receive a complete health supervision checkup. This chapter will discuss some of the particular aspects that may need to be addressed in children and adolescents who are interested in participating in sports, but a full history and physical also are warranted. Many of these issues also may be reviewed in adolescents and children who do not participate in organized sports.
Syncope. Syncope is a sudden, transient loss of postural tone and consciousness with spontaneous recovery, not due to head injury or seizure. Syncope occurring during exercise is concerning for a cardiac disorder (both anatomical abnormalities [HCM] and conduction [Wolfe-Parkinson-White syndrome, prolonged QT] abnormalities).

Syncope occurring while standing or sitting with no other pertinent historical events is not a contraindication to sports participation. Nutrition counseling, with particular attention to salt and hydration status, is needed.

Perform a Musculoskeletal History and Examination

A musculoskeletal history and examination are important because these types of conditions and injuries are identified more than any other conditions and injuries.

After taking the history and performing the examination, determine clearance, establish a referral mechanism, and determine scope of participation.

Acute (ankle sprain, shoulder dislocation, patella dislocation) and chronic (Osgood-Schlatter disease, Sever’s disease, shin splints) conditions may present themselves during the history or the physical examination.

Ankle sprains. These injuries are most commonly lateral and are graded for function as mild, moderate, or severe.

- In a mild sprain, the athlete can typically run and jump but may have difficulty with lateral movement. Noncontact sports may be permitted at the time of the examination.
- In a moderate sprain, the athlete can usually walk but not run and jump.
- In a severe sprain, walking may be difficult. The return to play may be anywhere from 2 to 12 weeks.

Shoulder and patella dislocations. An athlete should not return to play until full range of motion and 90% of baseline strength are achieved. Range of motion is easy to test but strength may be difficult. In the case of a patella dislocation, functional testing, such as sprinting and jumping on one foot, may be performed. Once the athlete can demonstrate function, he or she may begin to practice.

Osgood-Schlatter disease (tibial tuberosity inflammation at patella tendon insertion). The athlete may participate if he or she is not limping at the end of a game or practice. Nonsteroidal anti-inflammatory drugs may be used for analgesia and anti-inflammatory effects, but limited duration is advised. Stretching and strengthening is suggested.

Sever’s disease (calcaneal apophysitis). The patient will have pain at the distal Achilles tendon insertion into the calcaneous. Like Osgood-Schlatter disease, athletes may participate as long as they are not limping at the end of a game or practice and have full range of motion and 90% strength.

Shin splints (medial tibia stress syndrome). This injury is defined as diffuse pain over the anteromedial tibia. Shin splints should not be confused with a tibial stress fracture, which may be differentiated from medial tibial stress syndrome by well-localized, pinpoint pain and tenderness. Running and jumping may not be permitted for 4 to 6 weeks following tibial stress fractures.

Scoliosis and kyphosis. These conditions are typically diagnosed at the time of the physical examination. Neither is a contradiction to full participation; however, you may need to conduct an assessment for underlying genetic or neuromuscular disorder.

Perform a Neurologic History and Examination

The neurologic history is important because many athletes who have experienced concussions return to play but still experience symptoms, such as inability to concentrate and learning difficulties.

Perform Eye and Kidney Histories and Examinations

Conduct a funduscopic examination for cataracts and screening for visual acuity. Athletes with poor vision and best-corrected visual acuity of 20/40 in one eye are considered functionally one-eyed. In such cases, protective eyewear is recommended. Noncontact sports are permitted in all cases of decreased visual acuity. Participation in high-contact sports, such as wrestling or full-contact martial arts, is not recommended.
For patients who have a single kidney or a single functioning kidney, the athlete needs individual assessment for contact, collision, and limited-contact sports and a clear discussion about the risks of participation in sports and recreational activities that may have incidental or deliberate contact. Protective equipment may reduce risk of injury to the remaining kidney sufficiently to allow participation in most sports, providing such equipment remains in place during activity.

For athletes who have one paired organ, every effort should be made for some type of sports participation, with protective gear if necessary.

**What Should You Do With an Abnormal Result?**

The results of your history and examination will lead to 1 of 3 categories for sports participation: **cleared, not cleared,** and **in need of further evaluation.** It is quite straightforward when an athlete is cleared. The confusing area is when a student athlete is temporarily not cleared or is in need of further evaluation. This category may result from an injury (eg, a fracture or recent surgery) or medical condition (infectious mononucleosis or concussion).

In these circumstances, it is extremely important to have a coordinated approach with the team coach, family, and athlete.

**What Results Should You Document?**

The patient’s health record and school forms need to indicate the student’s participation or restrictions.

**Resources**

**Articles**


**Reference**

PERFORMING PREVENTIVE SERVICES

HISTORY FORM

Date of Exam

Name

Sex

Age

Grade

School

Date of birth

Sports

Medicines and Allergies: Please list all of the prescription and over-the-counter medicines and supplements (herbal and nutritional) that you are currently taking.

________________________________________________________

Do you have any allergies? □ Yes □ No  If yes, please identify specific allergy below.
□ Medicines  □ Pollens  □ Food  □ Stinging Insects

Explain "Yes" answers below. Circle questions you don’t know the answers to.

GENERAL QUESTIONS

1. Has a doctor ever denied or restricted your participation in sports for any reason?

□ Yes □ No

2. Do you have any ongoing medical condition? If so, please identify below:

□ Asthma  □ Anemia  □ Diabetes  □ Infections  Other:

□ Yes □ No

3. Have you ever spent the night in the hospital?

□ Yes □ No

4. Have you ever had surgery?

□ Yes □ No

HEART HEALTH QUESTIONS

5. Have you ever passed out or nearly passed out during or after exercise?

□ Yes □ No

6. Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?

□ Yes □ No

7. Does your heart ever race or skip beats (irregular beats) during exercise?

□ Yes □ No

8. Has a doctor ever told you that you have any heart problems? If so, check all that apply:

□ High blood pressure  □ A heart murmur  □ High cholesterol  □ A heart infection

□ Kawasaki disease  Other:

□ Yes □ No

9. Has a doctor ever ordered a test for your heart? (For example, ECG/EKG, echocardiogram)

□ Yes □ No

10. Do you get light headed or feel more short of breath than expected during exercise?

□ Yes □ No

11. Have you ever had an unexplained seizure?

□ Yes □ No

12. Do you get more tired or short of breath more quickly than your friends during exercise?

□ Yes □ No

HEART HEALTH QUESTIONS ABOUT YOUR FAMILY

13. Has any family member or relative died of heart problems or had an unexpected or unexplained sudden death before age 50 (including drowning, unexplained car accident, or sudden infant death syndrome)?

□ Yes □ No

14. Does anyone in your family have hypertrophic cardiomyopathy, Marfan syndrome, arrhythmogenic right ventricular cardiomyopathy, long QT syndrome, short QT syndrome, Brugada syndrome, or catecholaminergic polymorphic ventricular tachycardia?

□ Yes □ No

15. Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator?

□ Yes □ No

16. Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning?

□ Yes □ No

BONE AND JOINT QUESTIONS

17. Have you ever had an injury to a bone, muscle, ligament, or tendon that caused you to miss a practice or a game?

□ Yes □ No

18. Have you ever had any broken or fractured bones or dislocated joints?

□ Yes □ No

19. Have you ever had an injury that required x-rays, MRI, CT scan, injections, therapy, a brace, a cast, or crutches?

□ Yes □ No

20. Have you ever had a stress fracture?

□ Yes □ No

21. Have you ever been told that you have or had an x-ray for neck instability or atlantoaxial instability? (Downs syndrome or torticollis)

□ Yes □ No

22. Do you regularly use a brace, orthotics, or other assistive device?

□ Yes □ No

23. Do you have a bone, muscle, or joint injury that bothers you?

□ Yes □ No

24. Do any of your joints become painful, swollen, feel warm, or look red?

□ Yes □ No

25. Do you have any history of juvenile arthritis or connective tissue disease?

□ Yes □ No

Explain "yes" answers here

I hereby state that, to the best of my knowledge, my answers to the above questions are complete and correct.

Signature of athlete

Signature of parent/guardian

Date


HE0035 9-2011/0410
Preparticipation Physical Evaluation

The Athlete with Special Needs: Supplemental History Form

Date of Exam __________________________

Name __________________________ Date of birth __________________________

Sex _______ Age _______ Grade _______ School _______ Sport(s) _______

1. Type of disability
2. Date of disability
3. Classification (if applicable)
4. Cause of disability (birth, disease, accident/trauma, other)
5. List the sports you are interested in playing

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Do you regularly use a brace, assistive device, or prosthesis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Do you use any special bracs or assistive devices for sports?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Do you have any rashes, pressure sores, or any other skin problems?</td>
<td></td>
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<tr>
<td>9. Do you have a hearing loss? Do you use a hearing aid?</td>
<td></td>
<td></td>
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<tr>
<td>10. Do you have a visual impairment?</td>
<td></td>
<td></td>
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<tr>
<td>11. Do you use any special devices for bowel or bladder function?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Do you have burning or discomfort when urinating?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Have you had autonomic dysreflexia?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Have you ever been diagnosed with a heat-related (hyperthermia) or cool-related (hypothermia) illness?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Do you have muscle spasticity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Do you have frequent seizures that cannot be controlled by medication?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explain “yes” answers here

Please indicate if you have ever had any of the following.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantoaxial instability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-ray evidence of atlantoaxial instability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dislocated joints (more than one)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy bleeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enlarged spleen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteopenia or osteoporosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty controlling bowel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty controlling bladder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbness or tingling in arms or hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbness or tingling in legs or feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weakness in arms or hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weakness in legs or feet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recent change in coordination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recent change in ability to walk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sclera icterica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latex allergy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explain “yes” answers here

I hereby state that, to the best of my knowledge, my answers to the above questions are complete and correct.

Signature of athlete __________________________ Signature of parent/guardian __________________________ Date __________________________

# Preparticipation Physical Evaluation

## Physical Examination Form

### PHYSICIAN REMinders

1. Consider additional questions on more sensitive issues
   - Do you feel stressed out or under a lot of pressure?
   - Do you ever feel sad, hopeless, depressed, or anxious?
   - Do you feel safe at your home or residence?
   - Have you ever tried cigarettes, chewing tobacco, snuff, or dip?
   - During the past 30 days, did you use chewing tobacco, snuff, or dip?
   - Do you drink alcohol or use any other drugs?
   - Have you ever taken anabolic steroids or used any other performance supplement?
   - Have you ever taken any supplements to help you gain or lose weight or improve your performance?
   - Do you wear a seat belt, use a helmet, and use condoms?

2. Consider reviewing questions on cardiovascular symptoms (questions 5-14).

### Examination

<table>
<thead>
<tr>
<th>MEDICAL</th>
<th>NORMAL</th>
<th>ABNORMAL FINDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Marfan deformities</em> (kyphoscoliosis, high-arched palate, pectus excavatum, arachnodactyly, arm span &gt; height, hyperlaxity, myopia, MVP, aortic insufficiency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyes/nose/throat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lymph nodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Murmurs (auscultation standing, supine. +/- Valsalva) Location of point of maximal impulse (PMI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palses</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Simultaneous femoral and radial pulses</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lungs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auscultation (males only)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genitourinary (males only)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>HSV lesions suggestive of MRSA, toe eczema</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurologic*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Musculoskeletal

| Neck         |        |
| Back         |        |
| Shoulder/arm |        |
| Elbow/forearm|        |
| Wrist/hand/fingers |      |
| Hip/leg     |        |
| Knee        |        |
| Leg/ankle   |        |
| Foot/leg    |        |

*Consider EOS, echocardiogram, and referral to cardiologist for abnormal cardiac history or exam.

*Consider HIV exam if in private setting, having third party present is recommended.

*Consider cognitive/evaluation or baseline neuropsychiatric testing if a history of significant concussion.

- ☐ Cleared for all sports without restriction
- ☐ Cleared for all sports without restriction with recommendations for further evaluation or treatment for

- ☐ Not cleared
  - ☐ Pending further evaluation
  - ☐ For any sports
  - ☐ For certain sports

Reason:  

Recommendations:  

I have examined the above-named student and completed the preparticipation physical evaluation. The athlete does not present apparent clinical contraindications to practice and participate in the sport(s) as outlined above. A copy of the physical exam is on record in my office and can be made available to the school at the request of the parents. If conditions arise after the athlete has been cleared for participation, the physician may rescind the clearance until the problem is resolved and the potential consequences are completely explained to the athlete (and parents/guardians).

Name of physician (print/type)  
Address  
Signature of physician  
Date  
Phone  
MD or DO

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Preparticipation Physical Evaluation

CLEARANCE FORM

Name ___________________________ Sex □ M □ F Age ______________ Date of birth ______________

☐ Cleared for all sports without restriction

☐ Cleared for all sports without restriction with recommendations for further evaluation or treatment for ___________________________

☐ Not cleared

☐ Pending further evaluation

☐ For any sports

☐ For certain sports ___________________________

Reason ___________________________

Recommendations

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

I have examined the above-named student and completed the preparticipation physical evaluation. The athlete does not present apparent clinical contraindications to practice and participate in the sport(s) as outlined above. A copy of the physical exam is on record in my office and can be made available to the school at the request of the parents. If conditions arise after the athlete has been cleared for participation, the physician may rescind the clearance until the problem is resolved and the potential consequences are completely explained to the athlete (and parents/guardians).

Name of physician (print/type) ___________________________ Date ______________

Address ___________________________ Phone ______________

Signature of physician ___________________________ MD or DO

EMERGENCY INFORMATION

Allergies ___________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

Other information ___________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
SCREENING

Screening occurs at each Bright Futures health supervision visit. Certain screenings are universal (ie, they are applied to each child at a particular visit). For example, all children at the 1-year visit are screened for lead exposure. Other screenings are selective (ie, they occur only if a risk assessment is positive). For example, a child will receive a tuberculin skin test at the 7-year visit if he or she answers positively on risk screening questions.

The chapters in this section of the book were selected because they provide important “how-to” information to guide health care professionals. The Immunizations, Newborn Screening, and Capillary Blood Tests chapter provides up-to-date information on all the immunization schedules. Ensuring that all children’s and adolescents’ immunizations are complete is an essential element of preventive health services and a key component of each Bright Futures visit.

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