

GROWTH AND DEVELOPMENT

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CHAPTER 5

Normal Growth

HEALTH MAINTENANCE VISIT

The frequent office visits for health maintenance in the first 2 years of life are more than physicals. Although a somatic history and physical examination are important parts of each visit, many other issues are discussed, including nutrition, behavior, development, safety, and **anticipatory guidance**.

Disorders of growth and development are often associated with chronic or severe illness or may be the only symptom of parental neglect or abuse. Although normal growth and development does not eliminate a serious or chronic illness, in general, it supports a judgment that a child is healthy except for acute, often benign illnesses.

The processes of growth and development are intertwined. However, it is convenient to refer to **growth** as the increase in size and **development** as an increase in function of processes related to body and mind. Being familiar with normal patterns of growth and development allows practitioners who care for children to recognize and manage abnormal variations.

The genetic makeup and the physical, emotional, and social environment of the individual determine how a child grows and develops throughout childhood. Helping each child achieve individual potential through periodically monitoring and screening for the normal progression or abnormalities of growth and development is one goal of pediatrics. The American Academy of Pediatrics recommends routine office visits in the first week of life (within 72 hours of routine nursery discharges); by 1 month of age; at 2, 4, 6, 9, 12, 15, and 18 months; at 2, 2 1/2, and 3 years; and then annually through adolescence/young adulthood (see Fig. 9.1; the *Bright Futures* 'Recommendations for Preventive Pediatric Health Care' found at https://www.aap.org/en-us/documents/periodicity_schedule.pdf).

Deviations in growth patterns may be nonspecific or may be important indicators of serious and chronic medical disorders. An accurate measurement of length/height, weight, and head circumference (measure head circumference through age 24 months) should be obtained at every health supervision visit and compared with statistical norms on growth charts. Table 5.1 summarizes several convenient benchmarks to evaluate normal growth. Serial measurements that establish a growth trend are much more useful than single measurements for detecting abnormal growth patterns. A single

measurement may be within statistically defined normal limits (percentiles) while being at a vastly different percentile from previous measurements, representing a growth pattern that warrants further evaluation.

Growth is assessed by plotting accurate measurements on growth charts and comparing each set of measurements with previous measurements obtained at health visits. Please see examples in Figs. 5.1–5.4. Complete charts can be found at www.cdc.gov/growthcharts. The body mass index is defined as body weight in kilograms divided by height in meters squared; it is used to classify adiposity and is recommended as a screening tool for children and adolescents to identify those overweight or at risk for being overweight (see Chapter 29).

Normal growth patterns have spurts and plateaus, so some shifting on percentile graphs can be expected. Large shifts in percentiles warrant attention, as do large discrepancies in height, weight, and head circumference percentiles. When caloric intake is inadequate, the weight percentile falls first, then the height; the head circumference is last. Caloric intake may be poor as a result of inadequate feeding or because the child is not receiving adequate attention and stimulation (*nonorganic* failure to thrive [see Chapter 21]).

TABLE 5.1 Rules of Thumb for Growth

WEIGHT

Weight loss in first few days: 5–10% of birthweight

Return to birthweight: 7–10 days of age

Double birthweight: 4–5 months

Triple birthweight: 1 year

Daily weight gain:

20–30 g for first 3–4 months

15–20 g for rest of the first year

HEIGHT

Average length: 20 in. at birth, 30 in. at 1 year

At age 4 years, the average child is double birth length or 40 in.

HEAD CIRCUMFERENCE (HC)

Average HC: 35 cm at birth (13.5 in.)

HC increases: 1 cm per month for first year (2 cm per month for first 3 months, then slower)

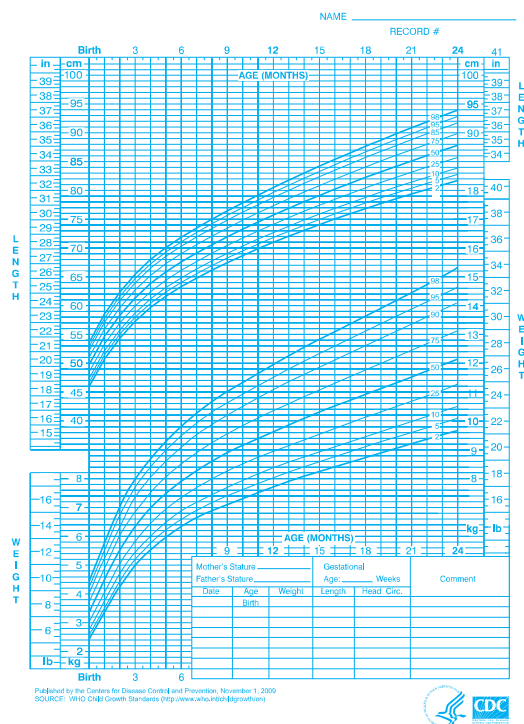


FIGURE 5.1 Length-by-age and weight-by-age percentiles for boys, birth to 2 years of age. Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion. (From Centers for Disease Control and Prevention. *WHO Child Growth Standards*. Atlanta, GA: CDC; 2009. <http://www.cdc.gov/growthcharts>.)

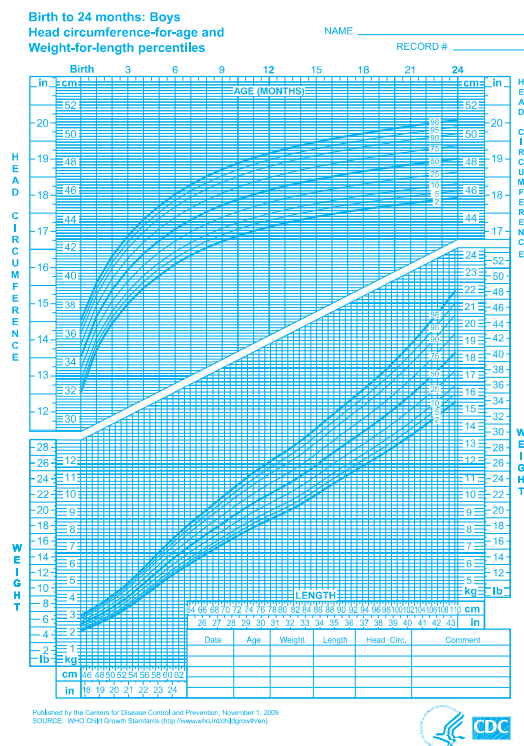


FIGURE 5.2 Head circumference and weight-by-length percentiles for boys, birth to 2 years of age. Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion. (From Centers for Disease Control and Prevention. *WHO Child Growth Standards*. Atlanta, GA: CDC; 2009. <http://www.cdc.gov/growthcharts>.)

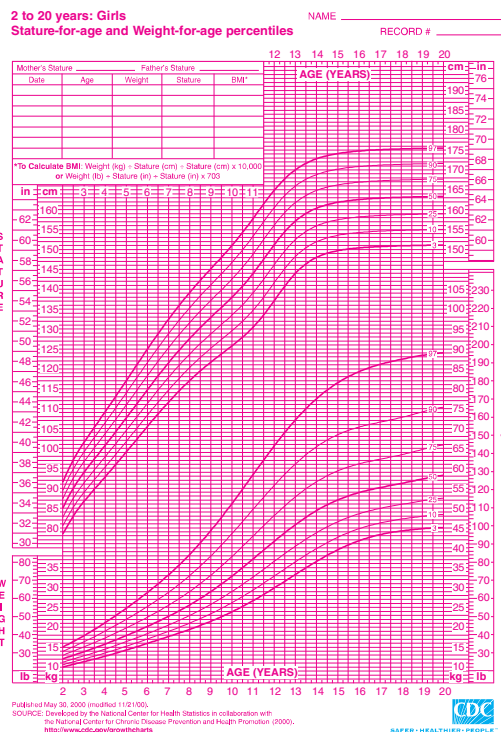


FIGURE 5.3 Stature-for-age and weight-for-age percentiles for girls, 2–20 years of age. Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion. (From Centers for Disease Control and Prevention. Atlanta, GA; 2001. <http://www.cdc.gov/growthcharts>.)

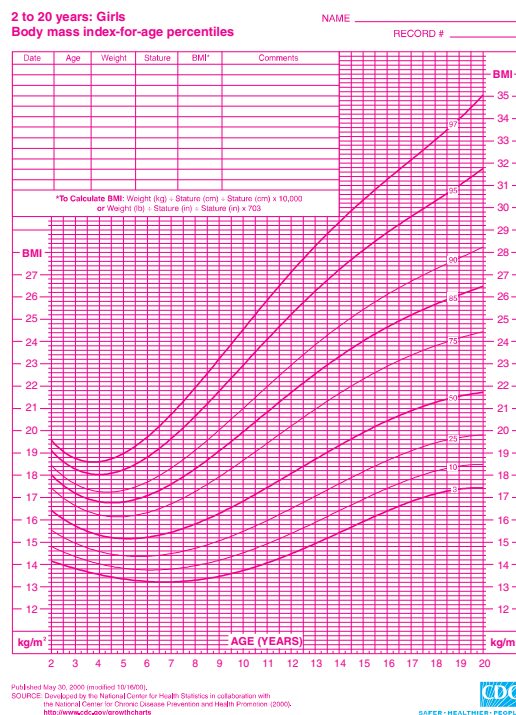


FIGURE 5.4 Body mass index-for-age percentiles for girls, 2–20 years of age. Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion. (From Centers for Disease Control and Prevention. Atlanta, GA; 2001. <http://www.cdc.gov/growthcharts>.)

Caloric intake also may be inadequate because of increased caloric needs. Children with chronic illnesses, such as heart failure or cystic fibrosis, may require a significantly higher caloric intake to sustain growth. An increasing weight percentile in the face of a falling height percentile suggests hypothyroidism. Head circumference may be disproportionately large when there is familial megalcephaly, hydrocephalus, or merely *catch-up* growth in a neurologically normal premature infant. A child is considered microcephalic if the head circumference is less than the 3rd percentile, even if length and weight measurements also are proportionately low. Serial measurements of head circumference are crucial during infancy, a period of rapid brain development, and should be plotted regularly until the child is 2 years of age. Any suspicion of abnormal growth warrants at least a close follow-up, further evaluation, or both.

PEARLS FOR PRACTITIONERS

See *Growth and Development: Pearls for Practitioners* at the end of this section.

CHAPTER 6

Disorders of Growth

The most common reasons for deviant measurements are technical (i.e., faulty equipment and human errors). Repeating a deviant measurement is the first step. Separate growth charts are available and should be used for very low birthweight infants (weight <1,500 g) and for those with Turner syndrome, Down syndrome, achondroplasia, and various other dysmorphism syndromes.

Variability in body proportions occurs from fetal to adult life. Newborns' heads are significantly larger in proportion to the rest of their body. This difference gradually disappears. Certain growth disturbances result in characteristic changes in the proportional sizes of the trunk, extremities, and head. Patterns requiring further assessment are summarized in [Table 6.1](#).

Evaluating a child over time, coupled with a careful history and physical examination, helps determine whether the growth pattern is normal or abnormal. Parental heights may be useful when deciding whether to proceed with a further evaluation. Children, in general, follow their parents' growth patterns, although there are many exceptions.

For a girl, midparental height is calculated as follows:

$$\frac{\text{Paternal height (inches)} + \text{Maternal height (inches)}}{2} - 2.5$$

For a boy, midparental height is calculated as follows:

$$\frac{\text{Paternal height (inches)} + \text{Maternal height (inches)}}{2} + 2.5$$

Actual growth depends on too many variables to make an accurate prediction from midparental height determination for every child. The growth pattern of a child with low weight, length, and head circumference is commonly associated with **familial short stature** (see [Chapter 173](#)). These children are genetically normal but are smaller than most children. A child who, by age, is preadolescent or adolescent and who starts puberty later than others may have the normal variant called **constitutional short stature** (see [Chapter 173](#)); careful

TABLE 6.1 Specific Growth Patterns Requiring Further Evaluation

PATTERN	REPRESENTATIVE DIAGNOSES TO CONSIDER	FURTHER EVALUATION
Weight, length, head circumference all <5th percentile	- Familial short stature - Constitutional short stature - Intrauterine insult - Genetic abnormality	- Midparental height - Evaluation of pubertal development - Examination of prenatal records - Chromosome analysis
Discrepant percentiles (e.g., weight 5th, length 5th, head circumference 50th, or other discrepancies)	- Normal variant (familial or constitutional) - Endocrine growth failure - Caloric insufficiency	- Midparental height - Thyroid hormone - Growth factors, growth hormone testing - Evaluation of pubertal development
Declining percentiles	- Catch-down growth - Caloric insufficiency - Endocrine growth failure	- Midparental height - Complete history and physical examination - Dietary and social history - Growth factors, growth hormone testing

examination for abnormalities of pubertal development should be done. An evaluation for primary amenorrhea should be considered for any female adolescent who has not reached menarche by 15 years or has not done so within 3 years of thelarche (beginning of breast development). Lack of breast development by age 13 years also should be evaluated (see [Chapter 174](#)).

Starting out in high growth percentiles, many children assume a lower percentile between 6 and 18 months of age until they match their genetic programming; then they grow along new, lower percentiles. They usually do not decrease more than two major percentiles and have normal developmental, behavioral, and physical examinations. These children with *catch-down growth* should be followed closely, but no further evaluation is warranted.

Infants born small for gestational age, or prematurely, ingest more breast milk or formula and, unless there are complications that require extra calories, usually exhibit *catch-up growth* in the first 6 months. These infants should be fed on demand and provided as much as they want unless they are vomiting (not just spitting up [see [Chapter 128](#)]). Some may benefit from a higher caloric content formula. Many psychosocial risk factors that may have led to being born small or early may contribute to nonorganic failure to thrive (see [Chapter 21](#)). Conversely, infants who recover from being low birthweight or premature have an increased risk of developing childhood obesity.

Growth of the nervous system is most rapid in the first 2 years, correlating with increasing physical, emotional, behavioral, and cognitive development. There is again rapid change during adolescence. Osseous maturation (bone age) is determined from radiographs on the basis of the number and size of calcified epiphyseal centers; the size, shape, density, and sharpness of outline of the ends of bones; and the distance separating the epiphyseal center from the zone of provisional calcification.

PEARLS FOR PRACTITIONERS

See *Growth and Development: Pearls for Practitioners* at the end of this section.

CHAPTER 7

Normal Development

PHYSICAL DEVELOPMENT

Parallel to the changes in the developing brain (i.e., cognition, language, behavior) are changes in the physical development of the body.

NEWBORN PERIOD

Observation of any asymmetric movement or altered muscle tone and function may indicate a significant central nervous system abnormality or a nerve palsy resulting from the delivery and requires further evaluation. Primitive neonatal reflexes are unique in the newborn period and can further elucidate or eliminate concerns over asymmetric function. The most important reflexes to assess during the newborn period are as follows:

The **Moro reflex** is elicited by allowing the infant's head to gently move back suddenly (from a few inches off of the mattress onto the examiner's hand), resulting in a startle, then abduction and upward movement of the arms followed by adduction and flexion. The legs respond with flexion.

The **rooting reflex** is elicited by touching the corner of the infant's mouth, resulting in lowering of the lower lip on the same side with tongue movement toward the stimulus. The face also turns toward the stimulus.

The **sucking reflex** occurs with almost any object placed in the newborn's mouth. The infant responds with vigorous sucking. The sucking reflex is replaced later by voluntary sucking.

The **asymmetric tonic neck reflex** is elicited by placing the infant supine and turning the head to the side. This placement results in ipsilateral extension of the arm and the leg into a "fencing" position. The contralateral side flexes as well.

A delay in the expected disappearance of the reflexes may also warrant an evaluation of the central nervous system.

See Sections 11 and 26 for additional information on the newborn period.

LATER INFANCY

With the development of gross motor skills, the infant is first able to control posture, then proximal musculature, and, last, distal musculature. As the infant progresses through these stages, the parents may notice orthopedic deformities (see Chapters 202 and 203). The infant also may have deformities that are related to intrauterine positioning. Physical examination should indicate whether the deformity is fixed or can be moved passively into the proper position. When a joint held in an abnormal fashion can be moved passively into the proper position, there is a high likelihood of resolving with the progression of gross motor development. Fixed deformities warrant immediate pediatric orthopedic consultation (see Section 26).

Evaluation of vision and ocular movements is important to prevent the serious outcome of strabismus. The cover test and light reflex should be performed at early health

maintenance visits; interventions after age 2 decrease the chance of preserving binocular vision or normal visual acuity (see Chapter 179).

SCHOOL AGE/PREADOLESCENT

In addition to routine health supervision, older school-age children who begin to participate in competitive sports should have a comprehensive sports history and physical examination that includes a careful evaluation of the cardiovascular system. The American Academy of Pediatrics 5th edition sports preparticipation form is excellent for documenting cardiovascular and other risks. The patient and parent should complete the history form and be interviewed to assess cardiovascular risk. Any history of heart disease or a murmur must be referred for evaluation by a pediatric cardiologist. A child with a history of dyspnea or chest pain on exertion, irregular heart rate (i.e., skipped beats, palpitations), or syncope should also be referred to a pediatric cardiologist. A family history of a primary (immediate family) or secondary (immediate family's immediate family) atherosclerotic disease (myocardial infarction or cerebrovascular disease) before 50 years of age or sudden unexplained death at any age also requires additional assessment.

Children interested in contact sports should be assessed for special vulnerabilities. Similarly, vision should be assessed as a crucial part of the evaluation before participation in sports.

ADOLESCENCE

Adolescents need annual comprehensive health assessments to ensure progression through puberty without major problems (see Chapters 67 and 68). Sexual maturity is an important issue in adolescents, and all adolescents should be assessed to monitor progression through sexual maturity rating stages (see Chapter 67). Other issues in physical development include scoliosis, obesity, and common orthopedic growth issues (e.g., Osgood Schlatter; see Chapters 29 and 203). Most scoliosis is mild and requires only observation for resolution. Obesity may first manifest during childhood and is a growing public health concern for many adolescents.

DEVELOPMENTAL MILESTONES

The use of milestones to assess development focuses on discrete behaviors that the clinician can observe or accept as present by parental report. This approach is based on comparing the patient's behavior with that of many normal children whose behaviors evolve in a uniform sequence within specific age ranges (see Chapter 8). The development of the neuromuscular system, similar to that of other organ systems, is determined first by genetic endowment and then is molded by environmental influences.

Although a sequence of specific, easily measured behaviors can adequately represent some areas of development (**gross motor**, **fine motor**, and **language**), other areas, particularly social and emotional development, are not as easy to assess. Easily measured developmental milestones are well established through age 6 years only. Other types of assessment (e.g., intelligence tests, school performance, and personality profiles) that expand the developmental milestone approach are available for older children.

PSYCHOSOCIAL ASSESSMENT

Bonding and Attachment in Infancy

The terms *bonding* and *attachment* describe the affective relationships between parents and infants. **Bonding** occurs shortly after birth and reflects the feelings of the parents toward the newborn (unidirectional). **Attachment** involves reciprocal feelings between parent and infant and develops gradually over the first year.

Attachment of infants outside of the newborn period is crucial for optimal development. Infants who receive extra attention, such as parents responding immediately to any crying or fussiness in the first 4 months, show less crying and fussiness at the end of the first year. **Stranger anxiety** develops between 9 and 18 months of age, when infants normally become insecure about separation from the primary caregiver. The infant's new motor skills and attraction to novelty may lead to headlong plunges into new adventures that result in fright or pain followed by frantic efforts to find and cling to the primary caregiver. The result is dramatic swings from stubborn independence to clinging dependence that can be frustrating and confusing to parents. With secure attachment, this period of ambivalence may be shorter and less tumultuous.

Developing Autonomy in Early Childhood

Toddlers build on attachment and begin developing autonomy that allows separation from parents. In times of stress, toddlers often cling to their parents, but in their usual activities they may be actively separated. Ages 2–3 years are a time of major accomplishments in fine motor skills, social skills, cognitive skills, and language skills. The dependency of infancy yields to developing independence and the “I can do it myself” age. Limit setting is essential to a balance of the child's emerging independence.

Early Childhood Education

There is a growing body of evidence that notes that children who are in high-quality early learning environments are more prepared to succeed in school. Every dollar invested in early childhood education may save taxpayers up to 13 dollars in future costs. These children commit fewer crimes and are better prepared to enter the workforce after school. Early Head Start (<3 years), Head Start (3–4 years), and prekindergarten programs (4–5 years) all demonstrate better educational attainment, although the earlier the start, the better the results.

School Readiness

Readiness for preschool depends on the development of autonomy and the ability of the parent and the child to separate for hours at a time. Preschool experiences help children develop socialization skills; improve language; increase skill building in areas such as colors, numbers, and letters; and increase problem solving (puzzles).

Readiness for school (kindergarten) requires emotional maturity, peer group and individual social skills, cognitive abilities, and fine and gross motor skills (Table 7.1). Other issues include chronological age and gender. Children tend to do better in kindergarten if their fifth birthday is at least 4–6 months before the beginning of school. Girls usually are ready earlier than boys. If the child is in less than the average developmental

TABLE 7.1 Evaluating School Readiness

PHYSICIAN OBSERVATIONS (BEHAVIORS OBSERVED IN THE OFFICE)
Ease of separation of the child from the parent
Speech development and articulation
Understanding of and ability to follow complex directions
Specific pre-academic skills
Knowledge of colors
Counts to 10
Knows age, first and last name, address, and phone number
Ability to copy shapes
Motor skills
Stand on one foot, skip, and catch a bounced ball
Dresses and undresses without assistance
PARENT OBSERVATIONS (QUESTIONS ANSWERED BY HISTORY)
Does the child play well with other children?
Does the child separate well, such as a child playing in the backyard alone with occasional monitoring by the parent?
Does the child show interest in books, letters, and numbers?
Can the child sustain attention to quiet activities?
How frequent are toilet-training accidents?

range, the child should not be forced into early kindergarten. Holding a child back for reasons of developmental delay, in the false hope that the child will catch up, can also lead to difficulties. The child should enroll on schedule, and educational planning should be initiated to address any deficiencies.

Physicians should be able to identify children at risk for school difficulties, such as those who have developmental delays or physical disabilities. These children may require specialized school services in an individualized education plan (IEP) and/or environment accommodations in a 504 plan.

Adolescence

Some define adolescence as 10–25 years of age, but adolescence is perhaps better characterized by the developmental stages (*early*, *middle*, and *late* adolescence) that all teens must negotiate to develop into healthy, functional adults. Different behavioral and developmental issues characterize each stage. The age at which each issue manifests and the importance of these issues vary widely among individuals, as do the rates of cognitive, psychosexual, psychosocial, and physical development.

During **early adolescence**, attention is focused on the present and on the peer group. Concerns are primarily related to the body's physical changes and normality. Strivings for independence are ambivalent. These young adolescents are difficult to interview because they often respond with short, clipped conversation and may have little insight. They are just becoming accustomed to abstract thinking.

Middle adolescence can be a difficult time for adolescents and the adults who have contact with them. Cognitive processes

are more sophisticated. Through abstract thinking, middle adolescents can experiment with ideas, consider things as they might be, develop insight, and reflect on their own feelings and the feelings of others. As they mature, these adolescents focus on issues of identity not limited solely to the physical aspects of their body. They explore their parents' and culture's values, sometimes by expressing the contrary side of the dominant value. Many middle adolescents explore these values in their minds only; others do so by challenging their parents' authority. Many engage in high-risk behaviors, including unprotected sexual intercourse, substance abuse, or dangerous driving. The strivings of middle adolescents for independence, limit testing, and need for autonomy often distress their families, teachers, or other authority figures. These adolescents are at higher risk for morbidity and mortality from accidents, homicide, or suicide.

Late adolescence usually is marked by formal operational thinking, including thoughts about the future (e.g., educational, vocational, and sexual). Late adolescents are usually more committed to their sexual partners than are middle adolescents. Unresolved separation anxiety from previous developmental stages may emerge, at this time, as the young person begins to move physically away from the family of origin to college or vocational school, a job, or military service.

MODIFYING PSYCHOSOCIAL BEHAVIORS

Child behavior is determined by heredity and by the environment. Behavioral theory postulates that behavior is primarily a product of external environmental determinants and that manipulation of the environmental antecedents and consequences of behavior can be used to modify maladaptive behavior and increase desirable behavior (operant conditioning). The four major methods of operant conditioning are positive reinforcement, negative reinforcement, extinction, and punishment. Many common behavioral problems of children can be ameliorated by these methods.

Positive reinforcement increases the frequency of a behavior by following the behavior with a favorable event (e.g., praising a child for excellent school performance). Sometimes this reinforcement may occur unintentionally, increasing the frequency of an undesirable behavior. For example, a toddler may purposely try to stick a pencil in a light socket to obtain attention, whether it be positive or negative. **Negative reinforcement** increases the frequency of a behavior by removal, cessation, or avoidance of an unpleasant event (e.g., no longer having to sit at table once vegetables are eaten). **Extinction** occurs when there is a decrease in the frequency of a previously reinforced behavior because the reinforcement is withheld. Extinction is the principle behind the common advice to ignore behavior such as crying at bedtime or temper tantrums, which parents may unwittingly reinforce through attention and comforting. While reinforcement increases behavior frequency, **punishment** decreases the frequency of a behavior through unpleasant consequences. Punishment can be positive (undesired event is increased or introduced) or negative (desired event is decreased).

Positive reinforcement is more effective than punishment. Punishment is more effective when combined with positive reinforcement. A toddler who draws on the wall with a crayon may be punished, but the child learns much quicker when positive reinforcement is given for the proper use of the crayon—on paper, not the wall. Interrupting and modifying behaviors are discussed in detail in [Section 3](#).

TEMPERAMENT

Significant individual differences exist within the normal development of temperament (behavioral style). Temperament must be appreciated because, if an expected pattern of behavior is too narrowly defined, normal behavior may be inappropriately labeled as abnormal or pathologic. Three common constellations of temperamental characteristics are as follows:

1. The **easy child** (about 40% of children) demonstrates regularity of biologic functions (consistent, predictable times for eating, sleeping, and elimination), a positive approach to new stimuli, high adaptability to change, mild or moderate intensity in responses, and a positive mood.
2. The **difficult child** (about 10%) demonstrates irregularity of biologic functions, negative withdrawal from new stimuli, poor adaptability, intense responses, and a negative mood.
3. The **slow to warm up child** (about 15%) demonstrates a low activity level, withdrawal from new stimuli, slow adaptability, mild intensity in responses, and a somewhat negative mood.

The remaining 35% of children have more mixed temperaments. The individual temperament of a child has important implications for parenting and for the advice a pediatrician may give in anticipatory guidance or behavioral problem counseling.

Although temperament may be hardwired (*nature*) in each child to some degree, the environment (*nurture*) in which the child grows has a strong effect on the child's adjustment. Social and cultural factors can have marked effects on the child through differences in parenting style, educational approaches, and behavioral expectations.

PEARLS FOR PRACTITIONERS

See [Growth and Development: Pearls for Practitioners](#) at the end of this section.

CHAPTER 8

Disorders of Development

DEVELOPMENTAL SURVEILLANCE AND SCREENING

Developmental and behavioral problems are more common than any other category of problems in pediatrics, except acute infections and trauma. In 2008, 15% of children ages 3–7 had a developmental disability and others had behavioral disabilities. As many as 25% of children have serious psychosocial problems. Parents often neglect to mention these problems because they think the physician is uninterested or cannot help. It is necessary to monitor development and screen for the presence of these problems at health supervision visits, particularly in the years before preschool or early childhood learning center enrollment.

Development surveillance, done at every office visit, is an informal process comparing skill levels to lists of milestones. If suspicion of developmental or behavioral issues recurs, further evaluation is warranted ([Table 8.1](#)). Surveillance does not have a standard, so screening tests are necessary.

Developmental screening involves the use of standardized screening tests to identify children who require further diagnostic assessment. The American Academy of Pediatrics

TABLE 8.1 Developmental Milestones

AGE	GROSS MOTOR	FINE MOTOR-ADAPTIVE	PERSONAL-SOCIAL	LANGUAGE	OTHER COGNITIVE
2 wk	Moves head side to side	—	Regards face	Alerts to bell	—
2 mo	Lifts shoulder while prone	Tracks past midline	Smiles responsively	Cooing Searches for sound with eyes	—
4 mo	Lifts up on hands Rolls front to back If pulled to sit from supine, no head lag	Reaches for object Raking grasp	Looks at hand Begins to work toward toy	Laughs and squeals	—
6 mo	Sits alone Rolls back to front	Transfers object hand to hand	Feeds self Holds bottle	Babbles	—
9 mo	Pulls to stand Gets into sitting position	Starting to pincer grasp Bangs two blocks together	Waves bye-bye Plays pat-a-cake	Says <i>Dada</i> and <i>Mama</i> , but nonspecific Two-syllable sounds	—
12 mo	Walks Stoops and stands	Puts block in cup	Drinks from a cup Imitates others	Says <i>Mama</i> and <i>Dada</i> , specific Says one to two other words	—
15 mo	Walks backward Stoops and recovers	Scribbles Stacks two blocks	Uses spoon and fork Helps in housework	Says three to six words Follows commands	—
18 mo	Runs	Stacks four blocks Kicks a ball	Removes garment “Feeds” doll	Says at least six words	—
2 yr	Walks up and down stairs Throws overhand	Stacks six blocks Copies line	Washes and dries hands Brushes teeth Puts on clothes	Puts two words together Points to pictures Knows body parts	Understands concept of <i>today</i>
3 yr	Walks steps alternating feet Broad jump	Stacks eight blocks Wiggles thumb	Uses spoon well, spilling little Puts on T-shirt	Names pictures Speech understandable to stranger 75% Says three-word sentences	Understands concepts of <i>tomorrow</i> and <i>yesterday</i>
4 yr	Balances well on each foot Hops on one foot	Copies <i>O</i> , maybe + Draws person with three parts	Brushes teeth without help Dresses without help	Names colors Understands adjectives	—
5 yr	Skips Heel-to-toe walks	Copies □	—	Counts Understands opposites	—
6 yr	Balances on each foot 6 sec	Copies Δ Draws person with six parts	—	Defines words	Begins to understand <i>right</i> and <i>left</i>

Mo, Month; sec, second; wk, week; yr, year.

recommends the use of validated standardized screening tools at three of the health maintenance visits: 9 months, 18 months, and 30 months. Clinics and offices that serve a higher risk patient population (e.g., children living in poverty) often perform a screening test at *every* health maintenance visit. A child who fails to pass a developmental screening test requires more comprehensive evaluation but does not necessarily have a delay; definitive testing must confirm. Developmental evaluations for children with suspected delays and intervention services for children with diagnosed disabilities are available free to families. A combination of U.S. state and federal funds provides these services.

Screening tests can be categorized as general screens that cover all behavioral domains or as targeted screens that focus on one area of development. Some may be administered in the office by professionals, while others may be completed at home (or in a waiting room) by parents. Good developmental/behavioral screening instruments have a sensitivity of 70–80% in detecting suspected problems and a specificity of 70–80% in detecting normal development. Although 30% of children

screened may be *over-referred* for definitive developmental testing, this group also includes children whose skills are below average and who may benefit from testing that may help address relative developmental deficits. The 20–30% of children who have disabilities that are not detected by the single administration of a screening instrument are likely to be identified on repeat screening at subsequent health maintenance visits.

The Denver Developmental Screening Test II was the first test used by general pediatricians, but it is now out of date, and the company has closed. The test required observation of objective behavior and was difficult to administer consistently.

Today's most used developmental screening tools include **Ages and Stages Questionnaires** (developmental milestone driven) and **Parents' Evaluation of Developmental Status (PEDS)**. The latter is a simple, 10-item questionnaire that parents complete at office visits based on concerns with function and progression of development. Parent-reported screens have good validity compared to office-based screening measures. Many offices combine PEDS with developmental surveillance to track milestone attainment.

TABLE 8.2 Rules of Thumb for Speech Screening

AGE (YR)	SPEECH PRODUCTION	ARTICULATION (AMOUNT OF SPEECH UNDERSTOOD BY A STRANGER)	FOLLOWING COMMANDS
1	One to three words	—	One-step commands
2	Two- to three-word phrases	One half	Two-step commands
3	Routine use of sentences	Three fourths	—
4	Routine use of sentence sequences; conversational give-and-take	Almost all	—
5	Complex sentences; extensive use of modifiers, pronouns, and prepositions	Almost all	—

Autism screening is mandated for all children at 18 and 24 months of age. Although there are several tools, many pediatricians use the **Modified Checklist for Autism in Toddlers—Revised (M-CHAT-R)**. M-CHAT-R is an office-based questionnaire that asks parents about typical behaviors, some of which are more predictive than others for autism or other pervasive developmental disorders. If the child demonstrates more than two predictive or three total behaviors, further assessment with an interview algorithm is indicated to distinguish normal variant behaviors from those children needing a referral for definitive testing. The test is freely distributed on the Internet and is available at <https://www.m-chat.org> (see Chapter 20).

Language screening correlates best with cognitive development in the early years. Table 8.2 provides some rules of thumb for language development that focus on speech production (expressive language). Although expressive language is the most obvious language element, the most dramatic changes in language development in the first years involve recognition and understanding (receptive language).

Whenever there is a speech and/or language delay, a **hearing deficit** must be considered and screened for. If hearing is abnormal and not addressed, speech cannot develop appropriately or appropriately respond to therapy. The implementation of universal newborn hearing screening detects many, if not most, of these children in the newborn period, and appropriate early intervention services may be provided. Conditions that present a high risk of an associated hearing deficit are listed in Table 8.3. Dysfluency (*stuttering*) is common in a 3- and 4-year-old child. Unless the dysfluency is severe, is accompanied by tics or unusual posturing, or occurs after 4 years of age, parents should be counseled that it is normal and transient and to accept it calmly and patiently.

After the child's sixth birthday and until adolescence, developmental assessment is initially done by inquiring about school performance (academic achievement and behavior). Inquiring about concerns raised by teachers or other adults who care for the child (after-school program counselor, coach,

TABLE 8.3 Conditions Considered High Risk for Associated Hearing Deficit

Congenital hearing loss in first cousin or closer relative
Bilirubin level of ≥ 20 mg/dL
Congenital rubella or other nonbacterial intrauterine infection
Defects in the ear, nose, or throat
Birthweight of $\leq 1,500$ g
Multiple apneic episodes
Exchange transfusion
Meningitis
Five-minute Apgar score of ≤ 5
Persistent fetal circulation (primary pulmonary hypertension)
Treatment with ototoxic drugs (e.g., aminoglycosides and loop diuretics)

religious leader) is prudent. Formal developmental testing of these older children is beyond the scope of the primary care pediatrician. Nonetheless, the health care provider should be the coordinator of the testing and evaluation performed by other specialists (e.g., psychologists, psychiatrists, developmental pediatricians, and educational professionals).

OTHER ISSUES IN ASSESSING DEVELOPMENT AND BEHAVIOR

Ignorance of environmental influences on child behavior may result in ineffective or inappropriate management (or both). Adverse childhood experiences (ACEs) are traumatic experiences, including witnessed or experienced abuse or neglect, that occur prior to age 18. Social determinants of health (SDOH) are conditions of where a person is born, grows, works, and lives. ACEs and SDOH can greatly affect growth and development so should be asked about and addressed. Table 8.4 lists some contextual factors that should be considered in the etiology of a child's behavioral or developmental problem.

Building rapport with the parents and the child is a prerequisite for obtaining the often-sensitive information that is essential for understanding a behavioral or developmental issue. Rapport usually can be established quickly if the parents sense that the clinician respects them and is genuinely interested in listening to their concerns. The clinician develops rapport with the child by engaging in developmentally appropriate conversation or play, perhaps providing toys while interviewing the parents, and being sensitive to the fears the child may have. Too often, the child is ignored until it is time for the physical examination. Similar to their parents, children feel more comfortable if they are greeted by name and involved in pleasant interactions before they are asked sensitive questions or threatened with examinations. Young children can be engaged in conversation on the parent's lap, which provides security and places the child at the eye level of the examiner.

With adolescents, emphasis should be placed on building a physician-patient relationship that is distinct from the relationship with the parents. The parents should not be excluded; however, the adolescent should have the opportunity to express

TABLE 8.4 Context of Behavioral Problems

CHILD FACTORS
Health (past and current)
Developmental status
Temperament (e.g., difficult, slow to warm up)
Coping mechanisms
PARENTAL FACTORS
Misinterpretations of stage-related behaviors
Mismatch of parental expectations and characteristics of child
Mismatch of personality style between parent and child
Parental characteristics (e.g., depression, lack of interest, rejection, overprotective, coping)
ENVIRONMENTAL FACTORS
Stress (e.g., marital discord, unemployment, personal loss, perceived racism)
Support (e.g., emotional, material, informational, child care)
Poverty—including poor housing, poorer education facilities, lack of access to healthy foods (food deserts), unsafe environments, toxic stress, poor access to primary care
Racism

concerns and ask questions of the physician in confidence. Two intertwined issues must be taken into consideration—consent and confidentiality. Although laws vary from state to state, in general, adolescents who are able to give informed consent (i.e., mature minors) may consent to visits and care related to high-risk behaviors (i.e., depression and mental health issues, substance abuse; sexual health, including prevention, detection, and treatment of sexually transmitted infections; and pregnancy). Most states support the physician who wishes the visit to be confidential. Physicians should become familiar with the governing law in the state where they practice (see <https://www.guttmacher.org>). Providing confidentiality is crucial, allowing for optimal care (especially for obtaining a history of risk behaviors). When assessing development and behavior, confidentiality can be achieved by meeting with the adolescent alone for at least part of each visit. However, parents must be informed when the clinician has significant and immediate concerns about the health and safety of the child. Often, the clinician can convince the adolescent to inform the parents directly about a problem or can reach an agreement with the adolescent about how the parents will be informed by the physician (see [Chapter 67](#)).

EVALUATING DEVELOPMENTAL AND BEHAVIORAL ISSUES

Responses to open-ended questions often provide clues to underlying, unstated problems and identify the appropriate direction for further, more directed questions. Histories about developmental and behavioral problems are often vague and confusing; to reconcile apparent contradictions, the interviewer frequently must request clarification, more detail, or mere repetition. By summarizing an understanding of the

information at frequent intervals and by recapitulating at the close of the visit, the interviewer and patient and family can ensure that they understand each other.

If the clinician's impression of the child differs markedly from the parent's description, there may be a crucial parental concern or issue that has not yet been expressed, either because it may be difficult to talk about (e.g., marital problems), because it is unconscious, or because the parent overlooks its relevance to the child's behavior. Alternatively, the physician's observations may be atypical, even with multiple visits. The observations of teachers, relatives, and other regular caregivers may be crucial in sorting out this possibility. The parent also may have a distorted image of the child, rooted in parental psychopathology. A sensitive, supportive, and non-critical approach to the parent is crucial to appropriate intervention. More information about referral and intervention for behavioral and developmental issues is covered in [Chapter 10](#).

PEARLS FOR PRACTITIONERS

See *Growth and Development: Pearls for Practitioners* at the end of this section.