Growth, Development, and Behavior

PART II

Chapter 19

Developmental and Behavioral Theories

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The field of pediatrics is dedicated to optimizing the growth and development of each child. Pediatricians require knowledge of normal growth, development, and behavior to effectively monitor children's progress, identify delays or abnormalities in development, help obtain needed services, and counsel parents and caretakers. To alter factors that increase or decrease risk and resilience, pediatricians need to understand how biologic and social forces interact within the parent–child relationship, within the family, and between the family and the larger society. Growth is an indicator of overall well-being, status of chronic disease, and interpersonal and psychologic stress. By monitoring children and families over time, pediatricians are uniquely situated to observe the interrelationships between physical growth and cognitive, motor, and emotional development. Observation is enhanced by familiarity with developmental and behavioral theories that inform one about typical patterns of development and provide guidance for prevention or intervention for behavior problems. Familiarity with theories of health behavior may assist clinicians in guiding patients and families in disease management and wellness care.

BIOPSYCHOSOCIAL MODEL AND ECOBIODEVELOPMENTAL FRAMEWORK: MODELS OF DEVELOPMENT

The **medical model** presumes that a patient presents with signs and symptoms and a physician focuses on diagnosing and treating diseases of the body. This model neglects the social and psychologic aspect of a person who exists in the larger realm of the family and society. In the **biopsychosocial model**, societal and community systems are simultaneously considered along with more proximal systems that make up the person and the person's environment (Fig. 19.1). A patient's symptoms are examined and explained in the context of the patient's existence. This multidimensional model can be used to understand health and both acute and chronic disease, and this model has been increasingly used to develop care models over the past few decades.

With the advances in neurology, genomics (including epigenetics), molecular biology, and the social sciences, a broader model, the **ecobiodevelopmental framework**, has emerged. This framework emphasizes how the ecology of childhood (social and physical environments) interacts with biologic processes to determine outcomes and life trajectories. Early influences, particularly those producing **toxic levels of stress**, affect the individual through their impact on the body's stress response systems, brain development, and modification of gene expression. Epigenetic changes, such as DNA methylation and histone acetylation, may be influenced by early life experiences (the environment) and impact gene expression without changing the DNA sequence. These changes can produce long-lasting effects on the health and well-being of the individual and may be passed on to future generations (Fig. 19.2).

Critical to learning and remembering (and therefore development) is **neuronal plasticity**, which permits the central nervous system to reorganize neuronal networks in response to environmental stimulation, both positive and negative. An overproduction of neuronal precursors eventually leads to about 100 billion neurons in the adult brain. Each neuron develops on average 15,000 synapses by 3 years of age. During early childhood, synapses in frequently used pathways are preserved, whereas less-used ones atrophy, a process termed *pruning*. Changes in the strength and number of synapses and reorganization of neuronal circuits also play important roles in brain plasticity. Increases or decreases in synaptic activity result in persistent increases or decreases in synaptic strength. Thus experience (**environment**) has a direct effect on the physical and therefore functional properties of the brain. Children with different talents and temperaments (already a combination of genetics and environment) further elicit different stimuli from their varying environments.

Periods of rapid development generally correlate with periods of great changes in synaptic numbers in relevant areas of the brain. Accordingly, sensory deprivation during the time when synaptic changes should be occurring has profound effects. The effects of strabismus leading to amblyopia occur quickly during early childhood; patching the eye with good vision to reverse amblyopia is less effective in late childhood (see Chapter 663). Early experience is particularly important because learning proceeds more efficiently along established synaptic pathways. However, some plasticity of the brain continues into adolescence, with further development of the prefrontal cortex, which is important in decision-making, future planning, and emotional control; neurogenesis persists in adulthood in certain areas of the brain.

Early traumatic experiences modify the expression of stress mediators (in particular the hypothalamic-pituitary-adrenal axis) and neurotransmitters, leading to changes in brain connectivity and function. These effects may be persistent, leading to alterations and dysfunction in the stress response throughout life. Chronic stress has negative effects on cognitive functions, including memory and emotional regulation. Positive and negative experiences do not determine the ultimate outcome but shift the probabilities by influencing the child's ability to respond adaptively to future stimuli.

There is increasing evidence that positive experiences and relationships can buffer the impact of negative or traumatic experience and toxic stress. In fact, there is a recent call for pediatrics to recognize and promote relational health as a protective factor. By promoting positive relationships, labeled safe, stable, and nurturing relationships (SSNRs) within primary care, healthcare providers can work with families to build relational health, thereby combatting the deleterious effects of toxic stress and promoting resilience. Pediatric care can do this by employing a public health approach, partnering with families and communities, to build healthy relationships by connecting to and integrating with primary, secondary, and tertiary prevention programs. This can include embedding interventions within primary care and creating robust referral networks to connect families to needed services.

Biologic Influences

Biologic influences on development include genetics, in utero exposure to teratogens, the long-term negative effects of low birthweight (neonatal morbidities plus increased rates of subsequent adult-onset obesity, coronary heart disease, stroke, hypertension, and type 2 diabetes), postnatal illnesses, exposure to hazardous substances, and maturation. Adoption and twin studies consistently show that heredity accounts for approximately 40% of the variance in IQ and in other personality traits, such as sociability and desire for novelty, whereas shared environment accounts for another 50%. The negative effects on development of prenatal exposure to teratogens, such as mercury and alcohol, and of postnatal insults, such as meningitis and traumatic brain injury, have been extensively studied (see Chapters 117, 122, and 146). Any chronic illness can affect growth and development, either directly or through changes in factors such as nutrition, parenting, school attendance, peer interactions, or self-esteem.

Most children follow similar motor developmental sequences despite great variability in child-rearing practices. The attainment of skills such as the use of complex sentences is less tightly bound to a

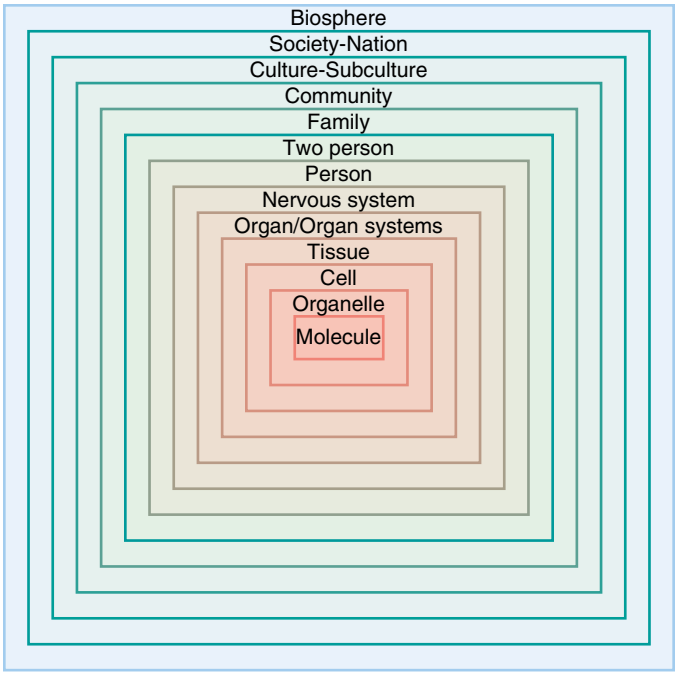

Fig. 19.1 Continuum and hierarchy of natural systems in the biopsychosocial model. *(From Engel GL. The clinical application of the biopsychosocial model. Am J Psychiatry. 1980;137:535–544.)*

maturational schedule. Maturational changes also generate behavioral challenges at predictable times. Decrements in growth rate and sleep requirements around 2 years of age often generate concern about poor appetite and refusal to nap. Although it is possible to accelerate many developmental milestones (toilet training a 12 month old or teaching a 3 year old to read), *the long-term benefits of such precocious accomplishments are questionable.*

In addition to physical changes in size, body proportions, and strength, maturation brings about hormonal changes. Sexual differentiation, both somatic and neurologic, begins in utero. Both stress and reproductive hormones affect brain development as well as behavior throughout development. Steroid production by the fetal gonads leads to differences in brain structures between males and females.

Temperament describes the stable, early-appearing individual variations in behavioral dimensions, including emotionality (crying, laughing, sulking), activity level, attention, sociability, and persistence. The classic theory proposes nine dimensions of temperament (Table 19.1). These characteristics lead to three common constellations: (1) the easy, highly adaptable child, who has regular biologic cycles; (2) the difficult child, who is inflexible, moody, and easily frustrated; and (3) the slow-to-warm-up child, who needs extra time to adapt to new circumstances. Various combinations of these clusters also occur. Temperament has long been described as biologic or "inherited." Monozygotic twins are rated by their parents as temperamentally similar more often than are dizygotic twins. Estimates of heritability suggest that genetic differences account for 20–60% of the variability of temperament within a population. The remainder of the variance is attributed to the child's environment. Maternal prenatal stress and anxiety is associated with child temperament, possibly through stress hormones. However, certain polymorphisms of specific genes moderate the influence of maternal stress on infant temperament. Children who are easily frustrated, fearful, or irritable may elicit negative parental reactions, making these children even more susceptible to negative parenting behaviors and to poor adjustment to adversity. Longitudinal twin studies of adult personality indicate that changes in personality over time largely result from dissimilar environmental influences, whereas stability of temperament appears to result from genetic factors.

The concept of temperament can help parents understand and accept the characteristics of their children without feeling responsible for having caused them. Children who have difficulty adjusting to change may have behavior problems when a new baby arrives or at the time of school entry. In addition, pointing out the child's temperament may allow for adjustment in parenting styles. Behavioral and emotional problems may develop when the temperamental characteristics of children and parents are in conflict. If parents who keep an irregular schedule have a child who is not readily adaptable, behavioral difficulties are more likely than if the child has parents who have predictable routines.

Psychologic Influences: Attachment and Contingency

The influence of the child-rearing environment dominates most current models of development. Infants in hospitals and orphanages, devoid of opportunities for attachment, have severe developmental deficits. **Attachment** refers to a biologically determined tendency of a young child to seek proximity to the parent during times of stress and to the relationship that allows securely attached children to use their parents to reestablish a sense of well-being after a stressful experience. Insecure attachment may be predictive of later behavioral and learning problems.

At all stages of development, children progress optimally when they have adult caregivers who pay attention to their verbal and nonverbal cues and respond accordingly. In early infancy, such contingent responsiveness to signs of overarousal or underarousal helps maintain infants in a state of quiet alertness and fosters autonomic self-regulation. **Consistent contingent responses** (reinforcement depending on the behavior of the other) to nonverbal gestures create the groundwork for the shared attention and reciprocity that are critical for later language and social development.

Social Factors: Family Systems and the Ecologic Model

Contemporary models of child development recognize the critical importance of influences outside the mother–child dyad. Fathers play critical roles, both in their direct relationships with their children and in supporting mothers. As traditional nuclear families become less dominant, the influence of other family members and caregivers (grandparents, foster and adoptive parents, same-sex partners) becomes increasingly important. Furthermore, the presence of nurturing and stable caregivers, in or out of the nuclear family, can help to buffer the impact of a parent who may struggle with mental illness, substance use, or other afflictions. As children grow within their larger ecosystem, it is important to recognize and include all relevant caregivers in the child's care.

Families function as systems, with internal and external boundaries, subsystems, roles, and rules for interaction. In families with rigidly defined parental subsystems, children may be denied any decision-making, exacerbating rebelliousness. In families with poorly defined parent–child boundaries, children may be required to take on responsibilities beyond their years or may be recruited to play a spousal role.

Family systems theory recognizes that individuals within systems adopt implicit roles. Although birth order does not have long-term effects on personality development, within families the members take on different roles. One child may be the troublemaker, whereas another is the negotiator and another is quiet. Changes in one person's behavior affects every other member of the system; roles shift until a new equilibrium is found. The birth of a new child, attainment of developmental milestones such as independent walking, the onset of nighttime fears, diagnosis of a chronic illness, or death of a family member are all changes that require renegotiation of roles within the family and have the potential for healthy adaptation or dysfunction.

The family system, in turn, functions within the larger systems of extended family, subculture, culture, and society. Bronfenbrenner's ecologic model depicts these relationships as concentric circles, with the parent–child dyad at the center (with associated risks and protective factors) and the larger society at the periphery. Changes at any level are reflected in the levels above and below. Furthermore, these systems and their interactions change over time, with some influences being persistent and chronic and others being temporary. The shift from an industrial economy to one based on service and information and the influence of systemic racism are examples of how society has profound effects on families and children. Understanding the child's greater ecosystem is important to understand their family and the context of their

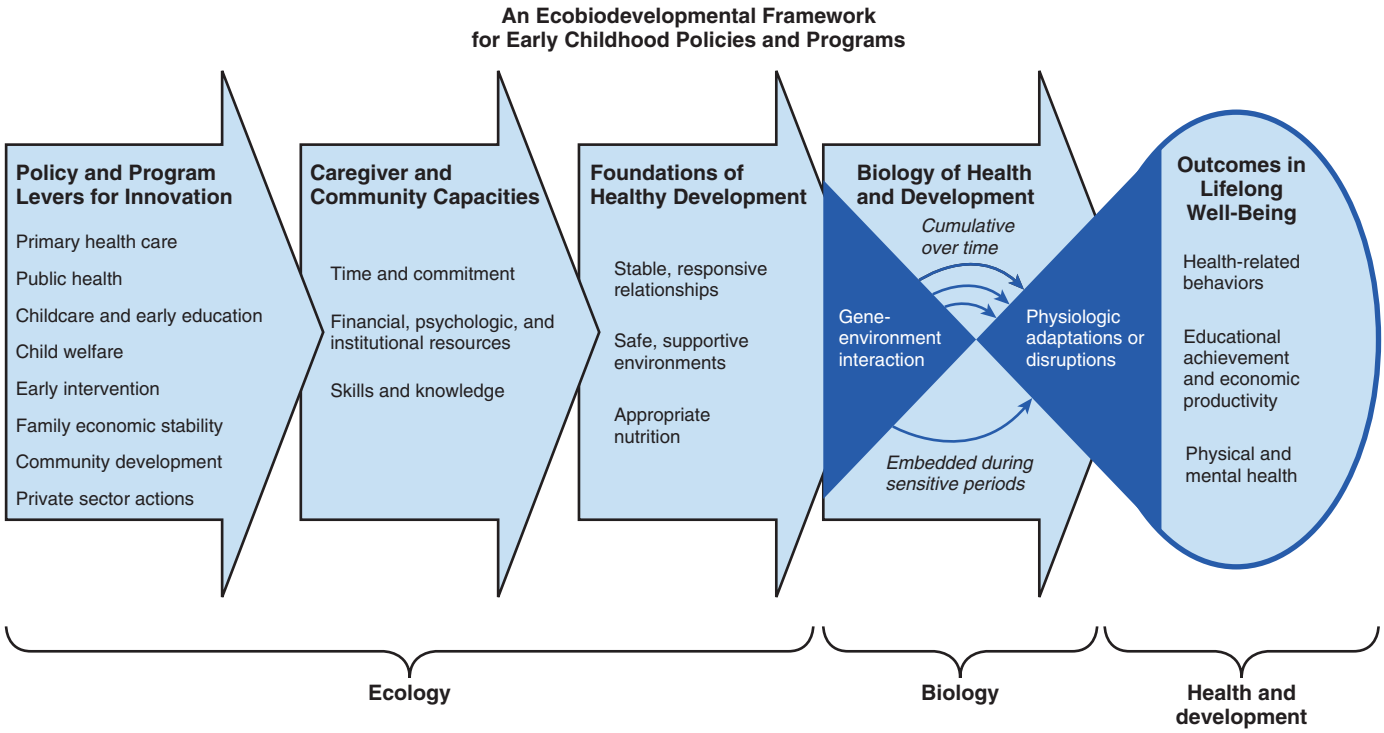

Fig. 19.2 Ecobiodevelopmental framework for early childhood policies and programs. (*Adapted from Center on the Developing Child. The foundations of lifelong health are built in early childhood. 2010; Available at: http://www.developingchild.harvard.edu.*)

Table 19.1 Temperamental Characteristics: Descriptions and Examples

CHARACTERISTIC	DESCRIPTION	EXAMPLES*
Activity level	Amount of gross motor movement	"She's constantly on the move." "He would rather sit still than run around."
Rhythmicity	Regularity of biologic cycles	"He's never hungry at the same time each day." "You could set a watch by her nap."
Approach and withdrawal	Initial response to new stimuli	"She rejects every new food at first." "He sleeps well in any place."
Adaptability	Ease of adaptation to novel stimulus	"Changes upset him." "She adjusts to new people quickly."
Threshold of responsiveness	Intensity of stimuli needed to evoke a response (e.g., touch, sound, light)	"He notices all the lumps in his food and objects to them." "She will eat anything, wear anything, do anything."
Intensity of reaction	Energy level of response	"She shouts when she is happy and wails when she is sad." "He never cries much."
Quality of mood	Usual disposition (e.g., pleasant, glum)	"He does not laugh much." "It seems like she is always happy."
Distractibility	How easily diverted from ongoing activity	"She is distracted at mealtime when other children are nearby." "He doesn't even hear me when he is playing."
Attention span and persistence	How long a child pays attention and sticks with difficult tasks	"He goes from toy to toy every minute." "She will keep at a puzzle until she has mastered it."

*Typical statements of parents, reflecting the range for each characteristic from very little to very much.
Based on data from Chess S, Thomas A. *Temperament in Clinical Practice.* New York: Guilford; 1986.

growth. Factors such as poverty, systemic racism, access to education, transportation, food, housing, parental employment, and local support systems are influential factors in a child's well-being. Whenever possible, identifying community supports and assets for families can help promote health and development.

Unifying Concepts: The Transactional Model, Risk, and Resilience

The **transactional model** proposes that a child's status at any point in time is a function of the interaction between biologic and social influences. The influences are bidirectional: biologic factors, such as temperament and health status, affect the child-rearing environment and are affected by it. A premature infant may cry little and sleep for long periods; the infant's depressed parent may welcome this behavior, setting up a cycle that leads to poor nutrition and inadequate growth. The child's failure to thrive may reinforce the parent's sense of failure as a parent. At a later stage, impulsivity and inattention associated with early, prolonged undernutrition may lead to aggressive behavior. The cause of the aggression in this case is not the prematurity, the undernutrition, or the maternal depression, but the interaction of all these factors (Fig. 19.3). Conversely, children with biologic risk factors may nevertheless do

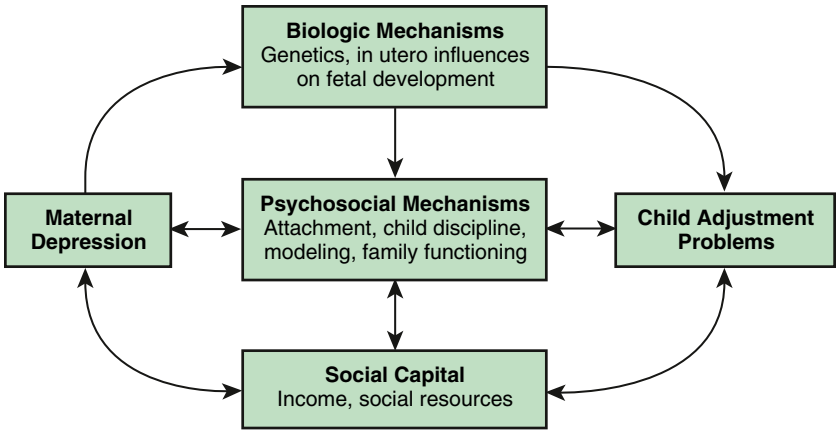

Fig. 19.3 Theoretical model of mutual influences on maternal depression and child adjustment. *(From Elgar FJ, McGrath PJ, Waschbusch DA, et al. Mutual influences on maternal depression and child adjustment problems, Clin Psychol Rev 2004;24:441–459.)*

well developmentally if the child-rearing environment is supportive. Premature infants with electroencephalographic evidence of neurologic immaturity may be at increased risk for cognitive delay. When parent–child interactions are optimal, risk of developmental disability is reduced.

An estimate of developmental risk can begin with risk factors, such as low income, low literacy, and lack of neighborhood resources. Stress and anxiety in pregnancy are associated with cognitive, behavioral, and emotional problems in the child. Early stress may have effects on aging mediated by shortening of telomere length, a link to health disparities. Risk for negative outcomes over time increases exponentially as a result of declining plasticity and accumulation of risk factors (both behavioral and environmental). Interventions are most effective in young children; over time, risk increases as the ability to change decreases.

Children growing up in poverty experience multiple levels of developmental risk: increased exposure to biologic risk factors, such as environmental lead and inadequate nutrition; lack of stimulation in the home; and decreased access to interventional education and therapeutic experiences. As they respond by withdrawal or acting out, they further discourage positive stimulation from those around them. Children of adolescent mothers are also at risk. When early intervention programs provide timely, intensive, comprehensive, and prolonged services, at-risk children show marked and sustained upswings in their developmental trajectory. Early identification of children at developmental risk, along with early intervention to support parenting, is critically important (see Chapter 20). Promoting relational health and identifying supportive community resources and interventions can buffer the negative impact of environmental risk factors.

Children can have appropriate developmental trajectories despite childhood trauma. **Resilience** is the ability to withstand, adapt to, and recover from adversities. There are several modifiable resilience factors: a positive appraisal or outlook and good executive functioning (see Chapter 49); nurturing parenting; good maternal mental health, self-care skills, and consistent household routines; and an understanding of trauma. The personal histories of children who overcome poverty often include at least one trusted adult (parent, grandparent, teacher) with whom the child has a special, supportive, close relationship. Pediatric providers are positioned to target and bolster resilience in their patients and families.

Developmental Domains and Theories of Emotion and Cognition

Child development can also be tracked by the child's developmental progress in particular domains, such as gross motor, fine motor, social, emotional, language, and cognition. Within each of these categories are *developmental* sequences of changes leading up to particular attainments. Development in the gross motor domain, from rolling to creeping to independent walking, are clear. Others, such as the line leading to the development of conscience, are subtler.

The concept of a developmental line implies that a child passes through successive stages. Several developmental theories are based on stages as qualitatively different epochs in the development of emotion and cognition (Table 19.2). In contrast, behavioral theories rely less on qualitative change and more on the gradual modification of behavior and accumulation of competence.

Psychoanalytic Theories

At the core of **Freudian theory** is the idea of body-centered (or broadly, "sexual") drives; the emotional health of both the child and the adult depends on adequate resolution of conflicts brought about by these drives. Although Freudian ideas have been challenged, they opened the door to subsequent theories of development.

Erikson recast Freud's stages in terms of the emerging personality (see Table 19.2). The child's sense of basic trust develops through the successful negotiation of infantile needs. As children progress through these psychosocial stages, different issues become salient. It is predictable that a toddler will be preoccupied with establishing a sense of autonomy, whereas a late adolescent may be more focused on establishing meaningful relationships and an occupational identity. Erikson recognized that these stages arise in the context of Western European societal expectations; in other cultures, the salient issues may be quite different.

Erikson's work calls attention to the intrapersonal challenges facing children at different ages in a way that facilitates professional intervention. Knowing that the salient issue for school-age children is industry vs inferiority, pediatricians inquire about a child's experiences of mastery and failure and (if necessary) suggest ways to ensure adequate successes.

Cognitive Theories

Cognitive development is best understood through the work of **Piaget**. A central tenet of Piaget's work is that cognition changes in *quality,* not just quantity (see Table 19.2). During the sensorimotor stage, an infant's thinking is tied to immediate sensations and a child's ability to manipulate objects. The concept of "in" is embodied in a child's act of putting a block into a cup. With the arrival of language, the nature of thinking changes dramatically; symbols increasingly take the place of objects and actions. Piaget described how children actively construct knowledge for themselves through the linked processes of **assimilation** (taking in new experiences according to existing schemata) and **accommodation** (creating new patterns of understanding to adapt to new information). In this way, children are continually and actively reorganizing cognitive processes.

There have been challenges to some of the Piaget's basic concepts. Children may reach the stages at variable ages. Of undeniable

Table 19.2 Classic Developmental Stage Theories

	INFANCY (0-1 YR)	TODDLERHOOD (2-3 YR)	PRESCHOOL (3-6 YR)	SCHOOL AGE (6-12 YR)	ADOLESCENCE (12-20 YR)
Freud: psychosexual	Oral	Anal	Phallic/oedipal	Latency	Genital
Erikson: psychosocial	Basic trust vs mistrust	Autonomy vs shame and doubt	Initiative vs guilt	Industry vs inferiority	Identity vs role diffusion
Piaget: cognitive	Sensorimotor	Sensorimotor	Preoperational	Concrete operations	Formal operations
Kohlberg: moral	—	Preconventional: avoid punishment/obtain rewards (stages 1 and 2)	Conventional: conformity (stage 3)	Conventional: law and order (stage 4)	Postconventional: moral principles

importance is Piaget's focus on cognition as a subject of empirical study, the universality of the progression of cognitive stages, and the image of a child as actively and creatively interpreting the world. Piaget's work is of special importance to pediatricians for three reasons: (1) Piaget's observations provide insight into many puzzling behaviors of infancy, such as the common exacerbation of sleep problems at 9 and 18 months of age; (2) Piaget's observations often lend themselves to quick replication in the office, with little special equipment; and (3) open-ended questioning, based on Piaget's work, can provide insights into children's understanding of illness and hospitalization.

However, other studies have found that even young children and infants are "natural scientists" and able to integrate new information through experimentation. Young children's learning is highly similar to the scientific thought process, including inductive reasoning, making predictions, and hypothesis testing. Hypotheses and conclusions about the world are constantly being revised based on the child's experience. When children are faced with evidence that conflicts with expected outcomes (**expectancy violation**), they are motivated to explore and resolve ambiguities. Children can alter their beliefs when given new evidence. That children utilize probabilistic models and exploration to resolve unexpected outcomes has strong implications for the advancement of educational theory.

Based on cognitive development, **Kohlberg** developed a theory of moral development in six stages, from early childhood through adulthood. Preschoolers' earliest sense of right and wrong is egocentric, motivated by externally applied controls. In later stages, children perceive equality, fairness, and reciprocity in their understanding of interpersonal interactions through perspective taking. Most youth will reach stage 4, conventional morality, by mid-to late adolescence. The basic theory has been modified to distinguish morality from social conventions. Whereas moral thinking considers interpersonal interactions, justice, and human welfare, social conventions are the agreed-on standards of behavior particular to a social or cultural group. Within each stage of development, children are guided by the basic precepts of moral behavior, but they also may take into account local standards, such as dress code, classroom behavior, and dating expectations. There is a broader understanding of moral development of even young infants and children theorizing an innate capacity to relate to others. Moral development can be found in very young infants, toddlers, and preschoolers who have a concept of self in relation to others, empathy and caring for others, and may incorporate their cultural context in a way that influences how and when moral development occurs.

Behavioral Theory

This theoretical perspective distinguishes itself by its lack of concern with a child's inner experience. Its focus is on observable behaviors and measurable factors that either increase or decrease the frequency with which these behaviors occur. No stages are implied; children, adults, and indeed animals all respond in the same way. In its simplest form, the behaviorist orientation asserts that behaviors that are reinforced occur more frequently; behaviors that are punished or ignored occur less frequently. Reinforcement may be further divided into *positive* reinforcement, when a reward or attention increases the chance of a behavior occurring, and *negative* reinforcement, when removal of an aversive stimulus increases the frequency of the behavior. A teacher who allows students who complete the homework Monday through Thursday not to have an assignment on Friday is using negative reinforcement to motivate homework completion during the week.

The strengths of behavioral theory are its simplicity, wide applicability, and conduciveness to scientific verification. A behavioral approach lends itself to interventions for various common problems, such as temper tantrums, aggressive preschool behavior, and eating disorders, in which behaviors are broken down into discrete units. In cognitively limited children and children with autism spectrum disorder, behavioral interventions using **applied behavior analysis** approaches have demonstrated the ability to teach new, complex behaviors. Applied behavior analysis has been particularly useful in the treatment of early-diagnosed autism spectrum disorder (see Chapter 58). However, when misbehavior is symptomatic of an underlying emotional, perceptual, or family problem, an exclusive reliance on behavior therapy risks leaving the cause untreated. Behavioral approaches can be taught to parents for application at home.

Theories Used in Behavioral Interventions

An increasing number of programs or interventions (within and outside the physician's office) are designed to influence health behaviors; some of these models are based on behavioral or cognitive theory or may have attributes of both. The most commonly employed models are the Health Belief Model, Theory of Reasoned Action, Theory of Planned Behavior, Social Cognitive Theory, and Transtheoretical Model, also known as Stages of Change Theory (see Chapter 18). Pediatricians should be aware of these models and their similarities and differences (Table 19.3). Interventions based on these theories have been designed for children and adolescents in community, clinic, and hospital-based settings.

Motivational interviewing (MI) is a technique often used in clinical settings to bring about behavior change (Chapter 18). Briefly, the goal is to enhance an individual's motivation to change behavior by exploring and overcoming ambivalence. The therapist is a partner rather than an authority figure and recognizes that, ultimately, the patient has control over his or her choices. Pediatric providers can learn brief MI techniques.

Statistics Used in Describing Growth and Development

See Chapter 27.

In everyday use, the term *normal* is synonymous with *healthy*. In a statistical sense, *normal* means that a set of values generates a

Table 19.3 Similar or Identical Elements Within Six Theories of Health Behavior

CONCEPT	GENERAL TENET OF "ENGAGING IN THE BEHAVIOR IS LIKELY IF..."	HEALTH BELIEF MODEL	THEORY OF REASONED ACTION	THEORY OF PLANNED BEHAVIOR	SOCIAL COGNITIVE THEORY	TRANS-THEORETICAL MODEL (STAGES OF CHANGE)	SOCIAL NORMS THEORY
ATTITUDINAL BELIEFS							
Appraisal of positive/ negative aspects of the behavior and expected outcome	Positive aspects outweigh negative aspects	Benefits vs. barriers; health motive	Behavioral beliefs and evaluation of those beliefs (attitudes)		Outcome expectation; expectancies	Pros, cons (decision balance)	Perceptions of peer attitudes and behaviors
SELF-EFFICACY/BELIEF ABOUT CONTROL OVER THE BEHAVIOR							
Belief in one's ability to perform the behavior; confidence	Belief that one can perform the behavior	Self-efficacy	—	Perceived behavioral control	Self-efficacy	Self-efficacy/ temptation	—
NORMATIVE AND NORM-RELATED BELIEFS AND ACTIVITIES							
Belief that others are supportive of the behavior	Belief that others support the behavior change	Cues from media, friends	Normative beliefs and motivation to comply (subjective norms)		Social support	Helping relationships (process of change)	Misperceptions of actual vs. perceived norms
Belief that others are engaging in the behavior	Other people are engaging in the behavior	—	—	—	Social environment; modeling	Social liberation (process of change)	Misperceptions of actual vs. perceived norms
Responses that increase or decrease the likelihood of engaging in the behavior; reminders	Receives positive reinforcement	Cues to action	—	—	Reinforcement	Reinforcement management/ stimulus control	Change in perceptions through media; social messaging
RISK-RELATED BELIEFS AND EMOTIONAL RESPONSES							
Belief that one is at risk if not engaging in the behavior; consequences may be severe	Belief that one is at risk for negative outcome or disease	Perceived susceptibility/ severity (perceived threat)	—	—	Emotional coping responses/ expectancies about environmental cues	Dramatic relief (process of change)	—
INTENTION/COMMITMENT/PLANNING							
Intending or planning to perform the behavior/ setting goals	Forms strong intentions to engage in the behavior/makes a commitment	—	Behavioral intentions		Self-control/ self-regulation	Contemplation/ preparation/; self-liberation (process of change)	Understanding actual norms leads to change

Adapted from Noar SM, Zimmerman RS. Health behavior theory and cumulative knowledge regarding health behaviors: are we moving in the right direction? Health Educ Res. 2005; 20:275-290, Table 1.

Table 19.4 Relationship Between Standard Deviation (SD) and Normal Range for Normally Distributed Quantities

OBSERVATIONS INCLUDED IN THE NORMAL RANGE		PROBABILITY OF A "NORMAL" MEASUREMENT DEVIATING FROM THE MEAN BY THIS AMOUNT	
SD	%	SD	%
±1	68.3	≥1	16.0
±2	95.4	≥2	2.3
±3	99.7	≥3	0.13

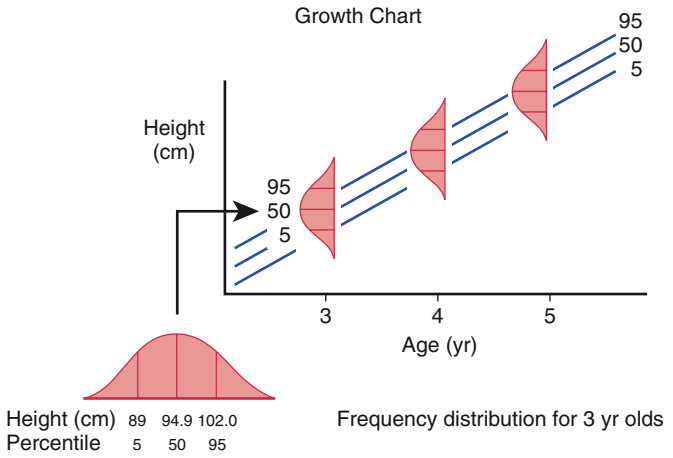

Fig. 19.4 Relationship between percentile lines on the growth curve and frequency distributions of height at different ages.

normal (bell-shaped or gaussian) distribution. This is the case with anthropometric quantities, such as height and weight, and with many developmental measures, such as IQ. For a **normally distributed measurement**, a histogram with the quantity (height, age) on the *x* axis and the frequency (the number of children of that height, or the number who stand on their own at that age) on the *y* axis generates a bell-shaped curve. In an ideal bell-shaped curve, the peak corresponds to the arithmetic **mean** (average) of the sample, as well as to the median and the mode. The **median** is the value above and below which 50% of the observations lie; the **mode** is the value with the highest number of observations. Distributions are termed *skewed* if the mean, median, and mode are not the same number.

The extent to which observed values cluster near the mean determines the width of the bell and can be described mathematically by the **standard deviation (SD)**. In the ideal normal curve, a range of values extending from 1 SD below the mean to 1 SD above the mean includes approximately 68% of the values, and each "tail" above and below that range contains 16% of the values. A range encompassing ±2 SD includes 95% of the values (with the upper and lower tails each comprising approximately 2.5% of the values), and ±3 SD encompasses 99.7% of the values (Table 19.4 and Fig. 19.4).

For any single measurement, its distance away from the mean can be expressed in terms of the number of SDs (also called a ***z* score**); one can then consult a table of the normal distribution to find out what percentage of measurements fall within that distance from the mean. Software to convert anthropometric data into *z* scores for epidemiologic purposes is available. A measurement that falls "outside the normal range" (arbitrarily defined as 2, or sometimes 3, SDs on either side of the mean) is atypical, but not necessarily indicative of illness. The further a measurement (height, weight, IQ) falls from the mean, the greater is the probability that it represents not simply normal variation, but rather a different, potentially pathologic condition.

Another way of relating an individual to a group uses percentiles. The **percentile** is the percentage of individuals in the group who have achieved a certain measured quantity (e.g., height of 95 cm) or a developmental milestone (e.g., walking independently). For anthropometric data, the percentile cutoffs can be calculated from the mean and SD. The 5th, 10th, and 25th percentiles correspond to −1.65 SD, −1.3 SD, and −0.7 SD, respectively. Figure 19.4 demonstrates how frequency distributions of a particular parameter (height) at different ages relate to the percentile lines on the growth curve.

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Chapter 20

Positive Parenting and Support

Rebecca A. Baum and Samantha Schilling

No single force may be more important to a child's development than the environment in which they are raised. Many factors, both positive and negative, contribute to this environment. Parenting practices provide a foundation to promote healthy child development, protect against adverse outcomes, and foster resilience. The term **positive parenting** describes an approach to parenting that achieves these goals.

THE IMPORTANCE OF PARENTING

Interactions between parents and their children provide stimulation that promotes the development of language, early cognitive skills, and school readiness. Less frequent participation in interactive parenting practices, such as reading aloud to children, eating family meals, and participating in family outings, predicts an increased risk of developmental delay in low-income families. Interventions that increase parents' reading to children promote positive developmental outcomes such as early language and literacy development.

The affective nature of the parent–child interaction is important for both cognitive and social emotional development. Persistent maternal depression has been linked to decreases in child IQ scores at school entry. Early exposure to positive parenting has been associated with lower rates of childhood depression, risky behavior, delinquency, injuries, behavior problems, and bullying, and with increased likelihood of empathy and prosocial behavior. The beneficial effects of early maternal sensitivity on social competence have been found to persist into adulthood, contributing to the growing evidence that early parent–child interactions have a long-term impact.

Positive parenting practices, such as using a warm, supportive approach during conflict, and negative practices, such as maternal aggression, have been associated with MRI changes in adolescent brain development in males. Animal models have been used to demonstrate the detrimental effects of stressful early life experiences. Offspring raised in these environments were more likely to exhibit fearful behavior and had differences in brain architecture and in epigenetic changes that alter gene expression. Importantly in these animal models, increased maternal nurturing could protect against these changes.

THE ROLE OF THE FAMILY

Parenting occurs in the context of the family, and yet a "one size fits all" approach to understanding families does not suffice. To understand the influence of the family environment on parenting practices, it is important to appreciate the evolving diversity among U.S. families with respect to culture, race/ethnicity, and family makeup. The U.S. population continues to become more racially/ethnically diverse (61.1% in 2020 vs 54.9% in 2010). Over the last several decades, the percentage of children raised in single-parent homes has continued to grow to nearly 25% in 2020, up from 9% in 1960. It is also important to appreciate that many families face disparities in health and developmental outcomes related to racism and other forms of discrimination that may occur on the basis of religion, sexuality/gender, disability, and socioeconomic status among other factors. For many children these factors interact to further increase risk for disparities in outcomes. Children living in single-parent homes experience poverty at a higher rate than those living in two-parent homes.

Chronic stress and adverse experiences in childhood can have far-reaching consequences that negatively affect health and developmental outcomes (see Chapters 1 and 2). However, parenting—in the form of safe, stable, and nurturing relationships (SSNRs)—has been suggested as one of a number of strategies that can promote resilience and buffer adversity and turn potentially toxic stress responses into tolerable or positive responses.

PARENTING STYLES

Parenting practices are significantly influenced by culture, defined as a pattern of social norms, values, language, and behavior shared by a group of individuals. Approaches to self-regulation, for example, vary across cultures with respect to promoting attention, compliance, delayed gratification, executive function, and effortful control. In examining parent practices, it is important to recognize the role of structural racism and bias on the design and interpretation of parenting research.

Three styles of parenting have been described: authoritative, authoritarian, and permissive. Each style has varying approaches to parental control and responsiveness. A fourth style, neglectful parenting, has also been suggested. **Authoritative parenting** describes a parenting style that is warm, responsive, and accepting but that also sets expectations for behavior and achievement. Differences are approached with reasoning and discussion rather than by exerting control. **Authoritarian parenting** is characterized by a high degree of parental control in which obedience is expected. Punishment is often employed to foster compliance rather than verbal discussion. **Permissive parenting** refers to an approach characterized by warmth and acceptance with the child's autonomy being highly valued, but with few rules or expectations. This contrasts with **neglectful parenting,** similarly characterized by few rules or expectations but also by limited parental warmth or responsiveness.

An authoritative parenting style is most likely to be associated with positive child outcomes across multiple domains, including educational achievement and social-emotional competence. Parental supervision, consistency, and open communication reduce risky behaviors in adolescents. Harsh, inconsistent, and coercive discipline and physical punishment have been associated with increases in emotional and behavioral problems. Child physical abuse is often preceded by corporal punishment. In addition to a higher rate of aggression and behavioral problems, children who have experienced physical punishment have been found to have lower IQs and smaller prefrontal cortexes compared to those who have not. Much of the initial research on parenting styles was based on select U.S. populations (White middle-class families).

CHILD TEMPERAMENT

As evidenced by the effects of family structure, culture/ethnicity, and economics, parenting does not occur in isolation. The child also brings to the parent–child relationship their own personality, or **temperament,** a collection of traits that stay relatively constant over time (see Chapter 19). The initial temperament research identified nine traits: activity level, predictability of behavior, reaction to new environments, adaptability, intensity, mood, distractibility, persistence, and sensitivity. Most infants (65%) fit into one of three groups, easy (40%), difficult (10%), and slow to warm up (15%), and these patterns are relatively stable over time. Although variations in temperament traits are part of normal human variations, certain behavioral difficulties have been associated with certain temperament types. For example, a difficult temperament has been associated with the development of externalizing behavior (e.g., acting out, disruptive, and aggressive behavior) and, not surprisingly, a slow-to-warm-up temperament with internalizing behavior (e.g., anxious and moody behavior).

Temperament traits are relatively stable, but how the child functions is affected by the environment, especially by parenting and the "goodness of fit" between the parent and child. Children with difficult temperament characteristics respond more negatively to neglectful parenting, and children of all temperament groups respond positively to responsive and sensitive parenting. Moreover, childhood traits such as low adaptability, impulsivity, and low frustration tolerance may lead some parents to engage in more negative parenting practices. These findings illustrate the interactive nature between parent and child, with parental behavior shaping child behavior, and vice versa.

CHILD BEHAVIORAL PROBLEMS

Emotional and behavioral problems are common in childhood. Early behavioral problems impact at least one in five children under age 5 in the United States and are associated with impairments in multiple domains, including family, academic, and social functioning, which often continue into adulthood. Emotional and behavioral problems have been associated with single-parent households and poverty. Children in underserved populations experience life circumstances and structural barriers to care that place them at greater risk of behavior problems and unmet needs. High rates of socioeconomic disadvantage, inadequate social infrastructure, neighborhood exposure to violence, repetitive experiences of discrimination, and chronic exposure to racism among minoritized children can have significant adverse effects on children's physical and mental health. Although negative parenting may contribute to and exacerbate such problems, positive parenting practices have been shown to buffer against poor outcome for children growing up in such adversity.

Other risk factors for the development of challenging behavior include trauma and developmental problems. **Adverse childhood experiences (ACEs)**, defined as abuse and neglect, caregiver substance use, caregiver mental health problems, and domestic violence or criminality, are often present during childhood (see Chapter 1). In the National Survey of Child and Adolescent Well-Being there was a cumulative relationship between emotional and behavioral problems and ACE exposure, with children exposed to four or more ACEs being almost five times more likely to have internalizing problems than children not exposed to ACEs. A similar relationship was found for externalizing problems. Studies involving children with developmental disabilities suggest emotional and behavioral problems occur more frequently in this group than in typically developing children. These children may have delays in self-regulation and communication skills as well as increased family stress, which contribute to the increased likelihood of behavioral challenges.

DEFINING POSITIVE PARENTING

The precise definition of the components of positive parenting is lacking. Positive parenting must ensure the child's safety, health, and nutrition as well as developmental promotion. Common attributes of positive parenting include caring, leading, providing, teaching, and communicating with the child in a consistent and unconditional manner. To account for the long-term goals of successful parenting in promoting optimal emotional, behavioral, and developmental outcomes, some suggest the term **purposeful parenting** and related characteristics (Table 20.1). The characterization of an ideal approach to parenting will evolve with ever-changing societal norms, but key components such as those in Table 20.1 will likely remain fundamental.

PARENTING AS AN INTERVENTION

The influence of parenting practices on child behavior, development, and overall adjustment has led to efforts to teach parenting as a method of primary prevention. The Video Interaction Project (VIP) uses a coaching and education model with recorded parent–child interactions to foster positive parenting behavior. These parenting behaviors range from reading aloud to encouraging interactive play. In an urban, low-income, primary care setting, parent and child outcomes for the VIP group were compared to those from a lower-intensity intervention (parent mailings encouraging positive parenting behaviors) and a control group. VIP produced the most robust impacts on socioemotional outcomes, including decreased distress with separation, hyperactivity, and externalizing behavior in toddlers.

Table 20.1 Components of Purposeful Parenting

ATTRIBUTE	DEFINING ACTIONS
Protective	Ensure the child's emotional, developmental, and physiologic needs are met. Provide a safe environment. Balance the need for safety with the child's need for exploration and independence.
Personal	Show unconditional love and acceptance. Be kind and gentle. Avoid name-calling and harsh language. Label emotions and behaviors to help children understand their feelings. Teach and model helpful behavior rather than just saying "no."
Progressive	Adapt parenting skills and discipline to meet the child's developmental needs. Learn about child development to know what to expect. Notice and praise new skills and desirable behaviors.
Positive	Be warm, supportive, and optimistic, even during times of misbehavior. Avoid harsh or physical punishments. Provide encouragement and reward effort, not just a positive result.
Playful	Enjoy child-led time together to encourage exploration, foster creativity, and learn new skills. Read together.
Purposeful	Take care of your needs as a parent. Keep the long-term goals of parenting in mind. Preferentially use teaching instead of punishment to encourage desirable behavior. Be consistent with routines and expectations. Try to understand the reason behind the child's behavior.

Adapted from the work of Andrew Garner and the Ohio Chapter, American Academy of Pediatrics. http://ohioaap.org/wp-content/uploads/2013/07/BPoM_PurposefulParenting.pdf.

Table 20.2 Parent Training Program Components

COMPONENT	ACTIVITIES
Knowledge about child development and behavior	Providing developmentally appropriate environment Learning about child development Promoting positive emotional development
Positive parent–child interactions	Learning the importance of positive, non–discipline-focused interactions Using skills that promote positive interactions Providing frequent positive attention
Responsiveness and warmth	Responding sensitively to the child's emotional needs Providing appropriate physical contact and affection
Emotional communication	Using active listening to foster communication Helping children identify and express emotion
Disciplinary communication	Setting clear, appropriate, and consistent expectations Establishing limits and rules Choosing and following through with appropriate consequences
Discipline and behavior management	Understanding child misbehavior Understanding appropriate discipline strategies Using safe and appropriate monitoring and supervision practices Using reinforcement techniques Using problem solving for challenging behavior Being consistent
Promoting children's social skills and prosocial behavior	Teaching children to share, cooperate, and get along with others Using good manners
Promoting children's cognitive or academic skills	Fostering language and literacy development Promoting school readiness

Adapted from U.S. Centers for Disease Control and Prevention: *Parent training programs: insight for practitioners*, Atlanta, CDC;2009.

Positive parenting as a public health intervention has resulted in decreased rates of substantiated child maltreatment cases, out-of-home placements, and child maltreatment injuries. Other effective public health approaches include home-visiting programs, which have been deployed to at-risk families in an effort to improve maternal and child outcomes. The Maternal, Infant and Early Childhood Home Visiting Program, authorized as part of the Affordable Care Act of 2010 and again in 2015, is part of the Medicare Access and Children's Health Insurance Program (CHIP) Reauthorization Act. A key component of home-visiting programs is the promotion of positive parenting behavior to foster child developmental and school readiness. Group parenting programs have been deployed as primary prevention to promote emotional and behavioral adjustment in young children. There is moderate-quality evidence that group-based parenting programs may improve parent–child interactions. These programs typically employ praise, encouragement, and affection and have been associated with improved self-esteem and social and academic competence.

Parenting behaviors have also been employed as an *intervention* to treat emotional and behavioral problems in young children. Parenting interventions such as Incredible Years, Triple P Positive Parenting Program, New Forrest Parenting Program, and Child Adult Relationship Enhancement in Primary Care are effective for at least short-term improvements in child conduct problems, parental mental health, and parenting practices. Also called *parent training programs*, most teach the importance of play, rewards, praise, and consistent discipline and allow parents to practice new skills. This active-learning component distinguishes parent training programs from educational programs, which have been shown to be less effective.

Teaching emotional communication skills and positive parent–child interaction skills are associated with parent training programs that demonstrate a greater increase in parenting skills (Table 20.2). Several components are associated with programs that show greater improvements in child externalizing behavior including teaching parents to interact positively and respond consistently to their children as well as to use time-out correctly. All successful programs require parents to practice parenting skills during the program.

Parents have been found to benefit from participation in parenting programs. Before their participation, parents experienced a loss of control, self-blame, social isolation, and difficulty dealing with their child's emotional and behavioral problems, all of which improved after participation. The few studies that have assessed the long-term efficacy of parent-training programs suggest overall positive child outcomes but also periods of relapse during which the use of positive parenting skills decreased. Use of social supports is associated with positive child outcomes and may be an important program component when considering long-term success.

THE ROLE OF THE PEDIATRICIAN

Pediatricians and other pediatric practitioners have a primary responsibility to support the needs of parents and their children. Numerous programs and interventions have been developed to be delivered effectively and efficiently in the primary care setting.

The American Academy of Pediatrics (AAP) publishes Bright Futures and the associated Guidelines for Preventive Care to standardize child health promotion and prevention in primary care. A substantial amount of the content in Bright Futures maps to the positive-parenting domains of safety, feeding, developmental promotion, and protection. Implementing Bright Futures guidelines in health supervision visits is an important way for pediatric practitioners to support the promotion of positive parenting in practice. The AAP's policy statement titled Preventing Childhood Toxic Stress: Partnering with Families and Communities to Promote Relational Health describes the importance of the parent–child relationship in building the foundation for healthy child development as well as buffering the effects of more significant stressors.

Reading aloud to children is a powerful strategy to promote language development, early literacy, and positive parent–child interaction. The Reach Out and Read program is a primary care–based intervention that trains practitioners to encourage parents to read with their child and provides books to at-risk families. In the absence of a formal partnership with Reach Out and Read, practitioners should promote the benefits of reading aloud to children and support parents in their efforts to develop habits that incorporate reading into daily routines.

In addition to VIP described earlier, other primary care models to promote parenting have been studied. The Healthy Steps for Young Children program is a strengths-based approach delivered in the primary care setting from infancy to age 3 years. Healthy Steps promotes changes in parents' knowledge, beliefs, and psychologic health and changes in parenting behaviors using a variety of methods delivered in the office setting by the practitioner and Healthy Steps specialists and through home visits. Extensive evaluations have shown improvements in parental well-being, parenting practices, and parent–child attachment and decreased child behavior problems. Another promising approach uses community health workers and nurses to provide parenting education and allow mothers to practice parenting skills outside the office setting.

If participation in a formal parenting program is not possible, pediatric practitioners can still implement a systematic approach to support the needs of parents and their children. Practitioners can take advantage of materials in the public domain from national organizations devoted to child and family health, such as ZERO TO THREE (https://www.zerotothree.org/) and AAP (https://www.aap.org/). The U.S. Centers for Disease Control and Prevention (CDC) also provides evidenced-based parenting resources (https://www.cdc.gov/parents/essentials/index.html). Additional components include early identification of parents' concerns, addressing concerns in a supportive and nonjudgmental way, and providing linkage to treatment services when appropriate.

Parents want more information about child development, but parents of children with behavior problems often feel stigmatized and isolated. Practitioners are encouraged to be supportive and optimistic in their interactions with families and to develop a partnership aimed at promoting parent and child health (see Chapter 18). Practitioners may also encourage parents to practice new skills briefly in the office setting before trying a new skill at home. Active modeling by the practitioner using "teachable moments" may also be effective.

DISCIPLINE/PUNISHMENT

Discipline is meant to teach children to learn good behavior and thus enhance child development. There are many positive parenting approaches to discipline that help avoid confrontations and to also correct behavior without conflict or physical punishment (Tables 20.3 and 20.4) (see Chapters 25 and 26). In addition, parents should teach by example; rather than prompting a child to say thank you, the parents saying thank you is a behavior that an imitating child will follow. Furthermore, when possible, give the child a choice between positive activities, thus enhancing autonomy and preventing conflict. In verbal children, it is helpful to engage the child in problem solving by asking "how can *we* make this better?"

Table 20.3 UNICEF Approach to Positive Discipline

- Create one-on-one times for engagement
- Praise good behavior
- Set clear and realistic expectations
- Distract to a more positive activity
- Calm (not shouting) realistic consequences (if/then)

Data from United Nations Children's Fund (UNICEF). *How to discipline your child the smart and healthy way.* https://www.unicef.org/parenting/child-care/how-discipline-your-child-smart-and-healthy-way.

Table 20.4 CDC Time-Out Steps

1. Identify behavior and give warning
2. Explain why time-out
3. Go to time-out space
   - No talking
   - No playing
   - No lecturing
   - No scolding
   - No excuses from child
   - Ignore protesting or promise to be good
   - Time for both parent and child to calm down
4. End time-out
5. Explain why there was a time-out
6. Praise next positive behavior

Time-out duration rule is ~1 minute per child age in years

Adapted from U.S. Centers for Disease Control and Prevention (CDC). *Using discipline and consequences.* https://www.cdc.gov/parents/essentials/consequences/index.html. Accessed 14 March 2022.

Corporal (physical) punishment is viewed as a violation of the child's right of protection by the United Nations Convention on the Rights of Children. It is viewed by the CDC as a form of child abuse. Corporal punishment is the use of force to produce harm, pain, or discomfort in a dependent child for the purpose of correcting behavior or showing disapproval. It may be manifest by hitting, striking, smacking, slapping, whupping, pinching, kicking, shaking, burning/scalding, pulling hair, washing the mouth with soap or other harmful substances, forcing the child to assume a painful or prolonged posture/position, or using an object to inflict harm. Parents who use corporal punishment may have experienced this punishment as a child. Use of corporal punishment is also associated with adults who misuse drugs, are depressed, or experience intimate partner violence.

The consequences of corporal punishment to the child include worsening behavioral problems including aggression and adverse effects on cognitive development and mental health (anxiety, depression). In addition, corporal punishment does not correct the behavior. Furthermore, there may be a dose-response relationship between the frequency of corporal punishment and adverse child behaviors and development.

For age-related approaches to discipline see Chapters 24, 25, and 26.

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Chapter 21

Assessment of Fetal Growth and Development

Alexander S. Whitaker and Susan Feigelman

The developing fetus is affected by social and environmental influences, including maternal nutritional status, substance use (both legal and illicit), and psychologic trauma. Correspondingly, the psychologic alterations experienced by the parents during the gestation profoundly impact the lives of all members of the family. The complex interplay among these forces and the somatic and neurologic transformations occurring in the fetus influence growth and behavior at birth, through infancy, and potentially throughout the individual's life.

SOMATIC DEVELOPMENT

Embryonic Period

Table 21.1 lists milestones of prenatal development. By 6 days postconception age, as implantation begins, the embryo consists of a spherical mass of cells with a central cavity (the *blastocyst*). By 2 weeks, implantation is complete and the uteroplacental circulation has begun; the embryo has two distinct layers, *endoderm* and *ectoderm*, and the amnion has started to form. By 3 weeks, the third primary germ layer *(mesoderm)* has appeared, along with a primitive neural tube and blood vessels. Paired heart tubes have begun to pump.

During weeks 4-8, lateral folding of the embryologic plate, followed by growth at the cranial and caudal ends and the budding of arms and legs, produces a human-like shape. Precursors of skeletal muscle and vertebrae (somites) appear, along with the branchial arches that will form the mandible, maxilla, palate, external ear, and other head and neck structures. Lens placodes appear, marking the site of future eyes; the brain grows rapidly. By the end of week 8, as the embryonic period closes, the rudiments of all major organ systems have developed; the crown-rump length is 3 cm.

Fetal Period

From the ninth week on (fetal period), somatic changes consist of rapid body growth as well as differentiation of tissues, organs, and organ systems. Figure 21.1 depicts changes in body proportion. By week 10, the face is recognizably human. The midgut returns to the abdomen from the umbilical cord, rotating counterclockwise to bring the stomach, small intestine, and large intestine into their normal positions. By week 12, the gender of the external genitals becomes clearly distinguishable. Lung development proceeds, with the budding of bronchi, bronchioles, and successively smaller divisions. By weeks 20-24, primitive alveoli have formed and surfactant production has begun; before that time, the absence of alveoli renders the lungs useless as organs of gas exchange.

During the third trimester, weight triples and length doubles as body stores of protein, fat, iron, and calcium increase.

NEUROLOGIC DEVELOPMENT

During the third week, a neural plate appears on the ectodermal surface of the trilaminar embryo. Infolding produces a neural tube that will become the central nervous system and a neural crest that will become the peripheral nervous system. Neuroectodermal cells differentiate into neurons, astrocytes, oligodendrocytes, and ependymal cells, whereas microglial cells are derived from mesoderm. By the fifth week, the three main subdivisions of forebrain, midbrain, and hindbrain are evident. The dorsal and ventral horns of the spinal cord have begun to form, along with the peripheral motor and sensory nerves. Myelination begins at midgestation and continues for years.

By the end of the embryonic period (week 8), the gross structure of the nervous system has been established. On a cellular level, neurons migrate outward to form the six cortical layers. Migration is complete by the sixth month, but differentiation continues. Axons and dendrites form synaptic connections at a rapid pace, making the central nervous system vulnerable to teratogenic or hypoxic influences throughout gestation. Figure 21.2 shows rates of increase in DNA (a marker of cell number), overall brain weight, and cholesterol (a marker of myelinization). Epigenetic modifications are made in the presence of fetal gonadal steroids, directing masculinization of the male brain. The prenatal and postnatal peaks of DNA probably represent rapid growth of neurons and glia, respectively. The glial cells are important in shaping the brain and neuronal circuits. The various types of glial cells are needed for the formation of axonal myelin sheaths, a range of functions in the formation and maintenance of neural pathways, and removal of waste (the brain has no lymphoid system for this task).

By the time of birth, the structure of the brain is complete. However, many cells will undergo *apoptosis* (cell death). Synapses will be pruned back substantially, and new connections will be made, largely as a result of experience. Many psychiatric and developmental disorders are thought to result at least in part from disruptions in the **functional connectivity** of brain networks. Disorders of connectivity may begin during fetal life; MRI studies provide a developmental timetable for such connections that lend support to the possible role of disruptions in the establishment of such connections.

BEHAVIORAL DEVELOPMENT

No behavioral evidence of neural function is detectable until the third month. Reflexive responses to tactile stimulation develop in a craniocaudal sequence. By weeks 13-14, breathing and swallowing motions appear. The grasp reflex appears at 17 weeks and is well developed by 27 weeks. Eye opening occurs around 26-28 weeks. By midgestation, the full range of neonatal movements can be observed.

During the third trimester, fetuses respond to external stimuli with heart rate elevation and body movements, which can be observed with ultrasound (see Chapter 117). Reactivity to auditory (vibroacoustic) and visual (bright light) stimuli vary, depending on their behavioral state, which can be characterized as quiet sleep, active sleep, or awake. Individual differences in the level of fetal activity are usually noted by mothers. Fetuses will preferentially turn to light patterns in the configuration of the human face. Fetal movement is affected by maternal medications and diet, increasing after ingestion of caffeine. Behavior may be entrained to the mother's diurnal rhythms: asleep during the day, active at night. Abnormal fetal movement patterns are found in neonates with subsequent muscular or neurologic abnormalities.

Fetal movement increases in response to a sudden auditory tone but decreases after several repetitions. This demonstrates **habituation**, a basic form of learning in which repeated stimulation results in a response decrement. If the tone changes in pitch, the movement increases again, which is evidence that the fetus distinguishes between a familiar, repeated tone and a novel tone. Habituation improves in older fetuses and decreases in neurologically impaired or physically stressed fetuses. Similar responses to visual and tactile stimuli have been observed.

PSYCHOLOGIC CHANGES IN PARENTS

Many psychologic changes occur during pregnancy. An unplanned pregnancy may be met with anger, denial, or depression. Ambivalent feelings are common, whether or not the pregnancy was planned. Elation at the thought of producing a baby and the wish to be the perfect parent compete with fears of inadequacy and of the lifestyle changes that parenting will impose. Parents of an existing child may feel protective of the child, worried that the child may feel less valued. Old conflicts may resurface as a woman psychologically identifies with her own mother and with herself as a child. The father-to-be faces similar mixed feelings, and problems in the parental relationship may intensify.

Tangible evidence that a fetus exists as a separate being, whether as a result of ultrasonic visualization or awareness of fetal movements known as *quickening* (at 16-20 weeks), often heightens a

woman's feelings. Parents worry about the fetus's healthy development and mentally rehearse what they will do if the child is malformed, including their response to evidence of abnormality through ultrasound, amniocentesis, or other fetal laboratory tests. Toward the end of pregnancy, a woman becomes aware of patterns of fetal activity and reactivity and begins to ascribe to her fetus an individual personality and an ability to survive independently. Appreciation of the psychologic vulnerability of the expectant parents and of the powerful contribution of fetal behavior facilitates supportive clinical intervention.

Table 21.1 Milestones of Prenatal Development

WK	DEVELOPMENTAL EVENTS
1	Fertilization and implantation; beginning of *embryonic* period
2	Endoderm and ectoderm appear (bilaminar embryo)
3	First missed menstrual period; mesoderm appears (trilaminar embryo); somites begin to form
4	Neural folds fuse; folding of embryo into human-like shape; arm and leg buds appear; crown-rump length 4-5 mm
5	Lens placodes, primitive mouth, digital rays on hands
6	Primitive nose, philtrum, primary palate
7	Eyelids begin; crown-rump length 2 cm
8	Ovaries and testes distinguishable
9	*Fetal* period begins; crown-rump length 5 cm; weight 8 g
12	External genitals distinguishable
20	Usual lower limit of viability; weight 460 g; length 19 cm
25	Third trimester begins; weight 900 g; length 24 cm
28	Eyes open; fetus turns head down; weight 1,000-1,300 g
38	Term

THREATS TO FETAL DEVELOPMENT

Mortality and morbidity are highest during the prenatal period (see Chapter 114). An estimated 50% of all pregnancies end in spontaneous abortion, including 10–15% of all clinically recognized pregnancies. The majority occur in the first trimester. Many spontaneous abortions occur as a result of chromosomal abnormalities, most commonly aneuploidies.

Teratogens associated with gross physical and mental abnormalities include various infectious agents (e.g., toxoplasmosis, rubella, syphilis, Zika virus), chemical agents (e.g., mercury, thalidomide, antiepileptic medications, retinoids, ethanol), high temperature, and radiation (see Chapters 117 and 758).

Teratogenic effects may also result in decreased growth and cognitive or behavioral deficits that only become apparent later in life. Nicotine has vasoconstrictor properties and may disrupt dopaminergic and serotonergic pathways. Prenatal exposure to cigarette smoke is associated with lower birthweight, stunting, and smaller head circumference. It is also associated with changes in neonatal neurodevelopmental assessments; later, these children are at increased risk for learning problems, attention and behavior disorders, and other long-term health effects. Alcohol is a common teratogen affecting physical development, cognition, and behavior (see Chapter 146). Prenatal exposure to opiates can result in neonatal abstinence syndrome (NAS) characterized by irritability, poor feeding, tremors and temperature instability in newborn infants. Affected infants may require treatment with low-dose opiates to abate the symptoms. School-age children with a history of NAS are significantly more likely to have educational disabilities, even when controlling for external factors such as maternal educational attainment and gestational age.

The effects of prenatal exposure to cocaine, also occurring through alternations in placental blood flow and in direct toxic effects to the developing brain, have been followed in several cohorts and are less dramatic than previously believed. Exposed adolescents show small but significant effects in behavior and functioning but may not show cognitive impairment. Associated risk factors including alcohol and tobacco use, and postnatal environments frequently characterized by toxic stress, may explain some of the observed negative developmental outcomes. (see Chapters 1, 15, and 17).

The association between an inadequate nutrient supply to the fetus and low birthweight has been recognized for decades; this adaptation

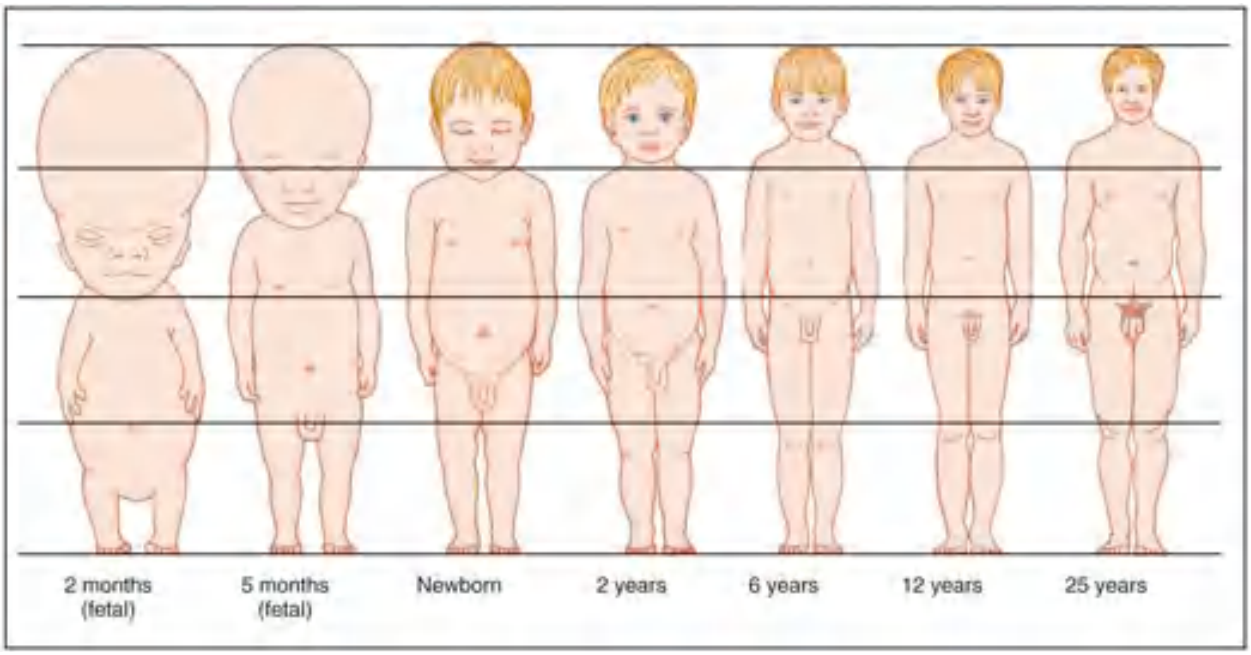

Fig. 21.1 Changes in body proportions. Approximate changes in body proportions from fetal life through adulthood. *(From Leifer G. Introduction to Maternity & Pediatric Nursing. Philadelphia: WB Saunders;2011: pp 347–385, Fig. 15-2.)*

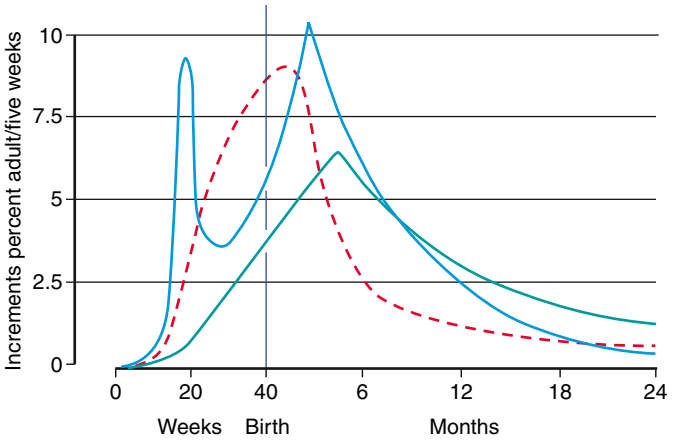

Fig. 21.2 Velocity curves of the various components of human brain growth. *Blue line,* DNA; *red line,* brain weight; *green line,* cholesterol. *From Brasel JA, Gruen RK. In Falkner F, Tanner JM, eds: Human Growth: a comprehensive treatise. New York: Plenum Press; 1986: pp 78–95.*

on the part of the fetus presumably increases the likelihood that the fetus will survive until birth. For any potential fetal insult, the extent and nature of its effects are determined by characteristics of the host as well as the dose and timing of the exposure. Inherited differences in the metabolism of ethanol, timing of exposure, and the mother's diet may explain the variability in fetal alcohol effects. Organ systems are most vulnerable during periods of maximum growth and differentiation, generally during the first trimester (**organogenesis**) (http://www.epa.gov/children/children-are-not-little-adults details critical periods and specific developmental abnormalities).

Fetal adaptations or responses to an adverse situation in utero, termed **fetal programming** or **developmental plasticity**, have lifelong implications. Fetal programming may prepare the fetus for an environment that matches that experienced in utero. Fetal programming in response to some environmental and nutritional signals in utero increases the risk of cardiovascular disease, diabetes, and obesity in later life. These adverse long-term effects appear to represent a mismatch between environmental conditions faced by a fetus or neonate and the conditions that the individual will confront later in life. A fetus deprived of adequate calories may or may not face famine as a child or adolescent. One proposed mechanism for fetal programming is epigenetic imprinting, in which one of two alleles is turned off through environmentally induced epigenetic modification (see Chapter 97). Many environmental factors have been found to play a role in producing epigenetic modifications that are both transgenerational (direct effect on the developing fetus) and intergenerational (changes in the germ cells that will affect future generations).

Just as the fetal adaptations to the in utero environment may increase the likelihood of later metabolic conditions, the fetus adapts to the mother's psychologic distress. In response to the stressful environment, physiologic changes involving the hypothalamic-pituitary-adrenal axis and the autonomic nervous system occur. Dysregulation of these systems may explain the associations observed in some but not all studies between maternal distress and negative infant outcomes. These negative outcomes include low birthweight, spontaneous abortion, prematurity, and decreased head circumference. In addition, children born to mothers experiencing high stress levels have been found to have higher rates of inattention, impulsivity, conduct disorders, and negative cognitive changes. Although these changes may have been adaptive in primitive cultures, they are maladaptive in modern societies, leading to psychopathology. Genetic variability, timing of stress during sensitive periods, and the quality of postnatal parenting can attenuate or exacerbate these associations.

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Chapter 22

The Newborn

Elisa Hampton and John M. Olsson

See also Chapter 115.

Regardless of gestational age, the newborn (neonatal) period begins at birth and includes the first month of life. During this time, marked physiologic transitions occur in all organ systems, and the infant learns to respond to many forms of external stimuli. Because infants thrive physically and psychologically only in the context of their social relationships, any description of the newborn's developmental status has to include consideration of the parents' role as well.

PARENTAL ROLE IN PARENT–INFANT ATTACHMENT

Parenting a newborn infant requires dedication because a newborn's needs are urgent, continuous, and often unclear. Parents must attend to an infant's signals and respond empathically. Many factors influence parents' ability to assume this role.

Prenatal Factors

Pregnancy is a period of psychologic preparation for the profound demands of parenting. Expectant parents may experience ambivalence, particularly (but not exclusively) if the pregnancy was unplanned. Financial concerns, physical illness, prior miscarriages or stillbirths, or other crises may interfere with future bonding. For adolescent parents, the demand that they relinquish their own developmental agenda, such as an active social life, may be especially burdensome.

The transition to parenthood is a unique developmental phase, and a stressful one. Lifetime experiences of parents, particularly traumatic ones, may affect their approaches to developing a nurturing relationship with their infant (Table 22.1). It has been shown that an increasing number of adverse childhood experiences (ACEs) may be associated with increased parental stress, a more authoritarian style of parenting, increased risk for child abuse, and greater insecurity in parent–child attachment (bonding). Identifying parental ACEs and addressing them with community resources, including parenting classes, parent aides, and parent support groups may help provide parents with the resilience to mitigate the effects of ACEs.

Table 22.1 Prenatal Risk Factors for Attachment

Recent death of a loved one
Previous loss of or serious illness in another child
Prior removal of a child
History of depression or serious mental illness
History of infertility or pregnancy loss
Troubled relationship with parents
Financial stress or job loss
Marital discord or poor relationship with the other parent
Recent move or no community ties
No friends or social network
Unwanted pregnancy
No good parenting model
Experience of poor parenting
Drug and/or alcohol use
Extreme immaturity

From Dixon SD, Stein MT. *Encounters With Children: Pediatric Behavior and Development.* 4th ed. Philadelphia: Mosby, 2006. p 131.

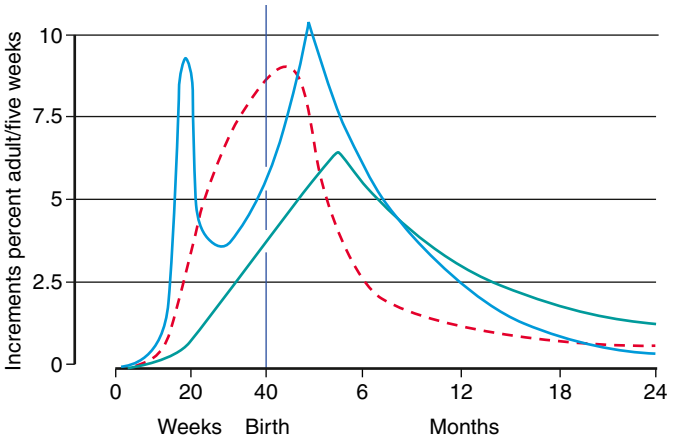

Fig. 21.2 Velocity curves of the various components of human brain growth. *Blue line,* DNA; *red line,* brain weight; *green line,* cholesterol. *From Brasel JA, Gruen RK. In Falkner F, Tanner JM, eds: Human Growth: a comprehensive treatise. New York: Plenum Press; 1986: pp 78–95.*

on the part of the fetus presumably increases the likelihood that the fetus will survive until birth. For any potential fetal insult, the extent and nature of its effects are determined by characteristics of the host as well as the dose and timing of the exposure. Inherited differences in the metabolism of ethanol, timing of exposure, and the mother's diet may explain the variability in fetal alcohol effects. Organ systems are most vulnerable during periods of maximum growth and differentiation, generally during the first trimester (**organogenesis**) (http://www.epa.gov/children/children-are-not-little-adults details critical periods and specific developmental abnormalities).

Fetal adaptations or responses to an adverse situation in utero, termed **fetal programming** or **developmental plasticity**, have lifelong implications. Fetal programming may prepare the fetus for an environment that matches that experienced in utero. Fetal programming in response to some environmental and nutritional signals in utero increases the risk of cardiovascular disease, diabetes, and obesity in later life. These adverse long-term effects appear to represent a mismatch between environmental conditions faced by a fetus or neonate and the conditions that the individual will confront later in life. A fetus deprived of adequate calories may or may not face famine as a child or adolescent. One proposed mechanism for fetal programming is epigenetic imprinting, in which one of two alleles is turned off through environmentally induced epigenetic modification (see Chapter 97). Many environmental factors have been found to play a role in producing epigenetic modifications that are both transgenerational (direct effect on the developing fetus) and intergenerational (changes in the germ cells that will affect future generations).

Just as the fetal adaptations to the in utero environment may increase the likelihood of later metabolic conditions, the fetus adapts to the mother's psychologic distress. In response to the stressful environment, physiologic changes involving the hypothalamic-pituitary-adrenal axis and the autonomic nervous system occur. Dysregulation of these systems may explain the associations observed in some but not all studies between maternal distress and negative infant outcomes. These negative outcomes include low birthweight, spontaneous abortion, prematurity, and decreased head circumference. In addition, children born to mothers experiencing high stress levels have been found to have higher rates of inattention, impulsivity, conduct disorders, and negative cognitive changes. Although these changes may have been adaptive in primitive cultures, they are maladaptive in modern societies, leading to psychopathology. Genetic variability, timing of stress during sensitive periods, and the quality of postnatal parenting can attenuate or exacerbate these associations.

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Chapter 22

The Newborn

Elisa Hampton and John M. Olsson

See also Chapter 115.

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Extreme immaturity

From Dixon SD, Stein MT. *Encounters With Children: Pediatric Behavior and Development.* 4th ed. Philadelphia: Mosby, 2006. p 131.

Social support during pregnancy, particularly support from the partner and close family members, is also important. Family support can promote resilience in the face of ACEs as described earlier.

Many decisions have to be made by parents in anticipation of the birth of their child. One important choice is how the infant will be nourished. Among the important benefits of **breastfeeding** is its promotion of bonding. Providing breastfeeding education for the parents during prenatal pediatric or obstetric care can increase maternal confidence in breastfeeding after delivery, reduce stress during the newborn period, and promote increased breastfeeding rates and duration (see Chapter 61).

Peripartum and Postpartum Influences

The continuous presence of a support person during labor results in shorter labor and fewer obstetric complications (including cesarean section). These beneficial effects may be even more pronounced when the support person is specially trained and present solely for the purpose of continuous support (a **doula**). Early skin-to-skin contact between mothers and infants immediately after birth is associated with an increased rate and longer duration of breastfeeding. Most new parents value even a brief period of uninterrupted time in which to get to know their new infant, and increased mother–infant contact over the first days of life may improve long-term mother–child interactions. Nonetheless, early separation, although predictably very stressful, does not inevitably impair a mother's ability to bond with her infant.

Postpartum mood and anxiety disorder (PMAD) may occur in the first week or up to 6 months after delivery and can adversely affect neonatal growth and development. Screening tools, such as the **Edinburgh Postnatal Depression Scale (EPDS)**, are available for use during neonatal and infant visits to the pediatric provider. Screening mothers for PMAD is recommended at the 1, 2, 4, and 6 month well child visit. PMAD is also seen in partners of postpartum women, but peaks later at 3-6 months. Pediatric providers should consider screening partners at the 6 month well child visit using the EPDS. A score of 10 or higher, or a positive response to question 10 (suicidal thoughts), in either postpartum women or their partners warrants referral for evaluation (Table 22.2).

THE INFANT'S ROLE IN PARENT–INFANT ATTACHMENT

The in utero environment contributes greatly but not completely to the future growth and development of the fetus. Abnormalities in maternal-fetal placental circulation and maternal glucose metabolism or the presence of maternal infection can result in abnormal fetal growth. Infants may be small or large for gestational age as a result. These abnormal growth patterns not only predispose infants to an increased requirement for medical intervention, but they also may affect their ability to respond behaviorally to their parents.

Physical Examination

Examination of the newborn should include an **evaluation of growth** (see Chapter 21) and an **observation of behavior**. The average term newborn weighs approximately 3.4 kg (7.5 lb); boys are slightly heavier than girls. The average length and head circumference are about 50 cm (20 in) and 35 cm (14 in), respectively, in term infants. Each newborn's growth parameters should be plotted on growth curves specific for that infant's gestational age to determine the appropriateness of size. Specific growth charts for conditions associated with variations in growth patterns have also been developed. It is important to note that in the United States, significant disparities exist in low birthweight (<2,500 g) rates with higher rates in low socioeconomic status (SES) groups and in minoritized populations.

The infant's response to being examined may be useful in assessing its vigor, alertness, and tone. Observing how the parents handle their infant, their comfort, and affection is also important. The order of the physical examination should be from the least to the most intrusive maneuvers. Assessing visual tracking and response to sound and noting changes of tone with level of activity and alertness are very helpful. Performing this examination and sharing impressions with parents is an important opportunity to facilitate bonding (see Chapter 115).

Interactional Abilities

Soon after birth, neonates are alert and ready to interact and nurse. This first alert-awake period may be affected by maternal analgesics and anesthetics or fetal hypoxia. Neonates are nearsighted, having a fixed focal length of 8-12 inches, approximately the distance from the breast to the mother's face, as well as an inborn visual preference for faces. Hearing is well developed, and infants preferentially turn toward a female voice. These innate abilities and predilections increase the likelihood that when a mother gazes at her newborn, the baby will gaze back. The initial period of social interaction, usually lasting about 40 minutes, is followed by a period of somnolence. After that, briefer periods of alertness or excitation alternate with sleep. If a mother misses her baby's first alert-awake period, she may not experience as long a period of social interaction for several days. The hypothalamic-midbrain-limbic-paralimbic-cortical circuits of the parent's brain together support responses to the infant that are critical for effective parenting (e.g., emotion, attention, motivation, empathy, decision-making).

Modulation of Arousal

Adaptation to extrauterine life requires rapid and profound physiologic changes, including aeration of the lungs, rerouting of the circulation, and activation of the intestinal tract. The necessary behavioral changes are no less profound. To obtain nourishment, to avoid hypo- and hyperthermia, and to ensure safety, neonates must react appropriately to an expanded range of sensory stimuli. Infants must become aroused in response to stimulation, but not so overaroused that their behavior becomes disorganized. Underaroused infants are not able to feed and interact; overaroused infants show signs of **autonomic instability**, including flushing or mottling, perioral pallor, hiccupping, vomiting, uncontrolled limb movements, and inconsolable crying.

Behavioral States

The organization of infant behavior into discrete behavioral states may reflect an infant's inborn ability to regulate arousal. *Six states* have been described: quiet sleep, active sleep, drowsy, alert, fussy, and crying. In the **alert state**, infants visually fixate on objects or faces and follow them horizontally and (within a month) vertically; they also reliably turn toward a novel sound, as if searching for its source. When overstimulated, they may calm themselves by looking away, yawning, or sucking on their lips or hands, thereby increasing parasympathetic activity and reducing sympathetic nervous system activity. The behavioral state determines an infant's muscle tone, spontaneous movement, electroencephalogram pattern, and response to stimuli. In **active sleep**, an infant may show progressively less reaction to a repeated heelstick (habituation), whereas in the **drowsy state**, the same stimulus may push a child into fussing or crying.

Mutual Regulation

Parents actively participate in an infant's state regulation, alternately stimulating and soothing. In turn, they are regulated by the infant's signals, responding to cries of hunger with a letdown of milk (or with a bottle). Such interactions constitute a system directed toward furthering the infant's physiologic homeostasis and physical growth. At the same time, they form the basis for the emerging psychologic relationship between parent and child. Infants come to associate the presence of the parent with the pleasurable reduction of tension (as

Table 22.2 | Edinburgh Postnatal Depression Scale

INSTRUCTIONS FOR USERS

1. The mother is asked to underline the response that comes closest to how she has been feeling in the previous 7 days.
2. All 10 items must be completed.
3. Care should be taken to avoid the possibility of the mother discussing her answers with others.
4. The mother should complete the scale herself, unless she has limited English or has difficulty with reading.
5. The Edinburgh Postnatal Depression Scale may be used at 6-8 wk to screen postnatal women. The child health clinic, a postnatal checkup, or a home visit may provide a suitable opportunity for its completion.

EDINBURGH POSTNATAL DEPRESSION SCALE

Name:

Address:

Baby's age:

Because you have recently had a baby, we would like to know how you are feeling. Please underline the answer that comes closest to how you have felt in the past 7 days, not just how you feel today.

Here is an example, already completed.

I have felt happy:

Yes, all the time
Yes, most of the time
No, not very often
No, not at all

This would mean: "I have felt happy most of the time" during the past week. Please complete the other questions in the same way.

In the past 7 days:

1. I have been able to laugh and see the funny side of things
   - As much as I always could
   - Not quite so much now
   - Definitely not so much now
   - Not at all
2. I have looked forward with enjoyment to things
   - As much as I ever did
   - Rather less than I used to
   - Definitely less than I used to
   - Hardly at all

*3. I have blamed myself unnecessarily when things went wrong
   - Yes, most of the time
   - Yes, some of the time
   - Not very often
   - No, never

4. I have been anxious or worried for no good reason
   - No, not at all
   - Hardly ever
   - Yes, sometimes
   - Yes, very often

*5. I have felt scared or panicky for no very good reason
   - Yes, quite a lot
   - Yes, sometimes
   - No, not much
   - No, not at all

*6. Things have been getting on top of me
   - Yes, most of the time I haven't been able to cope at all
   - Yes, sometimes I haven't been coping as well as usual
   - No, most of the time I have coped quite well
   - No, I have been coping as well as ever

*7. I have been so unhappy that I have had difficulty sleeping
   - Yes, most of the time
   - Yes, sometimes
   - Not very often
   - No, not at all

*8. I have felt sad or miserable
   - Yes, most of the time
   - Yes, quite often
   - Not very often
   - No, not at all

*9. I have been so unhappy that I have been crying
   - Yes, most of the time
   - Yes, quite often
   - Only occasionally
   - No, never

*10. The thought of harming myself has occurred to me
   - Yes, quite often
   - Sometimes
   - Hardly ever
   - Never

Response categories are scored 0, 1, 2, and 3 according to increased severity of the symptom. Items marked with an asterisk (*) are reverse-scored (i.e., 3, 2, 1, and 0). The total score is calculated by adding the scores for each of the 10 items. Users may reproduce the scale without further permission provided they respect copyright (which remains with the *British Journal of Psychiatry*) by quoting the names of the authors, the title, and the source of the paper in all reproduced copies.

Adapted from Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry*. 1987;150:782–786; reproduced from Currie ML, Rademacher R. The pediatrician's role in recognizing and intervening in postpartum depression. *Pediatr Clin North Am*. 2004;51(3):785–xi.

in feeding) and show this preference by calming more quickly for their parent than for a stranger. This response in turn strengthens a parent's sense of efficacy and their connection with their baby.

IMPLICATIONS FOR THE PEDIATRICIAN

The pediatrician can support healthy newborn development in several ways.

Optimal Practices

A **prenatal pediatric visit** allows pediatricians to assess both the strengths of the expectant parents and any needs they may have in anticipation of the birth of their infant. This should include assessment of social determinants of health and may consist of addressing needs such as baby supplies, financial assistance, and parental mental health support. **Supportive hospital policies** include the use of birthing rooms rather than operating suites and delivery rooms; encouraging the partner or a trusted relative or friend to remain with the mother during labor or the provision of a professional doula; the practice of giving the newborn infant to the mother immediately after drying and a brief assessment; keeping the newborn with the mother rather than in a central nursery; and avoiding in-hospital distribution of infant formula. Such policies ("Baby Friendly Hospital") have been shown to significantly increase breastfeeding rates (see Chapter 115.3). After discharge, **home visits** by nurses and lactation counselors can reduce early feeding problems and identify emerging medical conditions in either mother or baby. Infants requiring transport to another hospital should be brought to see the mother first, if at all possible. Timing of hospital discharge should be individualized for each maternal–infant dyad based on the mode of delivery, presence or absence of specific risk factors, and any problems identified during the birth hospitalization. Some healthy term newborns may be discharged before 48 hours of life, and these newborns should be evaluated with a follow up visit by 3-5 days after birth and within 48-72 hours after discharge. The timing of the first visit for newborns with a longer initial hospital stay will depend on the newborn's specific issues and identified needs.

Assessing Parent–Infant Interactions

During a feeding or when infants are alert and face-to-face with their parents, it is normal for the dyad to appear absorbed in one another. Infants who become overstimulated by the parent's voice or activity may turn away or close their eyes, leading to a premature termination of the encounter. Alternatively, the infant may be ready to interact, but the parent may appear preoccupied. Asking a new mother about her own emotional state, and inquiring specifically about a history of depression, facilitates referral for therapy, which may provide long-term benefits to the child.

Teaching About Individual Competencies

The **Newborn Behavior Assessment Scale (NBAS)** provides a formal measure of an infant's neurodevelopmental competencies, including state control, autonomic reactivity, reflexes, habituation, and orientation toward auditory and visual stimuli. This examination can also be used to demonstrate to parents an infant's capabilities and vulnerabilities. Parents might learn that they need to undress their infant to increase the level of arousal or to swaddle the infant to reduce overstimulation by containing random arm movements. The NBAS can be used to support the development of positive early parent–infant relationships. Demonstration of the NBAS to parents in the first week of life has been shown to correlate with improvements in the caretaking environment months later.

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Chapter 23
The First Year

Mutiat T. Onigbanjo and Susan Feigelman

The prenatal period and the first year of life provide the platform for remarkable growth and development, setting the trajectory for a child's life. **Neural plasticity**, the ability of the brain to be shaped by experience, both positive and negative, is at its peak. Total brain volume doubles in the first year of life and increases by an additional 15% over the second year. Total brain volume at age 1 month is approximately 36% of adult volume but by age 1 year is approximately 72% (83% by 2 years) (Fig. 23.1).

The acquisition of seemingly "simple" skills, such as swallowing, reflects a series of intricate and highly coordinated processes involving multiple levels of neural control distributed among several physiologic systems whose nature and relationships mature throughout the first year of life. Substantial learning of the basic tools of language (phonology, word segmentation) occurs during infancy. Speech processing in older individuals requires defined and precise neuronal networks; the infant brain possesses a structural and functional organization similar to that of adults, suggesting that structural neurologic processing of speech may guide infants to discover the properties of their native language. Myelination of the cortex begins at 7-8 months' gestation and continues into adolescence and young adulthood. It proceeds posterior to anterior, allowing progressive maturation of sensory, motor, and finally associative pathways. Given the importance of iron, cholesterol, and other nutrients in myelination, adequate stores throughout infancy are critical (see Chapter 61). Insufficient interactions with caregivers or the wider environment may alter experience-dependent processes that are critical to brain structure development and function during infancy. Although for some processes, subsequent stimulation may allow catch-up; as the periods of plasticity close during the rapid developmental changes occurring in infancy, more permanent deficits may result.

The infant acquires new competences in all developmental domains. The concept of **developmental trajectories** recognizes that complex skills build on simpler ones; it is also important to realize how development in each domain affects functioning in all the others. All growth parameters should be plotted using the World Health Organization charts, which show how children from birth through 72 months "should" grow under optimal circumstances (see Figs. 24.1 and 24.2). Table 23.1 presents an overview of key milestones by domain; Table 23.2 presents similar information arranged by age. Table 23.3 presents age at time of x-ray appearance of centers of ossification. Parents often seek information about "normal development" during this period and should be directed to reliable sources, including the American Academy of Pediatrics website (www.healthychildren.org) or the Center for Disease Control website (www.cdc.gov/ncbddd/actearly/milestones/index.html).

AGE 0-2 MONTHS

In the full-term infant, **myelination** is present by the time of birth in the dorsal brainstem, cerebellar peduncles, and posterior limb of the internal capsule. The cerebellar white matter acquires myelin by 1 month of age and is well myelinated by 3 months. The subcortical white matter of the parietal, posterior frontal, temporal, and calcarine cortex is partially myelinated by 3 months of age. In this period the infant experiences tremendous growth. Physiologic changes allow the establishment of effective feeding routines and a predictable sleep–wake cycle. The social interactions that occur as parents and infants accomplish these tasks lay the foundation for cognitive and emotional development.

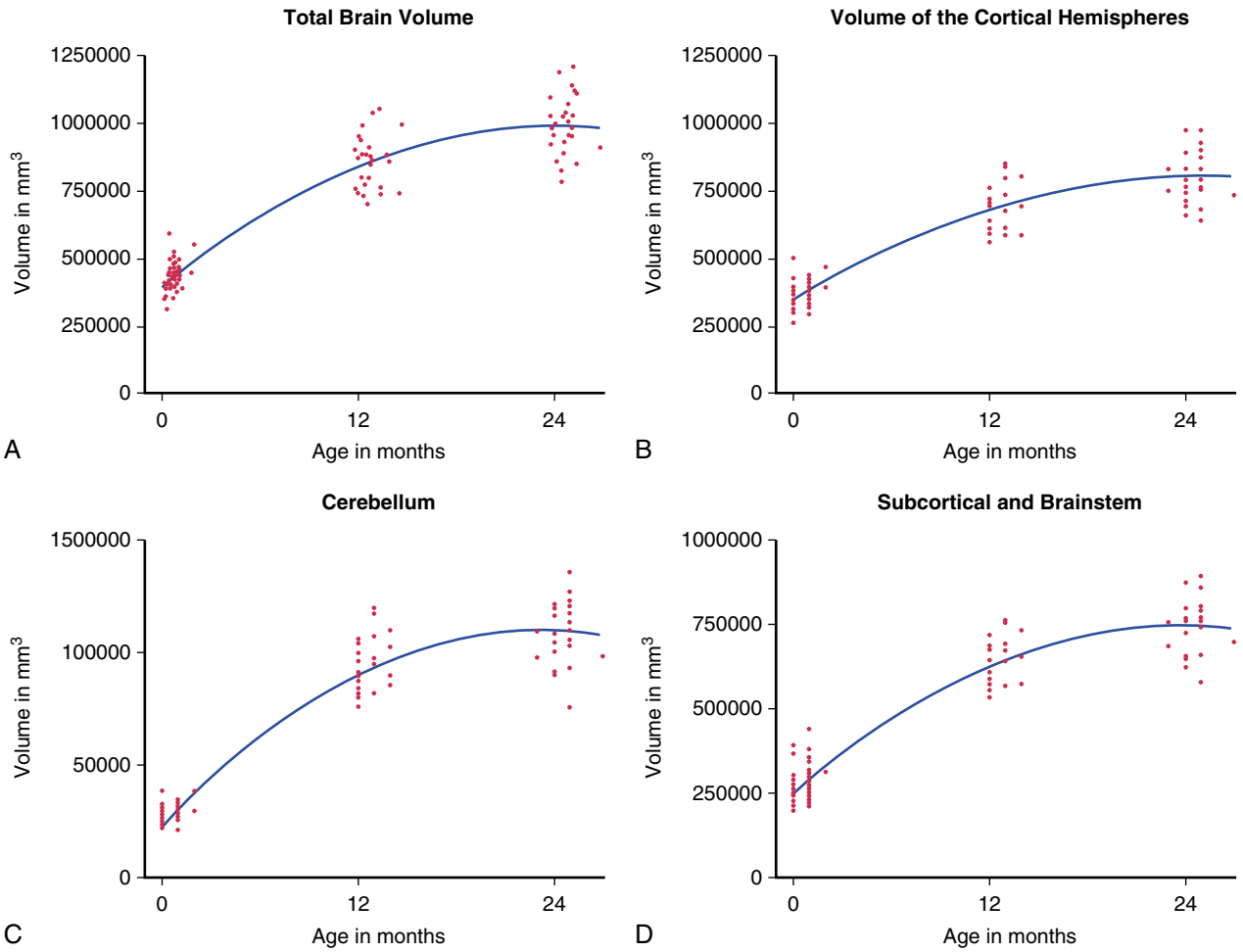

Fig. 23.1 Scatterplots showing brain growth in the first 2 years of life. A, Total brain volume by age at scan. B, Cortical hemispheres. C, Cerebellum. D, Subcortical region and brainstem. *(From Knickmeyer RC, Gouttard S, Kang C, et al. A structural MRI study of human brain development from birth to 2 years. J Neurosci. 2008;28:12176–12182.)*

Physical Development

A newborn's weight may initially decrease 10% (vaginal delivery) to 12% (cesarean section) below birthweight in the first week as a result of excretion of excess extravascular fluid and limited nutritional intake. Nutrition improves as colostrum is replaced by higher-fat content breast milk, infants learn to latch on and suck more efficiently, and mothers become more comfortable with feeding techniques. Infants regain or exceed birthweight by 2 weeks of age and should grow at approximately 30 g (1 oz) per day during the first month (see Table 27.1). This is the period of fastest postnatal growth. Arms are held to the sides. Limb movements consist largely of uncontrolled writhing, with apparently purposeless opening and closing of the hands. Smiling occurs involuntarily. Eye gaze, head turning, and sucking are under better control and thus can be used to demonstrate infant perception and cognition. An infant's preferential turning toward the mother's voice is evidence of recognition memory.

Six **behavioral states** have been described (see Chapter 22). Initially, sleep and wakefulness are evenly distributed throughout the 24 hour day (Fig. 23.2). Neurologic maturation accounts for the consolidation of sleep into blocks of 5 or 6 hours at night, with brief awake, feeding periods. Learning also occurs; infants whose parents are consistently more interactive and stimulating during the day learn to concentrate their sleeping during the night.

Cognitive Development

Infants can differentiate among patterns, colors, and consonants. They can recognize facial expressions (smiles) as similar, even when they appear on different faces. They also can match abstract properties of stimuli, such as contour, intensity, or temporal pattern, across sensory modalities. Infants at 2 months of age can discriminate rhythmic patterns in native vs nonnative language. Infants appear to seek stimuli actively, as though satisfying an innate need to make sense of the world. These phenomena point to the integration of sensory inputs in the central nervous system. Caretaking activities provide visual, tactile, olfactory, and auditory stimuli, all of which support the development of cognition. Infants **habituate** to the familiar, attending less to repeated stimuli and increasing their attention to novel stimuli.

Emotional Development

The infant is dependent on the environment to meet its needs. The consistent availability of a trusted adult to meet the infant's urgent needs creates the conditions for **secure attachment**. Basic **trust vs mistrust,** the first of Erikson's psychosocial stages (see Chapter 19), depends on attachment and reciprocal maternal bonding. Crying occurs in response to stimuli that may be obvious (a soiled diaper) but are often obscure (see Chapter 23.1). Infants who are consistently picked up and held in response to distress cry less at 1 year and show less aggressive behavior at 2 years. Infants of adolescent mothers who are trained to carry their babies demonstrate secure attachment. Infants cry in response to the cry of another infant, which has been interpreted as an early sign of empathy.

Implications for Parents and Pediatricians

Success or failure in establishing feeding and sleep cycles influences parents' feelings of competence. When things go well, the parents' anxiety and ambivalence, as well as the exhaustion of the early weeks, decrease. Infant issues (e.g., colic) or familial conflict may prevent this from occurring. With physical recovery from delivery and hormonal

Table 23.1 Developmental Milestones in First 2 Years of Life

MILESTONE	AVERAGE AGE OF ATTAINMENT (MO)	DEVELOPMENTAL IMPLICATIONS
GROSS MOTOR		
Holds head steady while sitting	2	Allows more visual interaction
Pulls to sit, with no head lag	3	Muscle tone
Brings hands together in midline	3	Self-discovery of hands
Asymmetric tonic neck reflex gone	4	Can inspect hands in midline
Sits without support	6	Increasing exploration
Rolls back to stomach	6.5	Truncal flexion, risk of falls
Walks alone	12	Exploration, control of proximity to parents
Runs	16	Supervision more difficult
FINE MOTOR		
Grasps rattle	3.5	Object use
Reaches for objects	4	Visuomotor coordination
Palmar grasp gone	4	Voluntary release
Transfers object hand to hand	5.5	Comparison of objects
Thumb-finger grasp	8	Able to explore small objects
Turns pages of book	12	Increasing autonomy during book time
Scribbles	13	Visuomotor coordination
Builds tower of two cubes	15	Uses objects in combination
Builds tower of six cubes	22	Requires visual, gross, and fine motor coordination
COMMUNICATION AND LANGUAGE		
Smiles in response to face, voice	1.5	More active social participant
Monosyllabic babble	6	Experimentation with sound, tactile sense
Inhibits to "no"	7	Response to tone (nonverbal)
Follows one-step command with gesture	7	Nonverbal communication
Follows one-step command without gesture	10	Verbal receptive language (e.g., "Give it to me")
Says "mama" or "dada"	10	Expressive language
Points to objects	10	Interactive communication
Speaks first real word	12	Beginning of labeling
Speaks 4-6 words	15	Acquisition of object and personal names
Speaks 10-15 words	18	Acquisition of object and personal names
Speaks two-word sentences (e.g., "Mommy shoe")	19	Beginning grammatization, corresponds with 50-word vocabulary
COGNITIVE		
Stares momentarily at spot where object disappeared	2	Lack of object permanence (out of sight, out of mind; e.g., yarn ball dropped)
Stares at own hand	4	Self-discovery, cause and effect
Bangs two cubes	8	Active comparison of objects
Uncovers toy (after seeing it hidden)	8	Object permanence
Egocentric symbolic play (e.g., pretends to drink from cup)	12	Beginning symbolic thought
Uses stick to reach toy	17	Able to link actions to solve problems
Pretend play with doll (e.g., gives doll bottle)	17	Symbolic thought

normalization, the mild postpartum "blues" that affects many mothers passes. If the mother continues to feel sad, overwhelmed, or anxiety, the possibility of moderate to severe **postpartum depression or anxiety,** found in 20–25% of postpartum women, needs to be considered. Major depression that arises during pregnancy or in the postpartum period threatens the mother–child relationship and is a risk factor for later cognitive and behavioral problems. Postpartum depression is often reported in mothers and can also occur in fathers. It can present over the course of a year with symptoms of depression or irritability. The pediatrician may be the first professional to encounter the depressed parent and should be instrumental in assisting the parent in seeking treatment (see Chapter 22).

AGE 2–6 MONTHS

At about age 2 months, the emergence of voluntary (social) smiles and increasing eye contact mark a change in the parent–child relationship, heightening the parents' sense of being loved reciprocally. During the next months, an infant's range of motor and social control and cognitive engagement increases dramatically. Mutual regulation takes the form of complex social interchanges, resulting in strong mutual attachment and enjoyment. Routines are established. Parents are less fatigued.

Physical Development

Between 3 and 4 months of age, the rate of growth slows to approximately 20 g/day (see Table 27.1 and Figs. 24.1 and 24.2). By age 4 months, birthweight is doubled. Early reflexes that limited voluntary movement recede (e.g., **primitive reflexes**; see Chapter 630). Disappearance of the asymmetric tonic neck reflex means that infants can begin to examine objects in the midline and manipulate them with both hands. Waning of the early grasp reflex allows infants both to hold objects and to let them go voluntarily. A novel object may elicit purposeful, although inefficient, reaching. The quality of spontaneous movements also changes, from larger (proximal) writhing to smaller, circular (distal) movements that have been described as "fidgety." Abnormal or absent fidgety movements may constitute a risk factor for later neurologic abnormalities.

Increasing control of truncal flexion makes intentional rolling possible. Once infants can hold their heads steady while sitting, they can

Table 23.2 Emerging Patterns of Behavior During the First Year of Life*

NEONATAL PERIOD (0-4 WK)	
Prone:	Lies in flexed attitude; turns head from side to side; head sags on ventral suspension
Supine:	Generally flexed and a little stiff
Visual:	May fixate face on light in line of vision; doll's eye movement (oculocephalic reflex) of eyes on turning of the body
Reflex:	Moro response active; stepping and placing reflexes; grasp reflex active
Social:	Visual preference for human face
AT 1 MO	
Prone:	Legs more extended; holds chin up; turns head; head lifted momentarily to plane of body on ventral suspension
Supine:	Tonic neck posture predominates; supple and relaxed; head lags when pulled to sitting position
Visual:	Watches person; follows moving object
Social:	Body movements in cadence with voice of other in social contact; beginning to smile
AT 2 MO	
Prone:	Raises head slightly farther; head sustained in plane of body on ventral suspension
Supine:	Tonic neck posture predominates; head lags when pulled to sitting position
Visual:	Follows moving object 180 degrees
Social:	Smiles on social contact; listens to voice and coos
AT 3 MO	
Prone:	Lifts head and chest with arms extended; head above plane of body on ventral suspension
Supine:	Tonic neck posture predominates; reaches toward and misses objects; waves at toy
Sitting:	Head lag partially compensated when pulled to sitting position; early head control with bobbing motion; back rounded
Reflex:	Typical Moro response has not persisted; makes defensive movements or selective withdrawal reactions
Social:	Sustained social contact; listens to music; says "aah, ngah"
AT 4 MO	
Prone:	Lifts head and chest, with head in approximately vertical axis; legs extended
Supine:	Symmetric posture predominates, hands in midline; reaches and grasps objects and brings them to mouth
Sitting:	No head lag when pulled to sitting position; head steady, tipped forward; enjoys sitting with full truncal support
Standing:	When held erect, pushes with feet
Adaptive:	Sees raisin, but makes no move to reach for it
Social:	Laughs out loud; may show displeasure if social contact is broken; excited at sight of food
AT 7 MO	
Prone:	Rolls over; pivots; crawls or creep-crawls (Knobloch)
Supine:	Lifts head; rolls over; squirms
Sitting:	Sits briefly, with support of pelvis; leans forward on hands; back rounded
Standing:	May support most of weight; bounces actively
Adaptive:	Reaches out for and grasps large object; transfers objects from hand to hand; grasp uses radial palm; rakes at raisin
Language:	Forms polysyllabic vowel sounds
Social:	Prefers mother; babbles; enjoys mirror; responds to changes in emotional content of social contact
AT 10 MO	
Sitting:	Sits up alone and indefinitely without support, with back straight
Standing:	Pulls to standing position; "cruises" or walks holding on to furniture
Motor:	Creeps or crawls
Adaptive:	Grasps objects with thumb and forefinger; pokes at things with forefinger; picks up pellet with assisted pincer movement; uncovers hidden toy; attempts to retrieve dropped object; releases object grasped by other person
Language:	Repetitive consonant sounds ("mama," "dada")
Social:	Responds to sound of name; plays peek-a-boo or pat-a-cake; waves bye-bye
AT 1 YR	
Motor:	Walks with one hand held; rises independently, takes several steps (Knobloch)
Adaptive:	Picks up raisin with unassisted pincer movement of forefinger and thumb; releases object to other person on request or gesture
Language:	Says a few words besides "mama," "dada"
Social:	Plays simple ball game; makes postural adjustment to dressing

*Data are derived from those of Gesell (as revised by Knobloch), Shirley, Provence, Wolf, Bailey, and others.
Data from Knobloch H, Stevens F, Malone AF. *Manual of Developmental Diagnosis.* Hagerstown, MD: Harper & Row;1980.

gaze across at things rather than merely looking up at them, opening up a new visual range. They can begin taking food from a spoon. At the same time, maturation of the visual system allows greater depth perception.

In this period, infants achieve stable state regulation and regular sleep–wake cycles. Total sleep requirements are approximately 14-16 hours per 24 hours, with about 9-10 hours concentrated at night and 2 naps per day. Approximately 70% of infants sleep for a 6-8 hour stretch by age 6 months (see Fig. 23.2). By 4-6 months, the sleep electroencephalogram shows a mature pattern, with demarcation of rapid eye movement and three stages of non–rapid eye movement sleep. The sleep cycle remains shorter than in adults (50-60 minutes vs approximately 90 minutes). As a result, infants arouse to light sleep or wake frequently during the night, setting the stage for behavioral sleep problems (see Chapter 31).

Cognitive Development

The overall effect of these developments is a qualitative change. At 4 months of age, infants are described as "hatching" socially, becoming interested in a wider world. During feeding, infants no longer focus exclusively on the mother, but become distracted. In the mother's arms, the infant may literally turn around, preferring to face outward.

Table 23.3 Time of Radiographic Appearance of Centers of Ossification in Infancy and Childhood

MALES: AGE AT APPEARANCE*	BONES AND EPIPHYSEAL CENTERS	FEMALES: AGE AT APPEARANCE*
HUMERUS, HEAD		
3 wk		3 wk
CARPAL BONES		
2 mo ± 2 mo	Capitate	2 mo ± 2 mo
3 mo ± 2 mo	Hamate	2 mo ± 2 mo
30 mo ± 16 mo	Triangular†	21 mo ± 14 mo
42 mo ± 19 mo	Lunate†	34 mo ± 13 mo
67 mo ± 19 mo	Trapezium†	47 mo ± 14 mo
69 mo ± 15 mo	Trapezoid†	49 mo ± 12 mo
66 mo ± 15 mo	Scaphoid†	51 mo ± 12 mo
No standards available	Pisiform†	No standards available
METACARPAL BONES		
18 mo ± 5 mo	II	12 mo ± 3 mo
20 mo ± 5 mo	III	13 mo ± 3 mo
23 mo ± 6 mo	IV	15 mo ± 4 mo
26 mo ± 7 mo	V	16 mo ± 5 mo
32 mo ± 9 mo	I	18 mo ± 5 mo
FINGERS (EPIPHYSES)		
16 mo ± 4 mo	Proximal phalanx, 3rd finger	10 mo ± 3 mo
16 mo ± 4 mo	Proximal phalanx, 2nd finger	11 mo ± 3 mo
17 mo ± 5 mo	Proximal phalanx, 4th finger	11 mo ± 3 mo
19 mo ± 7 mo	Distal phalanx, 1st finger	12 mo ± 4 mo
21 mo ± 5 mo	Proximal phalanx, 5th finger	14 mo ± 4 mo
24 mo ± 6 mo	Middle phalanx, 3rd finger	15 mo ± 5 mo
24 mo ± 6 mo	Middle phalanx, 4th finger	15 mo ± 5 mo
26 mo ± 6 mo	Middle phalanx, 2nd finger	16 mo ± 5 mo
28 mo ± 6 mo	Distal phalanx, 3rd finger	18 mo ± 4 mo
28 mo ± 6 mo	Distal phalanx, 4th finger	18 mo ± 5 mo
32 mo ± 7 mo	Proximal phalanx, 1st finger	20 mo ± 5 mo
37 mo ± 9 mo	Distal phalanx, 5th finger	23 mo ± 6 mo
37 mo ± 8 mo	Distal phalanx, 2nd finger	23 mo ± 6 mo
39 mo ± 10 mo	Middle phalanx, 5th finger	22 mo ± 7 mo
152 mo ± 18 mo	Sesamoid (adductor pollicis)	121 mo ± 13 mo
HIP AND KNEE		
Usually present at birth	Femur, distal	Usually present at birth
Usually present at birth	Tibia, proximal	Usually present at birth
4 mo ± 2 mo	Femur, head	4 mo ± 2 mo
46 mo ± 11 mo	Patella	29 mo ± 7 mo
FOOT AND ANKLE‡		

*To nearest month.
†Except for the capitate and hamate bones, the variability of carpal centers is too great to make them very useful clinically.
‡Standards for the foot are available, but normal variation is wide, including some familial variants, so this area is of little clinical use.
Values represent mean ± standard deviation, when applicable.
The norms present a composite of published data from the Fels Research Institute, Yellow Springs, OH (Pyle SI, Sontag L. *AJR Am J Roentgenol.* 1943, 49:102), and unpublished data from the Brush Foundation, Case Western Reserve University, Cleveland, OH, and the Harvard School of Public Health, Boston, MA. Compiled by Lieb, Buehl, and Pyle.

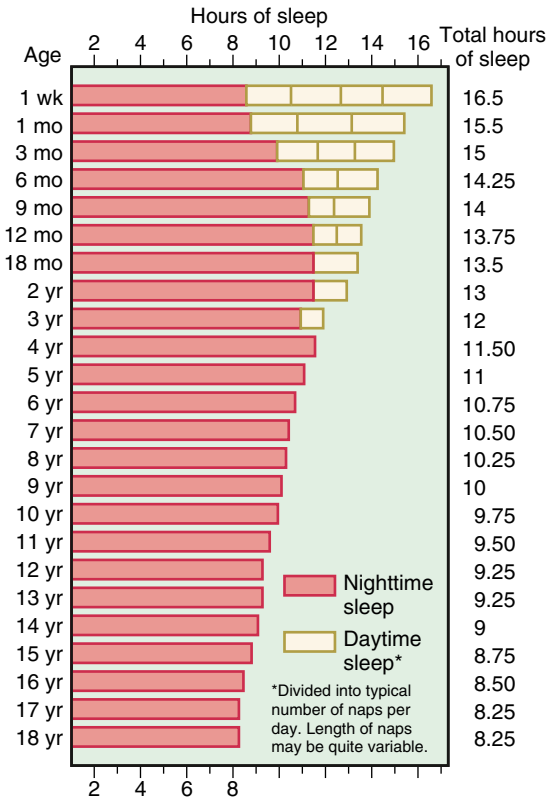

Fig. 23.2 Typical sleep requirements in children. *(From Ferber R. Solve Your Child's Sleep Problems, New York: Simon & Schuster; 1985.)*

Infants at this age also explore their own bodies, staring intently at their hands; vocalizing; blowing bubbles; and touching their ears, cheeks, and genitals. These explorations represent an early stage in the understanding of cause and effect as infants learn that voluntary muscle movements generate predictable tactile and visual sensations. Learning and memory involving the hippocampus can be demonstrated at 3 months. These activities have a role in the emergence of a sense of self, separate from the parents. This is the first stage of personality development. Infants come to associate certain sensations through frequent repetition. The proprioceptive feeling of holding up the hand and wiggling the fingers always accompanies the sight of the fingers moving. Such "self" sensations are consistently linked and reproducible at will. In contrast, sensations that are associated with "other" occur with less regularity and in varying combinations. The sound, smell, and feel of the parent sometimes appear promptly in response to crying, but sometimes do not. The satisfaction that the mother or another loving adult provides continues the process of attachment.

Emotional Development and Communication

Babies interact with increasing sophistication and range. They have an innate ability for facial expressions that, over time, become the functional expressions of emotion (anger, joy, interest, fear, disgust, and surprise). Infants can discriminate and imitate facial expressions, when paired with vocalizations, of adults as well as other infants. Initiating games (singing, hand games) increases social development. Such face-to-face behavior reveals the infant's ability to share emotional states, the first step in the development of communication. Infants of depressed parents show a different pattern, spending less time in coordinated movement with their parents and making fewer efforts to reengage. Rather than anger, they show sadness and a loss of energy when the parents continue to be unavailable.

Implications for Parents and Pediatricians

Motor and sensory maturation makes infants at 3-6 months exciting and interactive. Some parents experience their 4-month-old child's outward turning as a rejection, secretly fearing that their infants no longer love them. For most parents, this is a happy period and they may excitedly report that they can hold conversations with their infants, taking turns vocalizing and listening. Pediatricians share in the enjoyment, as the baby coos, makes eye contact, and moves rhythmically. Infants who do not show this reciprocal language and movements are at risk for autism spectrum disorder or other developmental disabilities (see Chapters 56 and 58). If this visit does not feel joyful and relaxed, causes such as social

stress, family dysfunction, parental mental illness, or problems in the infant–parent relationship should be considered. Parents can be reassured that responding to an infant's emotional needs cannot spoil the infant. Giving vaccines and drawing blood while the child is seated on the parent's lap or nursing at the breast increases pain tolerance.

AGE 6–12 MONTHS

With achievement of the sitting position, increased mobility, and new skills to explore the world around them, 6-12 month old infants show advances in cognitive understanding and communication, and new tensions arise in regard to attachment and separation. Infants develop will and intentions, characteristics that most parents welcome but still find challenging to manage.

Physical Development

Growth slows more (see Table 27.1 and Figs. 24.1 and 24.2). By the first birthday, birthweight has tripled, length has increased by 50%, and head circumference has increased by 10 cm (4 in). The ability to sit unsupported (6-7 months) and to pivot while sitting (around 9-10 months) provides increasing opportunities to manipulate several objects at a time and to experiment with novel combinations of objects. These explorations are aided by the emergence of a thumb-finger grasp (8-9 months) and a neat pincer grasp by 12 months. Voluntary release emerges at 9 months. Many infants begin crawling and pulling to stand around 8 months, followed by cruising. Some walk by 1 year. Motor achievements correlate with increasing myelinization and cerebellar growth. These gross motor skills expand infants' exploratory range and create new physical dangers, as well as opportunities for learning. Tooth eruption occurs, usually starting with the mandibular central incisors. Tooth development (see Table 353.1) reflects skeletal maturation and bone age, although there is wide individual variation.

Cognitive Development

The 6-month-old infant has discovered his hands and will soon learn to manipulate objects. At first, everything is mouthed. In time, novel objects are picked up, inspected, passed from hand to hand, banged, dropped, and then mouthed. Each action represents a nonverbal idea about what things are for (in Piagetian terms, a *schema*; see Chapter 19). The complexity of an infant's play, how many different schemata are brought to bear, is a useful index of cognitive development at this age. The pleasure, persistence, and energy with which infants tackle these challenges suggest the existence of an intrinsic drive or mastery motivation. Mastery behavior occurs when infants feel secure; those with less secure attachments show limited experimentation and less competence.

A major milestone is the achievement by 9 months of **object permanence** (**constancy**), the understanding that objects continue to exist, even when not seen. At 4-7 months of age, infants look down for a yarn ball that has been dropped but quickly give up if it is not seen. With object constancy, older infants persist in searching. They will find objects hidden under a cloth or behind the examiner's back. Peek-a-boo brings unlimited pleasure as the child magically brings back the other player. Events seem to occur as a result of the child's own activities.

Emotional Development

The advent of object permanence corresponds with qualitative changes in social and communicative development. Infants look back and forth between an approaching stranger and a parent and may cling or cry anxiously, demonstrating **stranger anxiety**. Separations often become more difficult. Infants who have been sleeping through the night for months begin to awaken regularly and cry, as though remembering that the parents are nearby or in the next room (see Chapter 31).

A new demand for **autonomy** also emerges. Poor weight gain at this age often reflects a struggle between an infant's emerging independence and parent's control of the feeding situation. Use of the two-spoon method of feeding (one for the child and one for the parent), finger foods, and a high chair with tray table can avert potential problems. Tantrums make their first appearance as the drives for autonomy and mastery come in conflict with parental controls and the infant's still-limited abilities.

Communication

Infants at 7 months of age are adept at nonverbal communication, expressing a range of emotions and responding to vocal tone and facial expressions. At about 9 months of age infants become aware that emotions can be shared between people; they show parents toys as a way of sharing their happy feelings. Between 8 and 10 months of age, babbling takes on a new complexity, with multisyllabic sounds ("ba-da-ma") called **canonical babbling**. Babies can discriminate between languages. Infants in bilingual homes learn the characteristics and rules that govern two different languages. Social interaction (attentive adults taking turns vocalizing with the infant) profoundly influences the acquisition and production of new sounds. The first true word (i.e., a sound used consistently to refer to a specific object or person) appears in concert with an infant's discovery of object permanence. Picture books now provide an ideal context for verbal language acquisition. With a familiar book as a shared focus of attention, a parent and child engage in repeated cycles of pointing and labeling, with elaboration and feedback by the parent. Often infants learn a gesture to communicate before the can say the word (e.g., waving bye-bye before saying "bye-bye"), and there is limited evidence that the addition of sign language may support infant development while enhancing parent–infant communication.

Implications for Parents and Pediatricians

With the developmental reorganization that occurs around 9 months of age, previously resolved issues of feeding and sleeping reemerge. Pediatricians can prepare parents at the 6 month visit so that these problems can be understood as the result of developmental progress and not regression. Parents should be encouraged to plan ahead for necessary, and inevitable, separations (e.g., babysitter, daycare). Routine preparations may make these separations easier. Dual parent employment has not been consistently found to be harmful or beneficial for long-term cognitive or social-emotional outcomes. Introduction of a **transitional object** may allow the infant to self-comfort in the parents' absence. The object cannot have any potential for asphyxiation or strangulation.

Infants' wariness of strangers often makes the 9 month examination difficult, particularly if the infant is temperamentally prone to react negatively to unfamiliar situations. Initially, the pediatrician should avoid direct eye contact with the child. Time spent talking with the parent and introducing the child to a small, washable toy will be rewarded with more cooperation. The examination can be continued on the parent's lap when feasible. Encourage parents to read, play, and communicate with their infant.

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23.1 Infant Crying and Colic

Mutiat T. Onigbanjo and Susan Feigelman

Crying or fussiness is present in all babies but reaches medical attention in about 20% of infants younger than 2 months. Although usually a transient and normal infant behavior, crying is often associated with parental concern and distress. On average, babies cry 2 hours per day, peaking at 6 weeks of age. Premature infants will have peak crying at 6 weeks corrected age (Fig. 23.3). Small-for-gestational-age and premature babies may be at higher risk. The peak period of infant crying usually occurs in the evenings and early part of the night. Excessive crying or fussiness persisting longer than 3-5 months may be associated with behavioral problems in an older child (anxiety, aggression, hyperactivity), decreased duration of breastfeeding, or postnatal depression, but it is uncertain which is the cause or effect. Most infants with crying/fussiness do not have gastroesophageal reflux, lactose intolerance, constipation, or cow's milk protein allergy.

Acute-onset uncontrollable crying could be caused by a medical condition. Potentially overlooked conditions to consider include corneal abrasion, tourniquet effect of a hair wrapped around a digit or

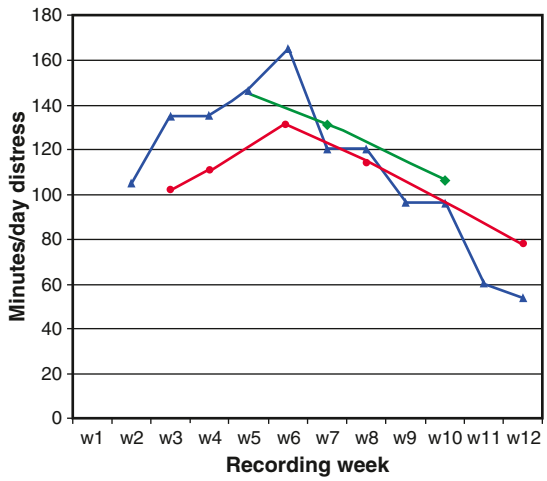

Fig. 23.3 Crying amounts and patterns from three North American studies illustrating similarities in crying pattern. *(From Barr RG, Trent RB, Cross J. Age-related incidence curve of hospitalized shaken baby syndrome cases: convergent evidence for crying as a trigger to shaking. Child Abuse Negl. 2006;30:7–16.)*

penis, occult fracture, urinary tract infection, acute abdomen including inguinal hernia, or anomalous coronary artery. Breastfeeding mothers should be asked about medications, drugs, and diet. Gastrointestinal distress can result from a maternal diet high in cruciferous vegetables. Most of the time, the etiology of a serious problem can be discovered with a careful history and physical examination.

Crying is a normal part of neurobehavioral development. Infants have various signals for their needs and for getting attention from a caregiver. These behaviors progressively increase in intensity in many infants, from changes in breathing and color, to postural and movement changes, and then to calm vocalizations. These precry cues, if not attended to, will eventually lead to active crying. Some infants may go directly to crying, perhaps based on temperament; these infants may be less easily consolable, more intense, or more responsive to sensory stimuli. Management of crying/fussiness should include teaching caregivers about precry cues and responding to the signal for feeding in a calm, relaxed manner. If sensory overstimulation is a factor, creating a nondistracting, calm environment may help, as well as swaddling. When lack of sensory stimulation is present, parent–infant skin-to-skin contact and carrying the infant may be beneficial. In all situations, reassurance that this is both normal and transient, with only 5% of infants persisting beyond 3 months of age, helps the family cope. Teaching families about expectations for normal crying behavior can reduce emergency department visits.

The emotional significance of any experience depends on both the individual child's temperament and the parent's responses (see Table 19.1); differing feeding schedules produce differing reactions. Hunger generates increasing tension; as the urgency peaks, the infant cries, the parent offers the breast or bottle, and the tension dissipates. Infants fed "on demand" consistently experience this link among their distress, the arrival of the parent, and relief from hunger. Most infants fed on a fixed schedule quickly adapt their hunger cycle to the schedule. Those who cannot adapt, because they are temperamentally prone to irregular biologic rhythms, experience periods of unrelieved hunger as well as unwanted feedings when they already feel full. Similarly, infants who are fed at the parents' convenience, with neither attention to the infant's hunger cues nor a fixed schedule, may not consistently experience feeding as the pleasurable reduction of tension. Infants with early dysregulation often show increased irritability and physiologic instability (spitting, diarrhea, poor weight gain) as well as later behavioral problems. Infants with excess crying after 4-6 months may have neurobehavioral dysregulation and may be at higher risk of other behavior problems (sleep, behavior, feeding).

Colic is characterized by the "rule of 3." It occurs in a healthy, thriving infant beginning in the second or third week of life with crying that lasts at least 3 hours per day, occurs at least 3 days per week, lasts for more than 3 weeks, and resolves by 3 or 4 months of age. It is equally common in breastfed and bottle-fed infants, although prevalence is variable (up to 20%). There is no racial, socioeconomic status, or gender risk for colic. Colic is a diagnosis of exclusion following a careful history and physical examination. Few cases will be found to have an organic etiology. Although all babies have crying episodes, colicky babies cry excessively and are difficult to settle. The fussiness is not associated with hunger or any other form of discomfort. Colicky babies may be more reactive to the same stimulus and may cry louder than other babies. Although crying periods are a normal developmental phenomenon, babies with colic can cause parents to become anxious, distraught, frustrated, and sleep deprived. Mothers are at higher risk for postpartum depression if they report inconsolable crying episodes lasting more than 20 minutes. Depression may lead to cessation of breastfeeding. The risk of abuse increases as frustrated parents may use aggressive means in an attempt to quiet the child, resulting in the **shaken baby syndrome**.

There is no specific treatment for colic, but practitioners should provide advice and reassurance to parents. Parents must be counseled about the problem, the importance of implementing a series of calm, systematic steps to soothe the infant, and having a plan for stress relief, such as timeout for parents and substitute caregivers. Parents can be advised that colic is self-limited with no adverse effects on the child. Public health programs, such as the **Period of PURPLE Crying** (http://purplecrying.info/) and **Take 5 Safety Plan for Crying**, are invaluable tools for parents. These programs inform parents that all babies go through periods of crying, deflecting parental guilt and self-recrimination. Most importantly, parents are reminded that it is better to allow the baby to cry than engage in shaking that leads to head trauma. Although babies with colic will have inconsolable periods when there is no relief, parents can try some simple steps. Predictable daily schedules may help, ensuring the baby has adequate sleep. Parents should provide appropriate stimulation throughout the day when baby is in an alert/awake period. The sleep environment should be free of stimulation. Swaddling, rocking, white noise, and movement (e.g., stroller, car ride) help some babies settle. Infants who are carried by a parent show different physiologic changes than when held in a sitting position, although there is no evidence that continuous carrying is effective in colic management. A study in a hunter-gatherer society showed that children who are continuously carried by their mothers display similar crying periods as those in Western societies.

Some studies have found differences in **fecal microflora (dysbiosis)** between babies with excess crying and controls. Results include fewer bifidobacteria and lactobacilli and more coliform bacteria such as *Escherichia coli*. None has been conclusive, however, and each study was found to have limitations such as lack of precise inclusion criteria, lack of blinded observers, and variability in outcome measurements.

If the child appears to have gastrointestinal symptoms, breastfeeding mothers may try elimination of milk, beans, and cruciferous vegetables from their diets. In allergic families, mothers may try a stricter elimination of food allergens (milk, egg, wheat, nuts, soy, and fish), although nutritional status should be monitored. For formula-fed infants, changing from milk-based to soy-based or other lactose-free formulas had no effect in most studies. A protein hydrolysate formula may moderately improve symptoms.

The cause of colic in not known, and no medical intervention has been consistently effective. Colic has been described as a "functional gastrointestinal disorder" and has been associated with maternal migraines, as well as later development of **migraine** in the child. Simethicone has not been shown to be better than placebo. Anticholinergic medications should not be used in infants younger than 6 months. Early studies of probiotics look promising, but evidence is insufficient to recommend their routine use. Among various complementary therapies, certain **herbal teas**, sugar solutions, Gripe water (containing herbal supplements), chamomile and fennel extract may have benefit, but the evidence is weak. Baby massage may be helpful, but chiropractic manipulation should not be performed in young children. Acupuncture was effective in one trial and singing while in utero may produce babies who cry less.

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Chapter 24

The Second Year

Rebecca G. Carter and Susan Feigelman

The second year of life is a time of rapid growth and development, particularly in the realms of social-emotional and cognitive skills as well as motor development. The toddler's newly found ability to walk allows separation and independence; however, the toddler continues to need secure attachment to the parents. At approximately 18 months of age, the emergence of symbolic thought and language causes a reorganization of behavior, with implications across many developmental domains.

AGE 12–18 MONTHS

Physical Development

Although overall rate of growth continues to decline, the toddler continues to experience considerable brain growth and myelination in the second year of life, resulting in an increase in head circumference of 2 cm over the year (Figs. 24.1 and 24.2). Toddlers have relatively short legs and long torsos, with exaggerated lumbar lordosis and protruding abdomens.

Most children begin to walk independently at about 12-15 months of age. Early walking is not associated with advanced development in other domains. Infants initially toddle with a wide-based gait, with the knees bent and the arms flexed at the elbow; the entire torso rotates with each stride; the toes may point in or out, and the feet strike the floor flat. The appearance is that of genu varum (**bowleg**). Subsequent refinement leads to greater steadiness and energy efficiency. After several months of practice, the center of gravity shifts back and the torso stabilizes, while the knees extend and the arms swing at the sides for balance. The feet are held in better alignment, and the child is able to stop, pivot, and stoop without toppling over (see Chapters 713 and 714).

Cognitive Development

Exploration of the environment increases in parallel with improved dexterity (reaching, grasping, releasing) and mobility. Learning follows the precepts of Piaget's **sensorimotor stage** (see Chapter 19). Toddlers manipulate objects in novel ways to create interesting effects, such as stacking blocks or filling and dumping buckets. Playthings are also more likely to be used for their intended purposes (combs for hair, cups for drinking). Imitation of parents and older siblings or other children is an important mode of learning. Make-believe play (**symbolic play**) centers on the child's own body, such as pretending to drink from an empty cup (Table 24.1; see also Table 23.1).

Emotional Development

Infants who are approaching the developmental milestone of taking their first steps may be irritable. Once they start walking, their predominant mood changes markedly. Toddlers are often elated with their new ability and with the power to control the distance between themselves and their parents. Exploring toddlers will orbit around their trusted adults, moving away and then returning for a reassuring touch before moving away again. A child with **secure attachment** will use the trusted adult as a secure base from which to explore independently. Proud of their accomplishments, the child illustrates Erikson's **stage of autonomy and separation** (see Chapter 19). The toddler who is overly controlled and discouraged from active exploration may feel doubt, shame, anger, and insecurity. All children will experience tantrums, reflecting their inability to delay gratification, suppress or displace anger, or verbally communicate their emotional states. Children may form secure attachments with parents as well as other trusted adults, thereby reinforcing the value of quality childcare if parents are employed out of the home.

Linguistic Development

Receptive language precedes *expressive* language. By the time infants speak their first words around 12 months of age, they already respond appropriately to several simple statements, such as "no," "bye-bye," and "give me." By 15 months, the average child points to major body parts and uses four to six words spontaneously and correctly. Toddlers also enjoy **polysyllabic jargoning** (see Tables 23.1 and 24.1) and do not seem upset that no one understands. Most communication of wants and ideas continues to be nonverbal (e.g., by pointing, facial expressions).

Implications for Parents and Pediatricians

Parents who cannot recall any other milestone tend to remember when their child began to walk, perhaps because of the symbolic significance of walking as an act of independence and because of the new demands that the ambulating toddler places on the parent. All toddlers should be encouraged to explore their environment; however, a child's ability to wander out of sight also increases the risks of injury and the need for supervision, making recommendations regarding **childproofing** an integral focus of physician visits.

Parents must understand the importance of exploration. Rather than limiting movement, parents should place toddlers in safe environments or substitute one activity for another. In the office setting, many toddlers are comfortable exploring the examination room, but cling to the parents under the stress of the examination. Children who become more, not less, distressed in their parents' arms or who avoid their parents at times of stress may be insecurely attached. Young children who, when distressed, turn to strangers rather than parents for comfort are particularly worrisome. Children raised in environments with extreme and/or chronic levels of stress (**toxic stress**) have increased vulnerability to disease that continues into adulthood (see Chapter 1). These effects can be mediated by fostering elements of resiliency including introduction of a supportive or encouraging trusted adult. The conflicts between independence and security manifest in issues of **discipline**, temper tantrums, toilet training, and changing feeding behaviors. Parents should be counseled on these matters within the framework of normal development.

Parents may express concern about poor food intake as growth slows. The growth chart should provide reassurance. Many children still take two daytime naps, although the duration steadily decreases and may start to condense to one longer nap (see Fig. 23.2).

AGE 18–24 MONTHS

Physical Development

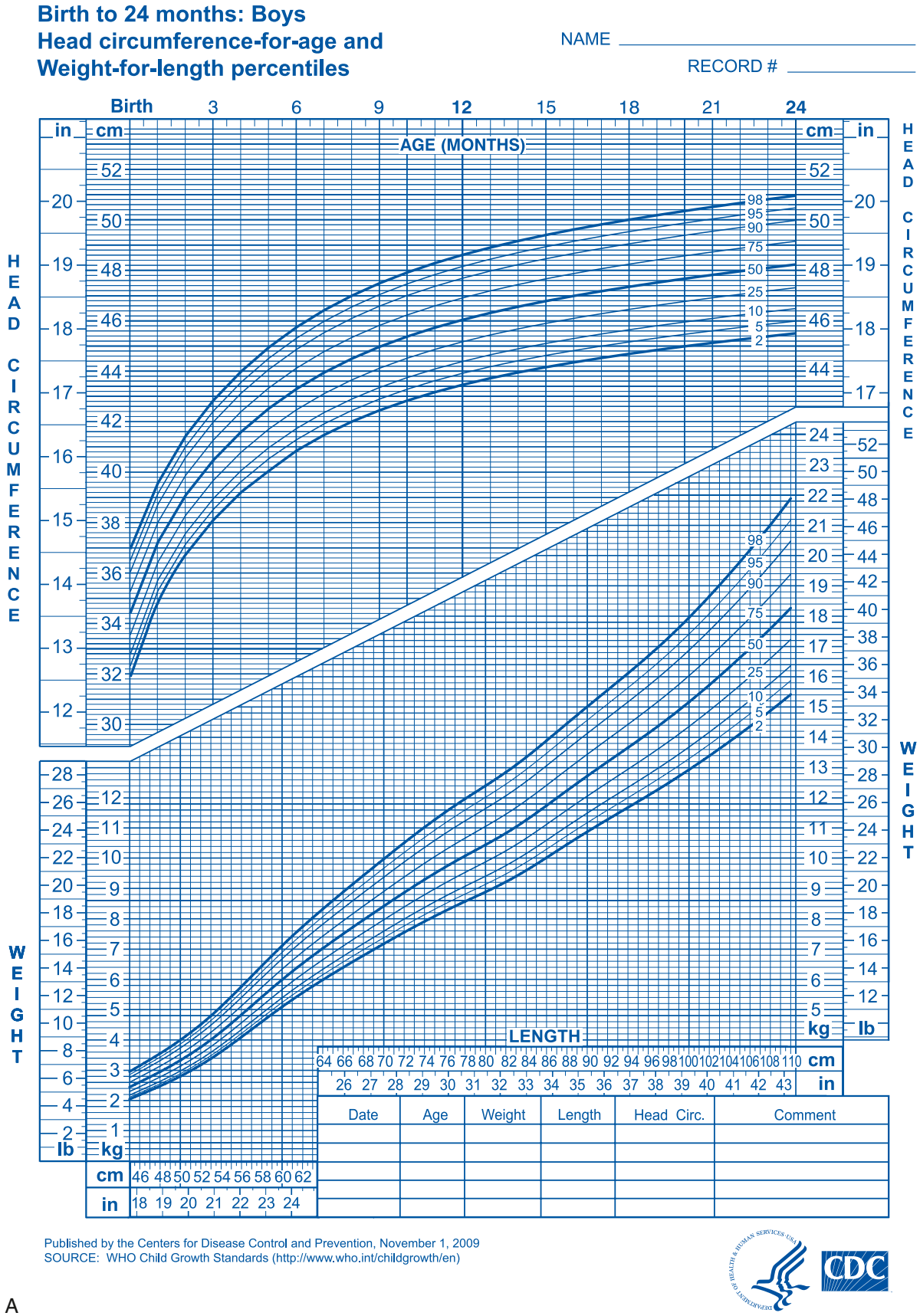
Motor development during this period is reflected in improvements in balance and agility and the emergence of running and stair climbing. Height and weight increase at a steady rate during this year, with a gain of 5 in and 5 lb. By 24 months, children are about half their ultimate adult height. Head growth slows slightly, with 85% of adult head circumference achieved by age 2 years, leaving only an additional 5 cm (2 in) gain over the next few years (see Fig. 24.1 and Table 27.1).

Cognitive Development

At approximately 18 mo of age, several cognitive changes coalesce, marking the conclusion of the sensorimotor period. These can be observed during *self-initiated play*. **Object permanence,** which was first demonstrated around 9 months of age (see Chapter 23), is now firmly established; toddlers anticipate where an object will end up, even though the object was not visible while it was being moved. Cause and effect are better understood, and toddlers demonstrate flexibility in problem solving (e.g., using a stick to obtain a toy that is out of reach, figuring out how to wind a mechanical toy). Symbolic transformations in play are no longer tied to the toddler's own body; thus a doll can be "fed" from an empty plate. As with the reorganization that occurs at 9 months (see Chapter 23), the cognitive changes at 18 months correlate with important changes in the emotional and linguistic domains (see Table 24.1).

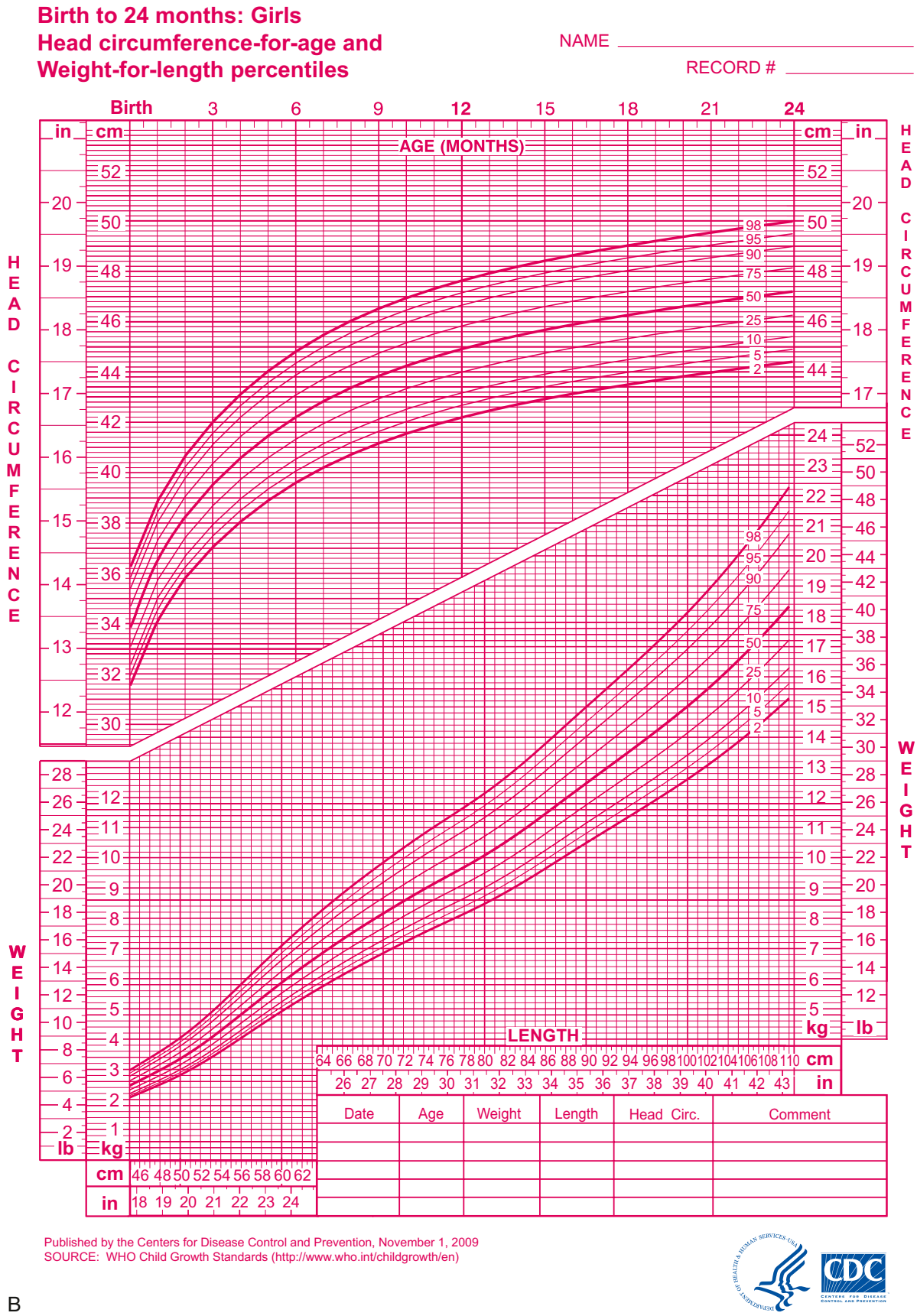
Emotional Development

The relative independence of the preceding half-year often gives way to increased clinginess at about 18 months. This stage, described as "rapprochement," may be a reaction to growing awareness of the possibility of separation. Many parents report that they cannot go anywhere without having a small child attached to them. **Separation anxiety** will manifest at bedtime. Many children use a special blanket or stuffed toy as a **transitional object**, which functions as a symbol of the absent parent. The transitional object remains important until the transition to symbolic thought



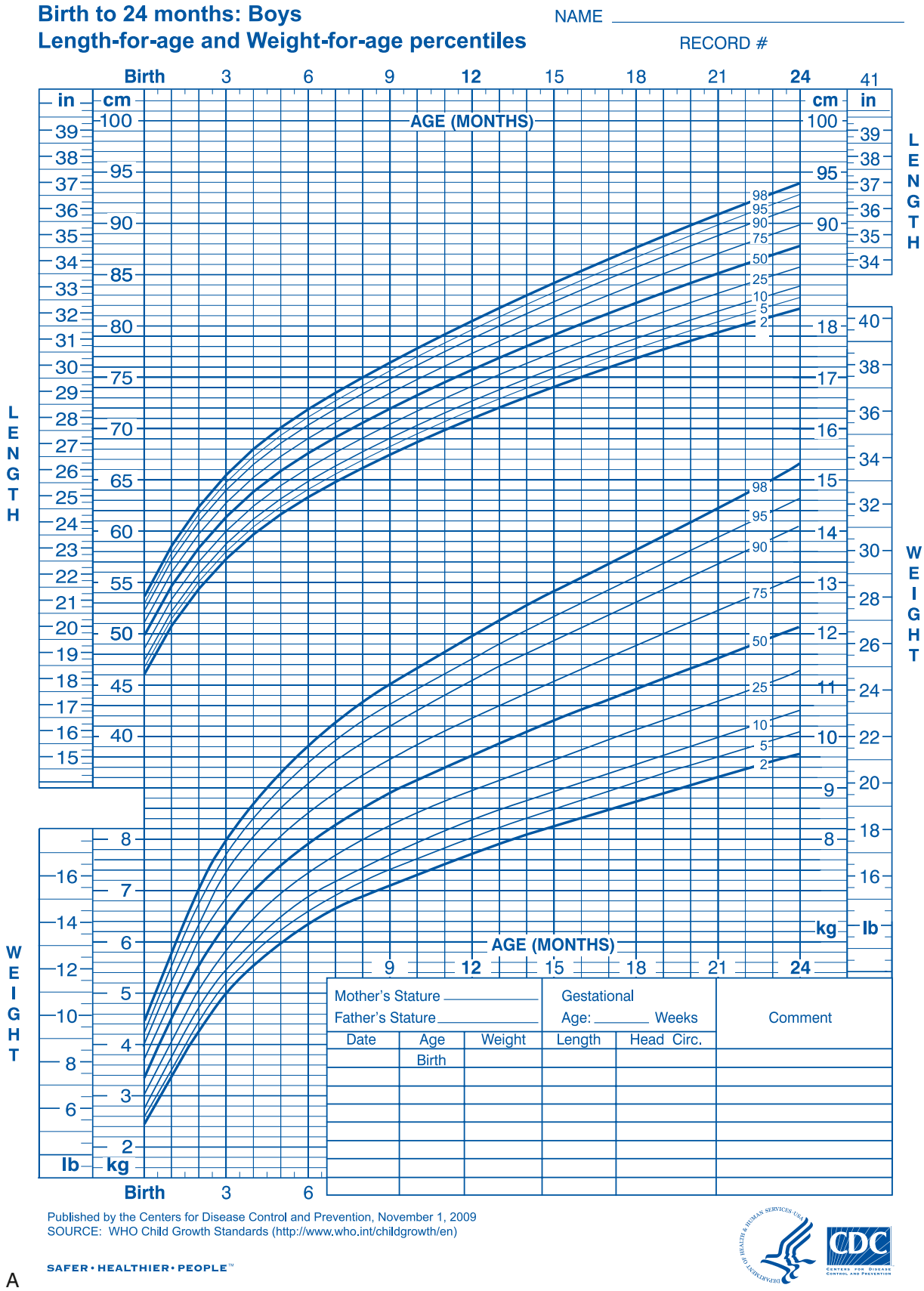
A

Fig. 24.1 World Health Organization growth charts. A, Weight for length and head circumference for age for boys, birth to 24 months. B, Weight for length and head circumference for age for girls, birth to 24 months. *(Courtesy World Health Organization: WHO Child Growth Standards, 2021.)*



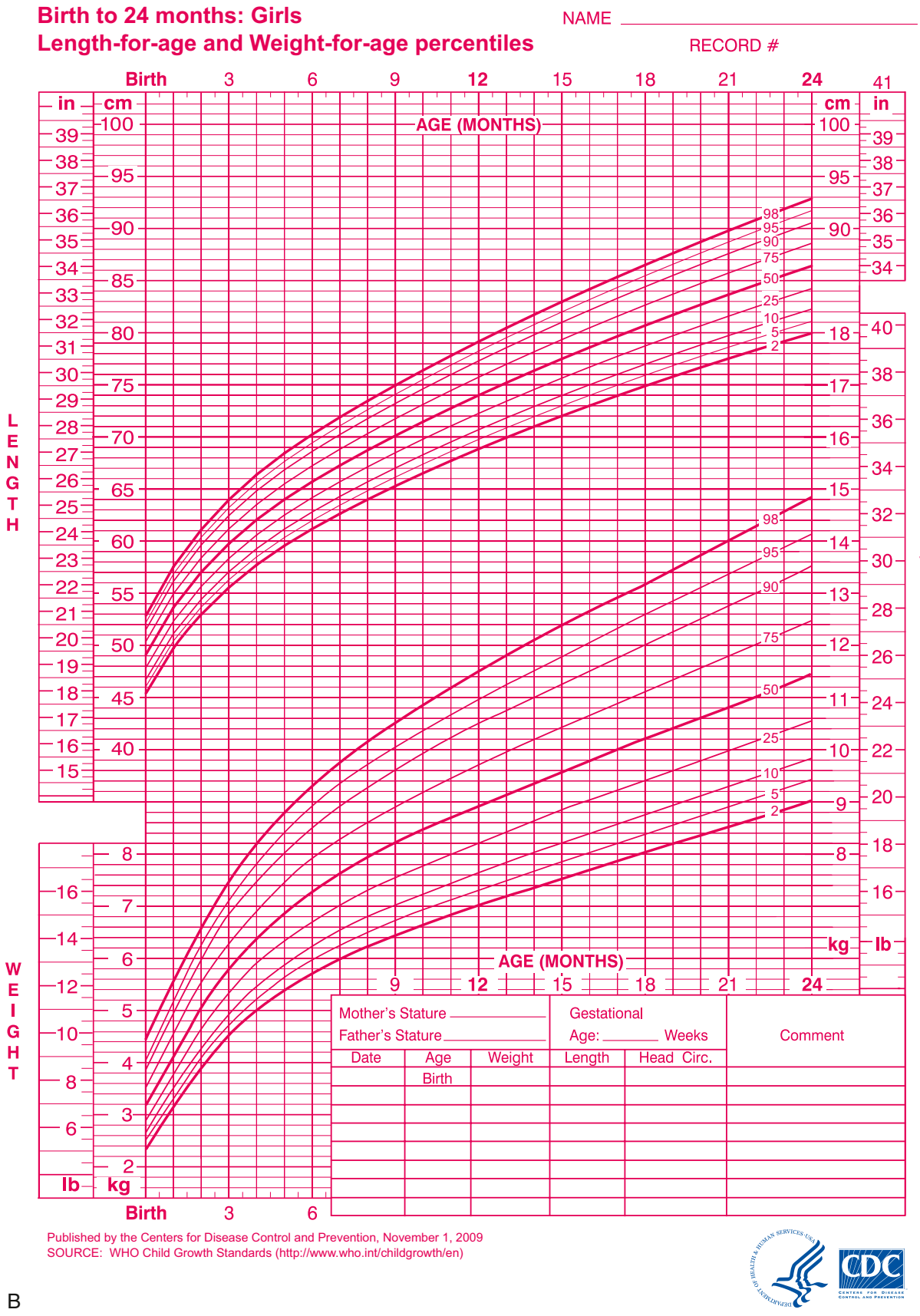
B

Fig. 24.1, cont'd



A

Fig. 24.2 World Health Organization growth charts. **A,** Length for age and weight for age for boys, birth to 24 months. **B,** Length for age and weight for age for girls, birth to 24 months. *(Courtesy World Health Organization: WHO Child Growth Standards, 2021.)*



B

Fig. 24.2, cont'd

Table 24.1	Emerging Patterns of Behavior from 1-5 Years of Age
15 MO	
Motor:	Walks alone; crawls up stairs
Adaptive:	Makes tower of 3 cubes; makes a line with crayon; inserts raisin in bottle
Language:	Jargon; follows simple commands; may name a familiar object (e.g., ball); responds to his/her name
Social:	Indicates some desires or needs by pointing; hugs parents
18 MO	
Motor:	Runs stiffly; sits on small chair; walks up stairs with 1 hand held; explores drawers and wastebaskets
Adaptive:	Makes tower of 4 cubes; imitates scribbling; imitates vertical stroke; dumps raisin from bottle
Language:	10 words (average); names pictures; identifies 1 or more parts of body
Social:	Feeds self; seeks help when in trouble; may complain when wet or soiled; kisses parent with pucker
24 MO	
Motor:	Runs well, walks up and down stairs, 1 step at a time; opens doors; climbs on furniture; jumps
Adaptive:	Makes tower of 7 cubes (6 at 21 mo); scribbles in circular pattern; imitates horizontal stroke; folds paper once imitatively
Language:	Puts 3 words together (subject, verb, object)
Social:	Handles spoon well; often tells about immediate experiences; helps to undress; listens to stories when shown pictures
30 MO	
Motor:	Goes up stairs alternating feet
Adaptive:	Makes tower of 9 cubes; makes vertical and horizontal strokes, but generally will not join them to make cross; imitates circular stroke, forming closed figure
Language:	Refers to self by pronoun "I"; knows full name
Social:	Helps put things away; pretends in play
36 MO	
Motor:	Rides tricycle; stands momentarily on 1 foot
Adaptive:	Makes tower of 10 cubes; imitates construction of "bridge" of 3 cubes; copies circle; imitates cross
Language:	Knows age and gender; counts 3 objects correctly; repeats 3 numbers or a sentence of 6 syllables; most of speech intelligible to strangers
Social:	Plays simple games (in "parallel" with other children); helps in dressing (unbuttons clothing and puts on shoes); washes hands
48 MO	
Motor:	Hops on 1 foot; throws ball overhand; uses scissors to cut out pictures; climbs well
Adaptive:	Copies bridge from model; imitates construction of "gate" of 5 cubes; copies cross and square; draws man with 2-4 parts besides head; identifies longer of 2 lines
Language:	Counts 4 pennies accurately; tells story
Social:	Plays with several children, with beginning of social interaction and role-playing; goes to toilet alone
60 MO	
Motor:	Skips
Adaptive:	Draws triangle from copy; names heavier of 2 weights
Language:	Names 4 colors; repeats sentence of 10 syllables; counts 10 pennies correctly
Social:	Dresses and undresses; asks questions about meaning of words; engages in domestic role-playing

Data derived from those of Gesell (as revised by Knobloch), Shirley, Provence, Wolf, Bailey, and others. After 6 yr, the Wechsler Intelligence Scales for Children (WISC-IV) and other scales offer the most precise estimates of cognitive development. To have their greatest value, they should be administered only by an experienced and qualified person.

has been completed and the symbolic presence of the parent fully internalized. Despite the attachment to the parent, the child's use of "no" is a way of declaring independence. Individual differences in **temperament**, in both the child and the parents, play a critical role in determining the balance of conflict vs cooperation in the parent–child relationship. As effective language emerges, conflicts often become less frequent.

Self-conscious awareness and internalized standards of behavior first appear at this age. Toddlers looking in a mirror will, for the first time, reach for their own face rather than the mirror image if they notice something unusual on their nose. They begin to recognize when toys are broken and may hand them to their parents to fix. Language becomes a means of impulse control, early reasoning, and connection between ideas. When tempted to touch a forbidden object, they may tell themselves "no, no." This is the very beginning of the formation of a conscience. The fact that they often go on to touch the object anyway demonstrates the relative weakness of **internalized inhibitions** at this stage.

Linguistic Development

Perhaps the most dramatic developments in this period are linguistic. Labeling of objects coincides with the advent of symbolic thought. After the realization occurs that words can stand for objects or ideas, a child's vocabulary grows from 10-15 words at 18 months to between 50 and 100 at 2 years. After acquiring a vocabulary of about 50 words, toddlers begin to combine them to make simple sentences, marking the beginning of grammar. At this stage, toddlers understand **two-step commands**, such as "Give me the ball and then get your shoes." Language also gives the toddler a sense of control over the surroundings, as in "night-night" or "bye-bye." The emergence of verbal language marks the end of the sensorimotor period. As toddlers learn to use symbols to express ideas and solve problems, the need for cognition based on direct sensation and motor manipulation wanes.

Implications for Parents and Pediatricians

With children's increasing mobility, physical limits on their explorations become less effective; words become increasingly important for behavior control as well as cognition. Children with delayed language acquisition often have greater behavior problems and frustrations due to problems with communication. Language development is facilitated when parents and caregivers use clear, simple sentences; ask questions; pause to allow time to process and generate verbal responses and respond to children's incomplete sentences and gestural communication with the appropriate words. Television and distracted screen-time viewing, as well as television as background noise, decreases parent–child verbal interactions, whereas looking at picture books and engaging the child in two-way conversations stimulates language development. In the world of constant access to tablets, phones, and screens, parents and children have more distractions from direct language engagement. Even educational programing needs to be limited on screens to reinforce face-to-face contact with caregivers during language acquisition; solo media use should be avoided in this age. As an introduction to this topic, the provider can ask "What are your child's favorite activities?" and "What activities do you like to do with your child?"

Performing most of the physical examination in the parent's lap may help allay fears of separation and **stranger anxiety**. Avoid direct eye contact initially and introduce all tools used during the exam such as the otoscope for the patient to explore before use. Save the more invasive portions of the exam to the end (i.e., ears, throat, etc.). Pediatricians can help parents understand the resurgence of problems with separation and the appearance of a transitional object as developmental phenomenon. Methods of **discipline** should be discussed; effective alternatives to corporal punishment will usually be appreciated (see Chapter 20 and Tables 20.3 and 20.4). Helping parents to understand and adapt to their children's different temperamental styles can constitute an important intervention (see Table 19.1). Developing daily routines is helpful to all children at this age. Rigidity in those routines reflects a need for mastery over a changing environment. Parents should also institute systems to help prepare their child during times of transition from one activity or setting to another to help foster a sense of trust and communication.

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Chapter 25

The Preschool Years

Rebecca G. Carter and Susan Feigelman

The emergence of language and exposure of children to an expanding social sphere represent the critical milestones for children age 2-5 years. As toddlers, children learn to walk away and come back to the secure adult. As preschoolers, they explore emotional separation, alternating between stubborn opposition and cheerful compliance, between bold exploration and clinging dependence. Increasing time spent in classrooms and playgrounds strengthens a child's ability to adapt to new rules and relationships. Emboldened by their growing array of new skills and accomplishments, preschool children also are increasingly cognizant of the constraints imposed on them by the adult world and their own limited abilities.

STRUCTURAL DEVELOPMENT OF THE BRAIN

The preschool brain experiences dramatic changes in its anatomic and physiologic characteristics, with increases in cortical area, decreases in cortical thickness, and changing cortical volume. These changes are not uniform across the brain and vary by region. Gray and white matter tissue properties change dramatically, including diffusion properties in the major cerebral fiber tracts. Dramatic increases occur in brain metabolic demands. In general, more brain regions are required in younger than in older children to complete the same cognitive task. This duplication has been interpreted as a form of "scaffolding," which is discarded with increasing age. The preschool brain is characterized by growth and expansion of synapses that will be followed in later years by "pruning."

PHYSICAL DEVELOPMENT

Somatic and brain growth slows by the end of the second year of life, with corresponding decreases in nutritional requirements and appetite, and the emergence of "picky" eating habits (see Table 27.1). Increases of approximately 2 kg (4-5 lb) in weight and 7-8 cm (2-3 in) in height per year are expected. Birthweight quadruples by 2.5 years of age. An average 4 year old weighs 40 lb and is 40 in tall. The head will grow only an additional 5-6 cm between ages 3 and 18 years. Current growth charts, with growth parameters, can be found on the U.S. Centers for Disease Control and Prevention website (http://www.cdc.gov/growthcharts/) and in Chapter 27. Children with early **adiposity rebound** (increase in body mass index) are at increased risk for adult obesity.

The preschooler has genu valgum (**knock-knees**) and mild pes planus (**flatfoot**). The torso slims as the legs lengthen. Growth of sexual organs is commensurate with somatic growth. Physical energy peaks, and the need for sleep declines to 11-13 hours per 24 hours, with the child eventually dropping the nap (see Fig. 23.2). Visual acuity reaches 20/30 by age 4 years and 20/20 by school age. All 20 primary teeth have erupted by 3 years of age (see Chapter 353).

Most children walk with a mature gait and run steadily before the end of their third year (see Table 24.1). Beyond this basic level, there is wide variation in ability as the range of motor activities expands to include throwing, catching, and kicking balls; riding on bicycles; climbing on playground structures; dancing; and other complex pattern behaviors. Stylistic features of gross motor activity, such as tempo, intensity, and cautiousness, also vary significantly. Although toddlers may walk with different styles, **toe walking** should not persist.

The effects of such individual differences on cognitive and emotional development depend in part on the demands of the social environment and alignment with their caregivers' temperaments. Energetic, coordinated children may thrive emotionally with parents or teachers who encourage physical activity; lower-energy, more cerebral children may thrive with adults who value quiet play.

Handedness is usually established by the third year. Frustration may result from inability to properly teach skills based on child's hand preference. Variations in fine motor development reflect both individual proclivities and different opportunities for learning. Children who are restricted from drawing with crayons, for example, develop a mature pencil grasp later.

Bowel and bladder control emerge during this period, with "readiness" for toileting having large individual and cultural variation. Females tend to potty "train" faster and earlier than males. Bed-wetting is common up to age 5 years (see Chapter 580). Many children master toileting with ease, particularly once they are able to verbalize their bodily needs. For others, **toilet training** can involve a protracted power struggle. Refusal to defecate in the toilet or potty is relatively common, associated with constipation, and can lead to parental frustration. Defusing the issue with a temporary cessation of training (and a return to diapers) often allows toilet mastery to proceed. Parents should focus on positive reinforcement and avoid negative reactions during the toilet training process.

Implications for Parents and Pediatricians

The normal decrease in appetite at this age may cause parental concern about nutrition; growth charts should reassure parents that the child's intake is adequate. Children normally modulate their food intake to match their somatic needs according to feelings of hunger and satiety. Daily intake fluctuates, at times widely, but intake over a week is relatively stable. Parents should provide a predictable eating schedule, with three meals and two snacks per day, allowing the child to choose how much to eat. This will avoid power struggles and allows the child to respond to satiety cues. However, it is important to obtain thorough diet histories for children at this age to advise parents about healthy choices and encourage physical activity to decrease long-term obesity risks and improve learning and cognitive development.

Highly active children face increased risks of injury, and parents should be counseled about safety precautions. Parental concerns about possible hyperactivity may reflect inappropriate expectations, heightened fears, or true overactivity. Children who engage in ongoing impulsive activity with no apparent regard for personal safety or those harming others on a regular basis should be evaluated further.

Assessment of motor skills must take into account a child's exposure history. Before diagnosing a motor delay based on screening tools, pediatricians should explore any limitations to a child's exposure and encourage parents to seek opportunities to work on these skills. Children should be followed closely at this age; referral to therapies should be pursued when true delays are identified given the proven benefits of early intervention.

LANGUAGE, COGNITION, AND PLAY

These three domains all involve **symbolic function**, a mode of dealing with the world that emerges during the preschool period.

Language

Our understanding of the acquisition of language is evolving. Preschool children command significant computational skills and understanding of statistical patterns that allow them to learn about both language and causation. The 2- and 3-year-old child employs frequency distributions to identify phonetic units distinguishing words in his or her native language from other languages.

Language development occurs most rapidly between 2 and 5 years of age. Vocabulary increases from 50-100 words to more than 2,000. Sentence structure advances from telegraphic phrases ("baby cry") to sentences incorporating all the major grammatical components (see Chapter 53). As a rule of thumb, between ages 2 and 5 years, the number of words the child puts in a typical sentence should, at a minimum, equal the child's age (2 by age 2 years, 3 by age 3 years, and so on). By 21-24 months, most children are using possessives ("my ball"), progressives (the "-ing" construction, as in "I playing"), questions, and negatives. By age 4 years, most children can count to 4 and use the past tense; by age 5 years, they can use the future tense. Young children do not use figurative speech; they will comprehend only the literal meaning of words. Referring to an object as "light as a feather" may produce a quizzical look on a child.

It is important to distinguish between **speech** (the production of intelligible sounds) and **language**, which refers to the underlying mental act. Language includes both expressive and receptive functions. *Receptive* language (understanding) varies less in its rate of acquisition than does *expressive* language; therefore it has greater prognostic importance (see Chapters 28 and 53).

Language acquisition depends critically on environmental input. Key determinants include the amount and variety of speech directed toward children and the frequency with which adults ask questions and encourage verbalization. Children raised in poverty typically perform lower on measures of language development than children from economically advantaged families, who tend to be exposed to many more words in the preschool period. Interventions aimed at increasing access to books in the home can temper these differences and improve language and pre-reading skills in the preschool child.

Although experience influences the rate of language development, many linguists believe that the basic mechanism for language learning is "hard-wired" in the brain. Children do not simply imitate adult speech; they abstract the complex rules of grammar from the ambient language, generating implicit hypotheses. Evidence for the existence of such implicit rules comes from analysis of grammatical errors, such as the overgeneralized use of "-s" to signify the plural and "-ed" to signify the past ("We seed lots of mouses.").

Language is linked to both cognitive and emotional development. Language delays may be the first indication of an intellectual disability, autism spectrum disorder, or child neglect or maltreatment. Language plays a critical part in the regulation of behavior through internalized "private speech" in which a child repeats adult prohibitions, first audibly and then mentally. Language also allows children to express feelings, such as anger or frustration, without acting them out; consequently, language-delayed children may show higher rates of tantrums and other externalizing behaviors.

Preschool language development lays the foundation for later success in school. Approximately 35% of U.S. children may enter school lacking the language skills that are the prerequisites for acquiring literacy. Children from socially and economically disadvantaged backgrounds have an increased risk of school problems, making early detection, along with referral and enrichment in programs such as Head Start, highly crucial for later development. Although children typically learn to read and write in elementary school, critical foundations for literacy are established during the preschool years. Through repeated early exposure to written words, children learn about the uses of writing (telling stories or sending messages) and about its form (left to right, top to bottom). Early errors in writing, like errors in speaking, reveal that literacy acquisition is an active process involving the generation and revision of hypotheses. **Bilingual children** may initially appear to lag behind their monolingual peers in acquiring language. They learn the differing rules governing both languages, and generally have the same number of total words between the languages. Bilingual children do not follow the same course of language development as monolingual children, but rather create a different system of language cues. Several cognitive advantages have been repeatedly demonstrated among bilingual compared to monolingual children.

Picture books have a special role in familiarizing young children with the printed word and in the development of verbal language. Children's vocabulary and receptive language improve when their parents or caregivers consistently read to them. Reading aloud with a young child is an interactive process in which a parent repeatedly focuses the child's attention on a particular picture, asks questions, and then gives the child feedback (**dialogic reading**). The elements of shared attention, active participation, immediate feedback, repetition, and graduated difficulty make such routines ideal for language learning. Programs in which physicians provide books to preschool children have shown improvement in language skills among the children (e.g., Reach Out and Read).

The period of rapid language acquisition is also when **developmental dysfluency** and **stuttering** are most likely to emerge (see Chapter 53.1); these can be traced to activation of the cortical motor, sensory, and cerebellar areas. Common difficulties include pauses and repetitions of initial sounds. Stress or excitement exacerbates these difficulties, which generally resolve on their own. Although 5% of preschool children will stutter, it will resolve in 80% of those children by age 8 years. Children with stuttering should be referred for evaluation if it is severe, persistent, or associated with anxiety, or if parental concern is elicited. Treatment includes guidance to parents to reduce pressures associated with speaking.

Cognition

The preschool period corresponds to Piaget's **preoperational** (prelogical) **stage,** characterized by magical thinking, egocentrism, and thinking that is dominated by perception, not abstraction (see Table 19.2). **Magical thinking** includes confusing coincidence with causality, *animism* (attributing motivations to inanimate objects and events), and unrealistic beliefs about the power of wishes. A child might believe that people cause it to rain by carrying umbrellas, that the sun goes down because it is tired, or that feeling resentment toward a sibling can actually make that sibling sick. **Egocentrism** refers to a child's inability to take another's point of view and does not connote selfishness. A child might try to comfort an adult who is upset by bringing the adult a favorite stuffed animal. After 2 years of age, the child develops a concept of herself or himself as an individual and senses the need to feel "whole."

Piaget demonstrated the dominance of **perception** over logic. In one experiment, water is poured back and forth between a tall, thin vase and a low, wide dish, and children are asked which container has more water. Typically, preschool-age children choose the one that looks larger (usually the tall vase), even when the examiner points out that no water has been added or taken away. Such misunderstandings reflect young children's developing hypotheses about the nature of the world, as well as their difficulty in attending simultaneously to multiple aspects of a situation. Preschool children also are able to understand **causal relationships**; this adds to our understanding of the ability of preschool children to engage in abstract thinking (see Chapter 19).

Imitation, central to the learning experience of preschool children, is a complex act because of differences in the size of the operators (the adult and the child), different levels of dexterity, and even different outcomes. A child who watches an adult unsuccessfully attempt a simple act (unscrew a lid) will imitate the action, but often with the intended outcome and not the demonstrated (failed) outcome. Thus "imitation" goes beyond the mere repetition of observed movements.

By age 3 years, children have self-identified their sex and are actively seeking understanding of the meaning of **gender identification**. There is a developmental progression from rigidity (males and female have strict gender roles) in the early preschool years to a more flexible realistic understanding (males and females can have a variety of interests that are not gender specific). Parents can facilitate this flexibility by eliminating gender-based expectations and expanding play options.

Play

Play involves learning, physical activity, socialization with peers, and practicing adult roles. Play increases in complexity and imagination, from simple imitation of common experiences, such as shopping and putting baby to bed (2 or 3 years of age), to more extended scenarios involving singular events, such as going to the zoo or going on a trip (3 or 4 years of age), to the creation of scenarios that have only been imagined, such as flying to the moon (4 or 5 years of age). By age 3 years, **cooperative play** is seen in activities such as building a tower of blocks together; later, more structured **role-play activity**, as in playing house, is seen. Play also becomes increasingly governed by rules, from early rules about asking (rather than taking) and sharing (2 or 3 years of age), to rules that change from moment to moment, according to the desires of the players (4 and 5 years of age), to the beginning of the recognition of rules as relatively immutable (5 years of age). Electronic forms of play (games) are best if interactive and educational and should remain limited in duration.

Play also allows for resolution of conflicts and anxiety and for creative outlets. Children can vent anger safely (reprimanding a doll), take on superpowers (dinosaur and superhero play), and obtain things that

are denied in real life (an imaginary friend or stuffed animal). Creativity is particularly apparent in drawing, painting, and other artistic activities. Themes and emotions that emerge in a child's drawings often reflect the emotional issues of greatest importance for the child.

Difficulty distinguishing fantasy from reality colors a child's perception of what the child views in the media, through programming and advertising. Twenty-five percent of young children have a television set or tablet in their bedroom; screen time in the bedroom is associated with more hours of watching. The number of hours that most preschoolers watch screens exceeds guidelines (1 hr/day for 2-5 year olds). Interactive quality educational programming in which children develop social relationships with the characters can increase learning if paired with adult interaction around the storyline. Exposure to commercial programming with violent content is associated with behavior problems, and because children younger than 8 years are not able to comprehend the concept of persuasive intent, they are more vulnerable to advertising.

Implications for Parents and Pediatricians

The significance of language as a target for assessment and intervention cannot be overestimated, because of its central role as an indicator of cognitive and emotional development and a key factor in behavioral regulation and later school success. As language emerges, parents can support emotional development by using words that describe the child's feeling states ("You sound angry right now") and urging the child to use words to express rather than act out feelings. Active imaginations will come into play when children offer explanations for misbehavior. A parent's best way of dealing with untruths is to address the event, not the child, and have the child participate in "making things right."

Parents should have a regular time each day for reading or looking at books with their children. Programs such as **Reach Out and Read,** in which clinicians give out picture books along with appropriate guidance during primary care visits, have been effective in increasing reading aloud and thereby promoting language development, particularly in lower-income families. TV and similar media should be limited to 1 hr/day of quality programming for children age 2-5 years, and parents should be watching the programs with their children and debriefing their young children afterward. At-risk children, particularly those living in poverty, can better meet future school challenges if they have early high-quality child care and learning experiences (e.g., Head Start).

Preoperational thinking constrains how children understand experiences of illness and treatment. Children begin to understand that bodies have "insides" and "outsides." Children should be given simple, concrete explanations for medical procedures and given some control over procedures if possible. Children should be reassured that they are not to blame when receiving a vaccine or venipuncture, and parents should be discouraged from making threats about needles if their child is not cooperating with the exam. An adhesive bandage will help to make the body "whole" again in a child's mind.

The active imagination that fuels play and the magical, animist thinking characteristic of preoperational cognition can also generate intense fears. More than 80% of parents report at least one fear in their preschool children. Refusal to take baths or to sit on the toilet may arise from the fear of being washed or flushed away, reflecting a child's immature appreciation of relative size. Attempts to demonstrate rationally that there are no monsters in the closet often fail, inasmuch as the fear arises from preoperational thinking. However, this same thinking allows parents to be endowed with magical powers that can banish the monsters with "monster spray" or a night-light. Parents should acknowledge the fears, offer reassurance and a sense of security, and give the child some sense of control over the situation. Use of the **Draw-a-Person**, in which a child is asked to draw the best person the child can, may help elucidate a child's viewpoint.

Emotional and Moral Development

Emotional challenges facing preschool children include accepting limits while maintaining a sense of self-direction, reigning in aggressive and sexual impulses, and interacting with a widening circle of adults and peers. At 2 years of age, behavioral limits are predominantly external; by 5 years of age, these controls need to be internalized if a child is to function in a typical classroom. Success in achieving this goal relies on prior emotional development, particularly the ability to use internalized images of trusted adults to provide a secure environment in times of stress. The love a child feels for important adults is the main incentive for the development of self-control.

Children learn what behaviors are acceptable and how much power they wield vis-à-vis important adults by testing limits. **Limit testing** increases when it elicits attention, even though that attention is often negative, and when limits are inconsistent. Testing often arouses parental anger or inappropriate solicitude as a child struggles to separate, and it gives rise to a corresponding parental challenge: letting go. Excessively tight limits can undermine a child's sense of initiative, whereas overly loose limits can provoke anxiety in a child who feels that no one is in control.

Control is a central issue. Young children cannot control many aspects of their lives, including where they go, how long they stay, and what they take home from the store. They are also prone to lose internal control, that is, to have **temper tantrums**. Fear, overtiredness, hunger, inconsistent expectations, or physical discomfort can also evoke tantrums. Tantrums normally appear toward the end of the first year of life and peak in prevalence between 2 and 4 years of age. Tantrums lasting more than 15 minutes or regularly occurring more than three times per day may reflect underlying medical, emotional, developmental, or social problems. Parents likely will not be able to reason or teach in the context of an active tantrum, and should offer emotional support during these times, sticking to short and concise explanations ("I can't let you hit"). Lessons about their behavior or discussions about strategies for future challenges should be delayed until the child is calm and able to engage.

Preschool children normally experience complicated feelings toward their parents that can include strong attachment and possessiveness toward the parent of the opposite sex, jealousy and resentment of the other parent, and fear that these negative feelings might lead to abandonment. These emotions, most of which are beyond a child's ability to comprehend or verbalize, often find expression in highly labile moods. The resolution of complicated feelings (a process extending over years) involves a child's unspoken decision to identify with the parents rather than compete with them. Play and language foster the development of emotional controls by allowing children to express emotions and role-play.

Curiosity about genitals and adult sexual organs is normal, as is **masturbation**. Excessive masturbation interfering with normal activity, acting out sexual intercourse, extreme modesty, or mimicry of adult seductive behavior all suggest the possibility of sexual abuse or inappropriate exposure (see Chapter 17.1). Modesty appears gradually between 4 and 6 years of age, with wide variations among cultures and families. Parents should begin to teach children about "private" body areas before school entry.

Moral thinking is constrained by a child's cognitive level and language abilities but develops as the child builds their identity with trusted adults. Beginning before the second birthday, the child's sense of right and wrong stems from the desire to earn adult approval and avoid negative consequences. The child's impulses are tempered by external forces; the child has not yet internalized societal rules or a sense of justice and fairness. Over time, as the child internalizes parental admonitions, words are substituted for aggressive behaviors. Finally, the child accepts personal responsibility. Actions will be viewed by damage caused, not by intent. Empathic responses to others' distress arise during the second year of life, but the ability to consider another child's point of view remains limited throughout this period. In keeping with a child's inability to focus on more than one aspect of a situation at a time, fairness is taken to mean equal treatment, regardless of circumstance. A 4 year old will acknowledge the importance of taking turns but will complain if he or she "didn't get enough time." Rules tend to be absolute, with guilt assigned for bad outcomes, regardless of intentions.

Implications for Parents and Pediatricians

The importance of the preschooler's sense of control over his or her body and surroundings have implications for practice. Preparing the

patient by letting the child know how the visit will proceed is reassuring. Tell the child what will happen, but do not ask permission unless you are willing to deal with a "no" answer. A brief introduction to "private parts" is warranted before the genital examination.

The visit of the 4 or 5 year old should be entertaining, because of the child's ability to communicate, as well as the child's natural curiosity. Physicians should realize that all children are occasionally difficult. Guidance emphasizing appropriate expectations for behavioral and emotional development and acknowledging normal parental feelings of anger, guilt, and confusion should be part of all visits at this time. Parents should be queried about daily routines and their expectations of child behavior. Providing children with **acceptable choices** (all options being acceptable to the parent) and encouraging independence in self-care activities (feeding, dressing, and bathing) will reduce conflicts.

Although some cultures condone the use of physical **punishment** for disciplining of young children, it is not a consistently effective means of behavioral control (Chapter 20). As children habituate to repeated spanking, parents have to spank ever harder to achieve the desired response, increasing the risk of serious injury. Sufficiently harsh punishment may acutely inhibit undesired behaviors, but at great long-term psychologic cost. Children may mimic the physical punishment that they receive; children who are spanked will have more aggressive behaviors later. Whereas spanking is the use of force, externally applied, to produce behavior change, **discipline** is the process that allows the child to internalize controls on behavior. Alternative discipline strategies should be offered, such as the "countdown" for transitions along with consistent limit setting, "time-outs" and "time-ins" (fun activities with caregiver present and interacting), clear communication of rules, and frequent approval with positive reinforcement of productive play and behavior (see Chapter 20 and Tables 20.3 and 20.4). Punishment should be immediate, specific to the behavior, and time limited. *Time-out for approximately 1 minute per year of age is very effective if children are getting sufficient time in.* A kitchen timer or digital phone alarm allows the parent to step back from the situation; the child is free when the timer rings. Although one strategy might not work for all children uniformly, consistency is integral to healthy learning and growth.

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Chapter 26

Middle Childhood

Mutiat T. Onigbanjo and Susan Feigelman

Middle childhood (6-11 years of age) is the period in which children increasingly separate from parents and seek acceptance from teachers, other adults, and peers. Children begin to feel under pressure to conform to the style and ideals of the peer group. Self-esteem becomes a central issue, as children develop the cognitive ability to consider their own self-evaluations and their perception of how others see them. For the first time, they are judged according to their ability to produce socially valued outputs, such as getting good grades, playing a musical instrument, or hitting home runs.

PHYSICAL DEVELOPMENT

Growth occurs *discontinuously,* in three to six irregularly timed spurts each year, but varies both within and among individuals. Growth during the period averages 3-3.5 kg (6.6-7.7 lb) and 6-7 cm (2.4-2.8 in) per year (Fig. 26.1). The head grows only 2 cm in circumference throughout the entire period, reflecting a slowing of brain growth. Myelination continues into adolescence, with peak gray matter at 12-14 years. Body habitus is more erect than previously, with long legs compared with the torso.

Growth of the midface and lower face occurs gradually. Loss of deciduous (baby) teeth is a more dramatic sign of maturation, beginning around 6 years of age. Replacement with adult teeth occurs at a rate of about four per year, so that by age 9 years, children will have eight permanent incisors and four permanent molars. Premolars erupt by 11-12 years of age (see Chapter 353). Lymphoid tissues hypertrophy and reach maximal size, often giving rise to impressive tonsils and adenoids.

Muscular strength, coordination, and stamina increase progressively, as does the ability to perform complex movements, such as dancing or shooting baskets. Such higher-order motor skills are the result of both maturation and training; the degree of accomplishment reflects wide variability in innate skill, interest, and opportunity.

Physical fitness has declined among school-age children. Sedentary habits at this age are associated with increased lifetime risk of obesity, cardiovascular disease, lower academic achievement, and lower self-esteem. The number of overweight children and the degree of overweight have been increasing (see Chapter 65). Only 15% of middle and junior high schools require physical education classes at least three days per week. One quarter of youth do not engage in any free-time physical activity, despite the recommendation for at least 1 hour of physical activity per day.

Perceptions of **body image** develop early during this period; children as young as 5 and 6 years may express dissatisfaction with their body image; by ages 8 and 9 years many of these youth report trying to diet, often using ill-advised regimens. Loss-of-control (binge) eating occurs among approximately 6% of children at this age.

Before puberty the sensitivity of the hypothalamus and pituitary changes, leading to increased gonadotropin synthesis. Interest in gender differences and sexual behavior increases progressively until puberty. Although this is a period when sexual drives are limited, masturbation is common, and children may be interested in differences between genders. Rates of maturation differ by geography, ethnicity, and country. Sexual maturity occurs earlier for both sexes in the United States. Differences in maturation rates have implications for differing expectations of others based on sexual maturation.

Implications for Parents and Pediatricians

Middle childhood is generally a time of excellent health. However, children have variable sizes, shapes, and abilities. Children of this age compare themselves with others, eliciting feelings about their physical attributes and abilities. Fears of being "abnormal" can lead to avoidance of situations in which physical differences might be revealed, such as gym class or medical examinations. However, all children, including those with disabilities, should participate in gym classes. Those with physical disabilities may face special stresses; medical, social, and psychologic risks tend to occur together.

Children should be asked about risk factors for **obesity**. Participation in physical activity, including organized sports or other organized activities, can foster skill, teamwork, and fitness as well as a sense of accomplishment, but pressure to compete when the activity is no longer enjoyable has negative effects. Counseling on establishing healthy eating habits and limited screen time should be given to all families. Prepubertal children should not engage in high-stress, high-impact sports, such as power lifting or tackle football, because skeletal immaturity increases the risk of injury and concussions may have long-term sequelae (see Chapter 729).

COGNITIVE DEVELOPMENT

The thinking of early elementary school-age children differs qualitatively from that of preschool children. In place of the magical, egocentric, and perception-bound cognition of preschool children, school-age children increasingly apply rules based on observable phenomena, factor in multiple dimensions and points of view, and interpret their perceptions using physical laws. Piaget documented this shift from preoperational to **concrete** (logical) **operations** (see Chapter 19). When 5 year olds watch a ball of clay being rolled into a snake, they might insist that the snake has "more" because it is longer. In contrast, 7 year olds typically reply that the ball and the snake must weigh the same because nothing has been added or taken away or because the

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____

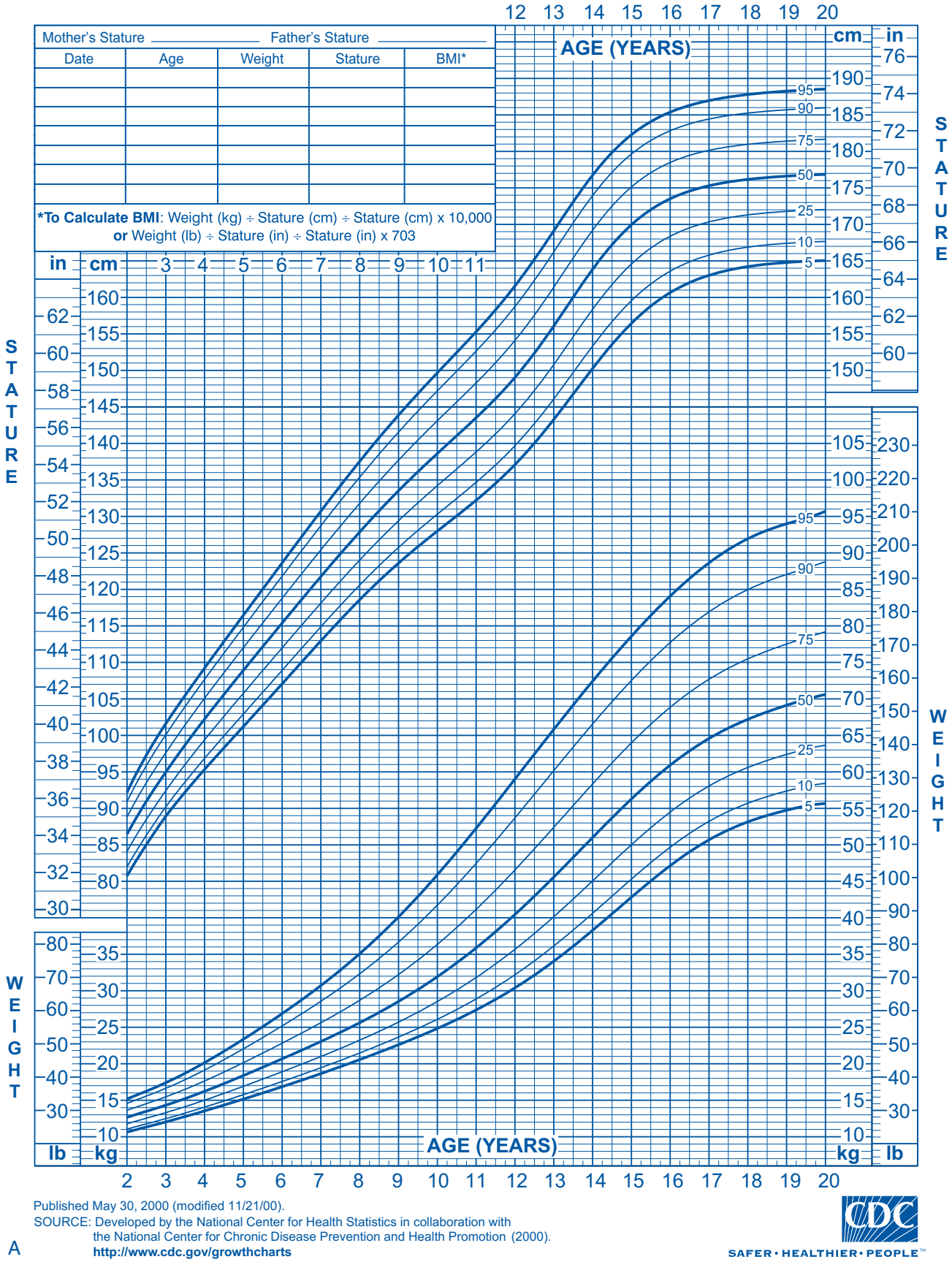
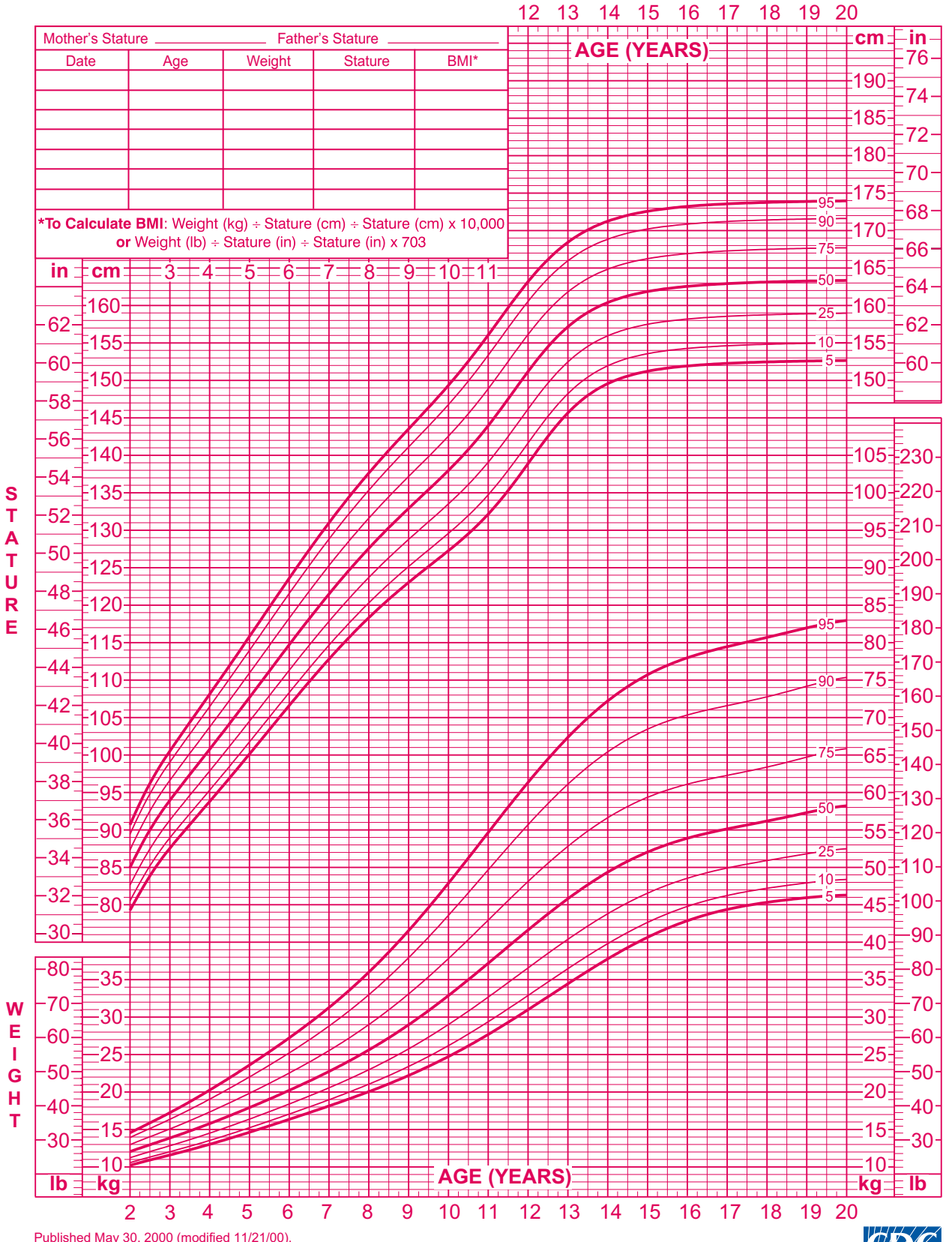


Fig. 26.1 A, Stature (height) for age and weight for boys, age 2-20 years. B, Stature (height) for age and weight for girls, age 2-20 years. *(Courtesy National Center for Health Statistics, in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, 2000. http://www.cdc.gov/growthcharts.)*

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

B

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Fig. 26.1, cont'd

Table 26.1 Selected Perceptual, Cognitive, and Language Processes Required for Elementary School Success

PROCESS	DESCRIPTION	ASSOCIATED PROBLEMS
PERCEPTUAL		
Visual analysis	Ability to break a complex figure into components and understand their spatial relationships	Persistent letter confusion (e.g., between *b*, *d*, and *g*); difficulty with basic reading and writing and limited "sight" vocabulary
Proprioception and motor control	Ability to obtain information about body position by feel and unconsciously program complex movements	Poor handwriting, requiring inordinate effort, often with overly tight pencil grasp; special difficulty with timed tasks
Phonologic processing	Ability to perceive differences between similar-sounding words and to break down words into constituent sounds	Delayed receptive language and reading skill; attention and behavior problems secondary to not understanding directions; delayed acquisition of letter-sound correlations (phonetics)
COGNITIVE		
Long-term memory, both storage and recall	Ability to acquire skills that are "automatic" (i.e., accessible without conscious thought)	Delayed mastery of the alphabet (reading and writing letters); slow handwriting; inability to progress beyond basic mathematics
Selective attention	Ability to attend to important stimuli and ignore distractions	Difficulty following multistep instructions, completing assignments, and behaving well; problems with peer interaction
Sequencing	Ability to remember things in order; facility with time concepts	Difficulty organizing assignments, planning, spelling, and telling time
LANGUAGE		
Receptive language	Ability to comprehend complex constructions, function words (e.g., if, when, only, except), nuances of speech, and extended blocks of language (e.g., paragraphs)	Difficulty following directions; wandering attention during lessons and stories; problems with reading comprehension; problems with peer relationships
Expressive language	Ability to recall required words effortlessly (word finding), control meanings by varying position and word endings, and construct meaningful paragraphs and stories	Difficulty expressing feelings and using words for self-defense, with resulting frustration and physical acting out; struggling during "circle time" and in language-based subjects (e.g., English)

snake is both longer and thinner. This cognitive reorganization occurs at different rates in different contexts. In the context of social interactions with siblings, young children often demonstrate an ability to understand alternate points of view long before they demonstrate that ability in their thinking about the physical world. Understanding time and space constructs occurs in the later part of this period.

The concept of **school readiness** has evolved. The American Academy of Pediatrics recommends following an "interactional relational" model in which the focus is on the child, the environment, and the resulting interactions. This model explicitly asserts that all children can learn and that the educational process is reciprocal between the child and the school. It is developmentally based, recognizing the importance of early experiences for later development. Rather than delaying school entry, high-quality early-education programs may be the key to ultimate school success.

School makes increasing cognitive demands on the child. Mastery of the elementary curriculum requires that many perceptual, cognitive, and language processes work efficiently (Table 26.1), and children are expected to attend to many inputs at once. The first 2-3 years of elementary school are devoted to acquiring the fundamentals: reading, writing, and basic mathematics skills. By third grade, children need to be able to sustain attention through a 45-minute period, and the curriculum requires more complex tasks. The goal of reading a paragraph is no longer to decode the words, but to understand the content; the goal of writing is no longer spelling or penmanship, but composition. The volume of work increases along with the complexity.

Cognitive abilities interact with a wide array of attitudinal and emotional factors in determining classroom performance. These factors include *external rewards* (eagerness to please adults and approval from peers) and *internal rewards* (competitiveness, willingness to work for a delayed reward, belief in one's abilities, and ability to risk trying when success is not ensured). Success predisposes to success, whereas failure impacts self-esteem and reduces self-efficacy, diminishing a child's willingness to take future risks.

Children's intellectual activity extends beyond the classroom. Beginning in the third or fourth grade, children increasingly enjoy strategy games and wordplay (puns and insults) that exercise their growing cognitive and linguistic mastery. Many become experts on subjects of their own choosing, such as sports trivia, or develop hobbies, such as special card collections. Others become avid readers or take on artistic pursuits. Whereas board and card games were once the usual leisure-time activity of youth, video, computer, and other electronic games currently fill this need.

Implications for Parents and Pediatricians

Pediatricians have an important role in preparing their patients for school entrance by promoting health through immunizations, adequate nutrition, appropriate recreation, and screening for physical, developmental, and cognitive disorders. The American Academy of Pediatrics recommends that pediatric providers promote the "5 Rs" of early education: (1) reading as a daily family activity; (2) rhyming, playing, and cuddling together; (3) routines and regular times for meals, play, and sleep; (4) reward through praise for successes; and (5) reciprocal nurturing relationships.

Concrete operations allow children to understand simple explanations for illnesses and necessary treatments, although they may revert to prelogical thinking when under stress. A child with pneumonia may be able to explain about white cells fighting the "germs" in the lungs but may still secretly harbor the belief that the sickness is a punishment for disobedience.

As children are faced with more abstract concepts, academic and classroom behavior problems emerge and come to the pediatrician's attention. Referrals may be made to the school for remediation or to community resources (medical or psychologic) when appropriate. The causes may be one or more of the following: deficits in perception (vision and hearing); specific learning disabilities (see Chapters 51 and 52); global cognitive delay (intellectual disability; Chapter 56); deficits in attention and executive function (Chapters 49 and 50);

and attention deficits secondary to family dysfunction, depression, anxiety, or chronic illness. Children whose learning style does not fit the classroom culture may have academic difficulties and need assessment before failure sets in. Simply having a child repeat a failed grade rarely has any beneficial effect and often seriously undercuts the child's self-esteem. In addition to finding the problem areas, identifying each child's strengths is important. Educational approaches that value a wide range of talents ("multiple intelligences") beyond the traditional reading, writing, and mathematics may allow more children to succeed.

The change in cognition allows the child to understand "if/when" clauses. Increased responsibilities and expectations accompany increased rights and privileges. Discipline strategies should move toward negotiation and a clear understanding of consequences, including removal of privileges for infringements.

SOCIAL, EMOTIONAL, AND MORAL DEVELOPMENT

Social and Emotional Development

In middle childhood, energy is directed toward creativity and productivity. Changes occur in three spheres: the home, the school, and the neighborhood. Of these, the home and family remain the most influential. Increasing independence is marked by the first sleepover at a friend's house and the first time at overnight camp. Parents should make demands for effort in school and extracurricular activities, celebrate successes, and offer unconditional acceptance when failures occur. Regular chores, associated with an allowance, provide an opportunity for children to contribute to family functioning and learn the value of money. These responsibilities may be a testing ground for psychologic separation, leading to conflict. Siblings have critical roles as competitors, loyal supporters, and role models.

The beginning of school coincides with a child's further separation from the family and the increasing importance of teacher and peer relationships. Social groups tend to be same-sex, with frequent changing of membership, contributing to a child's growing social development and competence. Popularity, a central ingredient of self-esteem, may be won through possessions (having the latest electronic gadgets or the right clothes), as well as through personal attractiveness, accomplishments, and actual social skills. Children are aware of racial differences and are beginning to form opinions about racial groups that impact their relationships. **Gender identification**, which began in early childhood, continues to evolve and can have significant implications for peer relationships and self-awareness.

Some children conform readily to the peer norms and enjoy easy social success. Those who adopt individualistic styles or have visible differences may be teased or bullied. Children with deficits in social skills may go to extreme lengths to win acceptance, only to meet with repeated failure. Attributions conferred by peers, such as funny, stupid, bad, or fat, may become incorporated into a child's self-image and affect the child's personality, as well as school performance. Parents may have their greatest effect indirectly, through actions that change the peer group (changing the child's school or encouraging involvement in structured after-school activities). Children who identify with a gender different from their sex of birth, or whose manner and dress reflect those more typically seen as "opposite" their birth sex, may be subject to teasing or **bullying** (Chapter 153). This can magnify the confusion for these children, who are formulating their own concept of "self."

In the neighborhood, real dangers, such as busy streets, bullies, violence, and strangers, tax school-age children's common sense and resourcefulness (see Chapter 15). Interactions with peers without close adult supervision call on increasing conflict resolution skills. Media exposure to adult materialism, sexuality, substance use, and violence may be frightening, reinforcing children's feeling of powerlessness in the larger world. Compensatory fantasies of being powerful may fuel the fascination with heroes and superheroes. A balance between fantasy and an appropriate ability to negotiate real-world challenges indicates healthy emotional development.

Moral Development

Although by age 6 years most children will have a **conscience** (internalized rules of society), they vary greatly in their level of moral development. For younger children, many still subscribe to the notion that rules are established and enforced by an authority figure (parent or teacher), and decision-making is guided by self-interest (avoidance of negative and receipt of positive consequences). The needs of others are not strongly considered in decision-making. As they grow older, most will recognize not only their own needs and desires but also those of others, although personal consequences are still the primary driver of behavior. Social behaviors that are socially undesirable are considered wrong. By age 10-11 years, the combination of peer pressure, a desire to please authority figures, and an understanding of **reciprocity** (treat others as you wish to be treated) shapes the child's behavior.

Implications for Parents and Pediatricians

Children need unconditional support as well as realistic demands as they venture into a world that is often frightening. A daily query from parents over the dinner table or at bedtime about the good and bad things that happened during the child's day may uncover problems early. Parents may have difficulty allowing the child independence or may exert excessive pressure on their children to achieve academic or competitive success. Children who struggle to meet such expectations may have behavior problems or psychosomatic complaints.

Many children face stressors that exceed the normal challenges of separation and success in school and the neighborhood. Approximately 50% of all marriages in the United States end in divorce. In addition, domestic violence, parental substance abuse, and other adverse childhood experiences (**ACEs**) may also impair a child's ability to use home as a secure base for refueling emotional energies. In many neighborhoods, random violence makes the normal development of independence extremely dangerous. Older children may join gangs as a means of self-protection and a way to attain recognition and to belong to a cohesive group. Children who bully others and those who are victims of bullying should be evaluated, because bullying is associated with mood disorders, family problems, and school adjustment problems. Parents should reduce exposure to hazards where possible. Because of the risk of unintentional firearm injuries to children, parents should be encouraged to ask parents of playmates whether a gun is kept in their home and, if so, how it is secured.

Pediatrician visits are infrequent in this period; therefore each visit is an opportunity to assess children's functioning in all contexts (home, school, neighborhood). Maladaptive behaviors, both internalizing and externalizing, occur when children do not have safe, secure attachments to adults and stress in any of these environments overwhelms the child's coping responses, becoming "toxic stress." Because of continuous exposure and the strong influence of media (programming and advertisements) on children's beliefs and attitudes, parents must be alert to exposures from television and internet. Youth 8-12 years of age spend over 6 hr/day with a variety of media; half have a TV in their bedroom. Parents should be advised to remove the TV from their children's rooms, limit viewing to 2 hr/day, and monitor what programs children watch. Nearly all children have exposure to mobile technology. Some computer screen time may be necessary for schoolwork and virtual learning. However, the widespread use of **social media** may have detrimental effects including risky health behaviors, cyberbullying, targeted advertisements, and low self-esteem. The **Draw-a-Person** (for ages 3-10 years, with instructions to "draw a complete person") and **Kinetic Family Drawing** (beginning at age 5 years, with instructions to "draw a picture of everyone in your family doing something") are useful office tools to assess a child's functioning.

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Chapter 27

Assessment of Growth

Vaneeta Bamba and Andrea Kelly

Growth can be considered a vital sign in children, and aberrant growth may be the first sign of an underlying pathologic condition. The most powerful tool in growth assessment is the **growth chart** (Figs. 24.1, 24.2, 26.1, and 27.1), used in combination with accurate measurements of height, weight, head circumference, and calculation of the **body mass index (BMI).**

TECHNIQUES TO MEASURE GROWTH

Growth assessment requires accurate and precise measurements. For infants and toddlers age <2 years, weight, length, and head circumference are obtained. **Head circumference** is measured with a flexible tape measure starting at the supraorbital ridge around to the occipital prominence in the back of the head, locating the maximal circumference. **Height** and **weight** measures should be performed with the infant naked, and ideally, repeated measures will be performed on the same equipment. **Recumbent length** is most accurately measured by two examiners (one to position the child). Hair ornaments and hairstyles that interfere with measurements and positioning should be removed. The child's head is positioned against an inflexible measuring board in the **Frankfurt plane**, in which the outer canthi of the eyes are in line with the external auditory meatus and are perpendicular to the long axis of the trunk. Legs should be fully extended, and feet are maintained perpendicular to the plane of the supine infant. For older children (>2 years) who can stand unassisted, standing heights should be obtained without shoes, using a stadiometer with the head in the Frankfurt plane, and the back of the head, thoracic spine, buttocks, and heels approximating the vertical axis of one another and the stadiometer.

Measurements obtained using alternative means, such as marking examination paper at the foot and head of a supine infant or using a tape measure or wall growth chart with a book or ruler on the head can lead to inaccuracy and render the measurement useless.

Measurements for height and weight should be plotted on the age-appropriate growth curve. Comparing measurements with previous growth trends, repeating measures that are inconsistent, and plotting results longitudinally are essential for monitoring growth. Calculation of interim linear height velocity, such as centimeters per year (cm/yr), allows more precise comparison of growth rate to the norm (Table 27.1).

If a child is growing faster or more slowly than expected, measurement of body proportions, which follow a predictable sequence of changes with development, are useful. The head and trunk are relatively large at birth, with progressive lengthening of the limbs throughout development, particularly during puberty. The **upper-to-lower body segment ratio** (**U/L ratio**) provides an assessment of truncal growth relative to limb growth. The **lower-body segment** is defined as the length from the top of the symphysis pubis to the floor, and the **upper-body segment** is the total height minus the lower-body segment. The U/L ratio equals approximately 1.7 at birth, 1.3 at 3 years, and 1.0 after 7 years. Higher U/L ratios are characteristic of short-limb dwarfism, as occurs with Turner syndrome or bone disorders, whereas lower ratios suggest hypogonadism or Marfan syndrome.

Arm span also provides assessment of proportionality and is measured as the distance between the tips of the middle fingers while the patient stands with the back against the wall with arms outstretched horizontally at a 90-degree angle to the trunk. This span should be close to height, although the proportion changes with age.

GROWTH CURVES

The American Academy of Pediatrics (AAP) and the U.S. Centers for Disease Control and Prevention (CDC) recommend use of the 2006 World Health Organization (WHO) growth curves for children age 0-24 months and the 2000 CDC growth curves for children age 2-19 years (https://www.cdc.gov/growthcharts). There are five standard gender-specific charts: (1) weight for age, (2) height (length and stature) for age, (3) head circumference for age, (4) weight for height (length and stature) for infants, and (5) BMI for age (see Fig. 27.1; see also Figs. 24.1, 24.2, and 26.1). Clinicians should confirm that the correct CDC and WHO growth charts are used in electronic medical records to ensure accurate characterization of growth.

The WHO curves describe growth differently than the CDC curves (Fig. 27.2). The WHO curves are **growth standards** that describe how children grow under optimal conditions, whereas the CDC curves are **growth references** that describe how children grew in a specific time and place. The WHO growth curves are based on longitudinal growth studies in which cohorts of newborns were chosen from six countries (Brazil, Ghana, India, Norway, Oman, United States) using specific inclusion and exclusion criteria; all infants were breastfed for at least 12 months and were predominantly breastfed for the first 4 months of life. They were measured regularly from birth to 23 months during 1997–2003. In contrast, the CDC curves are based on cross-sectional data from different studies during different time points. Growth curves for children age 2-59 months were based on the National Health and Nutrition Examination Survey (NHANES), which included a cross section of the U.S. population. These data were supplemented with additional participants in a separate nutrition surveillance study.

Several deficiencies of the older charts have been corrected, such as the overrepresentation of bottle-fed infants and the reliance on a local dataset for the infant charts. The disjunction between length and height when transitioning from the infant curves to those for older children is improved.

Each chart is composed of percentile curves, which indicate the percentage of children at a given age on the *x* axis whose measured value falls below the corresponding value on the *y* axis. The 2006 WHO growth curves include values that are 2 standard deviations (SD) above and below median (2nd and 98th percentiles), whereas the 2000 CDC growth curves include 3rd and 97th percentiles. On the WHO weight chart for boys ages 0-24 months (see Fig. 24.2A), the 9 month age line intersects the 25th percentile curve at 8.3 kg, indicating that 25% of 9-month-old males in the WHO cohorts weigh less than 8.3 kg (75% weigh more). Similarly, a 9-month-old male weighing more than 11 kg is heavier than 98% of his peers. The median or 50th percentile is also termed the **standard value,** in the sense that the standard length for a 7-month-old female is 67.3 cm (see Fig. 24.2B). The weight-for-length charts (see Fig. 24.1) are constructed in an analogous fashion, with length or stature in place of age on the *x* axis; the median or standard weight for a female measuring 100 cm is 15 kg.

Extremes of height or weight can also be expressed in terms of the age for which they would represent the standard or median. For instance, an 18-month-old female who is 74.9 cm (2nd percentile) is at the 50th percentile for a 13 month old. Thus the height age is 13 months. Weight age can similarly be expressed.

In assessing adolescents, caution must be used in applying cross-sectional charts. Growth during adolescence is linked temporally to the onset of puberty, which varies widely. Normal variations in the timing of the growth spurt can lead to misdiagnosis of growth abnormalities. By using cross-sectional data based on chronologic age, the charts combine youth who are at different stages of maturation. Data for 12-year-old males include both earlier-maturing males who are at the peak of their growth spurts and later-maturing ones who are still growing at their prepubertal rate. The net results are an artificially blunted growth peak, and the appearance that adolescents grow more gradually and for a longer duration than in actuality.

When additional insight is necessary, growth charts derived from longitudinal data, such as the **height velocity charts** of Tanner and colleagues, are recommended. The longitudinal component of these velocity curves is based on British children from the 1950s and 1960s, and cross-sectional data from U.S. children were superimposed. Height velocity curves based on longitudinal data from a multiethnic study conducted at five U.S. sites included SD scores for height velocity for

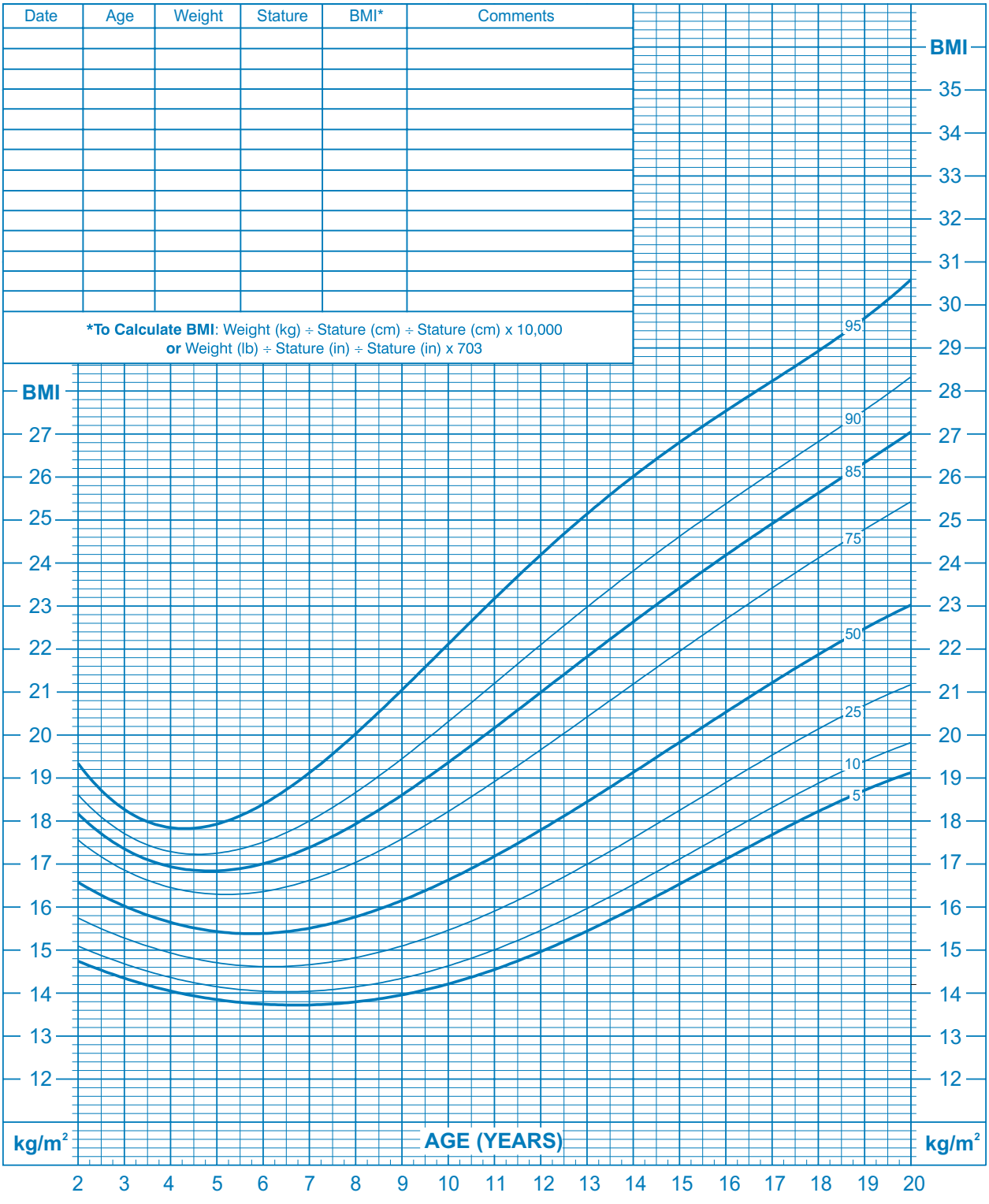
2 to 20 years: Boys
Body mass index-for-age percentiles

NAME _____

RECORD # _____

Date	Age	Weight	Stature	BMI*	Comments

***To Calculate BMI**: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000
or Weight (lb) ÷ Stature (in) ÷ Stature (in) x 703



Published May 30, 2000 (modified 10/16/00).

SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/growthcharts

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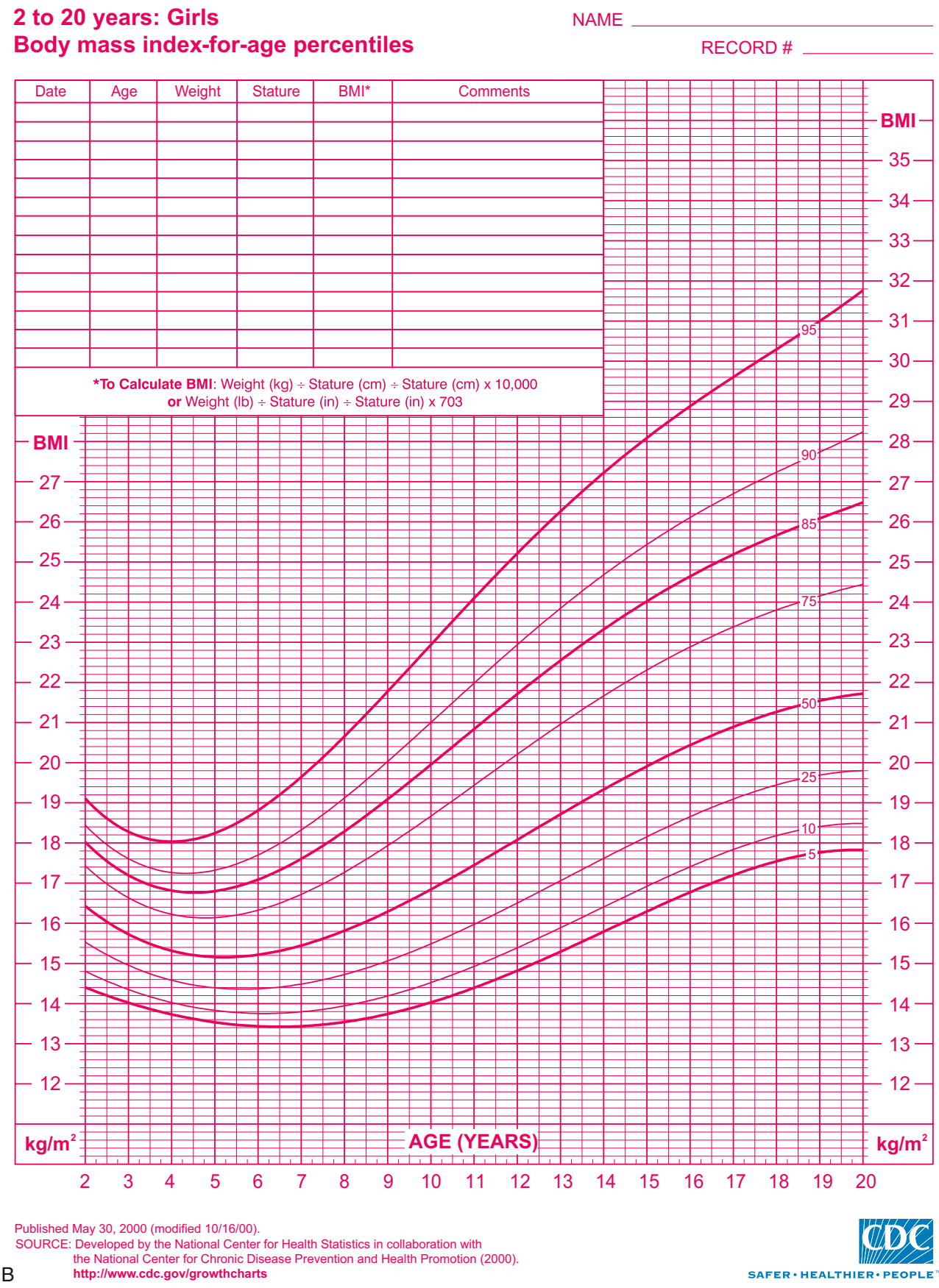
A

Fig. 27.1 A, Body mass index (BMI) percentiles for boys, age 2-20 years.



B

Fig. 27.1 Cont'd B, BMI percentiles for girls, age 2-20 years. *Official Centers for Disease Control and Prevention [CDC] growth charts, as described in this chapter.) The 85th to 95th percentile is at risk for overweight; >95th percentile is overweight; <5th percentile is underweight. Technical information and interpretation and management guides are available at www.cdc.gov/nchs. Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, 2000 (http://www.cdc.gov/growthcharts).*

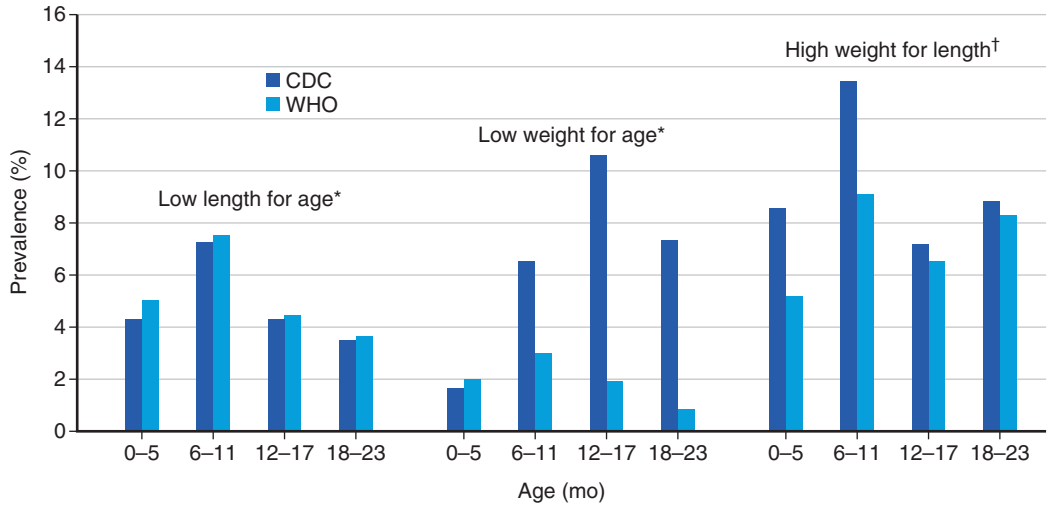


Fig. 27.2 Comparison of World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) growth chart prevalence of low length for age, low weight for age, and high weight for length among children age <24 months, United States, 1999–2004. *, ≤5th percentile on the CDC charts; ≤2.3rd percentile on the WHO charts. †, ≥95th percentile on the CDC charts; ≥97.7th percentile on the WHO charts. *(Data from the National Health and Nutrition Examination Survey, 1999–2004; from Grummer-Strawn LM, Reinold C, Krebs NF: Centers for Disease Control and Prevention: Use of World Health Organization and CDC growth charts for children ages 0-59 months in the United States, MMWR Recomm Rep 2010;59[RR-9]:1–15.)*

Table 27.1 Growth Velocity and Other Growth Characteristics by Age

INFANCY	CHILDHOOD	ADOLESCENCE
Birth-12 mo: 24 cm/yr 12-24 mo: 10 cm/yr 24-36 mo: 8 cm/yr	6 cm/yr Slowly decelerates before pubertal onset Height typically does not cross percentile lines	Sigmoid-shaped growth Adolescent growth spurt accounts for about 15% of adult height Peak height velocity Girls: 8 cm/yr Boys: 10 cm/yr

earlier- and later-maturing adolescents to facilitate the identification of poor or accelerated linear growth.

Specialized growth charts have been developed for U.S. children with various conditions, including very low birthweight (VLBW), small for gestational age, trisomy 21, Turner syndrome, and achondroplasia, and should be used when appropriate.

Facilitating identification of obesity, the charts include curves for plotting BMI for ages 2-20 years rather than weight for height (see Fig. 27.1). Methodologic steps have ensured that the increase in the prevalence of obesity has not unduly raised the upper limits of normal. BMI can be calculated as weight in kilograms/(height in meters)^2 or weight in pounds/(height in inches)^2 × 703, with fractions of pounds and inches expressed as decimals. Because of variable weight and height gains during childhood, BMI must be interpreted relative to age and sex; the BMI percentile provides a more standardized comparison. For example, a 6-year-old girl with a BMI of 19.7 kg/m^2 (97th percentile) is obese, whereas a 15-year-old female with BMI of 19.7 kg/m^2 (50th percentile) is normal weight.

Normal Growth

Height is highly correlated with genetics, specifically parental height. Calculation of sex-adjusted **midparental height** is important when assessing growth in a child to avoid misclassification of abnormal growth. The average difference in stature between males and females is 5 inches (13 cm); therefore 5 inches (13 cm) is subtracted from the father's height before averaging with mother's height in a female, whereas 5 inches (13 cm) is added to the mother's height before averaging with the father's height in a male:

- Males: [(Maternal height + 5 inches) + Paternal height]/2
- Females: [Maternal height + (Paternal height − 5 inches)]/2

Furthermore, generally 4 inches (2 SD) is applied above and below this value to provide a *genetic target height range*. For example, if the mother is 63 inches tall and the father 70 inches tall, the daughter's sex-adjusted midparental height is 64 inches ± 4 inches, for a target height range of 60-68 inches. The son of these same parents would have a sex-adjusted midparental height of 69 inches, with a range of 65-73 inches. Note that these general guidelines do not address extreme differences between parental heights that may affect individual target height range.

Growth can be divided into four major phases: fetal, infantile, childhood, and adolescence. Growth rate varies by age (see Table 27.1). Different factors are of different importance in each phase, and the various contributors to poor growth may feature more in one phase than another. Long-term height may be permanently compromised if one entire phase is characterized by poor growth. Therefore early detection and prevention are critical. **Fetal growth** is the fastest growth phase, with maternal, placental, fetal, and environmental factors playing key roles. Birthweight does not necessarily correlate with adult height, although factors that inhibit fetal growth may have long-lasting effects, as seen in children with intrauterine growth retardation. **Infantile growth** is particularly sensitive to nutrition as well as congenital conditions. Genetic height gradually becomes influential; indeed, crossing of percentiles in the first 2 years of life is common as children begin to approach their genetic potential. **Childhood growth** is often the most steady and predictable. During this phase the height percentile is fairly consistent in otherwise healthy children.

Adolescent growth is associated with a decrease in growth velocity before the onset of puberty; this deceleration tends to be more pronounced in males. During pubertal development, sex hormones

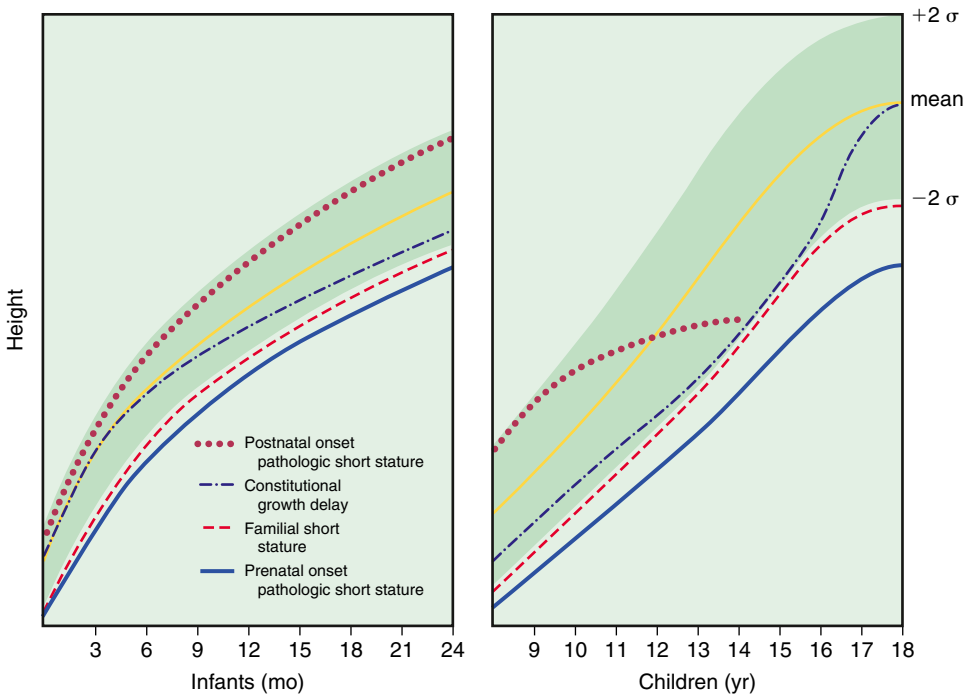


Fig. 27.3 Height-for-age growth curves of the four general causes of proportional short stature: postnatal onset pathologic short stature, constitutional growth delay, familial short stature, and prenatal onset short stature. *(From Mahoney CP: Evaluating the child with short stature, Pediatr Clin North Am 1987;34:825.)*

(testosterone and estrogen) are the primary drivers of growth and enhance growth hormone secretion, thereby facilitating pubertal growth acceleration. Females typically experience growth acceleration during Tanner stage 3 for breast development, whereas this acceleration occurs during Tanner stage 4 for pubic hair development in males. Males not only achieve greater height velocities than females during puberty, but also grow approximately 2 years longer than females, both of which contribute to the taller average height of adult males compared with adult females.

Abnormal Growth

Growth is a dynamic process. A child measured at the 5th percentile for stature may be growing normally, may be failing to grow, or may be recovering from growth failure, depending on the trajectory of the growth curve (Fig. 27.3). Growth failure must be distinguished from short stature. **Growth failure** is defined as achievement of height velocity that is less than expected for a child's age and sex (and pubertal development if relevant) or a downward crossing of more than 2 percentile lines for height on the growth chart. **Short stature** is defined as growing either below expected genetic potential or growing below −2 SD for age and sex. For some children, however, growth parameters ≤2 SD may be normal, and differentiating appropriately small vs. pathologically small is crucial. Midparental height, ethnicity, and other factors that may be inherent in the child's genetic height potential are important considerations in the assessment of growth. For children with particularly tall or short parents, overdiagnosing and underdiagnosing growth disorders are risks if parental heights are not considered. In the setting of familial short stature or tall stature, more specialized charts can help determine whether a child is even shorter or taller than expected for parental heights, to prevent misdiagnosis of growth disorders.

For **premature infants**, overdiagnosis of growth failure can be avoided by using growth charts developed specifically for this population. A cruder method, subtracting the weeks of prematurity from the postnatal age when plotting growth parameters, does not capture the variability in growth velocity that VLBW infants demonstrate. Although VLBW infants may continue to show **catch-up growth** through early school age, most achieve weight catch-up during the second year and height catch-up by 3-4 years, barring medical complications (see Chapter 119).

Abnormal growth may be caused by a variety of factors, including congenital conditions, systemic disease, endocrine disorders, nutritional deficiency (see Chapter 62), psychosocial conditions, constitutional delay, or familial disorders (Tables 27.2 and 27.3). In congenital pathologic short stature, an infant may or may not be born small, but growth gradually tapers throughout infancy (see Fig. 27.3). Causes include chromosome or genetic abnormalities (Turner syndrome, skeletal dysplasia, trisomy 21; see Chapters 57 and 99), perinatal infection, extreme prematurity, and teratogens (phenytoin, alcohol) (see Chapters 117.4 and 146). Linear growth deceleration with or without changes in weight can occur at the onset or as a result of a systemic illness or chronic inflammation. Medications such as high-dose glucocorticoids may also impact growth. Analysis of growth patterns requires consideration of weight status. Poor linear growth in the setting of decreasing BMI suggests a nutritional or gastrointestinal issue, whereas *poor linear growth* in the context of good or robust BMI may suggest a hormonal condition (hypothyroidism, growth hormone deficiency, cortisol excess).

Not all decreased growth is abnormal; variations of growth include constitutional growth (and pubertal) delay and familial short stature. In **constitutional growth delay**, weight and height decrease near the end of infancy, parallel the norm through middle childhood, and accelerate toward the end of adolescence with achievement of normal adult height. In **familial short stature**, both the infant/child and the parent(s) are small; growth runs parallel to and just below the normal curves.

Although **tall or accelerated growth** may be a variation of normal, unexpected increase in growth may also signal an underlying condition (see Table 27.3). Typically, obese individuals grow more quickly than their peers because of peripheral aromatization of estrogen and effects on bone maturation. Despite early taller stature, obese children are not ultimately taller than anticipated for genetic height. Early onset of puberty, growth hormone excess, and sex steroid exposure can also lead to accelerated growth. Several of these conditions may ultimately lead to short stature in adulthood. Genetic conditions associated with tall stature and overgrowth include Sotos, Klinefelter, and Marfan syndromes (see Chapter 598 and 598.1).

Table 27.2 Common Causes of Decreased Growth and Short Stature

Variation of normal
Familial short stature
Constitutional delay
Delayed puberty
Nutrition and gastrointestinal conditions
Malnutrition
Celiac disease
Inflammatory bowel disease
Genetic conditions
Turner syndrome
Prader-Willi syndrome
22q deletion syndrome
Trisomy 21
Skeletal dysplasias: achondroplasia, SHOX haploinsufficiency, osteogenesis imperfecta
Endocrine conditions
Hypothyroidism
Growth hormone deficiency
Poorly controlled diabetes mellitus
Poorly controlled diabetes insipidus
Metabolic bone disease: rickets, hypophosphatasia
Glucocorticoid excess
Psychosocial causes
Renal conditions
Renal tubular acidosis
Nephrotic syndrome
Medications
Glucocorticoids
Inappropriate sex steroid exposure
Antiepileptic medications

Table 27.3 Common Causes of Increased Growth and Tall Stature

Variation of normal
Constitutional tall stature
Familial tall stature
Endocrine conditions
Growth hormone excess
Precocious puberty (ultimate height may be decreased)
Congenital adrenal hyperplasia
Obesity
Genetic conditions
Marfan syndrome
Klinefelter syndrome
Sotos syndrome

Evaluation of Abnormal Growth

Evaluation of abnormal growth should include confirmation that the data are accurate and plotted correctly. Comparisons should be made with previous measurements. If poor or rapid growth or short or tall stature is a concern, a radiograph of the left hand and wrist to show the **bone age** can provide information about skeletal maturation. Skeletal development represents physiologic rather than chronologic age. Reference standards for bone maturation facilitate estimation of bone age (see Table 23.3). A delayed bone age (skeletal age younger than chronologic age) suggests catch-up potential for linear growth. Advanced bone age suggests a rapid maturation of the skeleton that may lead to earlier cessation of growth. Bone age should be interpreted with the guidance of a pediatric endocrinologist. Skeletal age correlates well with stage of pubertal development and may be helpful in predicting adult height in early- or late-maturing adolescents. In familial short stature the bone age is normal (comparable to chronologic age), whereas constitutional delay, endocrinologic short stature, and undernutrition may be associated with delay in bone age comparable to the height age.

Laboratory testing is also useful in assessment of growth and may be tailored to suspected etiology based on the patient history and physical examination. Initial assessment includes comprehensive metabolic panel, complete blood count, sedimentation rate, C-reactive protein, thyroid-stimulating hormone, thyroxine, celiac panel, and insulin-like growth factor (IGF)-I and IGF-BP3, which are surrogate markers for growth hormone secretion (see Chapter 595). A karyotype to exclude Turner syndrome is an essential component of the evaluation of short stature in females and should be performed even in the absence of characteristic physical features (see Chapter 626.1). If there is concern for abnormal timing of puberty contributing to growth pattern, gonadotropins (luteinizing hormone, follicle-stimulating hormone), and estradiol or testosterone may also be assessed. A urinalysis can provide additional information about renal function. Evaluation by a pediatric nutritionist for caloric needs assessment may be useful in patients with malnutrition, underweight status, or slow weight gain. Additional testing and referral to specialists should be performed as indicated.

OTHER GROWTH CONSIDERATIONS

Obesity

Obesity affects large numbers of children (see Chapter 65). The CDC defines *obesity* as BMI ≥95th percentile for age and sex, and *overweight* as BMI 85th to <95th percentile for age and sex. Although widely accepted as the best clinical measure of underweight and overweight, BMI may not provide an accurate index of adiposity because it does not differentiate lean tissue and bone from fat. In otherwise healthy individuals, lean body mass is largely represented by BMI at lower percentiles. BMI >80–85% largely reflects increased body fat with a nonlinear relationship between BMI and adiposity. In the setting of chronic illness, increased body fat may be present at low BMI, whereas in athletes, high BMI may reflect increased muscle mass. Measurement of the triceps, subscapular, and suprailiac skinfold thickness have been used to estimate adiposity. Other methods of measuring fat, such as hydrodensitometry, bioelectrical impedance, and total body water measurement, are used in research, but not in clinical evaluation, but whole body dual-energy x-ray absorptiometry (DXA) is beginning to emerge as a tool for measuring body fat and lean body mass.

Dental Development

Dental development includes mineralization, eruption, and exfoliation (Table 27.4). Initial mineralization begins as early as the second trimester (mean age for central incisors, 14 weeks) and continues through 3 years of age for the primary (deciduous) teeth and 25 years of age for the secondary (permanent) teeth. Mineralization begins at the crown and progresses toward the root. Eruption begins with the central incisors and progresses laterally. Exfoliation begins at about 6 years of age and continues through 12 years. Eruption of the permanent teeth may follow exfoliation immediately or may lag by 4-5 months. The timing of dental development is poorly correlated with other processes of growth and maturation. **Delayed eruption** is usually considered when no teeth have erupted by approximately 13 months of age (mean ± 3 SD). Common causes include congenital or genetic disorders, endocrine disorders (e.g., hypothyroidism, hypoparathyroidism), familial conditions, and (the most common) idiopathic conditions. Individual teeth may fail to erupt because of mechanical blockage (crowding, gum fibrosis). Causes of **early exfoliation** include hypophosphatasia, histiocytosis X, cyclic neutropenia, leukemia, trauma, and idiopathic factors. Nutritional and metabolic disturbances, prolonged illness, and certain medications (tetracycline) frequently result in discoloration or malformations of the dental enamel. A discrete line of pitting on the enamel suggests a time-limited insult.

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Table 27.4 Chronology of Human Dentition of Primary (Deciduous) and Secondary (Permanent) Teeth

	CALCIFICATION		AGE AT ERUPTION		AGE AT SHEDDING	
	BEGINS AT	COMPLETE AT	MAXILLARY	MANDIBULAR	MAXILLARY	MANDIBULAR
PRIMARY TEETH						
Central incisors	5th fetal mo	18-24 mo	6-8 mo	5-7 mo	7-8 yr	6-7 yr
Lateral incisors	5th fetal mo	18-24 mo	8-11 mo	7-10 mo	8-9 yr	7-8 yr
Cuspids (canines)	6th fetal mo	30-36 mo	16-20 mo	16-20 mo	11-12 yr	9-11 yr
First molars	5th fetal mo	24-30 mo	10-16 mo	10-16 mo	10-12 yr	10-12 yr
Second molars	6th fetal mo	36 mo	20-30 mo	20-30 mo	10-12 yr	11-13 yr
SECONDARY TEETH						
Central incisors	3-4 mo	9-10 yr	7-8 yr	6-7 yr		
Lateral incisors	Max, 10-12 mo Mand, 3-4 mo	10-11 yr	8-9 yr	7-8 yr		
Cuspids (canines)	4-5 mo	12-15 yr	11-12 yr	9-11 yr		
First premolars (bicuspids)	18-21 mo	12-13 yr	10-11 yr	10-12 yr		
Second premolars (bicuspids)	24-30 mo	12-14 yr	10-12 yr	11-13 yr		
First molars	Birth	9-10 yr	6-7 yr	6-7 yr		
Second molars	30-36 mo	14-16 yr	12-13 yr	12-13 yr		
Third molars	Max, 7-9 yr Mand, 8-10 yr	18-25 yr	17-22 yr	17-22 yr		

Mand, Mandibular; max, maxillary.
Adapted from a chart prepared by P.K. Losch, Harvard School of Dental Medicine, who provided the data for this table.

Chapter 28

Developmental and Behavioral Surveillance and Screening

Eliza Gordon-Lipkin and Paul H. Lipkin

In healthy development, a child will acquire new skills beginning prenatally and extending into at least young adulthood. The roots of this acquisition of skills lie in the development of the nervous system, with additional influences from the health status of other organ systems and the physical and social environment in which the development occurs. *Development* and its milestones are divided into the "streams" of gross motor, fine motor, language (expressive and receptive), social language, and self-help. *Behavior* can be categorized into observable, spontaneous, and responsive behaviors in the settings of home, school, and community.

Although typical development is associated with wide variability in the age of skill acquisition in each of these streams, specific developmental and behavioral disorders are seen in approximately 1 of 6 children and may affect the health, function, and well-being of the child and family for a lifetime. These disorders include relatively less common conditions that often cause severe impairments, such as cerebral palsy and autism, and relatively common conditions such as attention-deficit/hyperactivity disorder, speech language disorders, and behavioral and emotional disorders that affect as many as 25% of children. The more common conditions are generally perceived as "less severe," but these too can have major short-term and long-term impact on the child's health and daily functioning in the home, school, and community and can affect lifelong well-being. Because of their high prevalence in children; their impact on health, social, and economic status; and their effect on the child, the home, and the community, these disorders require the attention of the pediatrician throughout childhood. In addition, both the child and the family benefit from the early identification and treatment of many of these conditions, including the most severe. It is therefore incumbent on the primary care clinician to conduct regular **developmental surveillance** and periodic **developmental screening** at health supervision visits aimed at early identification and treatment.

Among the many types of developmental or behavioral conditions, the most common include *language problems,* affecting at least 10% of children (see Chapter 53); *behavior or emotional disorders,* affecting up to 25% of children, with 6% considered serious; *attention-deficit/hyperactivity disorder,* affecting 10% of children (Chapter 50); and *learning disabilities,* affecting up to 10% (Chapters 51 and 52). Less common and more disabling are the intellectual disabilities (1–2%; Chapter 56); autism spectrum disorders (1 in 36 children; Chapter 58); cerebral palsy and related motor impairments (0.3%, or 1 in 345 children; Chapter 638.1); hearing impairment, also referred to as deafness, hard-of-hearing, or hearing loss (0.12%; Chapters 55 and 677); and nonrefractive vision impairment (0.8%; Chapter 661).

DEVELOPMENTAL AND BEHAVIORAL SURVEILLANCE

General health surveillance is a critical responsibility of the primary care clinician and is a key component of health supervision visits. Regular developmental and behavioral surveillance should be performed at every health supervision visit from infancy through young adulthood. Surveillance of a child's development and behavior includes both obtaining historical information on the child and family and making observations at the office visit (Tables 28.1 and 28.2).

Key historical elements include (1) eliciting and attending to the parents' or caregivers' concerns around the child's development or behavior; (2) obtaining a history of the child's developmental skills and behavior at home, with peers, in school, and in the community; and (3) identifying the risks, strengths, and protective factors for development and behavior in the child and family, including the social determinants of health. During the office visit, the clinician should make and document direct observations of the child's developmental skills and behavioral interactions. Skills in all streams of development should be considered along with observations of related neurologic functioning made on physical examination.

With this history and observation, the clinician should create and maintain a longitudinal record of the child's development and behavior for tracking the child across visits. It is often helpful to obtain information from and share information with other professionals involved

Table 28.1 Key Components of Developmental and Behavioral Surveillance

HISTORY
1. Parental developmental concerns
2. Developmental history
   a. Streams of developmental milestone achievement
      i. Gross motor
      ii. Fine motor
      iii. Verbal speech and language
         (1) Expressive
         (2) Receptive
      iv. Social language and self-help
   b. Patterns of abnormality
      i. Delay
      ii. Dissociation
      iii. Deviation or deviant development
      iv. Regression
3. Behavior history
   a. Interactions
      i. Familiar settings (e.g., home, school): parents, siblings, other familiar people, peers, other children
      ii. Interaction in unfamiliar settings (e.g., community): unfamiliar adults and children
   b. Patterns of abnormality
      i. Noncompliance, disruption (including tantrums), aggression, impulsivity, increased activity, decreased attention span, decreased social engagement, decreased auditory or visual attention
      ii. Deviation or atypical behaviors
         (1) Repetitive play, rituals, perseverative thought or action, self-injury
4. Risk factor identification: medical, family, and social history (including social determinants of health)
5. Protective factor identification (also including social determinants)

DEVELOPMENTAL OBSERVATION
1. Movement: gross and fine motor skills
2. Verbal communication: expressive speech and language, language understanding
3. Social engagement and response
4. Behavior: spontaneous and responsive with caregiver and with staff
5. Related neurologic function on physical examination

Table 28.2 Red Flags in Developmental Screening and Surveillance

These indicators suggest that development is significantly delayed or disordered and that the child should be referred to a developmental pediatrician or pediatric neurologist. Any delay in achieving a milestone at the 75th percentile may be considered a red flag and merits further evaluation, vigilant surveillance, or repeat screening.

POSITIVE INDICATORS

Presence of any of the following:
- Loss of developmental skills at any age
- Parental or professional concerns about vision, fixing, or following an object or a confirmed visual impairment at any age (simultaneous referral to pediatric ophthalmology)
- Hearing loss at any age (simultaneous referral for expert audiologic or ear, nose, and throat assessment)
- Persistently low muscle tone or floppiness (check creatine kinase)
- No speech by 15 mo, especially if the child does not try to communicate by other means, such as gestures (simultaneous referral for urgent hearing test)
- Asymmetry of movements or other features suggestive of cerebral palsy, such as increased muscle tone
- Persistent toe walking
- Multiple organ involvement
- Head circumference above the 99.6th centile or below 0.4th centile; also, if circumference has crossed 2 centiles (up or down) on the appropriate chart or is disproportionate to parental head circumference

NEGATIVE INDICATORS

Activities that the child cannot do:
- Sit unsupported by 12 mo
- Walk by 18 mo (check creatine kinase)
- Walk other than on tiptoes
- Run by 24 mo
- Hold object placed in hand by 4 mo (corrected for gestation)
- Reach for objects by 6 mo (corrected for gestation)
- Points to show you something interesting by 18 months

Adapted from Horridge KA. Assessment and investigation of the child with disordered development. *Arch Dis Child Educ Pract Ed.* 2011;96:9–20; Zubler JM, Wiggins LD, Macias MM, et al. Evidence-informed milestones for developmental surveillance tools. Pediatrics. 2022;149(3):e2021052138.

with the child, including childcare professionals, home visitors, teachers, after-school providers, and developmental therapists. This provides a complete picture of the child's development and behavior and allows collaborative tracking of the child's progress.

The Developmental and Behavioral Histories

Developmental surveillance includes tracking a child's achievement of milestones, which represent key readily recognizable skills that usually occur in a predictable sequence and at predictable age ranges during childhood. The developmental skill areas can be divided into **gross motor**, **fine motor**, **speech and language** (expressive and receptive), **social language**, and **self-help**. Tracking milestones will reveal that most children achieve the milestones in a typical pattern and within typical age ranges. However, the pediatrician or the parent may recognize concerning patterns of development, such as delay, dissociation, deviation, or regression.

Developmental delay occurs when development is occurring in its usual sequence but at a slower rate, with milestones achieved later than the normal range (see Chapter 56). Delay can occur in a single area of development or across several streams and can be expressed as a *developmental quotient* (DQ). The DQ is calculated by dividing the age at which the child is functioning developmentally (*developmental age*; DA) by *chronologic age* (CA) and multiplying by 100 (DQ = DA/CA × 100). A DQ of 100 indicates that the child is developing at the mean or average rate, whereas a DQ below 70 is associated with delays of 2 or more standard deviations from the mean and suggests a significant delay that requires further evaluation.

Developmental dissociation indicates delay in a single stream with typical development in other streams. A child with autism may have delays in verbal or social language but normal motor skills. *Deviation or deviant development* is defined by development occurring out of sequence, as when a child stands before sitting (as in diplegic cerebral palsy) or has better expressive vocabulary than receptive understanding of words (language and autism spectrum disorders). *Regression* refers to a loss of skills. It may also be identified earlier or more subtly by a slowing or lack of advancement in skills. Although regression is uncommon in most developmental disabilities, regression is described in as many as 25% of children with autism and is also seen in rarer neurologic disorders, such as Rett syndrome and Duchenne muscular dystrophy.

Behavioral surveillance is conducted by obtaining a history of a child's behavior and interactions across settings, including home, daycare, school, and community, and in situations such as eating, sleeping, and play. In addition, interactions may differ based on who the child is with (parent or guardian, sibling, peers, teachers, strangers). Concerns may include limited engagement or socializing, compliance, tantrums, aggression, destruction, impulsivity, high activity level, decreased auditory or visual attention, and short attention span. Deviations from

Table 28.3 Standardized Tools for General Developmental Screening

SCREENING TEST*	AGE RANGE	ITEMS (NO.)	ADMIN TIME (MIN)	PUBLICATION INFORMATION
Ages & Stages Questionnaires-3 (ASQ3)[1]	2-66 mo	30	10-15	Paul H. Brookes Publishing www.agesandstages.com
Parents' Evaluation of Developmental Status (PEDS)[2]	0-8 yr	10	2-10	Ellsworth & Vandermeer Press 877-296-9972 www.pedstest.com
Parents' Evaluation of Developmental Status: Developmental Milestones (PEDS:DM) Screening Version[2]	0-8 yr	6-8 items at each age level	4-6	Ellsworth & Vandermeer Press 877-296-9972 www.pedstest.com
Survey of Well-Being of Young Children (SWYC)[3-6]	*Dev:* 1-65 mo *Autism:* 16-35 mo	*Dev:* 10 *Autism*: 7	*Dev*: <5 *Autism*: <5	www.theswyc.org

*Key reference sources:
[1]Squires J, Potter L, Bricker D. *The ASQ User's Guide*, 3rd ed, Baltimore, MD, Paul H. Brookes Publishing, 2009.
[2]Glascoe FP, Marks KP, Poon JK, et al. (eds). *Identifying and addressing developmental-behavioral problems: a practical guide for medical and non-medical professionals, trainees, researchers and advocates*. Nolensville, TN: PEDStest.com, 2013.
[3]Sheldrick RC, Perrin EC. Evidence-based milestones for surveillance of cognitive, language, and motor development. *Acad Pediatr*. 2013, 13(6):577–556.
[4]Smith N, Sheldrick R, Perrin E. An abbreviated screening instrument for autism spectrum disorders. *Infant Ment Health J*. 2012;34(2):149–155.
[5]Salisbury LA, Nyce JD, Hannum CD, et al. Sensitivity and specificity of 2 autism screeners among referred children between 16 and 48 months of age. *J Dev Behav Pediatr*. 2018;39(3):254–258.
[6]Publications and user's manual available at www.theswyc.org.

usual behavior may also occur, including repetitive play, ritualistic behaviors, perseverative thoughts or actions, and self-injury.

Observation

Observations of the child's developmental skills and behavioral interactions should be made in the examining room, with documentation in the medical record, and combined with the examination of other neurologic functioning, such as muscle tone, reflexes, and posture.

Developmental observations may include a child's gross and fine motor movements, both on the floor and on the examination table. Spoken language and response to others' communications, as well as interactions and engagement with the parent or guardian, should be noted. If siblings are in the room, the interaction between the child and a sibling may also be informative. Impulsivity, attention problems, tantrums, noncompliance, oppositionality, and aggression may be observed along with interactions with the clinician, but one should inquire about whether these behaviors are seen in *other settings*, given the possible unfamiliarity or discomfort of the child with the healthcare professional or in healthcare settings.

If inquiring about and observing the child's development and behavior suggests normal or typical patterns of development and behavior, discussions can be held about future milestones and usual behavior management strategies employable at home. If problems or concerns are identified by the parent or clinician, however, formal developmental screening, evaluation, or management should be considered, along with early follow-up and review.

DEVELOPMENTAL AND BEHAVIORAL SCREENING

Periodic episodic screening for developmental and behavioral conditions should be conducted on every child, as done for other health conditions such as anemia, lead poisoning, hearing, and congenital metabolic disorders. Developmental and behavioral screenings are centered on administration of low-cost, brief, and standardized tests in the primary care setting. These tests can be implemented by health assistants at age-determined visits, with interpretation of the results and referral or treatment initiation by the primary care clinician as indicated.

The American Academy of Pediatrics provides recommendations and guidelines on age-specific developmental screening for implementation in the primary care medical home. Developmental screening using a formal, validated, and standardized test is recommended during health supervision visits at 9, 18, and 30 months. Tests recommended at these ages screen development across all the streams. In addition, an autism screening test is recommended at the 18 and 24 month visits. Tables 28.3 and 28.4 provide recommended screening tests for general development and for autism. It is also recommended that a child have a screening test administered any time that a parent, guardian, or child health or early childhood professional has concerns identified during developmental surveillance, or through screening performed at early childhood programs. Although routine formal screening before the child's entry into elementary school is not included in current guidelines, the primary care clinician should be vigilant about surveillance regarding development at the 4 or 5 year old visit and perform formal screening if concerns are identified, because of the potential impact on learning and school services.

Each of the screening visits offers special opportunities to identify specific developmental conditions. At the 9 month screening, critical areas of development are vision, hearing, gross motor, fine motor, and receptive language. It is at this age that disabilities may be identified in vision or hearing, as well as cerebral palsy and other neuromotor disorders. At 18 months, expressive language and social language development are particularly important areas. Conditions identified at this age may include those considered at 9 months, although in milder forms, as well as autism spectrum, language, and intellectual disorders. By the 30 month visit, the child's behavioral interactions become an additional area of focus, with problems emerging tied to attention and disruptive behavior disorders. Although universal screening is not recommended at later ages, developmental surveillance may identify children in need of screening or evaluation for problems in learning, attention, and behavior.

Additional screening for *behavioral conditions* should be considered, although there is currently no recommended consensus on the ages at which behavioral screening should occur. One possibility would be to provide behavioral screening at the 30 month, 4 or 5 year, and 8 year visits to identify problems emerging in the toddler, preschool, and early elementary years. For older children, visits during preadolescent or adolescent ages also offer an opportunity for surveillance and possible screening for behavioral and emotional problems meriting professional assistance or intervention. Table 28.5 provides recommended behavior screening tools.

Evidence-Based Tools

Tables 28.3, 28.4, and 28.5 show a range of measures useful for early identification of developmental and behavioral problems. Because well-child visits are brief and with broad agendas (health

Table 28.4 Standardized Tools for Language and Autism Screening

SCREENING TEST*	AGE RANGE	ITEMS (NO.)	ADMIN TIME (MIN)	PUBLICATION INFORMATION
Communication and Symbolic Behavior Scales: Developmental Profile (CSBS-DP): Infant Toddler Checklist[1]	6 mo-6 years (for language function 6-24 mo)	24	5-10	Paul H. Brookes Publishing 800-638-3775 www.brookespublishing.com
Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F)[2]	16-48 mo	20 plus follow-up interview	5-10	www.mchatscreen.com
Screening Tool for Autism in Toddlers and Young Children (STAT)[3,4]	24-35 mo	12 (avg)	20-30	https://stat.vueinnovations.com
Social Communication Questionnaire (SCQ)[5,6]	4+ yr	40 (avg)	5-10	Western Psychological Services www.wpspublish.com

*Key reference sources:
[1]Wetherby AM, Prizant BM. *Communication and Symbolic Behavior Scales: developmental profile*. Baltimore, MD: Paul H. Brookes Publishing, 2002.
[2]Robins DL, Casagrande K, Barton M, et al. Validation of the Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F). *Pediatrics*. 2014;133(1):37–45.
[3]Stone WL, Coonrod EE, Ousley O. Brief report: screening tool for autism in 2-year-olds (STAT): development and preliminary data. *J Autism Dev Disord*. 2000;30:607–612
[4]Stone WL, Coonrod EE, Turner LM, Pozdol SL. Psychometric properties of the STAT for early autism screening. *J Autism Dev Disord*. 2004;34:691–701.
[5]Rutter M, Bailey A, Lord C: *The Social Communication Questionnaire (SCQ) Manual*. Los Angeles; Western Psychological Services, 2003.
[6]Corsello C, Hus V, Pickles A, et al. Between a ROC and a hard place: decision making and making decisions about using the SCQ. *J Child Psychol Psychiatry*. 2007;48(9):932–940.

Table 28.5 Standardized Tools for General Behavioral Screening

SCREENING TEST*	AGE RANGE	ITEMS (NO.)	ADMIN TIME (MIN)	PUBLICATION INFORMATION
Ages & Stages Questionnaire: Social-Emotional-2 (ASQ:SE-2) (2015)[1,2]	2-72 mo	9 age-specific forms with 19-33 items	10	Paul H. Brookes Publishing 800-638-3775 www.agesandstages.com
Brief Infant Toddler Social Emotional Assessment (BITSEA)[3]	12-36 mo	42	7-10	Mapi Research Trust https://eprovide.mapi-trust.org/
Pediatric Symptom Checklist–17 items (PSC-17b)[4]	4-16 yr PSC-35 Youth self-report: ≥11 yr	17	<5	Massachusetts General Hospital https://www.massgeneral.org/psychiatry/treatments-and-services/pediatric-symptom-checklist
Strengths and Difficulties Questionnaire (SDQ)[5]	4-17 yr 3-4 yr old version available Youth self-report 11-16 yr	25; 22 for 3-4 yr olds	5-10	www.sdqinfo.org

*Key reference sources:
[1]Squires J, Bricker DD, Twombly E. *Ages & Stages Questionnaires: Social-Emotional-2 (ASQ:SE-2): a parent-completed, child-monitoring system for social-emotional behaviors*. Baltimore, MD: Paul H. Brookes Publishing, 2016.
[2]Briggs RD, Stettler EM, Johnson Silver E, et al. Social-emotional screening for infants and toddlers in primary care. *Pediatrics*. 2012;129(2):1–8.
[3]Briggs-Gowan MJ, Carter AS, McCarthy K, et al. Clinical validity of a brief measure of early childhood social–emotional/behavioral problems. *J Pediatr Psychol*. 2013;38(5):557–587.
[4]Murphy JM, Stepanian S, Riobueno-Naylor A, et al. Implementation of an electronic approach to psychosocial screening in a network of pediatric practices. *Acad Pediatr*. 2021;21(4):702–709.
[5]Stone LL, Otten R, Engels RC, et al. Psychometric properties of the parent and teacher versions of the Strengths and Difficulties Questionnaire for 4- to 12-year-olds: a review. *Clin Child Fam Psychol Rev*. 2010;13(3):254–274.

surveillance and screening, physical examination, immunization, anticipatory guidance, safety and injury prevention, and developmental promotion), tools relying on parent completion with office staff administration and scoring are well suited for primary care settings. Such tests may be completed in advance of appointments, either online or in writing, whether at home or while waiting for the pediatric visit to begin. If a test is scored in advance of the visit, the pediatric clinician can enter the room with results in hand for review and discussion, including a description of the child's development and behavior compared with peers, general information on child development and behavior, any areas of concern, referrals needed, and information to share with the child's daycare, preschool, or other community providers, when applicable.

Screening Test Properties

Each of the tests provided in Tables 28.3 to 28.5 meets accepted psychometric test criteria. The test has standardized questions or milestones with norms based on administration to parents of a large sample of children with typical development. These norms allow comparison of an individual child's performance on the test with that of the large sample of typically developing children. In addition, the tests demonstrate accepted standards of *reliability*, or the ability to produce consistent results; *predictive validity*, or the ability to predict later test performance or development; *sensitivity*, or accuracy in the identification of delayed development or disability; and *specificity*, or accuracy in the identification of children who are not delayed. Some of the screening tests are general, evaluating multiple areas of development or behavior (sometimes referred to as "broad band"). Others are domain specific, evaluating one area of development (e.g., language), or disorder specific, aimed at identifying a specific developmental disorder (sometimes referred to as "narrow band").

BEYOND SURVEILLANCE AND SCREENING

Comprehensive Evaluation

When a developmental or behavioral concern is identified through surveillance or screening, the primary care clinician's role is to

ensure that the child receives an appropriate diagnostic evaluation, related medical testing, and indicated developmental interventions and medical treatment. When a concern is identified, a full diagnostic evaluation should be performed by a professional with appropriate training and experience. In the case of developmental concerns, this may be a pediatric specialist, such as a neurodevelopmental pediatrician/neurologist or a developmental-behavioral pediatrician, or a related developmental professional, depending on resources in the local community. Related professionals may include early childhood educators, psychologists, speech/language pathologists, audiologists, physical therapists, and occupational therapists, many of whom are available through the local early intervention system. Such an evaluation would typically include more detailed standardized developmental testing. The primary care physician should ensure that hearing and vision assessments are completed. For the child with motor concerns, the physician should pay particular attention to the motor and neurologic evaluation. Children with language delays should have hearing, speech, language, and learning skills (e.g., reading, phonics) evaluated.

The primary care clinician should also perform a comprehensive medical evaluation of the child to identify any related health conditions. Physical examination including head circumference should be reviewed to identify growth abnormalities and dysmorphic features. For the child with motor delay and decreased or normal muscle tone, serum creatine kinase and thyroid function testing are recommended to rule out muscular dystrophy and thyroid disease, respectively. When there is increased tone, MRI or referral to a neurologist should be considered. For the child with suspected autism or intellectual disability (or global developmental delay), chromosomal microarray and fragile X testing are recommended (see Chapter 56).

Referral and Intervention

Children with significant developmental delays or an identified developmental disability are entitled to and usually benefit from early intervention with therapy services directed at delayed or atypical development. The U.S. Individuals with Disabilities Education Act (IDEA) entitles any child with a disability or developmental delay to receive local education and related services, including therapy, from as early as birth, for known or high-risk conditions that lead to such delay or disability, through age 21 years. These interventions enhance the child's development through early intervention and family support as well as individualized public education with the goal of improving long-term functional outcomes and reducing public costs. The pediatric provider should therefore refer every child with developmental concerns to the local early intervention program or agency (ages 0-3 years), public school program (≥ 3 years), and/or local therapy providers. Typical service needs include special education for the child with intellectual or learning concerns, physical or occupational therapy for children with motor delays, speech language therapy for the child with language or social communication difficulties, and behavioral therapy services for the child with social engagement or other behavior problems.

Likewise, the child with specific behavior concerns should be referred to an appropriate pediatric or behavioral health professional who can perform a thorough evaluation and assist the family to alleviate the problems or concerns. Such professionals may include those trained in developmental-behavioral pediatrics, neurodevelopmental disabilities, adolescent medicine, child and adolescent psychiatry, pediatric psychology, psychiatric advanced practice nursing, and social work. Such an evaluation is similar to developmental evaluation in its aim of determining a diagnosis, as well as developing a treatment program that may include psychotherapeutic and medication management. Associated medical or developmental disorders should be considered and further evaluated as needed.

Ongoing Management

Children with developmental or behavioral disorders should be identified as *children with special healthcare needs* in the medical home, with a program of chronic condition management initiated by the clinical program staff, including its medical and nonmedical staff. In doing so, the clinician and family should work together to outline the child's short- and long-term goals and management plan. This includes a program of regular monitoring and follow-up of the child's development and behavior, referrals, treatment, and surveillance for identification and treatment of related medical, developmental, or behavioral comorbidities that may arise. Some children and families may warrant assignment of a case manager or care navigator either within the medical home or in a related local agency. The pediatric clinician or other medical home staff should participate in care coordination activities as needed and assist the family and other professionals in decision-making on medical care, therapies, and educational services.

The family can be further assisted during the screening and referral phases or later with ongoing care by referral to support service programs, such as respite care, parent-to-parent programs, and advocacy organizations. Some children may qualify for additional state or federal benefit programs, including insurance, supplemental security income, and state programs for children with special healthcare needs. Families often seek out information, support, or connection to other families with similarly affected children and find benefit in local or national networks (e.g., Family Voices, Family to Family Health Information centers) and condition-specific associations.

Implementation

The principles and professional guidelines for developmental-behavioral surveillance and screening have been solidified to identify children with developmental disabilities, including the specific conditions of intellectual disability, autism spectrum disorder, motor disorders, and behavioral-emotional problems. Specific algorithms are included in these guidelines to assist the clinician with implementation. However, primary care clinicians have reported difficulties in putting these into practice, with obstacles and barriers identified and policy changes made to ensure that screening and referral can be implemented. (See Bibliography online for specific guidelines.)

Implementation projects have identified key factors for successful incorporation of developmental surveillance and screening into practice. Successful office-based screening requires development of a comprehensive office-based system that extends from the child's home to the front office and into the clinic visit, rather than solely centered on the time in the clinic room. This requires utilizing office and medical support staff for scheduling, advance test distribution, and initiation of the surveillance and screening procedures before the health supervision visit. The practice must choose screening tests that are not only valid for screening of the specific condition at the recommended ages, but also appropriate to the population being served (including reading level and language). The tests chosen should be able to be completed by the caregiver in a short time and at low cost. Staff training on billing and coding for these procedures ensures appropriate payment.

Practice systems should also be developed for referral and tracking of children who have problems identified through screening. This should include systems for referral to early intervention, community therapy, developmental professionals, and medical consultants. Office representatives or the clinician should establish working relationships with local community programs and resources to assist the child and family.

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Chapter 29

Child Care

Laura Stout Sosinsky and Walter S. Gilliam

Child care impacts the health and development of children and the economic stability of families. For too many young children and their families, affordable high-quality child care is not accessible. Pediatricians have a role in helping children receive safe, enriching care in high-quality early childhood education (ECE) settings that allows parents to be able to work.

As an environment in which children learn, grow, and play, child care is a component of the social determinants of health. The majority of young children regularly spend time in at least one nonparental child care arrangement. Routine exposure to high-quality child care provides an opportunity for early education in language, early literacy, math, and social skills, as well as for teaching children health-promoting behaviors and for identifying early signs of delays or special needs. Inadequate child care supply and poor availability block these opportunities for many children, disproportionately those from low-resourced families. Instead, many young children are exposed to a patchwork of child care arrangements that are unstable, unaffordable, and often poorly resourced, adding stress that harms child and family well-being.

Child care provision is affected by many factors, derived from family demand, child care supply, and child/family policy. With increasing movement of mothers into the workplace across the globe, the prime reason most families use child care is to support employment of both parents. After childbirth, unpaid maternity leave is the typical situation among U.S. mothers. The U.S. federal leave program allows for 12 weeks of unpaid job-protected leave during pregnancy or after childbirth, but only covers approximately 50% of the workforce because companies with <50 employees, with part-time employees, and those working in informal labor markets are exempt. Several states and cities have passed paid family leave laws.

In part because of the financial burden of an unpaid maternity leave, many mothers return to work, and their children may begin child care in the first few weeks after birth. In a 2000 Family and Medical Leave Act survey, only 10% of respondents reported taking more than 60 days for maternity leave. Approximately 44% of mothers in 2005–2007 were working by the time their first child was 3-4 months of age, and approximately 63% of mothers were working by the time their first child was 12 months. Some mothers face work requirements if they are receiving public benefits because of the reforms to welfare passed by the U.S. Congress in 1996. Many mothers feel strong financial motivation or even pressure to work, especially in single-parent households, or have strong incentive to work for short- and long-term financial security. Employment is not the only factor driving child care use; young children of *unemployed* mothers spend on average 21 hours per week in child care. Many parents want their children to have child care experiences for the potential benefits that early learning environments can give to their children. Given these realities, child care quality is of great concern, yet the quality of child care and early education environments varies widely, and the supply of high-quality child care is largely deemed inadequate.

The COVID-19 pandemic revealed the fragility of America's child care system. Relative to adults, young children have been far less likely to suffer severe medical complications from coronavirus infection, and rates of transmission in child care facilities that followed mitigation protocols have been low. However, the downstream effects of the pandemic on young children have been acute. Burdensome child care cost and access barriers became exaggerated. Parents of young children report significant concerns about their children's safety and education during the pandemic and describe significant disruptions and impacts on families' well-being. Estimates indicate that 1 in every 500 U.S. children have experienced COVID-19 orphanhood or the loss of a caregiving grandparent, further highlighting a crisis in early childhood caregiving.

QUALITY, PROVISION, REGULATION, AND ACCESS

Child Care Quality

High-quality child care is characterized by warm, responsive, and stimulating interactions between children and child care providers. These caregivers express positive feelings toward the children; are emotionally involved, engaged, and aware of the child's needs and sensitive and responsive to their initiations; speak directly with children in a manner that is elaborative and stimulating while being age-appropriate; and ask questions and encourage children's ideas and verbalizations. Structural quality features of the setting, including ratio of children to adults, group size, and caregiver education and training, act indirectly on child outcomes by facilitating high-quality interactions. It would be highly unlikely, if not impossible, for even the most sensitive and stimulating provider to engage in high-quality interactions with each child, if, for example, the provider was the sole caregiver of 10 toddlers.

Poor-quality child care settings and unsafe environments that do not meet children's basic physical and emotional needs can result in developmental delays tied to lack of healthy relationships with adults or developmentally inappropriate activities, toxic stress, neglect, or injury or death from fire, building hazards, disease, and inadequate staff oversight. State regulations put a "floor" on structural quality and basic staff indicators to mitigate risks and safeguard health and safety. Although structural indicators are more easily monitored in licensing, some but not all research suggests only modest relationships of structural indicators with child outcomes. When it comes to process quality, a body of studies demonstrates small-to-modest associations with short-term child development and some evidence of long-term impacts.

The early childhood field is focusing increasingly on effective practices, evidence-based curricula, and programs that are reported to have moderate-to-large effects on child outcomes. Some specific teacher practices are related to gains in academic and social-emotional skills among preschool students. Evidence-informed and evaluated ECE curricula with aligned professional development can have substantial impacts on child outcomes across several developmental domains. Primary caregiving, the practice in infant and toddler classrooms of assigning one teacher the primary responsibility for the care of a small group of children and developing relationships with their families, is consistent with research showing that infants who experience stable, consistent, sensitive and responsive care develop more secure attachment relationships and more positive developmental outcomes. Family engagement, in which early educators partner with families to share their unique knowledge of each child to build positive and goal-oriented relationships, relates to gains in preschool children's social and early academic skills and reduced problem behaviors.

Integration of Health and Safety Within Quality Practices

The American Academy of Pediatrics (AAP), the American Public Health Association, and the National Resource Center for Health and Safety in Child Care and Early Education provide health and safety guidelines in *Caring for Our Children (CFOC): National Health and Safety Performance Standards; Guidelines for Early Care and Education Programs, 4th ed.* (https://nrckids.org/CFOC; 2019). These national standards represent the best evidence on quality practices and address health and safety as an integrated component of early care and education. The intent is for the guidelines to serve as a resource for states and other entities to improve health and safety standards in licensing and quality rating improvement systems. An additional objective is for the various monitoring agencies and mechanisms to work together to collaboratively safeguard children and minimize or eliminate the duplication and burden of complicated and sometimes conflicting procedures and requirements.

The current guidelines include sections in 10 areas (Table 29.1). The National Resource Center also provides updated online resources: (1) up-to-date CFOC Standards Online Database (https://nrckids.org/CFOC and (2) a crosswalk of COVID-19 questions with CFOC

Table 29.1 *Caring for Our Children* Performance Standards: Chapters and Topics

1. **Staffing:** Child-staff ratio, group size, minimum age; background checks (criminal history, sex offender registry, and child abuse and neglect registry checks), qualifications, professional development, training
2. **Program Activities for Healthy Development:** Developmental activities (general and by age), supervision and discipline, parent/guardian relationships, health education
3. **Health Promotion and Protection:** Health promotion in child care (health checks and supervision, physical activity, limiting screen time, safe sleep, oral health); hygiene (diapering, hand hygiene, exposure to bodily fluids); cleaning, sanitizing, and disinfecting; tobacco and drug use; animals; emergency procedures; child abuse and neglect; sun safety and insect repellent; strangulation hazards; management of illness
4. **Nutrition and Food Service:** General and by age, meal service, seating, and supervision, nutrition learning experiences for children and for parents/guardians, food safety, and more
5. **Facilities, Supplies, Equipment, and Environmental Health:** Space per child, exits, ventilation, lighting, noise, furnishings, equipment, and more
6. **Play Areas/Playgrounds and Transportation:** Playground equipment, water play areas, toys
7. **Infectious Diseases:** Immunizations, respiratory tract infections, enteric (diarrheal) infections and hepatitis A virus, skin and mucous membrane infections, blood-borne infections, herpes viruses, interaction with state or local health departments, judicious use of antibiotics
8. **Children with Special Healthcare Needs and Disabilities:** Inclusion, service plans, coordination and documentation, periodic reevaluation, assessment of facilities for children with special needs, additional standards
9. **Administration:** Governance, policies, human resources, records
10. **Licensing and Community Action:** Regulatory policy, licensing agency, facility licensing, health department responsibilities and role, caregiver/teacher support, public policy issues and resource development

From the American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education. Caring for Our Children: National Health and Safety Performance Standards; *Guidelines for Early Care and Education Programs*. 4th ed., Itasca, IL: American Academy of Pediatrics; 2019. (https://nrckids.org/CFOC/TOC).

standards (https://nrckids.org/files/CFOC.Crosswalk.pdf) to help child care health consultants and providers learn how the CFOC standards address provision of safe and healthy early care and education environments during the COVID-19 pandemic.

Child Care Settings and Use

Public early education programs (such as Head Start and targeted state-funded prekindergarten programs) have historically been designed as policy mechanisms to close the school readiness gap among children with fewer resources, whereas child care has been seen as necessary when parents (usually mothers) work while their children are young. Despite these historical "silos," all early care and education settings serve both purposes: they are early learning environments for children and necessary supports for working parents.

Quality of care matters for all child care settings, but there are key differences in the structure and provision of care that influence organizational and business operations, regulatory mandates, and accessibility and affordability for families.

Child care settings vary widely and fall into four broad categories from the least to the most formal:

1. Relative or friend cares for a child in the relative's or friend's home or in the child's home
2. Nonrelative care who comes to the child's home, such as nannies, babysitters, or au pairs
3. Home-based child care in which an individual runs a child care business in their own home and cares for a few or several children, often including children of mixed ages, siblings, or the provider's own children
4. Center-based care, provided in nonresidential facilities for children grouped by age, including preschools, prekindergarten programs, Head Start centers, and child care centers.

Child care centers and early education programs are administered by a wide array of businesses and organizations, including for-profit providers or companies, religious organizations, public and private schools including early childhood special education programs, nonprofits and other community organizations, cooperatives, employer-based child care, and public agencies. Increasingly, publicly funded prekindergarten programs contract with existing community-based centers and home-based providers for program delivery. With a few exceptions (such as faith-affiliated child care), center-based child care programs must satisfy state licensing laws for safety practices. For other child care options, governmental oversight for health and safety is rarer; many home-based child care programs are licensed, whereas many others are unknown to regulatory agencies, and family, friend, and nanny care are almost never regulated. Child care licensing and regulation is described in the next section.

Approximately 59% of children 5 years and younger and not yet in kindergarten were in at least 1 weekly nonparental child care arrangement, as reported by their parents in the U.S. Census Bureau's 2019 National Household Education Surveys Program. Forty-two percent of children less than 1 year of age, 55% of 1-2 year olds, and 74% of 3-5 year olds were in nonparental care. Nearly 60% of those in at least one child care arrangement were in a center-based arrangement, 38% were in relative care, and 20% were in nonrelative care in a private home; children may have been in more than one type of arrangement. Center-based arrangements were most common among preschoolers, whereas relative care arrangements were most common among infants.

Child Care Closures

The COVID-19 pandemic accelerated a worsening trend of child care closures. In 2012, there were approximately 129,000 center-based programs serving 6.98 million children from birth through age 5. Between 2014 and 2017, the number of licensed child care programs of all types in the United States decreased to approximately 109,000 centers. The number of listed home-based providers (which includes licensed or otherwise regulated providers) decreased by about 25% between 2012 and 2019.

In response to COVID-19, by April 2020 new state public health requirements resulted in closing 70% of U.S. child care centers; more than 35% of child care workers became unemployed. Reasons for this include COVID-19 outbreaks and preventative health protocols such as social distancing with limits in group sizes and child:staff ratios. As the pandemic continued, reasons for new or even permanent closures included staffing shortages as well as business models that cannot support a program's financial survival at low enrollment rates. However, child masking within the first year of the pandemic was associated with a 13-14% reduction in child care closure rates.

Licensing, Regulation, Monitoring, and Accreditation

State and territory licensing agencies enumerate which providers are subject to licensing to legally operate and monitor those providers' compliance with foundational, mandated regulations to protect children's safety, health, and well-being. Many states and territories also offer systems of child care monitoring that are usually voluntary in nature, such as quality rating and improvement systems (QRIS), and various professional organizations offer voluntary accreditation systems to assess whether providers meet higher-quality standards, often (but not always) requiring licensure as a prerequisite to participation.

Licensing

Licensing and regulatory requirements establish the minimum requirements necessary to protect the health and safety of children in

child care. Typically, these include basic health and safety standards such as sanitary practices, child and provider vaccinations, access to a healthcare professional, and facilities and equipment hazards and safety, as well as basic structural and caregiver characteristics such as background checks, the ratio of children to staff, group sizes, and minimum caregiver education and training requirements. Most child care centers and preschools and many family child care providers are subject to state licensing and regulation. All states regulate child care centers, as does the District of Columbia, and most states regulate family child care providers.

Pediatricians are encouraged to learn about their own state's child care licensing rules. Large differences between states mean large differences in allowable levels of quality. The most common child:staff ratios are 4:1 for infants, 6:1 for toddlers, and 10:1 for preschoolers. However, some states permit ratios that are 5:1 or 6:1 for infants 9 months of age or younger.

State and territory child care licensing regulations are maintained in a searchable National Database of Child Care Licensing Regulations (https://childcareta.acf.hhs.gov/licensing) by the National Center on Early Childhood Quality Assurance (NCECQA). The site provides a tool for searching state and territory licensing regulations and agency contact information. Licensing requirements are frequently updated.

Unlicensed settings and even licensed providers in states with low licensing and regulatory standards may be providing care at quality levels below professional recommendations. Moreover, various types of programs may be exempt from licensure, such as faith-affiliated child care programs, and exemptions are specific to each state; as many as one third of child care centers are legally exempt in some states. Centers are often exempted if care is offered by other organizations such as school districts that provide external oversight. The smallest homes (three or four children in care) are often license-exempt, encompassing relative, friend, and neighbor caregivers as well as babysitters, nannies, and au pairs. Some of these providers and the families who use them may not even think of themselves as providing "child care." The Child Care Development Block Grant (CCDBG) reauthorization in 2014 required states and territories to expand their monitoring of legally exempt providers to protect the health and safety of children receiving subsidized child care. Most states require exempt centers and family child care homes to meet some licensure requirements such as background checks and to receive an annual inspection to receive child care subsidy payments.

Other Quality Monitoring Systems

Several voluntary public and private initiatives require that child care settings meet their own sets of guidelines and regulations in areas considered critical to effective practice and child outcomes to receive either state or federal funding. These diverse initiatives include those that focus on nutrition (the Child and Adult Care Food Program [CACFP]), inclusion (the Individuals with Disabilities Education Act [IDEA]), and financial assistance to low-income working parents (child care subsidies through the CCDBG). Most states have quality initiatives called QRIS. Publicly funded early education programs, including the federal Head Start and Early Head Start program as well as state and local public prekindergarten have their own program performance standards.

Participating providers benefit in ways that may include technical assistance supports, professional development, and additional funding often tied to the numbers of children served under the program. About 75% of early care and education centers report receiving funds from multiple sources. Providers may also value earning a public-facing "seal of approval" to help families learn about higher-quality programs.

These programs all monitor eligibility and compliance with program standards. For example, Head Start and most of the state prekindergarten programs that restrict enrollment to low-income families require verification of family eligibility (although some states' and cities' prekindergarten programs are universally available to all preschool-age children regardless of family income). Other eligibility standards include verification of parental employment for child care subsidies or verification of nutritious food for low-income families for receipt of CACFP funds. Other monitoring may cover staffing, meals and snacks, curricula and teaching, and other areas of service delivery. QRIS systems work within the infrastructure of the early care and education system to assess, incentivize, and support higher levels of quality. Examples of incentives and supports include tiered subsidy reimbursement systems in which participating providers who achieve levels of quality beyond basic licensing requirements are entitled to higher subsidy payments, public funding to facilitate accreditation, professional development systems and coaching, and program assessments and technical assistance.

Accreditation

A smaller portion of providers become accredited by National Association for the Education of Young Children (NAEYC), National Association for Family Child Care (NAFCC), or other organizations by voluntarily meeting high-quality, developmentally appropriate, professionally recommended standards. The accreditation process goes beyond health and safety practices and structural and caregiver characteristics to examine the quality of child–caregiver interactions. Evidence indicates that child care programs that complete voluntary accreditation through NAEYC provide an environment that better facilitates children's overall development, but few providers are accredited. This is partly the result of a lack of knowledge, resources, and incentives for providers to improve quality, but it may also be partly because of expenses providers incur in becoming accredited.

Child Care Access

As one social determinant of health, access to affordable high-quality child care that supports child development and meets family needs is critical.

Access to child care goes beyond simple "supply" (numbers of available slots) and "demand" (numbers of young children needing extrafamilial care). Barriers to access include aspects of affordability, hours of operation, location, transportation, and culturally or linguistically appropriate care. Barriers to access to high-quality child care are pervasive among families in which caregivers work irregular, fluctuating, or nontraditional work schedules, families with infants and toddlers, families for whom English is not the primary language spoken at home, and families with children with disabilities or special needs.

Two thirds of children 5 years of age and younger have both parents in the workforce or in school or training programs. Nearly 30% of low-income mothers of children under 6 years of age work nonstandard hours, but child care supply during nonstandard or irregular hours is extremely limited. Over 30% of parents with children in weekly care report that the arrangement does not cover the hours needed for work very well. Many more report that they are not in the workforce or school, or not working the hours or shifts that they need or want, due to lack of affordable accessible child care.

SCREENING AND SUPPORT FOR CHILD DEVELOPMENT AND HEALTH

Child Care and Child Behavior

Before the COVID-19 pandemic, about 192,000 U.S. young children were being expelled or suspended from child care programs annually for concerns rising from developmentally typical crying and temper tantrums to physical aggression to violations of various "zero tolerance policies," such as bringing a water gun to child care. In fact, young children are expelled from child care and preschool programs at a rate more than 3 times that for kindergarten through 12th graders. Young children experiencing any number of adverse childhood events are at significantly increased odds of preschool expulsion, such as exposure to domestic or community violence, family mental illness and substance abuse, poverty, parental divorce, and parental incarceration. These disciplinary exclusions are disproportionately applied to young males and to children of color; implicit biases account for at least some of these disproportionalities. These early disciplinary exclusions predict later negative school attitudes, academic failure and grade retention, and later expulsions and suspensions, as well as a 10-fold increase in high-school dropout rates and an 8-fold increase in later incarceration.

State efforts to reduce early childhood exclusionary discipline include early childhood mental health consultation (ECMHC) models to support child care providers, who are often not well trained in managing child behavior, as well as build capacity to raise child care quality for all children. ECMHC links a mental health professional with an early education and care provider in an ongoing problem-solving and capacity-building relationship. ECMHC has been shown to be effective in statewide randomized controlled trials, and now exist in several states and cities. Because this is a rapidly evolving area of support, clinicians wishing to provide guidance to parents of young children at risk of early disciplinary exclusion should consider inquiring about the existence of an ECMHC system within their state or locality by contacting their state early childhood department and/or state/local child care resource and referral agency. Local regulations may limit or prohibit the exclusion of children in response to behaviors that may be a symptomatic expression of a diagnosed disability or special education need, providing a potential method for safeguarding a child's ability to receive early care and education, as described in the next section.

Children with Special Needs

Children with cognitive, physical, or emotional disabilities who require special care and instruction often require particular attention when it comes to their participation in most child care settings. Guiding principles of services for children with disabilities advocate supporting children in natural environments, including child care. Furthermore, the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973 prohibit discrimination against children and adults with disabilities by requiring equal access to offered programs and services.

Child care can be, and often is, utilized for delivery of support services to children with special needs and/or for linking families to services such as early intervention. Furthermore, clinicians can draw on child care providers for important evaluative data regarding a child's well-being, as these providers have extensive daily contact with the child and may have broad, professional understanding of normative child development. Child care providers often conduct screenings for developmental milestones and delays using standardized instruments. A child care provider may be the first to identify a child's potential language delay. Child care providers are also necessary and valuable partners in the development and administration of early intervention service plans. However, many child care providers and settings are unprepared to identify or administer services for children with special needs.

Children with special needs may be eligible for special educational services under IDEA. The purpose of this law is to provide "free appropriate public education," regardless of disability or chronic illness, to all eligible children, birth to 21 years of age, in a natural and/or least-restrictive environment. Eligible children include those with mental, physical, or emotional disabilities who, because of their disability or chronic illness, require special instruction to learn. As a part of these services, a formal plan of intervention is to be developed by the service providers, families, and the children's healthcare providers. Federal funds are available to implement a collaborative early intervention system of services for eligible infants and toddlers between the ages of birth and 3 years and their families. These services include screening, assessment, service coordination, and collaborative development of an **individualized family service plan (IFSP).** The IFSP describes early intervention services for the child's health, therapeutic, and educational needs and supports needed by the family. An understanding of the child's routines and real-life opportunities and activities, such as eating, playing, interacting with others, and working on developmental skills, is crucial to enhancing a child's ability to achieve the functional goals of the IFSP. Therefore it is critical that child care providers be involved in IFSP development or revision, with parental consent. Child care providers should also become familiar with the child's IFSP and understand the providers' role and the resources available to support the family and child care provider. Additionally, IDEA provides support for eligible children 3 years of age and older to receive services through the local school district. This includes development of a written **individualized education program (IEP)**, with implementation being the responsibility of the local education agency in either a public or private preschool setting. As with IFSPs, child care providers should become familiar with the preschooler's special needs as identified in the IEP and may become involved, with parental consent, in IEP development and review meetings. In cases where children may have or be at risk of developmental delays, a diagnosis is important for obtaining and coordinating services and further evaluation. To this end, clinicians can partner with child care providers to screen and monitor children's behavior and development. Even if a young child is not being provided special educational services, special accommodations may be requested for any child whose access to child care is being adversely impacted by a diagnosable developmental or behavioral disability through Section 504 of the Rehabilitation Act of 1973.

Sick Children and Control of Infectious Disease

When children are ill, they may be excluded from out-of-home child care and under state licensure child care programs are required to exclude children with certain conditions. Children in child care are of an age that places them at increased risk for acquiring infectious diseases. Participation in group settings elevates exposure, leading to increased infections, especially during the first year of child care exposure and especially with infants. Children enrolled in such settings have a higher incidence of illness (upper respiratory tract infections, otitis media, diarrhea, hepatitis A infections, skin conditions, and asthma) than those cared for at home, especially in the preschool years; these illnesses have no long-term adverse consequences. Child care providers that follow child care licensure guidelines for handwashing, diapering, and food handling, and manage child illness appropriately, can reduce communicable illnesses.

CFOC (2019) and its up-to-date online supplement and the AAP (Table 29.2) offer guidelines and recommendations regarding the conditions under which sick children should and should not be excluded from group programs. State laws typically mirror these guidelines but may be stricter in some states. Although exclusion from child care due to mild illness is often unnecessary, their summary of guidelines states that a child should be excluded temporarily from care if the signs or symptoms of the illness does any of the following:

- Prevents the child from participating in daycare activities
- Results in a level of care that is greater than the staff can provide
- Poses a contagion risk of serious diseases to other children and staff

For COVID-19 exposure or symptoms or recovery go to https://www.cdc.gov/coronavirus/2019-nCoV/index.html

Health checks should be performed on each child every day. If symptoms develop during child care but do not require exclusion, written or verbal communication after the daycare is appropriate. Emergencies must be addressed with 911 calls and immediate notification of the family. If nonemergent but requiring exclusion, the parents should be notified to take the child home. Parents should have a backup plan when exclusions occur. *Return to child care is usually permissible without a primary healthcare visit.*

CFOC also provides guidelines for control of infectious disease outbreaks and for exclusion of any child or staff member who is suspected of contributing to transmission of the illness, who is not adequately immunized when there is an outbreak of a vaccine-preventable disease, or when the circulating pathogen poses an increased risk to the individual.

During the first 3 months of the COVID-19 pandemic in the United States, exposure to child care was not associated with an elevated risk of COVID-19 transmission to adult child care providers within the context of the considerable efforts that were employed to reduce transmission. Although enhanced hand hygiene and surface disinfecting were the most common transmission mitigation methods, many child care programs also engaged in daily symptom screening and temperature checks, social distancing efforts, and cohorting (i.e., keeping groups of children separate to help control the speed of transmission). Despite Centers for Disease Control and Prevention (CDC) guidance, masking of adults and children were rarely employed; federal guidance and requirements in several states, child care provider COVID-19 vaccination rates in June 2021 were only 78.2%. COVID-19 modifications and

Table 29.2 Signs and Symptoms for Consideration of Exclusion or Inclusion in Child Care

SIGN OR SYMPTOM	COMMON CAUSES	COMPLAINTS OR WHAT MIGHT BE SEEN	NOTIFY HEALTH CONSULTANT	NOTIFY PARENT	TEMPORARILY EXCLUDE?	IF EXCLUDED, READMIT WHEN
Cold symptoms	*Viruses* (early stage of many viruses) • Adenovirus • Coronavirus • Enterovirus • Influenza virus • Parainfluenza virus • Respiratory syncytial virus (RSV) • Rhinovirus Bacteria • Mycoplasma • Pertussis	• Coughing • Runny or stuffy nose • Scratchy throat • Sneezing • Fever • Watery eyes	Not necessary unless epidemics occur (i.e., RSV or vaccine-preventable disease like measles or varicella [chickenpox])	Yes	No, unless • Fever accompanied by behavior change. • Child looks or acts very ill. • Child has difficulty breathing. • Child has blood-red or purple rash not associated with injury. • Child meets routine exclusion criteria.	Exclusion criteria are resolved.
Cough (cough is a body response to something that is irritating tissues in the airway anywhere from the nose to the lungs)	• Common cold • Lower respiratory infection (e.g., pneumonia, bronchiolitis) • Croup • Asthma • Sinus infection • Bronchitis • Pertussis • Noninfectious causes like allergies	• Dry or wet cough • Runny nose (clear, white, or yellow-green) • Sore throat • Throat irritation • Hoarse voice, barking cough • Coughing fits	Not necessary unless the cough is due to a vaccine-preventable disease, such as pertussis	Yes	No, unless • Severe cough. • Rapid or difficult breathing. • Wheezing if not already evaluated and treated. • Cyanosis (i.e., blue color of skin or mucous membranes). • Pertussis is diagnosed and not yet treated. • Fever with behavior change. • Child meets routine exclusion criteria.	Exclusion criteria are resolved.
Diaper rash	• Irritation by rubbing of diaper material against skin wet with urine or stool • Infection with yeast or bacteria	• Redness • Scaling • Red bumps • Sores • Cracking of skin in diaper region	Not necessary	Yes	No, unless • Oozing sores that leak body fluids outside the diaper. • Child meets routine exclusion criteria.	Exclusion criteria are resolved.
Diarrhea	• Usually viral, less commonly bacterial or parasitic • Noninfectious causes such as dietary (drinking too much juice), medications, inflammatory bowel disease, or cystic fibrosis	• Frequent loose or watery stools compared with child's normal pattern. (Note that exclusively breastfed infants normally have frequent unformed and somewhat watery stools or may have several days with no stools.) • Abdominal cramps • Fever • Generally not feeling well • Vomiting occasionally present	Yes, if one or more cases of bloody diarrhea or two or more children in same group with diarrhea within a week	Yes	Yes, if • Directed by the local health department as part of outbreak management. • Stool is not contained in the diaper for diapered children. • Diarrhea is causing "accidents" for toilet-trained children. • Stool frequency exceeds 2 stools above normal during the time the child is in the program because this may cause too much work for teachers/caregivers and make it difficult to maintain good sanitation. • Blood/mucus in stool. • Black stools. • No urine output in 8 hours. • Jaundice (i.e., yellow skin or eyes). • Fever with behavior change. • Looks or acts very ill. • Child meets routine exclusion criteria.	• Cleared to return by healthcare provider for all cases of bloody diarrhea and diarrhea caused by Shiga toxin-producing *Escherichia coli, Shigella*, or *Salmonella* serotype Typhi until negative stool culture requirement has been met. • Diapered children have their stool contained by the diaper (even if the stools remain loose) and toilet-trained children do not have toileting accidents. • Stool frequency is no more than 2 stools above normal during the time the child is in the program, or what has become normal for that child when the child seems otherwise well. • Exclusion criteria are resolved.

Continued

Table 29.2 Signs and Symptoms for Consideration of Exclusion or Inclusion in Child Care—cont'd

SIGN OR SYMPTOM	COMMON CAUSES	COMPLAINTS OR WHAT MIGHT BE SEEN	NOTIFY HEALTH CONSULTANT	NOTIFY PARENT	TEMPORARILY EXCLUDE?	IF EXCLUDED, READMIT WHEN
Difficult or noisy breathing	• Common cold • Croup • Epiglottitis • Bronchiolitis • Asthma • Pneumonia • Object stuck in airway • Exposed to a known trigger of asthma symptoms (e.g., animal dander, pollen)	• Common cold: stuffy/runny nose, sore throat, cough, or mild fever • Croup: barking cough, hoarseness, fever, possible chest discomfort (symptoms worse at night), or very noisy breathing, especially when breathing in • Epiglottitis: gasping noisily for breath with mouth wide open, chin pulled down, high fever, or bluish (cyanotic) nails and skin; drooling, unwilling to lie down • Bronchiolitis and asthma: child is working hard to breathe; rapid breathing; space between ribs looks like it is sucked in with each breath (retractions); wheezing; whistling sound with breathing; cold/cough; irritable and unwell. Takes longer to breathe out than to breathe in. • Pneumonia: deep cough, fever, rapid breathing, or space between ribs looks like it is sucked in with each breath (retractions) • Object stuck in airway: symptoms similar to croup (listed previously) • Exposed to a known trigger of asthma symptoms: a known trigger and breathing that sounds or looks different from what is normal for that child	Not necessary except for epiglottitis	Yes	Yes, if • Fever with behavior change. • Child looks or acts very ill. • Child has difficulty breathing. • Rapid or difficult breathing. • Wheezing if not already evaluated and treated. • Cyanosis (i.e., blue color of skin or mucous membranes). • Cough interferes with activities. • Breath sounds can be heard when the child is at rest. • Child has blood-red or purple rash not associated with injury. • Child meets routine exclusion criteria.	Exclusion criteria are resolved.
Earache	• Bacteria • Often occurs in context of common cold virus	• Fever • Pain or irritability • Difficulty hearing • "Blocked ears" • Drainage • Swelling around ear	Not necessary	Yes	No, unless child meets routine exclusion criteria.	Exclusion criteria are resolved.

Table 29.2 Signs and Symptoms for Consideration of Exclusion or Inclusion in Child Care—cont'd

SIGN OR SYMPTOM	COMMON CAUSES	COMPLAINTS OR WHAT MIGHT BE SEEN	NOTIFY HEALTH CONSULTANT	NOTIFY PARENT	TEMPORARILY EXCLUDE?	IF EXCLUDED, READMIT WHEN
Eye irritation, pinkeye	• Bacterial infection of the membrane covering one or both eyes and eyelids (bacterial conjunctivitis) • Viral infection of the membrane covering one or both eyes and eyelids (viral conjunctivitis) • Allergic irritation of the membrane covering one or both eyes and eyelids (allergic conjunctivitis) • Chemical irritation of the membrane covering the eye and eyelid (irritant conjunctivitis) (e.g., swimming in heavily chlorinated water, air pollution, smoke exposure)	• Bacterial infection: pink color of the "whites" of eyes and thick yellow/green discharge. Eyelid may be irritated, swollen, or crusted. • Viral infection: pinkish/red color of the whites of the eye; irritated, swollen eyelids; watery discharge with or without some crusting around the eyelids; may have associated cold symptoms. • Allergic and chemical irritation: red, tearing, itchy, puffy eyelids; runny nose, sneezing; watery/stringy discharge with or without some crusting around the eyelids.	Yes, if two or more children have red eyes with watery discharge	Yes	*For bacterial conjunctivitis* No. Exclusion is no longer required for this condition. Healthcare providers may vary on whether to treat this condition with antibiotic medication. The role of antibiotics in treatment and preventing spread is unclear. Most children with pinkeye get better after 5 or 6 days without antibiotics. *For other eye problems* No, unless child meets other exclusion criteria. *Note:* One type of viral conjunctivitis spreads rapidly and requires exclusion. If two or more children in the group have watery red eyes without any known chemical irritant exposure, exclusion may be required and health authorities should be notified to determine whether the situation involves the uncommon epidemic conjunctivitis caused by a specific type of adenovirus. Herpes simplex conjunctivitis (red eyes with blistering/vesicles on eyelid) occurs rarely and would also require exclusion if there is eye watering.	• *For bacterial conjunctivitis,* once parent has discussed with healthcare provider. Antibiotics may or may not be prescribed. • Exclusion criteria are resolved.
Fever	• Any viral, bacterial, or parasitic infection • Vigorous exercise • Reaction to medication or vaccine • Other noninfectious illnesses (e.g., rheumatoid arthritis, malignancy)	Flushing, tired, irritable, decreased activity *Notes:* • Fever alone is not harmful. When a child has an infection, raising the body temperature is part of the body's normal defense against germs. • Rapid elevation of body temperature sometimes triggers a febrile seizure in young children; this usually is outgrown by age 6 yr. The first time a febrile seizure happens, the child requires medical evaluation. These seizures are frightening but are usually brief (less than 15 minutes) and do not cause the child any long-term harm. Parents should inform their child's healthcare provider every time the child has a seizure, even if the child is known to have febrile seizures. Warning: *Do not* give aspirin. It has been linked to an increased risk of Reye syndrome (a rare and serious disease affecting the brain and liver).	Not necessary	Yes	No, unless • Behavior change or other signs of illness in addition to fever or child meets other routine exclusion criteria. • Unable to participate. • Care would compromise staff's ability to care for other children. *Note:* A temperature considered meaningfully elevated above normal, although not necessarily an indication of a significant health problem, for infants and children older than 2 mo is above 101°F (38.3°C) from any site (axillary, oral, or rectal). *Get medical attention* when infants younger than 4 mo have unexplained fever. In any infant younger than 2 mo, a temperature above 100.4°F (38.0°C) is considered meaningfully elevated and requires that the child get medical attention immediately, within an hour if possible. The fever is not harmful; however, the illness causing it may be serious in this age group.	Exclusion criteria are resolved.

Continued

Table 29.2 Signs and Symptoms for Consideration of Exclusion or Inclusion in Child Care—cont'd

SIGN OR SYMPTOM	COMMON CAUSES	COMPLAINTS OR WHAT MIGHT BE SEEN	NOTIFY HEALTH CONSULTANT	NOTIFY PARENT	TEMPORARILY EXCLUDE?	IF EXCLUDED, READMIT WHEN
Headache	• Any bacterial/viral infection • Other noninfectious causes	• Tired and irritable • Can occur with or without other symptoms	Not necessary	Yes	No, unless child meets routine exclusion criteria. *Note:* Notify healthcare provider in case of sudden, severe headache with vomiting or stiff neck that might signal meningitis. It would be concerning if the back of the neck is painful or the child cannot look at his or her belly button (putting chin to chest)—different from soreness in the side of the neck.	Exclusion criteria are resolved.
Itching	• Ringworm • Chickenpox • Pinworm • Head lice • Scabies • Allergic or irritant reaction (e.g., poison ivy) • Dry skin or eczema • Impetigo	• Ringworm: itchy ring-shaped patches on skin or bald patches on scalp. • Chickenpox: blister-like spots surrounded by red halos on scalp, face, and body; fever; irritable. • Pinworm: anal itching. • Head lice: small insects or white egg sheaths that look like grains of sand (nits) in hair. • Scabies: severely itchy red bumps on warm areas of body, especially between fingers or toes. • Allergic or irritant reaction: raised, circular, mobile rash; reddening of the skin; blisters occur with local reactions (poison ivy, contact reaction). • Dry skin or eczema: dry areas on body. More often worse on cheeks, in front of elbows, and behind knees. In infants, may be dry areas on face and anywhere on body but not usually in the diaper area. If swollen, red, or oozing, think about infection. • Impetigo: areas of crusted yellow, oozing sores. Often around mouth or nasal openings or areas of broken skin (insect bites, scrapes).	Yes, for infestations such as lice and scabies; if more than one child in group has impetigo or ringworm; for chickenpox	Yes	*For chickenpox:* Yes, until lesions are fully crusted *For ringworm, impetigo, scabies, and head lice:* Yes, at the end of the day Children should be referred to a healthcare provider at the end of the day for treatment. *For pinworm, allergic or irritant reactions like hives, and eczema:* No, unless appears infected as a weeping or crusty sore *Note:* Although exclusion for these conditions is not necessary, families should seek advice from the child's health professional for how to care for these health problems. *For any other itching:* No, unless the child meets routine exclusion criteria.	• Exclusion criteria are resolved. • On medication or treated as recommended by a healthcare provider if treatment is indicated for the condition. For conditions that require application of antibiotics to lesions or taking antibiotics by mouth, the period of treatment to reduce risk of spread to others is usually 24 hours. For most children with insect infestations or parasites, readmission as soon as the treatment has been given is acceptable.
Mouth sores	• Oral thrush (yeast infection) • Herpes or coxsackie-virus infection • Canker sores	• Oral thrush: white patches on tongue, gums, and along inner cheeks • Herpes or coxsackievirus infection: pain on swallowing; fever; painful, white/red spots in mouth; swollen neck glands; fever blister, cold sore; reddened, swollen, painful lips • Canker sores: painful ulcers inside cheeks or on gums	Not necessary	Yes	No, unless • Drooling steadily related to mouth sores. • Fever with behavior change. • Child meets routine exclusion criteria.	Exclusion criteria are resolved.

Table 29.2 Signs and Symptoms for Consideration of Exclusion or Inclusion in Child Care—cont'd

SIGN OR SYMPTOM	COMMON CAUSES	COMPLAINTS OR WHAT MIGHT BE SEEN	NOTIFY HEALTH CONSULTANT	NOTIFY PARENT	TEMPORARILY EXCLUDE?	IF EXCLUDED, READMIT WHEN
Rash	Many causes • Viral: roseola infantum, fifth disease, chickenpox, herpesvirus, molluscum contagiosum, warts, cold sores, shingles (herpes zoster), and others • Skin infections and infestations: ringworm (fungus), scabies (parasite), impetigo, abscesses, and cellulitis (bacteria) • Scarlet fever (strep infection) • Severe bacterial infections: meningococcus, pneumococcus, *Staphylococcus* (methicillin-susceptible *S. aureus*; methicillin-resistant *S. aureus*), *Streptococcus* • Noninfectious causes: allergy (hives), eczema, contact (irritant) dermatitis, medication related, poison ivy	• Skin may show similar findings with many different causes. Determining cause of rash requires a competent healthcare provider evaluation that takes into account information other than just how rash looks. However, if the child appears well other than the rash, a healthcare provider visit is not necessary. • Viral: usually signs of general illness such as runny nose, cough, and fever (except not for warts or molluscum). Some viral rashes have a distinctive appearance. • Minor skin infections and infestations: see Itching. • More serious skin infections: redness, pain, fever, pus. • Severe bacterial infections: rare. These children usually have fever with a rapidly spreading blood-red rash and may be very ill. • Allergy may be associated with a raised, itchy, pink rash with bumps that can be as small as a pinpoint or large welts known as hives. See also Itching for what might be seen for allergy or contact (irritant) dermatitis or eczema.	For outbreaks, such as multiple children with impetigo within a group	Yes	No, unless • Rash with behavior change or fever. • Has oozing/open wound. • Has bruising not associated with injury. • Has joint pain and rash. • Rapidly spreading blood-red rash. • Tender, red area of skin, especially if it is increasing in size or tenderness. • Child meets routine exclusion criteria. • Diagnosed with a vaccine-preventable condition, such as chickenpox.	• On antibiotic medication for required period (if indicated). • Infestations (lice and scabies) and ringworm can be treated at the end of the day with immediate return the following day. • Exclusion criteria are resolved.
Sore throat (pharyngitis)	• Viral: common cold viruses that cause upper respiratory infections • Strep throat	• Viral: verbal children will complain of sore throat; younger children may be irritable with decreased appetite and increased drooling (refusal to swallow). Often see symptoms associated with upper respiratory illness, such as runny nose, cough, and congestion. • Strep throat: signs of the body's fight against infection include red tissue with white patches on sides of throat, at back of tongue (tonsil area), and at back wall of throat. Unlike viral pharyngitis, strep throat infections are *not* accompanied with cough or runny nose in children older than 3 yr. • Tonsils may be large, even touching each other. Swollen lymph nodes (sometimes called "swollen glands") occur as body fights off the infection.	Not necessary	Yes	No, unless • Inability to swallow. • Excessive drooling with breathing difficulty. • Fever with behavior change. • Child meets routine exclusion criteria. *Note:* Most children with red back of throat or tonsils, pus on tonsils, or swollen lymph nodes have viral infections. If strep is present, 12 hours of antibiotics is required before return to care. However, tests for strep infection are not often necessary for children younger than 3 yr because these children do not develop rheumatic heart disease, which is the primary reason for treatment of strep throat.	• Able to swallow. • On medication at least 12 hours (if strep). • Exclusion criteria are resolved.

Continued

Table 29.2 Signs and Symptoms for Consideration of Exclusion or Inclusion in Child Care—cont'd

SIGN OR SYMPTOM	COMMON CAUSES	COMPLAINTS OR WHAT MIGHT BE SEEN	NOTIFY HEALTH CONSULTANT	NOTIFY PARENT	TEMPORARILY EXCLUDE?	IF EXCLUDED, READMIT WHEN
Stomachache	• Viral gastroenteritis or strep throat • Problems with internal organs of the abdomen such as intestine, colon, liver, bladder • Nonspecific, behavioral, and dietary causes • If combined with hives, may be associated with a severe allergic reaction	• Viral gastroenteritis or strep throat: Vomiting and diarrhea or cramping are signs of a viral infection of the stomach or intestine. Strep throat may cause stomachache with sore throat, headache, and possible fever. In children older than 3 yr, if cough or runny nose is present, strep is very unlikely. • Problems with internal organs of the abdomen: persistent severe pain in abdomen. • Nonspecific stomachache: vague complaints without vomiting/diarrhea or much change in activity.	If multiple cases in same group within 1 week	Yes	No, unless • Severe pain causing child to double over or scream. • Abdominal pain after injury. • Bloody/black stools. • No urine output for 8 hours. • Diarrhea (see Diarrhea). • Vomiting (see Vomiting). • Yellow skin/eyes. • Fever with behavior change. • Looks or acts very ill. • Child meets routine exclusion criteria.	• Pain resolves. • Able to participate. • Exclusion criteria are resolved.
Swollen glands (properly called swollen lymph nodes)	• Normal body defense response to viral or bacterial infection in the area where lymph nodes are located (i.e., in the neck for any upper respiratory infection) • Bacterial infection of lymph nodes that is more than the normal response to infection near where the lymph nodes are located	• Normal lymph node response: swelling at front, sides, and back of the neck and ear; in the armpit or groin; or anywhere else near an area of an infection. Usually, these nodes are less than 1 inch across. • Bacterial infection of lymph nodes: swollen, warm lymph nodes with overlying pink skin, tender to the touch, usually located near an area of the body that has been infected. Usually these nodes are larger than 1 inch across.	Not necessary	Yes	No, unless • Difficulty breathing or swallowing. • Red, tender, warm glands. • Fever with behavior change. • Child meets routine exclusion criteria.	• Child is on antibiotics (if indicated). • Exclusion criteria are resolved.
Vomiting	• Viral infection of the stomach or intestine (gastroenteritis) • Coughing strongly • Other viral illness with fever • Noninfectious causes: food allergy (vomiting, sometimes with hives), trauma, dietary and medication related, headache	Diarrhea, vomiting, or cramping for viral gastroenteritis	For outbreak	Yes	Yes, if • Vomited more than 2 times in 24 hours • Vomiting and fever • Vomiting with hives • Vomit that appears green/bloody • No urine output in 8 hours • Recent history of head injury • Looks or acts very ill • Child meets routine exclusion criteria.	• Vomiting ends. • Able to participate. • Exclusion criteria are resolved.

From Aronson SS, Shope TR, (eds). *Managing Infectious Diseases in Child Care and Schools: a quick reference guide.* 4th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2017.

considerations are itemized in the Crosswalk (https://nrckids.org/files/CFOC.Crosswalk.pdf) and include, for example, discussion of daily symptom checks for children as well as daily screening procedures and exclusion criteria for staff.

Most families need to arrange to keep sick children at home necessitating staying home from work or having backup plans with an alternative caregiver. Alternative care arrangements outside the home for sick children are relatively rare but may include either (1) care in the child's own center, if it offers special provisions designed for the care of ill children (sometimes called the **infirmary model** or **sick daycare**), or (2) care in a center that serves only children with illness or temporary conditions. Although it is important that such arrangements emphasize preventing further spread of disease, one study found no occurrence of additional transmission of communicable disease in children attending a sick center.

Protection and Promotion of Child Health

Child care has a role in protecting and promoting child health and well-being. Child care providers are often the first to notice signs of child abuse and neglect and are a major source of child welfare referrals. Findings of increased health-related issues in the first year of child care are likely a testament to early detection benefits provided by child care providers.

Sudden Infant Death Syndrome

A disproportionate number of sudden infant death syndrome (SIDS) deaths occur in child care centers or family-based child care homes. Infants who are back-sleepers at home but are put to sleep on their front in child care settings have a higher risk of SIDS. Providers and parents should be made aware of the importance of placing infants on their backs to sleep.

Asthma and Respiratory Illness

Children enrolled in prekindergarten may have a greater risk of asthma diagnosis during prekindergarten but a lower risk in the years following prekindergarten, when compared with children who were not exposed to prekindergarten. Enrollment in prekindergarten may increase the early detection of asthma symptoms.

A 10-year follow-up of a birth cohort has found no association between child care attendance and respiratory infections, asthma, allergic rhinitis, or skin-prick test reactivity. Another study found that in the first year of elementary school, children who had attended child care had fewer absences from school, half as many episodes of asthma, and less acute respiratory illness than their peers who had never attended child care. These results are perhaps related to protection against respiratory illness through early exposure or a shift in the age-related peak of illness, although selection of illness-prone children into homecare may play a role. Other factors include children in child care potentially being less exposed to passive smoking than children at home.

Vision and Hearing Problems

Children enrolled in a citywide universal prekindergarten program had higher probability of diagnosis of vision problems, receipt of treatment for hearing or vision problems, and receiving an immunization. These effects were not offset by lower rates in the kindergarten year, suggesting that identification and treatment of these conditions was accelerated by enrollment in universal prekindergarten. As hearing and vision problems could potentially delay learning and cause behavioral problems, early detection and treatment is beneficial for future health and school readiness.

Obesity and Promotion of Healthy Behaviors

There is insufficient research on longitudinal associations between child care, diet, and physical activity behaviors. Some limited research suggests a negative or mixed association between child care exposure and healthy behaviors, but the strength of these associations, and whether any causal implications exist, are difficult to tease apart. Other research suggests that child care center-based interventions are generally found to be effective in improving physical activity and may be effective at improving dietary behaviors.

The CDC identifies child care settings as one of the best places to reach young children with obesity prevention efforts. Through their Spectrum of Opportunities framework (https://www.cdc.gov/obesity/strategies/childcareece.html), they outline how a state's early care and education system can embed recommended standards and support for obesity prevention, including nutrition, infant feeding, physical activity, and screen time.

ROLE OF PEDIATRIC PROVIDERS

Consultation, Referrals, and Screening to Improve Access

Many parents are first-time purchasers of child care with little experience and very immediate needs; they may select care in a market that does little to provide them with useful information about child care arrangements. To inform their child care decisions, parents may turn to their child's healthcare provider as the only professional with expertise in child development with whom they have regular and convenient contact. Primary care clinicians should screen for child care just as they do for other social determinants of health, asking about child care arrangements and offering information about resources to help find and pay for child care to reinforce the importance of child care and increase the chances that children are enrolled in high-quality settings.

It is difficult for many parents to find high-quality child care that they can accept and afford. Many parents also worry how their child will fare in child care (e.g., they may worry that their child will feel distressed by the group settings, suffer from separation from the parents, or even be subjected to neglect or abuse). Practical concerns of transportation, scheduling to cover their work or school hours, and reliability are also common. The reliability of the arrangement is often rated as a "very important" selection factor by a higher proportion of parents than any other factor, followed by availability and staff qualifications. Among those who reported difficulty finding child care, cost was most often the primary reason, followed by lack of open slots, quality, then location or other reasons. Worries about finding quality child care are especially likely among parents with greater barriers to child care access and fewer personally accessible family and community resources. With the coronavirus pandemic, parents may be worried about the transmission of COVID-19 and about sporadic disruptions in service caused by quarantines or temporary closures, and unfounded fears about the safety of vaccines or facial masks.

Primary care practices can share information with parents about publicly available sources of information to help them find or pay for child care (Table 29.3). For example, they can

- Refer low-income parents to Head Start, which serves 3-4 year old children, or Early Head Start programs, which serves low-income expecting families and their children until their child's third birthday
- Refer low-income working parents to apply for child care subsidies and financial assistance in their state or county
- Refer parents to their local child care resource and referral agency for help finding and selecting child care; these can be located via the national association, Child Care Aware of America (www.childcareaware.org/families)

Some parents may think of child care only as babysitting focusing mainly on whether the child is safe and warm and may not fully appreciate the potential consequences of unenriched care for their child's cognitive, linguistic, and social development. These parents may be less likely to select a high-quality child care arrangement. Healthcare providers can help parents understand the importance for their child's development of selecting high-quality care by describing how it looks and providing referrals and tips on how to find and select high-quality child care. Families facing socioeconomic challenges accessing high-quality care should be referred to available resources listed previously and in Table 29.3.

When a healthcare provider talks with a parent about a child care arrangement, it also is important to consider the individual child's health concerns, dispositions, and physiologic responses to the environment. Like all environments, child care is experienced differently

Table 29.3 Child Care Information Resources

ORGANIZATION	SPONSOR	WEBSITE AND CONTACT INFORMATION
All Our Kin		https://allourkin.org/
Caring for Our Children: National Resource Center for Health and Safety in Child Care and Early Education (NRC)	American Academy of Pediatrics, the American Public Health Association, and the National Resource Center for Health and Safety in Child Care and Early Education	*Caring for Our Children, National Health and Safety Performance Standards* https://nrckids.org/CFOC
Child Care Aware of America		http://www.childcareaware.org
Healthy Child Care America	American Academy of Pediatrics	http://www.healthychildcare.org
HealthySteps	Zero to Three	https://www.healthysteps.org/
National Association for the Education of Young Children (NAEYC)		http://www.naeyc.org
National Association for Family Child Care		https://nafcc.org/
National Black Child Development Institute		https://www.nbcdi.org/
National Database of Child Care Licensing Regulations	National Center on Early Childhood Quality Assurance (NCECQA) funded by the U.S. Department of Health and Human Services, Administration for Children and Families.	https://childcareta.acf.hhs.gov/licensing
National Indian Child Care Association		https://www.nicca.us/
Office of Child Care (OCC)	U.S. Department of Health and Human Services, Administration for Children & Families	http://www.acf.hhs.gov/programs/occ
Office of Child Care Technical Assistance Network (CCTAN)	U.S. Department of Health and Human Services, Administration for Children & Families, Office of Child Care	https://childcareta.acf.hhs.gov/
UnidosUS		https://www.unidosus.org/
Zero to Three		https://www.zerotothree.org/

by different children. When an environment lacks adequate support for a child's unique needs, healthy development can be compromised. Some children may be more vulnerable to low-quality child care (or particularly responsive to high-quality child care), such as children with difficult or fearful temperaments, especially if their home environments are characterized by more risk factors, such as poverty or high conflict with a parent. Clinicians can help parents determine how to adjust child care arrangements to best meet their child's specific needs (e.g., allergies, eating and sleeping habits, temperament, and stress-regulation capacities).

Children Who Are Expelled from Child Care

A provider may tell a parent that they will not continue to serve a child because of the child's behaviors. Such expulsions are prohibited in some regulated child care settings, such as Head Start and many state-funded prekindergarten programs. In addition to complete termination of a child's child care arrangement (expulsion), children are sometimes told that they cannot attend for a certain number of days (suspension) or have their hours of care reduced, sent home from care early, or excluded in other ways. Regardless of the form of the exclusion or its stated reason, the result is often extremely stressful for the child and family, and often the child care provider too. Indeed, parents may lose their jobs due to the resulting lack of reliable child care or resort to dangerous alternatives, such as leaving the child unattended or in an unsafe arrangement. Healthcare providers should play an important role during child care expulsions by supporting families' efforts to find alternative care, perhaps through a referral to their local child care resource and referral agency, assessing for any potentially contributory underlying developmental or behavioral concerns, and asking parents about the safety of any alternative care arrangements. (See Standard 2.2.0.8 [Preventing Expulsions, Suspensions, and Other Limitations in Services] of Caring for Our Children, as well as the most recent policy statement on this issue by the AAP.)

Supporting Parents Regarding Children's Health

Parents frequently may ask primary care clinicians about sick children, exposure to and prevention of risks in child care, and support for children with special needs in child care. When children are ill, parents should be advised to follow guidelines for inclusion and temporary exclusion (see CFOF, CDC, and state guidelines) (see Table 29.2). Parents may disagree with child care staff about whether a child meets or does not meet the exclusion criteria, as a substantial amount of work absenteeism is due to a child illness, showing the impact of lost child care on parental employment. However, professional guidelines in CFOC state that if the reason for exclusion relates to the child's ability to participate or the caregiver's ability to provide care for the other children, the caregiver should not be required to accept responsibility for the care of the child.

Primary care clinicians should emphasize that parents of infants ensure that child care providers put infants on their backs to sleep to prevent SIDS and follow vaccination schedules, including COVID-19 vaccination as it is available to children of younger ages. Most states require compliance with scheduled vaccinations for children to participate in licensed group child care settings. As of October 2021, only three states (Connecticut, Illinois, New Jersey, and Washington) plus the District of Columbia required child care providers to be vaccinated against COVID-19 and/or participate in regular testing.

Helping Families of Children with Special Needs

Healthcare providers should work with parents and communicate with other service providers and early intervention staff to identify problems, remove access barriers, and coordinate service delivery for children with special needs. They should also encourage involvement of parents and child care providers in developing special education plans such as IEPs and IFSPs. Federal law emphasizes the central role of the family in the development of these plans, and the team writing this plan must consist of the parent or legal guardian and other professionals

that may be involved in the provision of these services, including child care providers. Healthcare providers have an important role to play on these IFSP teams and may attend meetings at the request of the family. Many children with developmental or other special needs that would qualify them for early childhood special education services will present with health concerns, making the healthcare professionals an essential part of adequate early education planning. Additionally, healthcare professionals may support a child's civil rights to access public services such as preschool when their access or ability to participate fully in the program are at risk of limitation due to a diagnosable disability, health, or mental health condition. Often this may require writing a letter stating the nature of the medical condition and the types of accommodations that may improve the child's ability to participate more fully in the range of activities offered by the program. By supporting a child's civil rights under Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, clinicians can and should play an integral role for safeguarding the rights of their patients.

Consulting and Partnering with Child Care Providers

Most state regulations mandate that licensed programs have a formal relationship with a healthcare provider. They can provide consultation to child care providers about measures to protect and maintain the health and safety of children and staff. This may include consultation regarding promoting practices to prevent SIDS; preventing and reducing the spread of communicable disease; reducing allergen, toxin, and parasite exposure; ensuring vaccinations for children and staff; removing environmental hazards; and preventing injuries. In some cases pediatricians have provided ongoing health and mental health consultation to child care programs, such through highly successful programs like HealthySteps (https://www.healthysteps.org/) and "Docs for Tots" (https://docsfortots.org/).

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Chapter 30

Loss, Separation, and Bereavement

Megan E. McCabe and Janet R. Serwint

All children will experience involuntary separations, whether from illness, death, or other causes, from loved ones at some time in their lives. Relatively brief separations of children from their parents usually produce minor transient effects, but more enduring and frequent separation may cause sequelae. The potential impact of each event must be considered in light of the age, stage of development, and experiences of the child; the particular relationship with the absent person; and the nature of the situation.

SEPARATION AND LOSS

Separations may be from temporary causes, such as vacations, parental job requirements, natural disasters or civil unrest, or parental or sibling illness requiring hospitalization. More long-term separations occur as a result of divorce, placement in foster care, or immigration, whereas permanent separation may occur because of death. The initial reaction of young children to separation of any duration may involve crying, such as a tantrum type, protesting type, and a quieter, sadder type. Children's behavior may appear subdued, withdrawn, fussy, or moody, or they may demonstrate resistance to authority. Specific problems may include poor appetite, behavior issues such as acting against caregiver requests, reluctance to go to bed, sleep problems, or regressive behavior, such as requesting a bottle or bed-wetting. School-age children may experience impaired cognitive functioning and poor performance in school. Some children may repeatedly ask for the absent parent and question when the absent parent will return. The child may go to the window or door or out into the neighborhood to look for the absent parent; a few may even leave home or their place of temporary placement to search for their parents. Other children may not refer to the parental absence at all.

A child's response to reunion may surprise or alarm an unprepared parent. A parent who joyfully returns to the family may be met by wary or cautious children. After a brief interchange of affection, children may seem indifferent to the parent's return. This response may indicate anger at being left or wariness that the event will happen again, or the young child may feel, as a result of **magical thinking** (see Chapter 25), as if the child caused the parent's departure. For example, if the parent who frequently says "Stop it, or you'll give me a headache" is hospitalized, the child may feel at fault and guilty. Because of these feelings, children may seem more closely attached to the present parent than to the absent one, or even to the grandparent or babysitter who cared for them during their parent's absence. Some children, particularly younger ones, may become more clinging and dependent than they were before the separation, while continuing any regressive behavior that occurred during the separation. Such behavior may engage the returned parent more closely and help to reestablish the bond that the child felt was broken. Such reactions are usually transient, and within 1-2 weeks, children will have recovered their usual behavior and equilibrium. Recurrent separations may tend to make children wary and guarded about reestablishing the relationship with the repeatedly absent parent, and these traits may affect other personal relationships. Parents should be advised not to try to modify a child's behavior by threatening to leave.

DIVORCE

More sustained experiences of loss, such as divorce or placement in foster care, can give rise to the same kinds of reactions noted earlier, but they are more intense and possibly more lasting. Currently in the United States, approximately 40% of first marriages end in divorce. Divorce has been found to be associated with negative parent functioning, such as parental depression and feelings of incompetence; negative child behavior, such as noncompliance and whining; and negative parent–child interaction, such as inconsistent discipline, decreased communication, and decreased affection. Greater childhood distress is associated with greater parental distress. Continued parental conflict and loss of contact with the noncustodial parent is common.

Two of the most important factors that contribute to morbidity of the children in a divorce include *parental psychopathology* and *disrupted parenting* before the separation. The year after the divorce is the period when problems are most apparent; these problems tend to dissipate over the next 2 years. Depression may be present up to 5 years later, and educational or occupational decline may occur even 10 years later. It is difficult to sort out all confounding factors. Children may suffer when exposed to parental conflict that continues after divorce and that in some cases may escalate. The degree of *interparental conflict* may be the most important factor associated with child morbidity. A continued relationship with the noncustodial parent when there is minimal interparental conflict is associated with more positive outcomes.

School-age children may become depressed, may seem indifferent, or may be extremely angry. Other children appear to deny or avoid the issue, behaviorally or verbally. Most children cling to the hope that the actual placement or separation is not real and only temporary. The child may experience guilt by feeling that the loss, separation, or placement represents rejection and perhaps punishment for misbehavior. Children may protect a parent and assume guilt, believing that their own "badness" caused the parent to depart. Children who feel that their misbehavior caused their parents to separate may have the fantasy that their own trivial or recurrent behavioral patterns caused their parents to become angry at each other. A child might perceive that outwardly

blaming parents is emotionally risky; parents who discover that a child harbors resentment might punish the child further for these thoughts or feelings. Some children have behavioral or psychosomatic symptoms and unwittingly adopt a "sick" role as a strategy they hope will reunite their parents.

In response to divorce of parents and the subsequent separation and loss, older children and adolescents usually show intense anger. Five years after the breakup, approximately 30% of children report intense unhappiness and dissatisfaction with their life and their reconfigured family; another 30% show clear evidence of a satisfactory adjustment; and the remaining children demonstrate a mixed picture, with good achievement in some areas and faltering achievement in others. After 10 years, approximately 45% do well, but 40% may have academic, social, or emotional problems. As adults, some are reluctant to form intimate relationships, fearful of repeating their parents' experience.

Parental divorce has a moderate long-term negative impact on the adult mental health status of children, even after controlling for changes in economic status and problems before divorce. Good adjustment of children after a divorce is related to ongoing involvement with two psychologically healthy parents who minimize conflict and to the siblings and other relatives who provide a positive support system. Divorcing parents should be encouraged to avoid adversarial processes and to use a trained mediator to resolve disputes if needed. Joint-custody arrangements may reduce ongoing parental conflict, but children in joint custody may feel overburdened by the demands of maintaining a strong presence in two homes.

When the primary care provider is asked about the effects of divorce, parents should be informed that different children may have different reactions, but that the parents' behavior and the way they interact will have a major and long-term effect on the child's adjustment. The continued presence of both parents in the child's life, with minimal interparental conflict, is most beneficial to the child.

MOVE/FAMILY RELOCATION

A significant proportion of the U.S. population changes residence each year. The effects of this movement on children and families are frequently overlooked. For children, the move is essentially involuntary and out of their control. When changes in family structure such as divorce or death precipitate moves, children face the stresses created by both the precipitating events and the move itself. Parental sadness surrounding the move may transmit unhappiness to the children. Children who move lose their old friends, the comfort of a familiar bedroom and house, and their ties to school and community. They not only must sever old relationships but also are faced with developing new ones in new neighborhoods and new schools. Children may enter neighborhoods with different customs and values, and because academic standards and curricula vary among communities, children who have performed well in one school may find themselves struggling in a new one. Frequent moves during the school years are likely to have adverse consequences on social and academic performance.

Migrant children and children who emigrate from other countries present with special circumstances. These children not only need to adjust to a new house, school, and community, but also need to adjust to a new culture and in many cases a new language. Because children have faster language acquisition than adults, they may function as translators for the adults in their families. This powerful position may lead to role reversal and potential conflict within the family. In the evaluation of migrant children and families, it is important to ask about the circumstances of the migration, including legal status, violence or threat of violence, conflict of loyalties, and moral, ethical, and religious differences.

Parents should prepare children well in advance of any move and allow them to express any unhappy feelings or misgivings. Parents should acknowledge their own mixed feelings and agree that they will miss their old home while looking forward to a new one. Visits to the new home in advance are often useful preludes to the actual move. Transient periods of regressive behavior may be noted in preschool children after moving, and these should be understood and accepted. Parents should assist the entry of their children into the new community, and whenever possible, exchanges of letters and visits with old friends should be encouraged.

SEPARATION BECAUSE OF HOSPITALIZATION

Potential challenges for hospitalized children include coping with separation; adapting to the new hospital environment; adjusting to multiple caregivers; seeing very sick children; and sometimes experiencing the disorientation of intensive care, anesthesia, and surgery. To help mitigate potential problems, a preadmission visit to the hospital can help by allowing the child to meet the people who will be offering care and ask questions about what will happen. Parents of children <5-6 years old should room with the child if feasible. Older children may also benefit from parents or other family members staying with them while in the hospital, depending on the severity of their illness. Creative and active recreational or socialization programs with child life specialists, chances to act out feared procedures in play with dolls or mannequins, and liberal visiting hours, including visits from siblings, are all helpful. Sensitive, sympathetic, and accepting attitudes toward children and parents by the hospital staff are very important. Healthcare providers need to remember that parents have the best interest of their children at heart and know their children the best. Whenever possible, school assignments and tutoring for hospitalized children should be available to engage them intellectually and prevent them from falling behind in their scholastic achievements.

The psychologic aspects of illness should be evaluated from the outset, and physicians should act as a model for parents and children by showing interest in a child's feelings, allowing them a venue for expression, and demonstrating that it is possible and appropriate to communicate about discomfort. Continuity of medical personnel may be reassuring to the child and family.

MILITARY FAMILIES

More than 2 million children live in military families in the United States, and approximately 50% of them obtain medical care in the community rather than at a military medical facility. Children whose parents are serving in the military may experience loss and separation in multiple ways. These include frequent relocations, relocation to foreign countries, and duty-related separation from parents. The most impactful experiences have been repeated wartime deployments of parents and the death of parents during military service. All branches of the military have increased their focus on preparing and supporting military families for a service member's deployment to improve family coping. Military families composed of young parents and young children are at risk for child maltreatment in the context of repeated or prolonged deployments.

PARENTAL/SIBLING DEATH

Approximately 5–8% of U.S. children will experience parental death; rates are much higher in parts of the world more directly affected by war, AIDS, and natural disasters. Anticipated deaths from chronic illness may place a significant strain on a family, with frequent bouts of illness, hospitalization, disruption of normal home life, absence of the ill parent, and perhaps more responsibilities placed on the child. Additional strains include changes in daily routines, financial pressures, and the need to cope with aggressive treatment options.

Children can and should continue to be involved with the sick parent or sibling, but they need to be prepared for what they will see in the home or hospital setting. The stresses that a child will face include visualizing the physical deterioration of the family member, helplessness, and emotional lability. Forewarning the child that the family member may demonstrate physical changes, such as appearing thinner or losing hair, will help the child to adjust. These warnings combined with simple yet specific explanations of the need for equipment, such as a nasogastric tube for nutrition, an oxygen mask, or a ventilator, will help lessen the child's fear. Children should be honestly informed of what is happening, in language they can understand, allowing them choices, but with parental involvement in decision-making. They should be encouraged, but not forced, to see their ill family member. Parents who are caring for a dying spouse or child may be too emotionally depleted

to be able to tend to their healthy child's needs or to continue regular routines. Children of a dying parent may suffer the loss of security and belief in the world as a safe place, and the surviving parent may be inclined to impose his or her own need for support and comfort onto the child. However, the well parent and caring relatives must keep in mind that children need to be allowed to remain children, with appropriate support and attention. Sudden, unexpected deaths lead to more anxiety and fear because there is no time for preparation, and explanations for the death can cause uncertainty. Examples of this may be death of a parent due to a motor vehicle crash, homicide or suicide, sudden health-related issue such as a myocardial infarction or stroke, or from infection such as the recent COVID pandemic. Providing support to the child is paramount to allow him or her to express sorrow and grief and to have stability in the child's remaining relationships.

GRIEF AND BEREAVEMENT

Grief is a personal, emotional state of bereavement or an anticipated response to loss, such as a death. Common reactions include sadness, anger, guilt, fear, and at times, relief. The normality of these reactions needs to be emphasized. Most bereaved families remain socially connected and expect that life will return to some new, albeit different, sense of normalcy. The pain and suffering imposed by grief should never be automatically deemed "normal" and thus neglected or ignored. In **uncomplicated grief** reactions, the steadfast concern of the pediatrician can help promote the family's sense of well-being. In more distressing reactions, as seen in traumatic grief of sudden death, the pediatrician may be a major, first-line force in helping children and families address their loss.

Participation in the care of a child with a life-threatening or terminal illness is a profound experience. Parents experience much anxiety and worry during the final stages of their child's life. In one study, 45% of children dying from cancer died in the pediatric intensive care unit, and parents report that 89% of their children suffered "a lot" or "a great deal" during the last month of life. Physicians consistently underreport children's symptoms compared with parents' reports. Better ways are needed to provide care for dying children. Providers need to maintain honest and open communication, provide appropriate pain management, and meet the families' wishes as to the preferred location of the child's death, in some cases in their own home. Inclusion of multiple disciplines, such as hospice, clergy, nursing, pain service, child life specialists, social work, and pet therapy, often helps to support patients and families fully during this difficult experience.

The practice of withholding information from children and parents regarding a child's diagnosis and prognosis has generally been abandoned, because physicians have learned that protecting parents and patients from the seriousness of their child's condition does not alleviate concerns and anxieties. Even very young children may have a real understanding of their illness. Children who have serious diseases and are undergoing aggressive treatment and medication regimens, but who are told by their parents that they are okay, are not reassured. These children understand that something serious is happening to them, and they are often forced to suffer in silence and isolation because the message they have been given by their parents is to not discuss it and to maintain a cheerful demeanor. Children have the right to know their diagnosis and should be informed early in their treatment. The content and depth of the discussion needs to be tailored to the child's personality and developmental level of understanding. Parents have choices as to how to orchestrate the disclosure. Parents may want to be the ones to inform the child themselves, may choose for the pediatric healthcare provider to do so, or may do it in partnership with the pediatrician.

A **death**, especially the death of a family member, is the most difficult loss for a child. Many changes in normal patterns of functioning may occur, including loss of love and support from the deceased family member, a change in income, the possible need to relocate, less emotional support from surviving family members, altering of routines, and a possible change in status from sibling to only child. Relationships between family members may become strained, and children may blame themselves or other family members for the death of a parent or sibling. Bereaved children may exhibit many of the emotions discussed earlier as a result of the loss, in addition to behaviors of withdrawal into their own world, sleep disturbances, nightmares, and symptoms such as headache, abdominal pains, or possibly symptoms similar to those of the family member who has died. Children 3-5 years of age who have experienced a family bereavement may show regressive behaviors such as bed-wetting and thumb sucking. School-age children may exhibit nonspecific symptoms, such as headache, abdominal pain, chest pain, fatigue, and lack of energy. Children and adolescents may also demonstrate enhanced anxiety if these symptoms resemble those of the family member who died. Bereavement may be measured by various published scales (Table 30.1). Behavioral patterns of *persistent complex bereavement disorder* are noted in Table 30.2.

Table 30.1 Example Items from the Three Grief Measurement Tools Assessed Through Cognitive Interviewing

CORE BEREAVEMENT ITEMS (CBI)
Do you experience images of the events surrounding your loved one's death? Do thoughts of your loved one make you feel distressed?
Do you find yourself pining for/yearning for your loved one?
Do reminders of your loved one such as photos, situations, music, places, etc., cause you to feel loneliness?
Do reminders of your loved one such as photos, situations, music, places, etc. cause you to cry about your loved one?
Response options: A lot of the time; Quite a bit of the time; A little bit of the time; Never
GRIEF COGNITIONS QUESTIONNAIRE FOR CHILDREN (GCQ-C)
Since my loved one died, I think of myself as a weak person.
I should have seen to it that he/she would not have died.
I blame myself for not having cared for him/her better than I did. It is not nice toward him/her, when I will begin to feel less sad. My life is worthless since he/she died.
Response options: Hardly ever; Sometimes; Always
INTRUSIVE GRIEF THOUGHTS SCALE (IGTS)
(During the past 4 wk) How often did you think about the death of your loved one?
How often did you find yourself thinking how unfair it is that your loved one died, even though you didn't want to think about it?
How often did you have trouble falling asleep because you were thinking about your loved one's death? How often have you had bad dreams related to your loved one's death?
How often did you have trouble doing things you like because you were worrying about how you and your family will get along?
Response options: Several times a day; About once a day; Once or twice a week; Less than once a week; Not at all

From Taylor TM, Thurman TR, Nogela L. Every time that month comes, I remember: using cognitive interviews to adapt grief measures for use with bereaved adolescents in South Africa. *J Child Adolesc Mental Health.* 2016;28(2):163–174, Table 1, p 166.

The presence of secure and stable adults who can meet the child's needs and who permit discussion about the loss is most important in helping a child to grieve. The pediatrician should help the family understand this necessary presence and encourage the protective functioning of the family unit (Table 30.3). More frequent visits to the healthcare professional may be necessary to address these symptoms and provide reassurance when appropriate. Suggested availability of clergy or mental health providers can provide additional support and strategies to facilitate the transitions after the death.

Death, separation, and loss as a result of **natural catastrophes** and **human-made disasters** have become increasingly common events in children's lives. Exposure to such disasters occurs either directly or indirectly, where the event is experienced through the media. Examples of **indirect exposure** include scenes of earthquakes, hurricanes, tsunamis, tornadoes, and terrorist attacks. Children who experience personal loss in disasters tend to watch more media coverage than children who do not. Children without a personal loss watch as a way of participating in the event and may thus experience repetitive exposure to traumatic scenes and stories. The loss and devastation for a child who personally lives through a disaster are significant; the effect of the simultaneous occurrence of disaster

Table 30.2 Developmental Manifestations of Persistent Complex Bereavement Disorder in Children and Adolescents: Developmental Considerations and Symptom Manifestation in Youth

CRITERION A	**CHILD HAS EXPERIENCED THE DEATH OF A LOVED ONE**
CRITERION B	
B1: Expression of persistent yearning or longing for the deceased	Children have an evolving understanding of the permanence of death, particularly among young children; behavioral expressions of separation distress from surviving caregivers are common, as are reunification fantasies (i.e., wanting to die to be reunited with the parent in the afterlife)
B2: Intense sorrow or emotional pain	Children focus on the more salient immediate physical environment rather than their own internal state; young children often have difficulties expressing inner mood; overt expressions of emotional pain might be interspersed within seemingly normal mood, which can lead to others incorrectly assuming they are not grieving
B3: Preoccupation with the person who died	Children might become distressed when separated from the deceased parent's belongings; it is common for youth to seek out physical connections to their parent, including sleeping in the parent's bed, or wearing their clothing or jewelry
B4: Preoccupation with the circumstances of the death	Young children might reenact the death through play, sometimes with alternate (i.e., counterfactual) actions that depict what children feel they or others could have done to prevent the death; reenacting might also take the form of drawing disturbing scenes or aspects of the death
CRITERION C	
C3: Difficulties related to positive reminiscing about the deceased	Children's ability to reminisce matures with development and is often facilitated by surviving caregivers
C4: Bitterness or anger related to the loss	Youth might show overall irritability, oppositional behavior, and problem behavior in the context of bereavement; externalizing behaviors are often precipitated by changes to the youth's daily routine that are a result of the parent's absence (including others assuming the deceased parent's roles)
C5: Maladaptive self-appraisals in relation to the deceased or the death	Youth, particularly adolescents, might become preoccupied by a perceived accountability (e.g., blaming others or oneself for their parent's death); in young children, this might manifest as magical thinking that their own thoughts or actions caused their parents to die
C6: Excessive avoidance of reminders of the loss	Avoidance might not always be under a child's control (e.g., a parent might choose not to bring the child to the gravesite, which prevents the child from confronting that reminder)
C7: Desire not to live so that they can be with the deceased	Children and adolescents often experience suicidal ideation as a means of reunification fantasies, and their reduced understanding of the complexities of death might exacerbate this mindset among young children; suicidal ideation associated with reunification fantasies might not be accompanied by intent or planning; adolescents might engage in risk-taking behaviors (e.g., substance use, reckless driving)
C8: Difficulty trusting other people since the death	Children might have difficulty establishing relationships with new caregivers, which is often reflective of difficulty with new life circumstances, rather than lack of trust; youth might also display overt anger or oppositional and defiant behaviors toward the surviving or new caregiver
C9: Feeling alone or detached from others since the death	Youth often report feelings of alienation from other peers who have not experienced a similar loss, particularly when reminders of this difference are salient (e.g., seeing other classmates' parents coming to a school event); children and adolescents might conceal their own grief reactions to protect their caregivers from additional distress
C10: Feeling that life is meaningless or empty without the deceased or the belief that they cannot function without the deceased	Developmental regressions (e.g., regression in toileting or language among young children; loss of study skills or emotion regulation in adolescents) are common, as are disruptions to sleep and appetite patterns; adolescents can show a lack of engagement in preparations for adulthood (e.g., applying to jobs)
C11: Confusion about their role in life or a diminished sense of their identity	Youth can express sadness over lost opportunities they were planning to experience with their deceased caregiver (e.g., riding a bicycle, walking down the aisle at their wedding); adolescents might show disorganization, lack of direction, or both

The letters and numbers refer to the symptom within each diagnostic criterion (e.g., criterion B, 4th symptom). Persistent complex bereavement disorder symptom criteria and descriptions have been adapted to the context of parental death.

From Kentor RA, Kaplow JB. Supporting children and adolescents following parental bereavement: guidance for health-care professionals. *Lancet Child Adolesc.* 2020;4:889–898, p 891.

and personal loss complicates the bereavement process as grief reactions become interwoven with posttraumatic stress symptoms (see Chapter 38). After a death resulting from aggressive or traumatic circumstances, access to expert help may be required. Under conditions of threat and fear, children seek proximity to safe, stable, protective figures.

It is important for parents to grieve with their children. Some parents want to protect their children from their grief, so they put on an outwardly brave front or do not talk about the deceased family member or traumatic event. Instead of the desired protective effect, the child receives the message that demonstrating grief or talking about death is wrong, leading the child to feel isolated, grieve privately, or delay grieving. The child may also conclude that the parents did not really care about the deceased because they seem to have forgotten the person so easily or demonstrate no emotion. The parents' efforts to avoid talking about the death may cause the parents to isolate themselves from their children at a time when the children most need them. Children need to know that their parents love them and will continue to protect them. Children need opportunities to talk about their relative's death and associated memories. A surviving sibling may feel guilty simply because he or she survived, especially if the death was the result of an accident that involved both children. Siblings' grief, especially when compounded by feelings of guilt, may manifest as regressive behavior or anger. Parents should be informed of this possibility and encouraged to discuss it with their children.

Table 30.3 Recommendations for Healthcare Professionals for Helping Children After Bereavement

- Help children and families recognize that there is no correct way to grieve and that every child grieves differently
- Help caregivers recognize that child grief is not the same as adult grief, and children express their grief reactions in very different ways
- Help caregivers understand that the circumstances of the death can play a major role in children's grief reactions, and deaths by homicide or suicide might be especially difficult for children (therefore could require more intensive mental healthcare)
- Empower caregivers by explaining they can be instrumental in facilitating adaptive grief in their children by providing empathy, reassurance, and a listening ear, and talking openly about the deceased person with their child
- Help caregivers to use language accessible to children when talking about the death, meaning that they should use simple and straightforward language that is appropriate for the child's developmental stage, and let the child ask questions as opposed to providing a lot of detailed information
- Provide accurate information to children about the cause of death; children can become preoccupied with thoughts about contagion (e.g., "will I catch cancer too?") or worries about the caregiver's level of suffering (e.g., "did it hurt when my dad had a stroke?"), and healthcare professionals can help children understand the circumstances of the death and assist in alleviating some of these concerns
- Never underestimate the importance of simply bearing witness to a child's grief; our society often sends children messages that it is not okay to talk about their own grief, and in allowing them the space to do that, healthcare professionals can help to both normalize and validate their reactions.

From Kentor RA, Kaplow JB. Supporting children and adolescents following parental bereavement: guidance for health-care professionals. *Lancet Child Adolesc.* 2020;4:889–898, p 896.

DEVELOPMENTAL PERSPECTIVE

Children's responses to death reflect the family's current culture, their past heritage, their experiences, and the sociopolitical environment. Personal experience with terminal illness and dying may also facilitate children's comprehension of death and familiarity with mourning. Developmental differences exist in children's efforts to make sense of and master the concept and reality of death and profoundly influence their grief reactions.

Children younger than 3 years have little or no understanding of the concept of death. Despair, separation anxiety, and detachment may occur at the withdrawal of nurturing caretakers. Young children may respond in reaction to observing distress in others, such as a parent or sibling who is crying, withdrawn, or angry. Young children also express signs and symptoms of grief in their emotional states, such as irritability or lethargy, and in severe cases, mutism. If the reaction is severe, failure to thrive may occur.

Preschool children are in the preoperational cognitive stage, in which communication takes place through play and fantasy (see Chapter 25). They do not show well-established cause-and-effect reasoning. They may feel that death is reversible, analogous to someone going away. In attempts to master the finality and permanence of death, preschoolers frequently ask unrelenting, repeated questions about when the person who died will be returning. This makes it difficult for parents, who may become frustrated because they do not understand why the child keeps asking and do not like the constant reminders of the person's death. The primary care provider has a very important role in helping families understand the child's struggle to comprehend death. Preschool children typically express magical explanations of death events, sometimes resulting in guilt and self-blame ("He died because I wouldn't play with him"; "She died because I was mad at her"). Some children have these thoughts but do not express them verbally because of embarrassment or guilt. Parents and primary care providers need to be aware of magical thinking and must reassure preschool children that their thoughts had nothing to do with the outcome. Children of this age are often frightened by prolonged, powerful expressions of grief by others. Children conceptualize events in the context of their own experiential reality, and therefore consider death in terms of sleep, separation, and injury. Young children express grief intermittently and show marked affective shifts over brief periods.

Younger school-age children think concretely, recognize that death is irreversible, but believe it will not happen to them or affect them, and begin to understand biologic processes of the human body ("You'll die if your body stops working"). Information gathered from the media, peers, and parents forms lasting impressions. Consequently, they may ask candid questions about death that adults will have difficulty addressing ("He must have been blown to pieces, huh?").

Children approximately 9 years and older do understand that death is irreversible and that it may involve them or their families. These children tend to experience more anxiety, overt symptoms of depression, and somatic complaints than do younger children. School-age children are often left with anger focused on the loved one, those who could not save the deceased, or those presumed responsible for the death. Contact with the primary care clinician may provide great reassurance, especially for the child with somatic symptoms, and particularly when the death followed a medical illness. School and learning problems may also occur, often linked to difficulty concentrating or preoccupation with the death. Close collaboration with the child's school may provide important diagnostic information and offer opportunities to mobilize intervention or support.

At **12-14 years of age**, children begin to use symbolic thinking, reason abstractly, and analyze hypothetical, or "what if," scenarios systematically. Death and the end of life become concepts rather than events. Teenagers are often ambivalent about dependence and independence and may withdraw emotionally from surviving family members, only to mourn in isolation. Adolescents begin to understand complex physiologic systems in relationship to death. Because they are often egocentric, they may be more concerned about the impact of the death on themselves than about the deceased or other family members. Fascination with dramatic, sensational, or romantic death sometimes occurs and may find expression in *copycat behavior,* such as cluster suicides, as well as *competitive behavior,* to forge emotional links to the deceased person ("He was my best friend"). Somatic expression of grief may revolve around highly complex syndromes such as eating disorders (see Chapter 41) or conversion reactions (Chapter 35), as well as symptoms limited to the more immediate perceptions (stomachaches). *Quality of life* takes on meaning, and the teenager develops a focus on the future. Depression, resentment, mood swings, rage, and risk-taking behaviors can emerge as the adolescent seeks answers to questions of values, safety, evil, and fairness. Alternately, adolescents may seek philosophic or spiritual explanations ("being at peace") to ease their sense of loss. The death of a peer may be especially traumatic.

Families often struggle with how to inform their children of the death of a family member. The answer depends on the child's developmental level. It is best to avoid misleading euphemisms and metaphor. A child who is told that the relative who died "went to sleep" may become frightened of falling asleep, resulting in sleep problems or nightmares. Children can be told that the person is "no longer living" or "no longer moving or feeling." Using examples of pets that have died sometimes can help children gain a more realistic idea of the meaning of death. Parents who have religious beliefs may comfort their children with explanations, such as, "Your sister's soul is in heaven," or "Grandfather is now with God," provided those beliefs are honestly held. If these are not religious beliefs that the parents share, children will sense the insincerity and experience anxiety rather than

the hoped-for reassurance. Children's books about death can provide an important source of information, and when read together, these books may help the parent to find the right words while addressing the child's needs.

ROLE OF THE PEDIATRIC HEALTHCARE PROVIDER IN GRIEF

The pediatric healthcare provider who has had a longitudinal relationship with the family will be an important source of support in the disclosure of bad news and in critical decision-making, during both the dying process and the bereavement period (see Table 30.3). The involvement of the healthcare provider may include being present at the time the diagnosis is disclosed, at the hospital or home at the time of death, being available to the family by phone during the bereavement period, sending a sympathy card, attending the funeral, and scheduling a follow-up visit. Attendance at the funeral sends a strong message that the family and their child are important, respected by the healthcare provider, and can also help the pediatric healthcare provider to grieve and reach personal closure about the death. A family meeting 1-3 months later may be helpful because parents may not be able to formulate their questions at the time of death. This meeting allows the family time to ask questions, share concerns, and review autopsy findings (if one was performed), and allows the healthcare provider to determine how the parents and family are adjusting to the death.

Instead of leaving the family feeling abandoned by a healthcare system that they have counted on, this visit allows them to have continued support. This is even more important when the healthcare provider will be continuing to provide care for surviving siblings. The visit can be used to determine how the mourning process is progressing, detect evidence of marital discord, and evaluate how well surviving siblings are coping. This is also an opportunity to evaluate whether referrals to support groups or mental health providers may be of benefit. Continuing to recognize the child who has died is important. Families appreciate the receipt of a card on their child's birthday, around holidays, or the anniversary of their child's death.

The healthcare provider needs to be an *educator* about disease, death, and grief. The pediatrician can offer a safe environment for the family to talk about painful emotions, express fears, and share memories. By giving families permission to talk and modeling how to address children's concerns, the clinician demystifies death. Parents often request practical help. The healthcare provider can offer families resources, such as literature (both fiction and nonfiction), referrals to therapeutic services, and tools to help them learn about illness, loss, and grief. In this way the physician reinforces the sense that other people understand what they are going through and helps to normalize their distressing emotions. The healthcare provider can also facilitate and demystify the grief process by sharing basic tenets of **grief therapy**. There is no single right or wrong way to grieve. Everyone grieves differently; mothers may grieve differently than fathers, and children mourn differently than adults. Helping family members to respect these differences and reach out to support each other is critical. Grief is not something to "get over," but a lifelong process of adapting, readjusting, and reconnecting.

Parents may need help in knowing what constitutes **normal grieving**. Hearing, seeing, or feeling their child's presence may be a normal response. Vivid memories or dreams may occur. The healthcare provider can help parents to learn that, although their pain and sadness may seem intolerable, other parents have survived similar experiences, and their pain will lessen over time.

Healthcare providers are often asked whether children should attend the **funeral** of a parent or sibling. These rituals allow the family to begin their mourning process. Children >4 years old should be given a choice. If the child chooses to attend, the child should have a designated, trusted adult who is not part of the immediate family and who will stay with the child, offer comfort, and be willing to leave with the child if the experience proves to be overwhelming. If the child chooses not to attend, the child should be offered additional opportunities to share in a ritual, go to the cemetery to view the grave, tell stories about the deceased, or obtain a keepsake object from the deceased family member as a remembrance.

In the era of regionalized tertiary care medicine, the primary care provider and medical home staff may not be informed when one of their patients dies in the hospital. Yet, this communication is critically important. Families assume their primary care provider has been notified and often feel hurt when they do not receive some symbol of condolence. Because of their longitudinal relationship with the family, primary care providers may offer much needed support. There are practical issues, such as the need to cancel previously made appointments and to alert office and nursing staff so that they are prepared should the family return for a follow-up visit or for ongoing health maintenance care with the surviving siblings. Even minor illnesses in the surviving siblings may frighten children. Parents may contribute to this anxiety because their inability to protect the child who has died may leave them with a sense of guilt or helplessness. They may seek medical attention sooner or may be hypervigilant in the care of the siblings because of guilt over the other child's death, concern about their judgment, or the need for continued reassurance. A primary care visit can do much to allay their fears.

Clinicians must remain vigilant for risk factors in each family member and in the family unit as a whole. Primary care providers, who care for families over time, know bereft patients' premorbid functioning and can identify those at current or future risk for physical and psychiatric morbidity. Providers must focus on symptoms that interfere with a patient's normal activities and compromise a child's attainment of developmental tasks. Symptom duration, intensity, and severity, in context with the family's culture, can help identify **complicated grief** reactions in need of therapeutic attention (see Table 30.2). Descriptive words such as "unrelenting," "intense," "intrusive," or "prolonged" should raise concern. Total absence of signs of mourning, specifically an inability to discuss the loss or express sadness, also suggests potential problems.

No specific sign, symptom, or cluster of behaviors identifies the child or family in need of help. Further assessment is indicated if the following occur: (1) persistent somatic or psychosomatic complaints of undetermined origin (headache, stomachache, eating and sleeping disorders, conversion symptoms, symptoms related to the deceased's condition, hypochondriasis); (2) unusual circumstances of death or loss (sudden, violent, or traumatic death; inexplicable, unbelievable, or particularly senseless death; prolonged, complicated illness; unexpected separation); (3) school or work difficulties (declining grades or school performance, social withdrawal, aggression); (4) changes in home or family functioning (multiple family stresses, lack of social support, unavailable or ineffective functioning of caretakers, multiple disruptions in routines, lack of safety); and (5) concerning psychologic factors (persistent guilt or blame, desire to die or talk of suicide, severe separation distress, disturbing hallucinations, self-abuse, risk-taking behaviors, symptoms of trauma such as hyperarousal or severe flashbacks, grief from previous or multiple deaths). Children who are intellectually impaired may require additional support.

TREATMENT

Suggesting interventions outside the natural support network of family and friends can often prove useful to grieving families. Bereavement counseling should be readily offered if needed or requested by the family. Interventions that enhance or promote attachments and security, as well as give the family a means of expressing and understanding death, help to reduce the likelihood of future or prolonged disturbance, especially in children. Collaboration between pediatric and mental health professionals can help determine the timing and appropriateness of services.

Interventions for children and families who are struggling to cope with a loss in the community include gestures such as sending a card or offering food to the relatives of the deceased and teaching children the etiquette of behaviors and rituals around bereavement and mutual support. Performing community service or joining

charitable organizations, such as fund-raising in memory of the deceased, may be useful. In the wake of a disaster, parents and older siblings can give blood or volunteer in search and recovery efforts. When a loss does not involve an actual death (e.g., parental divorce, geographic relocation), empowering the child to join or start a "divorced kids' club" in school or planning a "new kids in town" party may help. Participating in a constructive activity moves the family away from a sense of helplessness and hopelessness and helps them find meaning in their loss.

Psychotherapeutic services may benefit the entire family or individual members. Many support or self-help groups focus on specific types of losses (sudden infant death syndrome, suicide, widow/widowers, AIDS) and provide an opportunity to talk with other people who have experienced similar losses. Family, couple, sibling, or individual counseling may be useful, depending on the nature of the residual coping issues. Combinations of approaches may work well for children or parents with evolving needs. A child may participate in family therapy to deal with the loss of a sibling and use individual treatment to address issues of personal ambivalence and guilt related to the death.

The question of **pharmacologic intervention** for grief reactions often arises. Explaining that medication does not cure grief and often does not reduce the intensity of some symptoms (separation distress) can help. Although medication can blunt reactions, the psychologic work of grieving still must occur. The physician must consider the patient's premorbid psychiatric vulnerability, current level of functioning, other available supports, and the use of additional therapeutic interventions. Medication as a first line of defense rarely proves useful in normal or uncomplicated grief reactions. In certain situations (severe sleep disruption, incapacitating anxiety, intense hyperarousal), an anxiolytic or antidepressant may help to achieve symptom relief and provide the patient with the emotional energy to mourn. Medication used in conjunction with some form of psychotherapy, and in consultation with a psychopharmacologist, has optimal results.

Children who are **refugees** and may have experienced war, violence, or personal torture, while often resilient, may experience posttraumatic stress disorder if exposures were severe or repeated (see Chapters 15.3 and 38). Sequelae such as depression, anxiety, and grief need to be addressed, and mental health therapy is indicated. Cognitive-behavioral therapy, use of journaling and narratives to bear witness to the experiences, and use of translators may be essential.

SPIRITUAL ISSUES

Responding to patients' and families' spiritual beliefs can help in comforting them during family tragedies. Offering to call members of pastoral care teams or their own spiritual leader can provide needed support and can aid in decision-making. Families have found it important to have their beliefs and their need for hope acknowledged in end-of-life care. The majority of patients report welcoming discussions on spirituality, which may help individual patients cope with illness, disease, dying, and death. In addressing spirituality, physicians need to follow certain guidelines, including maintaining respect for the patient's beliefs, following the patient's lead in exploring how spirituality affects the patient's decision-making, acknowledging the limits of their own expertise and role in spirituality, and maintaining their own integrity by not saying or doing anything that violates their own spiritual or religious views. Healthcare providers should not impose their own religious or nonreligious beliefs on patients, but rather should listen respectfully to their patients. By responding to spiritual needs, clinicians may better aid their patients and families in end-of-life care and bereavement and take on the role of healers.

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Chapter 31

Sleep Medicine

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BASICS OF SLEEP AND CHRONOBIOLOGY

Sleep and wakefulness are a highly complex and intricately regulated neurobiologic system that both influences and is influenced by all physiologic systems in the body, as well as by the environment and sociocultural practices. The concept of **sleep regulation** is based on what is usually referred to as the "two-process model" because it requires the simultaneous operation of two basic, highly coupled processes that govern sleep and wakefulness. The **homeostatic process** ("Process S"), regulates the length and depth of sleep and is thought to be related to the accumulation of adenosine and other sleep-promoting chemicals ("somnogens"), such as cytokines, during prolonged periods of wakefulness. This sleep pressure appears to build more quickly in infants and young children, thus limiting the duration that wakefulness can be sustained during the day and necessitating periods of daytime sleep (i.e., naps). The endogenous **circadian rhythms** ("Process C") influence the internal organization of sleep and the timing and duration of daily sleep–wake cycles and govern predictable patterns of alertness throughout the 24-hour day.

The "master circadian clock" or "circadian pacemaker" that controls sleep–wake patterns, of which melatonin secretion is the principal biomarker, is located in the suprachiasmatic nucleus in the anterior hypothalamus. In addition, "circadian clocks" are present in virtually every cell in the body, which in turn govern the timing of multiple other physiologic systems (e.g., cardiovascular reactivity, hormone levels, renal and pulmonary functions). Because the human circadian clock is slightly longer than 24 hours, intrinsic circadian rhythms must be synchronized or "entrained" to the 24 hour-day cycle by environmental cues called *zeitgebers.* The **dark-light cycle** is the most powerful of the zeitgebers; light signals are transmitted to the suprachiasmatic nucleus via the circadian photoreceptor system within the retina (functionally and anatomically separate from the visual system), which switch the pineal gland's production of the hormone melatonin off (light) or on (dark). Circadian rhythms are also synchronized by other external time cues, such as timing of meals and clock time.

Sleep propensity, the relative level of sleepiness or alertness experienced at any given time during a 24-hour period, is partially determined by the homeostatic *sleep drive*, which in turn depends on the duration and quality of previous sleep and the amount of time awake since the last sleep period. Interacting with this *sleep homeostat* is the 24-hour cyclic pattern or rhythm characterized by clock-dependent periods of maximum sleepiness and maximum alertness. There are two periods of maximum sleepiness, one in the late afternoon (approximately 3:00-5:00 PM) and one toward the end of the night (around 3:00-5:00 AM), and two periods of maximum alertness, one in mid-morning and one in the evening just before the onset of natural sleep, the so-called forbidden zone or second-wind phenomenon, which allows for the maintenance of wakefulness in the face of an accumulated sleep drive.

There are significant health, safety, and performance consequences of failure to meet basic sleep needs, termed *insufficient/inadequate sleep* or **sleep loss**. Sufficient sleep is a biologic imperative, necessary for optimal brain and body functioning. **Slow-wave sleep (SWS)** (i.e., N3, delta, or deep sleep) appears to be the most restorative form of sleep; it is entered relatively quickly after sleep onset, is preserved in the face of reduced total sleep time and increases (rebounds) after a night of restricted sleep. These restorative properties of sleep may be linked to the "glymphatic system," which increases clearance of metabolic waste

products, including β-amyloid, produced by neural activity in the awake brain. **Rapid eye movement (REM)** sleep (stage R or "dream" sleep) appears to be involved in numerous important brain processes, including completion of vital cognitive functions (e.g., consolidation of memory), promoting the plasticity of the central nervous system (CNS), and protecting the brain from injury. Sufficient amounts of these sleep stages are necessary for optimal cognitive functioning and emotional and behavioral self-regulation.

Partial sleep loss (i.e., sleep restriction) on a chronic basis accumulates in a **sleep debt** and over several days produces deficits equivalent to those seen under conditions of one night of total sleep deprivation. If the sleep debt becomes large enough and is not voluntarily repaid by obtaining sufficient recovery sleep, the body may respond by overriding voluntary control of wakefulness. This results in periods of decreased alertness, dozing off, and unplanned napping, recognized as *excessive daytime sleepiness (EDS)*. The sleep-restricted individual may also experience very brief (several seconds) repeated daytime microsleeps, of which the individual may be completely unaware, but which nonetheless may result in significant lapses in attention and vigilance. There is also a relationship between the amount of sleep restriction and performance on cognitive tasks, particularly those requiring sustained attention and higher-level cognitive skills (*executive functions*; see Chapter 49), with a decay in performance correlating with declines in sleep amounts.

It has also been recognized that what may be globally described as "deficient" sleep involves alterations in both amount and *timing* of sleep. Misalignment of intrinsic circadian rhythms with extrinsic societal demands, such a shift work and early school start times, is associated with deficits in cognitive function and self-regulation, increased emotional and behavioral problems and risk-taking behaviors, and negative impacts on health, such as increased risk of cardiovascular disease, obesity, and metabolic dysfunction.

Insufficient quantity of sleep, mistimed sleep, and poor-quality sleep frequently result in EDS and decreased daytime alertness levels. Sleepiness in children may be recognizable as drowsiness, yawning, and other classic "sleepy behaviors" as well as resumption of napping in older children and extending sleep when given the opportunity such as on weekends. If a child can sleep more, they need more sleep. EDS can also manifest as mood disturbance, including irritability, emotional lability, low frustration tolerance and depressed or negative mood; fatigue and daytime lethargy, including increased somatic complaints (headaches, gastrointestinal disturbances); cognitive impairment, including problems with memory, attention, concentration, decision-making, and problem solving; daytime behavior problems, including hyperactivity, impulsivity, and noncompliance; and academic problems, including chronic tardiness related to insufficient sleep and school failure. While sleepiness and fatigue may overlap in their clinical presentation, sleepiness is characterized by the propensity to fall asleep, particularly under conditions of low stimulation (e.g., riding in the car), while fatigue is often described as a state of low energy, decreased motivation, and "exhaustion."

DEVELOPMENTAL CHANGES IN SLEEP

Sleep disturbances, as well as many characteristics of sleep itself, have some distinctly different features in children from sleep and sleep disorders in adults. Changes in sleep architecture and the evolution of sleep patterns and behaviors reflect the physiologic/chronobiologic, developmental, and social/environmental changes that are occurring across childhood. These trends may be summarized as the gradual assumption of more adult sleep patterns as children mature (Figs. 31.1 and 31.2):

1. Sleep is *the* primary activity of the brain during early development; for example, by age 2 years, the average child has spent 9,500 hours (approximately 13 months) asleep vs 8,000 hours awake, and between 2 and 5 years, the time asleep is equal to the time awake.
2. There is a gradual decline in the average 24-hour sleep duration from infancy through adolescence, which involves a decrease in both diurnal and nocturnal sleep amounts. The decline in daytime sleep (scheduled napping) results in termination of naps typically by age 5 years, although there is clearly considerable variability in the age at which children cease napping. There is also a gradual continued decrease in nocturnal sleep amounts into late adolescence; however, adolescents still require 8-10 hours of sleep per night.
3. There is also a decline in the relative percentage of REM sleep from birth (50% of sleep) through early childhood into adulthood (25–30%), and a similar initial predominance of SWS that peaks in early childhood, drops off abruptly after puberty (40–60% decline), and then further decreases over the life span. This SWS preponderance in early life has clinical significance; for example, the high prevalence of partial arousal parasomnias (sleepwalking and sleep terrors) in preschool- and early school–age children is related to the relative increased percentage of SWS in this age-group.
4. The within-sleep *ultradian cycle* lengthens from about 50 minutes in the term infant to 90-110 minutes in the school-age child. This has clinical significance in that typically a brief arousal or awakening occurs during the night at the termination of each ultradian cycle. As the length of the cycles increase, there is a concomitant decrease in the number of these end-of-cycle arousals (night wakings).
5. A gradual shift in the circadian sleep–wake rhythm to a delayed (later) sleep onset and offset time, linked to pubertal stage rather than chronologic age, begins with pubertal onset in middle childhood and accelerates in early to mid-adolescence. This biologic phenomenon often coincides with environmental factors, which further delay bedtime and advance wake time and result in insufficient sleep duration, including exposure to electronic "screens" in the evening, social networking, academic and extracurricular demands, and early (before 8:30 AM) high school start times. In addition, the accumulation of the homeostatic sleep drive across the day slows and both sensitivity and exposure to evening light increases (especially blue spectrum light from electronic devices) during adolescence, conspiring to further delay sleep onset.
6. Increasing irregularity of sleep–wake patterns is typically observed across childhood into adolescence; this is characterized by increasingly larger discrepancies between school night and non–school night bedtimes and wake times, and increased "weekend oversleep" in an attempt to compensate for chronic weekday sleep insufficiency. This phenomenon, often referred to as "social jet lag," not only fails to adequately address performance deficits associated with insufficient sleep on school nights but further exacerbates the normal adolescent phase delay and results in additional circadian disruption (analogous to that experienced by shift workers).

Table 31.1 lists normal developmental changes in children's sleep.

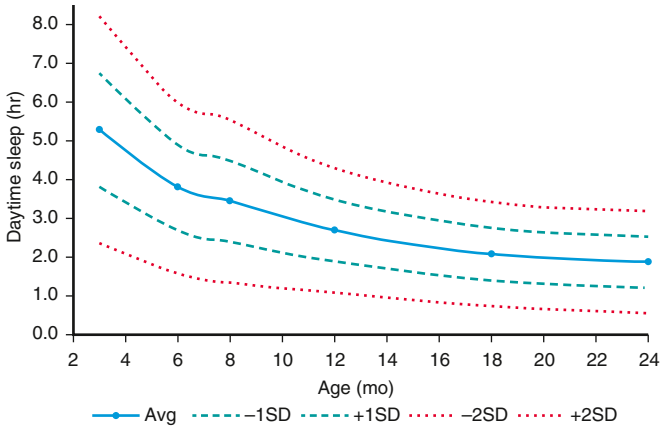

Fig. 31.1 Daytime sleep duration in infants ages 3-24 mo. SD, Standard deviation. *(From Paavonen EJ, Saarenpää-Heikkilä O, Morales-Munoz, I, et al. Normal sleep development in infants: findings from two large birth cohorts.* Sleep Med. *2020;69:145–154. Fig. 2, p 149.)*

COMMON SLEEP DISORDERS

Childhood sleep problems may be conceptualized as resulting from (1) inadequate duration of sleep for age and sleep needs (insufficient sleep quantity); (2) disruption and fragmentation of sleep (poor

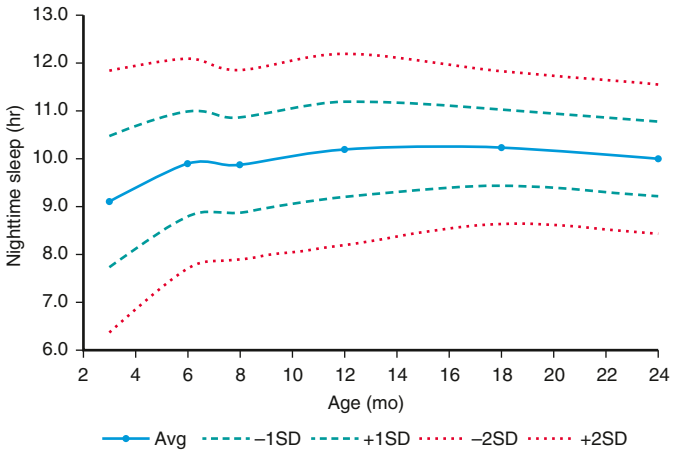

Fig. 31.2 Nighttime sleep duration in infants ages 3-24 mo. SD, Standard deviation. *(From Paavonen EJ, Saarenpää-Heikkilä O, Morales-Munoz, I, et al. Normal sleep development in infants: findings from two large birth cohorts.* Sleep Med. *2020;69:145–154. Fig. 3, p 149.)*

sleep quality) as a result of frequent, repetitive, and brief arousals during sleep; (3) misalignment of sleep–wake timing with circadian rhythms; or (4) CNS-mediated **hypersomnia** (EDS and increased sleep needs). Insufficient sleep is usually the result of difficulty initiating *(delayed sleep onset)* or maintaining sleep *(prolonged night wakings)* but, especially in older children and adolescents, may also represent a conscious lifestyle decision to sacrifice sleep in favor of competing priorities, such as homework and social activities. The underlying causes of delayed sleep onset/prolonged night wakings or sleep fragmentation may in turn be related to primarily behavioral factors (e.g., bedtime resistance resulting in shortened sleep duration) or medical causes (e.g., **obstructive sleep apnea [OSA]** causing frequent, brief arousals).

Certain pediatric populations are relatively more vulnerable to acute or chronic sleep problems. These include children with chronic illnesses or pain conditions (e.g., cystic fibrosis, asthma, idiopathic juvenile arthritis) and acute illnesses (e.g., otitis media); children taking stimulants (e.g., psychostimulants, caffeine), sleep-disrupting medications (e.g., corticosteroids), or daytime-sedating medications (some anticonvulsants, α-agonists); hospitalized children; and children with a variety of psychiatric disorders, including attention-deficit/hyperactivity disorder (ADHD), depression, bipolar disorder, and anxiety disorders. Children with neurodevelopmental disorders such as autism, intellectual disability, blindness, and some chromosomal syndromes (e.g., Smith-Magenis, fragile X) have especially high rates of sleep disturbances for a wide variety of reasons. They may have comorbid medical issues or may be taking sleep-disrupting medications, may be more prone to nocturnal seizures, may be less easily entrained by environmental cues and thus more vulnerable to circadian disruption, and are more likely to have psychiatric and behavioral comorbidities that further predispose them to disrupted sleep. Children from low socioeconomic households or minoritized racial and ethnic groups, as well as children in alternative care such as foster placement, are more likely to experience, are less likely to be diagnosed and treated, and are more vulnerable to the negative impact of sleep disorders resulting in significant sleep health disparities.

Insomnia of Childhood

Insomnia is defined as difficulty initiating and/or maintaining sleep that occurs despite age-appropriate time and opportunity for sleep and results in some degree of impairment in daytime functioning for the child and/or family (ranging from fatigue, irritability, lack of energy, and mild cognitive impairment to effects on mood, school performance, and quality of life). Insomnia may be of a short-term and transient nature (usually related to an acute event) or may be characterized as long-term and chronic. Insomnia is a set of *symptoms* with many possible etiologies (e.g., pain, medication, medical/psychiatric conditions, learned behaviors). As with many behavioral issues in children, insomnia is often primarily defined by parental concerns rather than by objective criteria and therefore should be viewed in the context of family (maternal depression, stress), child (temperament, developmental level), and environmental (cultural practices, sleeping space) considerations.

While current terminology (*Diagnostic and Statistical Manual of Mental Disorders,* 5th edition, 2015; *International Classification of Sleep Disorders,* 3rd edition, 2014) groups most types of insomnia in both children and adults under a single category of Chronic Insomnia Disorder, the descriptor of Behavioral Insomnia of Childhood and its subtypes (Sleep Onset Association and Limit Setting) remains a useful construct in clinical practice, particularly for young children (0-5 years). One of the most common presentations of insomnia found in infants and toddlers is the **sleep-onset association type.** In this situation the child learns to fall asleep only under certain conditions or associations, which typically require parental presence, such as being rocked or fed, and does not develop the ability to self-soothe. During the night, when the child experiences the type of brief arousal that normally occurs at the end of an ultradian sleep cycle or awakens for other reasons, the child is not able to get back to sleep without those same associations being present. The infant then "signals" the parent by crying (or coming into the parents' bedroom if the child is ambulatory) until the necessary associations are provided. The presenting complaint is typically one of prolonged night waking requiring caregiver intervention and resulting in insufficient sleep (for both child and caregiver).

Management of **night wakings** should include establishment of a set sleep schedule and bedtime routine and implementation of a behavioral program. The treatment approach typically involves a program of rapid withdrawal (extinction) or more gradual withdrawal (graduated extinction) of parental assistance at sleep onset and during the night. **Extinction** ("cry it out") involves putting the child to bed at a designated bedtime, "drowsy but awake," to maximize sleep propensity and then systematically ignoring any protests by the child until a set time the next morning. Although it has considerable empirical support, extinction is often not an acceptable choice for families. **Graduated extinction** (aka "check-ins," "Ferber method," "sleep training") involves gradually weaning the child from dependence on parental presence; typically, the parent leaves the room at "lights out" and then returns or "checks" periodically at fixed or successively longer intervals during the sleep–wake transition to provide *brief* reassurance until the child falls asleep. The exact interval between checks is generally determined by the parents' tolerance for crying and the child's temperament; the goal is to allow enough time between checks for the child to fall asleep independently while avoiding extended time intervals that result in continued escalation of protest behaviors such as screaming and

Table 31.1 Normal Developmental Changes in Children's Sleep

AGE CATEGORY	SLEEP DURATION* AND SLEEP PATTERNS	ADDITIONAL SLEEP ISSUES	SLEEP DISORDERS

Newborn (0-2 mo)	• Total sleep: 10-19 hr per 24 hr (average, 13-14.5 hr), may be higher in premature babies.
	• Bottle-fed babies generally sleep for longer periods (2-5 hr bouts) than breastfed babies (1-3 hr).
	• Sleep periods are separated by 1-2 hr awake.
	• No established nocturnal-diurnal pattern in first few wk; sleep is evenly distributed throughout the day and night, averaging 8.5 hr at night and 5.75 hr during day.
		• American Academy of Pediatrics issued a revised recommendation in 2016 advocating against bed-sharing in the first year of life, instead encouraging proximate but separate sleeping surfaces for mother and infant for at least the first 6 mo and preferably first year of life.
		• Safe sleep practices for infants:
		  • Place baby on his or her back to sleep at night and during nap times.
		  • Place baby on a firm mattress with well-fitting sheet in safety-approved crib.
		  • Do not use pillows or comforters.
		  • Standards require crib bars to be no farther apart than 2 3/8 in.
		  • Make sure baby's face and head stay uncovered and clear of blankets and other coverings during sleep.
			• Most sleep issues perceived as problematic at this stage represent a discrepancy between parental expectations and developmentally appropriate sleep behaviors.
			• Newborns who are extremely fussy and persistently difficult to console, as noted by parents, are more likely to have underlying medical issues such as colic, gastroesophageal reflux, and formula intolerance.

Infant (2-12 mo)	• Recommended sleep duration (4-12 mo) is 12-16 hr (note that there is great individual variability in sleep times during infancy).	• Sleep regulation or self-soothing involves the infant's ability to negotiate the sleep–wake transition, both at sleep onset and following normal awakenings throughout the night. The capacity to self-soothe begins to develop in the first 12 wk of life and is a reflection of both neurodevelopmental maturation and learning. • Sleep consolidation, or "sleeping through the night," is usually defined by parents as a continuous sleep episode without the need for parental intervention (e.g., feeding, soothing) from the child's bedtime through the early morning. Infants develop the ability to consolidate sleep between 6 wk and 3 mo.	• Behavioral insomnia of childhood; sleep-onset association type • Sleep-related rhythmic movements (head banging, body rocking)
Toddler (1-2 yr)	• Recommended sleep amount is 11-14 hr (including naps). • Naps decrease from two to one nap at average age of 18 mo.	• Cognitive, motor, social, and language developmental issues impact sleep. • Nighttime fears develop; transitional objects and bedtime routines are important.	• Behavioral insomnia of childhood, sleep-onset association type • Behavioral insomnia of childhood, limit-setting type
Preschool (3-5 yr)	• Recommended sleep amount is 10-13 hr (including naps). • Overall, 26% of 4 yr olds and just 15% of 5 yr olds nap.	• Persistent cosleeping tends to be highly associated with sleep problems in this age-group. • Sleep problems may become chronic.	• Behavioral insomnia of childhood, limit-setting type • Sleepwalking, sleep terrors, nighttime fears/nightmares, obstructive sleep apnea syndrome
Middle childhood (6-12 yr)	• Recommended sleep amount is 9-12 hr.	• School and behavior problems may be related to sleep problems. • Media and electronics, such as television, computer, video games, and the internet, increasingly compete for sleep time. • Irregularity of sleep–wake schedules reflects increasing discrepancy between school and non–school night bedtimes and wake times.	• Nightmares • Obstructive sleep apnea syndrome • Insufficient sleep
Adolescence (13-18 yr)	• Recommended sleep amount is 8-10 hr. • Later bedtimes; increased discrepancy between sleep patterns on weekdays and weekends	• Puberty-mediated phase delay (later sleep onset and wake times), relative to sleep–wake cycles in middle childhood • Earlier required wake times • Environmental competing priorities for sleep	• Insufficient sleep • Delayed sleep–wake phase disorder • Narcolepsy • Restless legs syndrome/ periodic limb movement disorder

*All recommended sleep amounts from Paruthi S, Brooks LJ, D'Ambrosio C, et al. Recommended amount of sleep for pediatric populations: a consensus statement of the American Academy of Sleep Medicine. *J Clin Sleep Med.* 2016;12:785–786.

gagging/vomiting. This allows the infant or child to develop the skills necessary for self-soothing at bedtime and also during the night. Sleep training is typically not instituted until about 6 months of age, but the practice of putting the infant to sleep "drowsy but awake" starting at 3-4 months to encourage self-soothing may avoid the need for later intervention. In older infants and young children, the introduction of more appropriate sleep associations that will be readily available to the child during the night (transitional

objects, such as a blanket or toy), in addition to positive reinforcement (stickers for remaining in bed), is often beneficial. As healthy, normally growing full-term infants no longer need night feedings from a nutritional standpoint, if the child has become habituated to awaken for nighttime feedings (learned hunger), these feedings should be eliminated (either "cold turkey" or by gradually decreasing volume and the milk:water ratio). Parents must be consistent in applying behavioral interventions to avoid inadvertent, intermittent reinforcement of night wakings. They should also be forewarned that crying behavior often temporarily escalates at the beginning of treatment *(postextinction burst)*.

Bedtime problems, including stalling and refusing to go to bed, are more common in preschool-age and older children. This type of insomnia is frequently related to inadequate **limit setting** at bedtime such as an inability or unwillingness to set consistent bedtime rules, and enforce a regular bedtime. In some cases, caregivers have adopted an inconsistent approach to night wakings that involves intermittently allowing the child to share their bed. This type of sleep problem may be associated with parental difficulty in setting limits or managing behavior in general and may be exacerbated by a child's tendency to engage in oppositional behavior. In some cases, the child's resistance at bedtime is the result of an underlying problem in falling asleep that is caused by other factors (medical conditions such as asthma or medication use; a sleep disorder such as restless legs syndrome; anxiety) or a mismatch between the child's intrinsic circadian rhythm ("night owl") and parental expectations regarding an "appropriate" bedtime.

Successful treatment of limit-setting sleep problems generally involves a combination of parent education regarding appropriate limit setting, decreased parental attention for bedtime-delaying behavior, establishment of bedtime routines, and positive reinforcement (sticker charts) for appropriate behavior at bedtime and during the night. For problematic night wakings, it is essential for caregivers to have a consistent response (e.g., returning the child to their bedroom after *every* night waking). Other behavioral management strategies that have empirical support include **bedtime fading**, or temporarily setting the bedtime closer to the actual sleep-onset time and then gradually advancing the bedtime to an earlier target bedtime. Older children may benefit from being taught relaxation techniques to help themselves fall asleep or back to sleep more readily. Following the principles of healthy sleep practices for children is essential (Table 31.2).

A third type of childhood insomnia is related to a mismatch between parental expectations regarding time in bed and the child's intrinsic sleep needs. If, as illustrated in Figure 31.3, a child's typical sleep time is 10 hours but the "sleep window" is set for 12 hours (7 PM to 7 AM), the result is likely to be a prolonged sleep onset of 2 hours, an extended period of wakefulness during the night, or early morning waking (or a combination); these periods are usually characterized by "normal" wakefulness in the child that is not accompanied by excessive distress. This situation is important to recognize because the solution (reducing the time in bed to actual sleep time) is typically simple and effective.

Another form of insomnia that is more common in older children and adolescents has often been referred to as *psychophysiologic, primary,* or *learned* insomnia. **Primary insomnia** occurs mainly in adolescents and is characterized by a combination of learned sleep-preventing associations and heightened physiologic arousal resulting in a complaint of sleeplessness and decreased daytime functioning. A hallmark of primary insomnia is excessive worry about sleep and an exaggerated concern of the potential daytime consequences. The physiologic arousal can be in the form of cognitive **hypervigilance**, such as "racing" thoughts; in many individuals with insomnia, an increased baseline level of arousal is further intensified by this secondary anxiety about sleeplessness. Treatment usually involves educating the adolescent about the principles of healthy sleep practices (Table 31.3), institution of a consistent sleep–wake schedule, avoidance of daytime napping, instructions to use the bed for sleep only and to get out of bed if unable to fall asleep *(stimulus control)*, restricting time in bed to the actual time asleep *(sleep restriction)*, addressing maladaptive cognitions about sleep, and teaching relaxation techniques to reduce anxiety (cognitive behavioral therapy for insomnia [CBT-I]).

Table 31.2 Basic Principles of Healthy Sleep for Children

1. **Have a set bedtime and bedtime routine** for your child.
2. **Bedtime and wake-up time should be about the same time on school nights and non–school nights.** There should not be more than about 1 hr difference from one day to another.
3. **Make the hour before bed shared quiet time.** Avoid high-energy activities, such as rough play, and stimulating activities, such as watching television or playing computer games, just before bed.
4. **Don't send your child to bed hungry.** A *light* snack (e.g., milk and cookies) before bed is a good idea. Heavy meals within 1 hr or 2 of bedtime, however, may interfere with sleep.
5. **Avoid products containing caffeine for at least several hours before bedtime.** These include caffeinated sodas, coffee, tea, and chocolate.
6. **Make sure your child spends time outside every day,** whenever possible, and is involved in regular exercise.
7. **Keep your child's bedroom quiet and dark.** A low-level night light is acceptable for children who find completely dark rooms frightening.
8. **Keep your child's bedroom at a comfortable temperature during the night (<24°C [75°F]).**
9. **Don't use your child's bedroom for time-out or punishment.**
10. **Keep the television out of your child's bedroom.** Children can easily develop the bad habit of "needing" the television to fall asleep. It is also much more difficult to control your child's viewing if the set is in the bedroom.

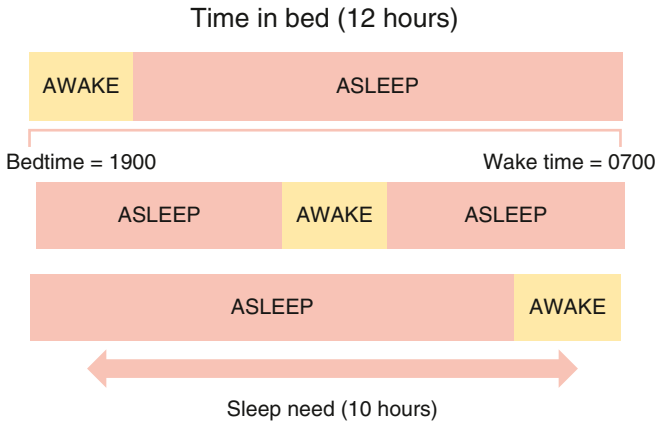

Fig. 31.3 Mismatch between sleep needs/duration and time in bed, resulting in insomnia.

The keys to successful behavioral sleep interventions involve forming an alliance with the family, negotiating tailored solutions that are more likely to be effective if families can be successful in implementing them, and setting appropriate agreed-on treatment goals with planned follow-up. Behavioral treatments for insomnia, even in young children, appear to be highly effective and well tolerated. Several studies have failed to demonstrate long-term negative effects of behavioral strategies such as "sleep training" on parent–child relationships and attachment, psychosocial-emotional functioning, and chronic stress. It should also be emphasized that, as in adults, behavioral interventions are the *first-line treatment* for insomnia in children, and in general, hypnotic medications or supplements such as melatonin are infrequently needed and should only be used as an adjunct to behavioral therapy to treat insomnia in typically developing and healthy children. If cognitive behavior therapy and sleep hygiene practices are ineffective in children with autism spectrum disorders or ADHD, melatonin may be an additional effective therapy.

Table 31.3 Basic Principles of Healthy Sleep for Adolescents

1. **Wake up and go to bed at about the same time** every night. Bedtime and wake-up time should not differ from school to non–school nights by more than approximately 1 hr.
2. **Avoid sleeping in on weekends** to "catch up" on sleep. This makes it more likely that you will have problems falling asleep.
3. If you take **naps**, they should be **short** (no more than 1 hr) and **scheduled in the early to mid-afternoon.** However, if you have a problem with falling asleep at night, napping during the day may make it worse and should be avoided.
4. **Spend time outside** every day. Exposure to sunlight helps to keep your body's internal clock on track.
5. **Exercise regularly.** Exercise may help you fall asleep and sleep more deeply.
6. **Use your bed for sleeping only.** Don't study, read, listen to music, or watch television on your bed.
7. **Make the 30-60 min before bedtime a quiet or wind-down time.** Relaxing, calm, enjoyable activities, such as reading a book or listening to calm music, help your body and mind slow down enough to let you get to sleep. Don't study, watch exciting/scary movies, exercise, or get involved in "energizing" activities just before bed.
8. Eat regular meals, and **don't go to bed hungry.** A light snack before bed is a good idea; eating a full meal within 1 hr before bed is not.
9. **Avoid** eating or drinking products containing **caffeine** from dinnertime to bedtime. These include caffeinated sodas, coffee, tea, and chocolate.
10. **Do not use alcohol.** Alcohol disrupts sleep and may cause you to awaken throughout the night.
11. Smoking (e.g., cigarettes) disturbs sleep. Although you should not smoke at all, if you do, **do not smoke at least 2 hr before bed.**
12. **Do not use sleeping pills, melatonin, or other nonprescription sleep aids** to help you sleep unless specifically recommended by your doctor. These can be dangerous, and the sleep problems often return when you stop taking the medicine.

Obstructive Sleep Apnea

Sleep disordered breathing (SDB) in children encompasses a broad spectrum of respiratory disorders that occur exclusively in sleep or that are exacerbated by sleep, including primary snoring and upper airway resistance syndrome, as well as apnea of prematurity (see Chapter 125) and central apnea (see Chapter 468.2). OSA, the most important clinical entity within the SDB spectrum, is characterized by repeated episodes of prolonged upper airway obstruction during sleep despite continued or increased respiratory effort, resulting in complete *(apnea)* or partial (*hypopnea*; ≥30% reduction in airflow accompanied by ≥3% O_2 desaturation and/or arousal) cessation of airflow at the nose and/or mouth, as well as disrupted sleep. Both intermittent hypoxia and the multiple arousals resulting from these obstructive events likely contribute to significant metabolic, cardiovascular, and neurocognitive-neurobehavioral morbidity.

Primary snoring is defined as snoring without associated ventilatory abnormalities on overnight **polysomnogram (PSG)** (e.g., no apneas or hypopneas, hypoxemia, hypercapnia) or respiratory-related arousals and is a manifestation of the vibrations of the oropharyngeal soft tissue walls that occur when an individual attempts to breathe against increased upper airway resistance during sleep. Although generally considered nonpathologic, primary snoring in children may still be associated with subtle breathing abnormalities during sleep, including evidence of increased respiratory effort, which in turn may be associated with adverse neurodevelopmental outcomes that may be similar to those associated with OSA.

Etiology

OSA results from an anatomically or functionally narrowed upper airway; this typically involves some combination of decreased upper airway patency (upper airway obstruction and/or decreased upper airway diameter), increased upper airway collapsibility (reduced pharyngeal muscle tone), and decreased drive to breathe in the face of reduced upper airway patency (reduced central ventilatory drive) (Table 31.4). Upper airway obstruction varies in degree and level (i.e., nose, nasopharynx/oropharynx, hypopharynx) and is most frequently caused by adenotonsillar hypertrophy, although tonsillar size does not necessarily correlate with degree of obstruction, especially in older children. Other causes of airway obstruction include allergies associated with chronic rhinitis or nasal obstruction; craniofacial abnormalities, including hypoplasia or displacement of the maxilla and mandible; gastroesophageal reflux with resulting pharyngeal reactive edema (see Chapter 369); nasal septal deviation (Chapter 425); and velopharyngeal flap cleft palate repair. Reduced upper airway tone may result from neuromuscular diseases, including hypotonic cerebral palsy and muscular dystrophies (see Chapter 649), or hypothyroidism (Chapter 603). Reduced central ventilatory drive may be present in some children with Arnold-Chiari malformation (see Chapter 631.09); rapid-onset obesity with hypothalamic dysfunction, hypoventilation, and autonomic dysregulation (Chapter 65); and meningomyelocele (Chapter 631.04). In other situations, the etiology is mixed; individuals with Down syndrome (see Chapter 57), because of their facial anatomy, hypotonia, macroglossia, and central adiposity, as well as the increased incidence of hypothyroidism, are at particularly high risk for OSA, with some estimates of prevalence as high as 70%.

Table 31.4 Anatomic Factors That Predispose to Obstructive Sleep Apnea Syndrome and Hypoventilation in Children

NOSE
Anterior nasal stenosis
Choanal stenosis/atresia
Deviated nasal septum
Seasonal or perennial rhinitis
Nasal polyps, foreign body, hematoma, mass lesion
NASOPHARYNGEAL AND OROPHARYNGEAL
Adenotonsillar hypertrophy
Macroglossia
Cystic hygroma
Velopharyngeal flap repair
Cleft palate repair
Pharyngeal mass lesion
CRANIOFACIAL
Micrognathia/retrognathia
Midface hypoplasia (e.g., trisomy 21, Crouzon disease, Apert syndrome)
Mandibular hypoplasia (Pierre Robin, Treacher Collins, Cornelia de Lange syndromes)
Craniofacial trauma
Skeletal and storage diseases
Achondroplasia
Storage diseases (e.g., glycogen; Hunter, Hurler syndromes)

Although children with OSA may be of normal weight, a large percentage are overweight or obese, and many of these children are school-age or younger. There is a significant correlation between weight and SDB (e.g., habitual snoring, OSA, sleep-related hypoventilation). Although adenotonsillar hypertrophy also plays an important etiologic role in overweight/obese children with OSA, mechanical factors related to an increase in the amount of adipose tissue in the throat (pharyngeal fat pads), neck (increased neck circumference), and chest wall and abdomen can increase upper airway resistance, worsen gas exchange, and increase the work of breathing, particularly in the supine position and during REM sleep. A component of blunted central ventilatory drive in response to hypoxia/hypercapnia and hypoventilation may occur as well (see Chapter 468.2), particularly in children with morbid or syndrome-based (e.g., Prader-Willi) obesity. Overweight and obese children and adolescents are at particularly high risk for

metabolic and cardiovascular complications of SDB, such as insulin resistance and systemic hypertension. Morbidly obese children are also at increased risk for postoperative complications as well as residual OSA after adenotonsillectomy.

Epidemiology

Overall prevalence of parent-reported snoring in the pediatric population is approximately 8%; "always" snoring is reported in 1.5–6%, and "often" snoring in 3–15%. When defined by parent-reported symptoms, the prevalence of OSA is 4–11%. The prevalence of pediatric OSA as documented by overnight sleep studies using ventilatory monitoring procedures (e.g., in-lab polysomnography, home studies) is 1–4% overall, with a reported range of 0.1–13%. Prevalence is also affected by the demographic characteristics such as age (increased prevalence between 2 and 8 years), gender (more common in males, especially after puberty), ethnicity (increased prevalence in African American and Asian children), history of prematurity, and family history of OSA.

Pathogenesis

The upregulation of inflammatory pathways, as indicated by an increase in peripheral markers of inflammation (e.g., C-reactive protein, interleukins), appears to be linked to metabolic dysfunction (e.g., insulin resistance, dyslipidemia, alterations in neurohormone levels such as leptin) in both obese and nonobese children with OSA. Systemic inflammation and arousal-mediated increases in sympathetic autonomic nervous system activity with altered vasomotor tone may be key contributors to increased cardiovascular risk due to alterations in vascular endothelium in both adults and children with OSA. Other potential mechanisms that may mediate cardiovascular sequelae in adults and children with OSA include elevated systemic blood pressure and ventricular dysfunction. Mechanical stress on the upper airway induced by chronic snoring may also result in both local mucosal inflammation of adenotonsillar tissues and subsequent upregulation of inflammatory molecules, most notably leukotrienes.

One of the primary mechanisms by which OSA is believed to exert negative influences on cognitive function appears to involve repeated episodic arousals from sleep leading to sleep fragmentation and sleepiness. Equally important, intermittent hypoxia may lead directly to systemic inflammatory vascular changes in the brain. Levels of inflammatory markers such as C-reactive protein and interleukin-6 are elevated in children with OSA and are also associated with cognitive dysfunction.

Clinical Manifestations

The clinical manifestations of OSA may be divided into sleep-related and daytime symptoms. The most common nocturnal manifestations of OSA in children and adolescents are loud, frequent, and disruptive snoring; breathing pauses; choking or gasping arousals; restless sleep; and nocturnal diaphoresis. Many children who snore do not have OSA, but few children with OSA do not snore (caregivers may not be aware of snoring in older children and adolescents). Children, like adults, tend to have more frequent and more severe obstructive events in REM sleep and when sleeping in the supine position. Children with OSA may adopt unusual sleeping positions, keeping their necks hyperextended to maintain airway patency. Frequent arousals associated with obstruction may result in nocturnal awakenings but are more likely to cause fragmented sleep.

Daytime symptoms of OSA include mouth breathing and dry mouth, chronic nasal congestion or rhinorrhea, hyponasal speech, morning headaches, difficulty swallowing, and poor appetite. Children with OSA may have *secondary enuresis,* postulated to result from the disruption of the normal nocturnal pattern of atrial natriuretic peptide secretion by changes in intrathoracic pressure associated with OSA. Partial arousal parasomnias (sleepwalking and sleep terrors) may occur more frequently in children with OSA, related to the frequent associated arousals and an increased percentage of SWS.

One of the most important but frequently overlooked sequelae of OSA in children is the effect on mood, behavior, learning, and academic functioning. The neurobehavioral consequences of OSA in children include daytime sleepiness with drowsiness, difficulty in morning waking, and unplanned napping or dozing off during activities, although evidence of frank hypersomnolence tends to be less common in children compared to adults with OSA (except in very obese children or those with severe disease). Mood changes include increased irritability, mood instability and emotional dysregulation, low frustration tolerance, and depression or anxiety. Behavioral issues include both "internalizing" (i.e., increased somatic complaints and social withdrawal) and "externalizing" behaviors, including aggression, impulsivity, hyperactivity, oppositional behavior, and conduct problems. There is substantial overlap between the clinical impairments associated with OSA and the diagnostic criteria for ADHD, including inattention, poor concentration, and distractibility (see Chapter 50).

Many of the studies that have looked at changes in behavior and neuropsychologic functioning in children after treatment (usually adenotonsillectomy) for OSA have found significant improvement in outcomes, both short term and long term, including daytime sleepiness, mood, behavior, academics, and quality of life. However, most studies failed to find a dose-dependent relationship between OSA in children and specific neurobehavioral-neurocognitive deficits, suggesting that other factors may influence neurocognitive outcomes, including individual genetic susceptibility, racial/ethnic background, environmental influences (e.g., passive smoking exposure), and comorbid conditions, such as obesity, shortened sleep duration, and other sleep disorders.

Diagnosis

The 2012 revised American Academy of Pediatrics clinical practice guidelines provide excellent information for the evaluation and management of uncomplicated childhood OSA (Table 31.5). No physical examination findings are truly pathognomonic for OSA, and most healthy children with OSA appear normal; however, certain physical examination findings may suggest OSA. Growth parameters may be abnormal (obesity, or less frequently, failure to thrive), and there may be evidence of chronic nasal obstruction (hyponasal speech, mouth breathing, septal deviation) and signs of atopic disease (i.e., "allergic shiners"). Oropharyngeal examination may reveal enlarged tonsils, excess soft tissue in the posterior pharynx, and a narrowed posterior pharyngeal space, as well as craniofacial features associated with an increased risk of obstruction including "adenoidal facies" with open mouth posture and long/asymmetric face, midface hypoplasia, retrognathia and micrognathia, forward head posture (best appreciated by inspection of the frontal and lateral facial profile), and teeth crowding, narrow arched palate, and tongue tie (short frenulum). In severe cases the child may have evidence of pulmonary hypertension, right-sided heart failure, and cor pulmonale; systemic hypertension may occur, especially in obese children.

Because no combination of clinical history and physical findings can accurately predict which children with snoring have OSA, the gold standard for diagnosing OSA remains an in-lab overnight **PSG**. Overnight PSG is a technician-supervised, monitored study that documents physiologic variables during sleep; sleep staging, arousal measurement, cardiovascular parameters, and body movements (electroencephalography [EEG], electrooculography, chin and leg electromyography [EMG], electrocardiogram, body position sensors, and video recording), and a combination of breathing monitors (oronasal thermal sensor and nasal air pressure transducer for airflow), chest/abdominal monitors (e.g., inductance plethysmography for respiratory effort, pulse oximeter for O_2 saturation, end-tidal or transcutaneous CO_2 for CO_2 retention, snore microphone). The PSG parameter most often used in evaluating for sleep-disordered breathing is the **apnea-hypopnea index (AHI)**, which indicates the number of apneic and hypopneic (both obstructive and central) events per hour of sleep. There are no universally accepted PSG normal reference values or parameters for diagnosing OSA in children, and it is still unclear which parameters best predict morbidity. Normal preschool- and school-age children generally have a total AHI <1.5 (obstructive AHI <1), and this is the most widely used cutoff value for OSA in children ≤12 years old; in older adolescents the adult cutoff of an AHI ≥5 is generally used. When AHI is between one and five obstructive events per hour, assessment of

Table 31.5 American Academy of Pediatrics Clinical Practice Guideline: Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

Key Action Statement 1: Screening for OSA
As part of routine health maintenance visits, clinicians should inquire whether the child or adolescent snores. If the answer is affirmative or if a child or adolescent presents with signs or symptoms of OSA, clinicians should perform a more focused evaluation. (Evidence Quality: Grade B; Recommendation Strength: Recommendation.)
Key Action Statement 2A: Polysomnography
If a child or adolescent snores on a regular basis and has any of the complaints or findings of OSA, clinicians should either (1) obtain a polysomnogram (Evidence Quality: Grade A; Recommendation Strength: Recommendation) *or* (2) refer the patient to a sleep specialist or otolaryngologist for a more extensive evaluation. (Evidence Quality: Grade D; Recommendation Strength: Option.)
Key Action Statement 2B: Alternative Testing
If polysomnography is not available, clinicians may order alternative diagnostic tests, such as nocturnal video recording, nocturnal oximetry, daytime nap polysomnography, or ambulatory polysomnography. (Evidence Quality: Grade C; Recommendation Strength: Option.)
Key Action Statement 3: Adenotonsillectomy
If a child is determined to have OSA, has a clinical examination consistent with adenotonsillar hypertrophy, and does not have a contraindication to surgery, the clinician should recommend adenotonsillectomy as the first line of treatment. If the child has OSA but does not have adenotonsillar hypertrophy, other treatment should be considered (see Key Action Statement 6). Clinical judgment is required to determine the benefits of adenotonsillectomy compared with other treatments in obese children with varying degrees of adenotonsillar hypertrophy. (Evidence Quality: Grade B; Recommendation Strength: Recommendation.)
Key Action Statement 4: High-Risk Patients Undergoing Adenotonsillectomy
Clinicians should monitor high-risk patients undergoing adenotonsillectomy as inpatients postoperatively. (Evidence Quality: Grade B; Recommendation Strength: Recommendation.)
Key Action Statement 5: Reevaluation
Clinicians should clinically reassess all patients with OSA for persisting signs and symptoms after therapy to determine whether further treatment is required. (Evidence Quality: Grade B; Recommendation Strength: Recommendation.)
Key Action Statement 5B: Reevaluation of High-Risk Patients
Clinicians should reevaluate high-risk patients for persistent OSA after adenotonsillectomy, including those who had a significantly abnormal baseline polysomnogram, have sequelae of OSA, are obese, or remain symptomatic after treatment, with an objective test (see Key Action Statement 2), or refer such patients to a sleep specialist. (Evidence Quality: Grade B; Recommendation Strength: Recommendation.)
Key Action Statement 6: CPAP
Clinicians should refer patients for CPAP management if symptoms/signs or objective evidence of OSA persists after adenotonsillectomy or if adenotonsillectomy is not performed. (Evidence Quality: Grade B; Recommendation Strength: Recommendation.)
Key Action Statement 7: Weight Loss
Clinicians should recommend weight loss in addition to other therapy if a child/adolescent with OSA is overweight or obese. (Evidence Quality: Grade C; Recommendation Strength: Recommendation.)
Key Action Statement 8: Intranasal Corticosteroids
Clinicians may prescribe topical intranasal corticosteroids for children with mild OSA in whom adenotonsillectomy is contraindicated or for children with mild postoperative OSA. (Evidence Quality: Grade B; Recommendation Strength: Option.)

CPAP, Continuous Positive Airway Pressure; OSA, obstructive sleep apnea.
Adapted from Marcus CL, Brooks LJ, Draper KA, et al. Diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics.* 2012;130:576–584.

additional PSG parameters (e.g., elevated CO_2 indicating obstructive hypoventilation, O_2 desaturation, respiratory-related arousals), clinical judgment regarding risk factors for SDB, presence and severity of clinical symptoms, and evidence of daytime sequelae should determine further management.

Treatment

No universally accepted guidelines exist regarding the indications for treatment of pediatric SDB, including primary snoring and OSA. Recommendations largely emphasize weighing what is known about the potential cardiovascular, metabolic, and neurocognitive sequelae of SDB in children in combination with the individual healthcare professional's clinical judgment. The decision of whether and how to treat OSA specifically in children depends on several parameters, including severity (nocturnal symptoms, daytime sequelae, sleep study results), duration of disease, and individual patient variables such as age, comorbid conditions, and underlying etiologic factors. In the case of moderate (AHI 5-10) to severe (AHI >10) disease, the decision to treat is usually straightforward, and most pediatric sleep experts recommend that any child with AHI >5 should be treated. However, a large randomized trial of early adenotonsillectomy vs watchful waiting with supportive care demonstrated that 46% of the control group children normalized on PSG (vs 79% of early adenotonsillectomy group) during the 7 month observation period. In addition, it is worth emphasizing that the child with habitual snoring (≥3×/week) but without polysomnographic evidence of OSA may also experience adverse neurobehavioral and neurocognitive outcomes; ongoing studies are examining whether these children may benefit from more aggressive treatment such as adenotonsillectomy.

In the majority of cases of pediatric OSA, adenotonsillectomy is the first-line treatment in any child with significant adenotonsillar hypertrophy, even in the presence of additional risk factors such as obesity. Adenotonsillectomy (or adenotonsillotomy, which is considered a less invasive procedure and may be indicated in some children) in uncomplicated cases generally (70–90% of children) results in complete resolution of symptoms; regrowth of adenoidal tissue after surgical removal occurs in some cases. Groups considered at high risk include young children (<3 years) as well as those with severe OSA documented by PSG, significant clinical sequelae of OSA (e.g., failure to thrive), or associated medical conditions, such as craniofacial syndromes, morbid obesity, and hypotonia. All patients should be reevaluated postoperatively to determine whether additional evaluation, a repeat PSG, and treatment are required. The American Academy of Sleep Medicine recommends that in high-risk groups (children with obesity, craniofacial anomalies, Down syndrome, or moderate-severe OSA) or in children with continued symptoms of OSA, a follow-up sleep study about 6 weeks after adenotonsillectomy is indicated. Also, a number of studies have suggested that children who are underweight, normal weight, or overweight/obese at baseline all tend to *gain weight* after adenotonsillectomy, and thus clinical vigilance is required during follow-up.

It should be noted that in cases of residual OSA postadenotonsillectomy, additional diagnostic evaluation to identify other sites of obstruction may be necessary to more specifically tailor treatment. An example of this type of advanced diagnostic tool is **drug-induced sleep**

endoscopy (DISE), a powerful method for studying the airway in a sleeping patient in real time. DISE provides direct visualization of the spontaneously breathing airway under light anesthesia and facilitates identification of obstructive lesions. Site of obstruction with potential surgical corrections include lingual (resection) tonsils, tongue base (reductions), turbinate (reduction), and supraglottoplasty.

Additional treatment measures that may be appropriate include weight loss, **positional therapy** (attaching a firm object, such as a tennis ball, to the back of a sleep garment to prevent the child from sleeping in the supine position), and aggressive treatment of additional risk factors when present, such as asthma, seasonal allergies, and gastroesophageal reflux. Evidence suggests that intranasal corticosteroids and leukotriene inhibitors may be helpful in reducing upper airway inflammation in mild OSA. Other surgical procedures (e.g., uvulopharyngopalatoplasty) and maxillofacial surgery (e.g., mandibular distraction osteogenesis) are seldom performed in children. Oral appliances, such as mandibular advancing devices and palatal expanders, may be considered in select cases, particularly in those children with craniofacial risk factors as mentioned earlier, and consultation with a pediatric dentist or orthodontist is recommended. Neuromuscular reeducation or repatterning of the oral and facial muscles with exercises to address abnormal tongue position and low upper airway tone (i.e., **myofunctional therapy**) have been shown to be beneficial in addressing pediatric OSA as well as alleviating chewing and swallowing problems in children able to cooperate with the behavioral program.

Continuous or **bilevel positive airway pressure (CPAP** or **BiPAP)** is the most common treatment for OSA in adults and can be used successfully in children and adolescents. Positive airway pressure (PAP) may be recommended if removing the adenoids and tonsils is not indicated, if there is residual disease following adenotonsillectomy, or if there are major risk factors not amenable to surgery (obesity, hypotonia). PAP delivers humidified, warmed air through an interface (mask, nasal pillows) that, under pressure, effectively "splints" the upper airway open. Optimal pressure settings (that abolish or significantly reduce obstructive respiratory events without increasing arousals or central apneas) are determined in the sleep lab during a full-night PAP titration. Careful attention should be paid to education of the child and family, and desensitization protocols should usually be implemented to increase the likelihood of adherence. Efficacy studies at the current pressure and retitrations should be conducted periodically with long-term use (at least annually) or in association with significant weight changes or resurgence of SDB symptoms. High-flow nasal cannula therapy may be another approach. A novel treatment for OSA in adults is hypoglossal nerve stimulation; case series suggest this may be an effective treatment in selected pediatric cases, especially in children with Down syndrome.

Parasomnias

Parasomnias are episodic nocturnal behaviors that often involve cognitive disorientation and autonomic and skeletal muscle disturbance. Parasomnias may be further characterized as occurring primarily during non-REM sleep (partial arousal parasomnias) or in association with REM sleep, including nightmares, hypnogogic hallucinations, and sleep paralysis; other common parasomnias include sleep-talking and hypnic jerks or "sleep starts."

Etiology

Partial arousal parasomnias represent a dissociated sleep–wake state, the neurobiology of which remains unclear, although genetic factors and an intrinsic oscillation of subcortical-cortical arousal with sleep have been proposed. These episodic events, which include sleepwalking, sleep terrors, and confusional arousals, are more common in preschool- and school-age children because of the relatively higher percentage of SWS in younger children. Partial arousal parasomnias typically occur when SWS predominates, in the first third of the night. In contrast, **nightmares**, which are much more common than partial arousal parasomnias but are often confused with them, tend to be concentrated in the last third of the night, when REM sleep is most prominent. Any factor associated with an increase in the relative percentage of SWS (certain medications, previous sleep restriction) may increase the frequency of events in a predisposed child. There appears to be a genetic predisposition for both sleepwalking and sleep terrors. Partial arousal parasomnias may also be difficult to distinguish from nocturnal seizures. Table 31.6 summarizes similarities and differences among these nocturnal arousal events.

Epidemiology

Many children sleepwalk on at least one occasion; the lifetime prevalence by age 10 years is 13%. **Sleepwalking** (somnambulism) may persist into adulthood, with the prevalence in adults of

Table 31.6 Key Similarities and Differentiating Features Between Non-REM and REM Parasomnias as Well as Nocturnal Seizures

	CONFUSIONAL AROUSALS	SLEEP TERRORS	SLEEPWALKING	NIGHTMARES	NOCTURNAL SEIZURES
Time	Early	Early	Early-mid	Late	Any
Sleep stage	SWA	SWA	SWA	REM	Any
EEG discharges	–	–	–	–	+
Scream	–	++++	–	++	+
Autonomic activation	+	++++	+	+	+
Motor activity	–	+	+++	+	++++
Awakens	–	–	–	+	+
Duration (min)	0.5-10; more gradual offset	1-10; more gradual offset	2-30; more gradual offset	3-20	5-15; abrupt onset and offset
Postevent confusion	+	+	+	–	+
Age	Child	Child	Child	Child, young adult	Adolescent, young adult
Genetics	+	+	+	–	±
Organic CNS lesion	–	–	–	–	++++

CNS, Central nervous system; EEG, electroencephalogram; REM, rapid eye movement; SWA, slow-wave arousal.
From Avidan A, Kaplish N. The parasomnias: epidemiology, clinical features and diagnostic approach. *Clin Chest Med.* 2010;31:353–370.

approximately 4%. The prevalence is approximately 10 times greater in children with a family history of sleepwalking. The peak prevalence of **sleep terrors** (or night terrors) is 34% at age 1-5 years, decreasing to 10% by age 7; the age at onset is usually between 4 and 12 years. Because of the common genetic predisposition, the likelihood of developing sleepwalking after age 5 is almost twofold higher in children with a history of sleep terrors. Although sleep terrors can occur at any age from infancy through adulthood, most individuals outgrow sleep terrors by adolescence. **Confusional arousals** may be accompanied by (and often precede in onset) episodes sleepwalking and sleep terrors; prevalence rates have been estimated at >15% in children age 3-13 years.

Clinical Manifestations

The partial arousal parasomnias have several features in common. Because they typically occur at the transition out of "deep" sleep or SWS, partial arousal parasomnias have clinical features of both the *awake* (ambulation, vocalizations) and the *sleeping* (high arousal threshold, unresponsiveness to environment) states, usually with amnesia for the events. External (noise) or internal (obstruction) factors may trigger events in some individuals. The duration is typically a few minutes (sleep terrors) up to 30-40 minutes (confusional arousals). Sleep terrors are sudden in onset and characteristically involve a high degree of autonomic arousal (tachycardia, diaphoresis, dilated pupils). Confusional arousals typically arise more gradually from sleep, may involve thrashing around, mumbling, and other vocalizations, but usually not displacement from bed, and are often accompanied by slow mentation, disorientation, and confusion on forced arousal from SWS or on waking in the morning. Sleepwalking may be associated with safety concerns (e.g., falling out of windows, wandering outside). The child's avoidance of, or increased agitation with, comforting by parents or prolongation of events by attempts at awakening are also common to all partial arousal parasomnias.

Treatment

Management of partial arousal parasomnias involves some combination of parental education and reassurance, healthy sleep practices, and avoidance of exacerbating factors such as sleep restriction and caffeine. Particularly in the case of sleepwalking, it is important to institute safety precautions such as use of gates in doorways and at the top of staircases, locking of outside doors and windows, and installation of parent notification systems such as bedroom door alarms. **Scheduled awakening** is a behavioral intervention that involves having the parent wake the child 15-30 minutes before the time of night that the first parasomnia episode typically occurs and is most likely to be successful in situations where partial arousal episodes occur on a nightly basis. Pharmacotherapy is rarely necessary but may be indicated in cases of frequent or severe episodes despite nonpharmacologic interventions and absence of treatable underlying sleep disorders exacerbating partial arousal parasomnias such as OSA or **periodic limb movement disorder (PLMD),** high risk of injury, violent behavior, or serious disruption to the family. The primary pharmacologic agents used are potent SWS suppressants, primarily benzodiazepines and tricyclic antidepressants.

Sleep-Related Movement Disorders: Restless Legs Syndrome/Periodic Limb Movement Disorder, Restless Sleep Disorder, and Rhythmic Movement Disorder

Although some of these sleep disorders share common features (e.g., movements of specific body parts such as extremities vs whole body movements) and pathogenesis (e.g., iron deficiency), each has a distinctive set of diagnostic criteria, epidemiology and clinical management, and may differ in the degree of disruption to sleep quality and quantity and related daytime consequences.

Although most of these sleep-related movement disorders do not require overnight polysomnographic evaluation for diagnosis (PLMD is a notable exception), a videotaped episode by caregivers in the home setting can prove very valuable in helping to differentiate sleep-related movements from nocturnal seizures. Such sleep-related seizures usually arise from the frontal and/or temporal lobes. Ambulatory EEG, in-patient video-EEG monitoring and overnight video PSG with chin and leg EMG recording may be necessary to establish a diagnosis of a sleep-related movement disorder.

Restless Legs Syndrome/Periodic Limb Movement Disorder

Restless legs syndrome (RLS), also termed *Willis-Ekbom disease*, is a primary disorder of the CNS sensorimotor network characterized by an almost irresistible urge to move the legs, often accompanied by uncomfortable sensations in the lower extremities. Both the urge to move and the sensations are usually worse at rest and in the evening and are at least partially relieved by movement, including walking, stretching, and rubbing, but only if the motion continues. RLS is a clinical diagnosis that is based on the presence of these key symptoms (Table 31.7).

PLMD is characterized by periodic, repetitive, brief (0.5-10 seconds), and highly stereotyped limb jerks typically occurring at 20-40 second intervals. These movements occur primarily during sleep, usually occur in the legs, and frequently consist of rhythmic extension of the big toe and dorsiflexion at the ankle. Although there may be clinical complaints of kicking movements in sleep or restless sleep, the diagnosis of **periodic limb movements (PLMs)** requires overnight PSG to document the characteristic limb movements with anterior tibialis EMG leads. However, like adults, children also show considerable individual night-to-night variability of PLMs, and a single-night PSG may not always reflect the true severity.

Etiology

RLS has a clear genetic component, with a sixfold to sevenfold increase in prevalence in first-degree relatives of RLS patients. The mode of inheritance is complex, and several genetic loci have been identified *(MEIS1, BTBD9, MAP2K5)*. Low serum iron levels (even without anemia) in both adults and children may be an important etiologic factor for the presence and severity of both RLS symptoms and PLMs. As a marker of decreased iron stores, serum ferritin levels in both children and adults with RLS are frequently low (<50 μg/mL). The postulated underlying mechanism is related to the role of iron as a cofactor in tyrosine hydroxylation, a rate-limiting step in dopamine

Table 31.7 Diagnostic Criteria for Restless Legs Syndrome

A. An urge to move legs, usually accompanied by or in response to uncomfortable and unpleasant sensations in the legs, characterized by the following:
   1. The urge to move the legs begins or worsens during periods of rest or inactivity.
   2. The urge to move the legs is partially or totally relieved by movement.
   3. The urge to move the legs is worse in the evening or at night than during the day, or occurs only in the evening or at night.

B. The symptoms in Criterion A occur at least 3 times per week and have persisted for at least 3 mo.

C. The symptoms in Criterion A are accompanied by significant distress or impairment in social, occupational, educational, academic, behavioral, or other important areas of functioning.

D. The symptoms in Criterion A are not attributable to another mental disorder or medical condition (e.g., arthritis, leg edema, peripheral ischemia, leg cramps) and are not better explained by a behavioral condition (e.g., positional discomfort, habitual foot tapping).

E. The symptoms are not attributable to the physiologic effects of a drug or abuse or medication (e.g., akathisia).

From American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed, Arlington, VA: American Psychiatric Association; 2013. p 410.

synthesis; in turn, dopaminergic dysfunction has been implicated, particularly in the genesis of the sensory component of RLS, as well as in PLMD. Certain medical conditions, including diabetes mellitus, end-stage renal disease, cancer, idiopathic juvenile arthritis, hypothyroidism, and pregnancy, may also be associated with RLS/PLMD, as are specific medications (e.g., antidepressants, including tricyclic antidepressants, and selective serotonin reuptake inhibitors (SSRIs), such as fluoxetine, first-generation sedating antihistamines, and dopamine receptor antagonists, such as Compazine and metoclopramide), as well as caffeine.

Epidemiology

Survey studies estimate the prevalence rates of RLS in the pediatric population as between 1 and 6%; approximately 2% of 8-17 year olds meet the criteria for "definite" RLS. Prevalence rates of PLMs >5 per hour in clinical populations of children referred for sleep studies range from 5–27%; in survey studies of PLM symptoms, rates are 8–12%. About 40% of adults with RLS have symptoms before age 20 years; 20% report symptoms before age 10. Familial cases usually have a younger age of onset. Several studies in referral populations have found that PLMs occur in as many as 25% of children diagnosed with ADHD.

Clinical Manifestations

In addition to the urge to move the legs and the sensory component (paresthesia-like, tingling, burning, itching, crawling), most RLS episodes are initiated or exacerbated by rest or inactivity, such as lying in bed to fall asleep or riding in a car for prolonged periods. Children may describe the sensory symptoms as a funny feeling, tickling, hurting, or pain or bugs, spiders, ants, or goosebumps in the legs. Sometimes, the child may draw pins, needles, tiny sand particles, and bugs over his or her legs when asked to depict the symptoms. An "informal" suggested clinical immobilization test (SCIT) (i.e., "If I asked you to lie perfectly still sitting on your bed at bedtime, would you be able to do it?") can be helpful in eliciting RLS complaints. A unique feature of RLS is that the timing of symptoms also appears to have a circadian component, in that they often peak in the evening hours. Some children may complain of "growing pains," although this is considered a nonspecific feature. Because RLS symptoms are usually worse in the evening, bedtime struggles and difficulty falling asleep are two of the most common presenting complaints. In contrast to patients with RLS, individuals with PLMs are usually unaware of these movements, but children may complain of morning muscle pain or fatigue; these movements may result in arousals during sleep and consequent significant sleep disruption. Parents of children with RLS/PLMD may report that their child is a restless sleeper and kicks a bed partner.

The differential diagnosis includes growing pains, leg cramps, neuropathy, arthritis, myalgias, nerve compression ("leg fell asleep"), and dopamine antagonist–associated akathisia.

Treatment

Because of the frequent co-occurrence and overlap in underlying pathophysiology and risk factors for RLS and PLMD, management strategies for both disorders are similar. The clinical decision to treat RLS and PLMs is based on the severity of symptoms, sleep disturbances, and effect on daytime functioning. An acronym that summarizes the management approach for RLS/PLMD in children is AIMS. This includes the following:

- *A*voidance of drugs/substances which may exacerbate RLS/PLMD (including caffeine, nicotine, alcohol)
- *I*ron supplementation
- *M*uscles: increased physical activity, massage, application of heat/cold, muscle relaxation and biofeedback
- *S*leep: regular and adequate sleep

Treatment with iron supplementation is indicated if serum ferritin is <50 ng/mL. Administration of oral supplements for ferritin levels >75-100 μg/L, at least in adults, are likely ineffective because of low absorption. It should be kept in mind that ferritin is an acute-phase reactant and thus may be falsely elevated (i.e., normal) in the setting of a concomitant illness. In addition, the ferritin level should be drawn, if possible, in the early morning after avoiding a dinner with a high iron content (e.g., red meat) on the previous evening. A typical iron regimen is ferrous fumarate or sulfate as an oral tablet or liquid: 3-6 mg/kg of elemental iron/day × 3 months with 200 mg vitamin C on an empty stomach while avoiding calcium-containing foods that may slow absorption. Ferritin levels should be repeated after 3 months to assess response and avoid iron overload.

If ferritin levels are very low or levels fail to improve after treatment with iron, these children may require referral to hematology for evaluation of their iron deficiency (e.g., occult blood loss, malabsorption). Although pediatric data regarding IV iron for RLS/PLMD are largely lacking, there are studies examining the role of IV iron therapy (e.g., ferric carboxymaltose, iron dextran) in the treatment of severe iron deficiency or with iron malabsorption in adults. Potential advantages of IV therapy include rapid response and avoidance of malabsorption/tolerance/compliance issues.

Treatment with pharmacologic agents may be indicated in children with moderate-severe RLS symptoms and PLMD, who did not respond to the previously mentioned measures. Currently, there are no Food and Drug Administration (FDA)-approved pharmacologic agents for RLS/PLMD in children. Dopaminergic medication is considered the first line of treatment for RLS in adults. Other classes of medications used to treat PLS/PLMD include α-agonists, opiates, benzodiazepines, and bupropion.

Restless Sleep Disorder

Restless sleep disorder **(RSD)** has both clinical and PSG features *distinct* from RLS and PLMD. Clinical descriptors include a complaint of "restless sleep" typically reported by a parent, caregiver, or bedpartner; the visible body movements, involving *large muscle groups of the whole body, all four limbs, arms, legs, or head* during sleep, may be characterized further as frequent repositioning disruption of the bedsheets, falling out of bed and being found in a completely different position compared to the position in which they fell asleep. Diagnostic criteria also include objective documentation on videography of increased levels of nocturnal activity and gross body movements with a total movement index during sleep that exceeds five per hour of sleep. RSD has also been found to be associated with low serum iron levels with symptomatic improvement following iron supplementation.

Sleep-related rhythmic movements, including head banging, body rocking, and head rolling, are characterized by repetitive, stereotyped, and rhythmic movements or behaviors that involve large muscle groups. These behaviors typically occur with the transition to sleep at bedtime, but also at nap times and after nighttime arousals. Children are thought to engage in these behaviors as a means of soothing themselves to (or back to) sleep. These behaviors are very common, with about two thirds of all infants having some type, typically beginning before 12 months and usually disappearing by preschool age. In most cases, rhythmic movement behaviors are benign, because sleep is not significantly disrupted, and associated significant injury is rare; however, these behaviors can potentially affect the sleep of a family member room-sharing and/or caregivers in nearby sleeping spaces. In addition, caregivers are often concerned about these behaviors as potentially being harmful to the child or possibly indicative of an underlying neurologic or neurodevelopmental disorder (e.g., autism). However, these behaviors typically occur in normally developing children and in the majority of cases do not indicate some underlying neurologic or psychologic problem. Usually, the most important aspect in management of sleep-related rhythmic movements is reassurance to the family that this behavior is normal, common, benign, and self-limited. Safety may be an important concern, and appropriate measures such as tightening of crib bolts and guardrails on the bed should be taken to prevent injury; noise dampening measures such as moving the bed away from adjoining walls may be helpful. If there are concerns about an associated sleep disorder, seizure disorder, or risk of injury referral to a sleep specialist may be considered.

Central Disorders of Hypersomnolence: Narcolepsy type 1, Narcolepsy type 2, Idiopathic Hypersomnia

Hypersomnia is a clinical term that is used to describe a group of disorders characterized by recurrent episodes of EDS, reduced baseline alertness, and/or prolonged nighttime sleep periods that interfere with normal daily functioning (Table 31.8). The many potential causes of EDS can be broadly grouped as "extrinsic" (e.g., secondary to insufficient and/or fragmented sleep) or "intrinsic" (e.g., resulting from an increased need for sleep).

Table 31.8 Diagnostic Criteria for Narcolepsy

A. Recurrent periods of an irrepressible need to sleep, lapsing into sleep, or napping occurring within the same day. These must have been occurring at least 3 times per week over the past 3 mo.
B. The presence of at least one of the following:
   1. Episodes of cataplexy, defined as either (a) or (b), occurring at least a few times per month:
      a. In individuals with long-standing disease, brief (seconds to minutes) episodes of sudden bilateral loss of muscle tone with maintained consciousness that are precipitated by laughter or joking.
      b. In children or individuals within 6 mo of onset, spontaneous grimaces or jaw-opening episodes with tongue thrusting or a global hypotonia, without any obvious emotional triggers.
   2. Hypocretin deficiency, as measured using CSF hypocretin-1 immunoreactivity values (less than or equal to one third of values obtained in healthy subjects tested using the same assay, or ≤110 pg/mL). Low CSF levels of hypocretin-1 must not be observed in the context of acute brain injury, inflammation, or infection.
   3. Nocturnal sleep polysomnography showing REM sleep latency ≤15 min, or a multiple sleep latency test showing a mean sleep latency ≤ 8 min and two or more sleep-onset REM periods.

Specify whether:

Narcolepsy without cataplexy but with hypocretin deficiency: Criterion B requirements of low CSF hypocretin-1 levels and positive polysomnography/multiple sleep latency test are met, but no cataplexy is present (Criterion B1 not met).

Narcolepsy with cataplexy but without hypocretin deficiency: In this rare subtype (<5% of narcolepsy cases), Criterion B requirements of cataplexy and positive polysomnography/multiple sleep latency test are met, but CSF hypocretin-1 levels are normal (Criterion B2 not met).

Autosomal dominant cerebellar ataxia, deafness, and narcolepsy: This subtype is caused by exon 21 DNA (cytosine-5)-methyltransferase-1 mutations and is characterized by late-onset (age 30-40 yr) narcolepsy (with low or intermediate CSF hypocretin-1 levels), deafness, cerebellar ataxia, and eventually dementia.

Autosomal dominant narcolepsy, obesity, and type 2 diabetes: Narcolepsy, obesity, and type 2 diabetes are low; CSF hypocretin-1 levels have been described in rare cases and are associated with a mutation in the myelin oligodendrocyte glycoprotein gene.

Narcolepsy without cataplexy but with hypocretin deficiency: This subtype is for narcolepsy that develops secondary to medical conditions that cause infectious (e.g., Whipple disease, sarcoidosis), traumatic, or tumoral destruction of hypocretin neurons.

Severity:

Mild: Infrequent cataplexy (less than once per week), need for naps only once or twice per day, and less disturbed nocturnal sleep.

Moderate: Cataplexy once daily or every few days, disturbed nocturnal sleep and need for multiple naps daily.

Severe: Drug-resistant cataplexy with multiple attacks daily, nearly constant sleepiness, and disturbed nocturnal sleep (i.e., movements, insomnia, and vivid dreaming).

CSF, Cerebrospinal fluid; REM, rapid eye movement.
From American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed, Arlington, VA: American Psychiatric Association; 2013. pp 372–373.

Narcolepsy

Narcolepsy is a chronic, lifelong CNS disorder, typically presenting in adolescence and early adulthood, characterized by profound daytime sleepiness resulting in significant functional impairment. More than half of patients with narcolepsy also present with **cataplexy** (type 1 narcolepsy), defined as the sudden, brief, partial, or complete loss of skeletal muscle tone, typically triggered by strong emotion (e.g., laughter, surprise, anger), with retained consciousness. Other symptoms frequently associated with narcolepsy, including hypnogogic/hypnopompic (immediately before falling asleep/awakening) visual, auditory, or perceptual hallucinations, and sleep paralysis, may be conceptualized as representing the "intrusion" of REM-related phenomena (dream mentation, loss of motor tone) into the waking state. Other REM-related features include observance of eye movements and twitches at sleep onset and vivid dreams. Somewhat paradoxically, increased sleep fragmentation is a common feature. Rapid weight gain, especially near symptom onset, may be observed, and young children with narcolepsy have been reported to develop precocious puberty.

Etiology

The genesis of narcolepsy with cataplexy (type 1) is thought to be related to a specific deficit in the hypothalamic orexin/hypocretin neurotransmitter system involving the selective loss of cells that secrete hypocretin/orexin in the lateral hypothalamus. *Hypocretin* neurons stimulate a range of wake-promoting neurons in the brainstem, hypothalamus, and cortex and basal forebrain that produce neurochemicals to sustain the wake state and prevent lapses into sleep.

The development of narcolepsy may involve autoimmune mechanisms, possibly triggered by streptococcal, influenza virus, H1N1, and other viral infections, likely in combination with a genetic predisposition and environmental factors. A 12-13–fold increase in narcolepsy type 1 cases, especially in children, was reported in parts of Europe in 2009–2010 following immunization with the AS03 adjuvanted H1N1 influenza vaccine. Human leukocyte antigen testing also shows a strong association with narcolepsy; the majority of individuals with this antigen (~25% of the general population) do not have narcolepsy, but most (>90%) patients with narcolepsy with cataplexy are HLA-DQB1*0602–positive. Patients with narcolepsy without cataplexy (type 2) are increasingly thought to have a significantly different underlying pathophysiology; they are much less likely to be HLA-DQB1*0602–positive (4–50%), and cerebrospinal fluid (CSF) hypocretin levels are normal in most patients.

Although most cases of narcolepsy are considered idiopathic (autoimmune), **secondary narcolepsy** can be caused by lesions to the posterior hypothalamus induced by traumatic brain injury, tumor, stroke, and neuroinflammatory processes such as poststreptococcal pediatric autoimmune neuropsychiatric disorder associated with streptococcal infection (PANDAS; see Chapter 229), as well as by neurogenetic diseases such as Prader-Willi syndrome (Chapter 99.7), Niemann-Pick type C (Chapter 106.4), myotonic dystrophy (Chapter 649.6), Angelman syndrome, autosomal dominant cerebellar ataxia-deafness-narcolepsy (ADCA-DN), Moebius syndrome, and Norrie disease.

Epidemiology

Narcolepsy is a rare disorder with a prevalence of approximately 1 in 2000 with equal sex distribution; however, specific countries (e.g., Japan) appear to have relatively higher prevalence rates. The risk of developing narcolepsy with cataplexy in a first-degree relative of a narcoleptic patient is estimated at 1–2%. This represents an increase of 10-40–fold compared to the general population, but the risk remains very low, reinforcing the likely role for other etiologic factors.

Clinical Manifestations and Diagnosis

The typical onset of symptoms of narcolepsy is in adolescence and early adulthood, although symptoms may initially present in school-age and even younger children. The early manifestations of narcolepsy are often ignored, misinterpreted, or misdiagnosed as other medical, neurologic, or psychiatric conditions, and the appropriate diagnosis is frequently delayed for years. The onset may be abrupt or slowly progressive.

The most prominent clinical manifestation of narcolepsy is profound daytime sleepiness, characterized by both an increased baseline level of daytime drowsiness and the repeated occurrence of sudden and unpredictable sleep episodes. These "sleep attacks" are often described as "irresistible," in that the child or adolescent is unable to stay awake despite considerable effort and occur even in the context of normally stimulating activities (e.g., during meals, in conversation). Very brief (several seconds) sleep attacks may also occur in which the individual may "stare off," appear unresponsive, or continue to engage in an ongoing activity *(automatic behavior)*. EDS may also be manifested by increased nighttime sleep needs and extreme difficulty waking in the morning or after a nap.

Cataplexy is considered virtually pathognomonic for narcolepsy but can develop several years after the onset of EDS. Manifestations are triggered by strong positive (laughing, joy) or negative (fright, anger, frustration) emotions and predominantly include facial slackening, head nodding, jaw dropping, and less often, knees buckling or complete collapse with falling to the ground. The cataplectic attacks are typically brief (seconds to minutes), the patient is awake and aware, and episodes are fully reversible, with complete recovery of normal tone when the episode ends. A form of cataplexy unique to children known as **cataplectic facies** is characterized by prolonged tongue protrusion, ptosis, slack jaw, slurred speech, grimacing, and gait instability. Additionally, children may have positive motor phenomenon similar to dyskinesias or motor tics, with repetitive grimacing and tongue thrusting. The cataplectic attacks are typically brief (seconds to minutes) but in children may last for hours or days (**status cataplecticus**). The differential diagnosis of cataplexy includes syncope, seizures, cataplexy-like episodes in *KCNA1* pathologic variants (ataxia-myokymia syndrome), hyperekplexia, hypo and hyperkalemic periodic paralysis syndromes, and pseudocataplexy.

Hypnogogic/hypnopompic hallucinations usually involve vivid visual but also auditory and sometimes tactile sensory experiences during transitions between sleep and wakefulness, either at sleep offset (hypnopompic) or sleep onset (hypnogogic). **Sleep paralysis** is the inability to move or speak for a few seconds or minutes at sleep onset or offset and often accompanies the hallucinations. Other symptoms associated with narcolepsy include disrupted nocturnal sleep, impaired cognition, inattention and ADHD-like symptoms, and behavioral and mood dysregulation.

Several pediatric screening questionnaires for EDS, including the modified Epworth Sleepiness Scale, help to guide the need for further evaluation in clinical practice when faced with the presenting complaint of daytime sleepiness. Physical examination should include a detailed neurologic assessment. Overnight PSG and a multiple sleep latency test (MSLT) are strongly recommended components in the evaluation of a patient with profound unexplained daytime sleepiness or suspected narcolepsy. The purpose of the overnight PSG is to evaluate for primary sleep disorders (e.g., OSA) that may cause EDS. The MSLT involves a series of five opportunities to nap (20 min long), during which patients with narcolepsy demonstrate a pathologically shortened mean sleep-onset latency (≤8 minutes, typically <5 minutes) as well as at least two periods of REM sleep occurring immediately after sleep onset. Alternatively, a diagnosis of type 1 narcolepsy can be made by findings of low CSF hypocretin-1 concentration (typically ≤110 pg/mL) with a standardized assay.

Treatment

In general, the management of pediatric narcolepsy is best done in conjunction with a pediatric sleep specialist. An individualized narcolepsy treatment plan usually involves education, good sleep hygiene, behavioral changes, and medication. Scheduled naps during the day are often helpful. Wake-promoting medications such as modafinil or armodafinil may be prescribed to control the EDS, although these are not approved for use in children by the U.S. FDA, and potential side effects include rare reports of Stevens-Johnson syndrome and reduced efficacy of hormone-based contraceptives. Psychostimulants are approved for ADHD in children and can be used for EDS; side effects include appetite suppression, mood lability, and cardiovascular effects. Antidepressants (serotonin reuptake inhibitors, tricyclic antidepressants, venlafaxine) may be used to reduce cataplexy. Sodium oxybate, which is approved for use in children, is a unique drug that appears to have a positive impact on daytime sleepiness, cataplexy, and nocturnal sleep disruption; reported side effects include dizziness, weight loss, enuresis, exacerbation of OSA, depression, and risk of respiratory depression, especially when combined with CNS depressants, including alcohol. Pitolisant has a novel mechanism as a histamine (H_3) receptor agonist and has been shown to improve cataplexy and EDS in adult patients with narcolepsy. Preliminary results in children have been encouraging. Solriamfetol, a norepinephrine-dopamine reuptake inhibitor, is another alertness-enhancing drug recently approved in adults. The goal for the child should be to allow the fullest possible return of normal functioning in school, at home, and in social situations.

Idiopathic Hypersomnia

Idiopathic hypersomnia **(IH)** is a central sleep disorder, presenting in adolescence and young adults, characterized by chronic and EDS, but without cataplexy or REM sleep intrusions. Patients typically present with prolonged nocturnal sleep duration and severe sleep inertia, making it difficult to arouse from nocturnal sleep or daytime naps. Patients often report transient periods of confusion and "sleep drunkenness" on awakening, sleep paralysis, and hypnagogic hallucinations. Unlike patients with narcolepsy, daytime naps tend to be long (more than 1 hour) and unrefreshing. The prevalence in the general population is not known because of challenges with diagnostic evaluation, but is estimated to be approximately 20-50 cases per million. The pathogenesis also is not well understood; however, some cases were documented to be precipitated by viral illnesses, suggesting a possible autoimmune process. A diagnosis of IH requires daily periods of irrepressible need to sleep or daytime lapses into sleep for at least 3 months, absence of cataplexy, and exclusion of other causes including insufficient sleep. Diagnosis is made by PSG followed by an MSLT showing mean sleep latency of <8 minutes and less than two sleep-onset REM periods (SOREMPs) on MSLT or no SOREMPs if the REM sleep latency preceding PSG is 15 minutes or less. When the mean sleep latency on the MSLT is >8 minutes, a 24-hour PSG or 2-week actigraphy to ensure a total 24-hour sleep time ≥660 minutes is needed. Treatment is mostly derived from experience with medications to treat EDS in narcolepsy. Wakeful promoting medications such as modafinil, armodafinil, methylphenidate, amphetamines, and oxybate are treatment options. Behavior modifications such as scheduled naps are not generally helpful.

Kleine-Levin syndrome (KLS) may mimic IH and manifests with recurrent episodes of hypersomnia (Table 31.9). KLS may resolve overtime; some reports support the use of parenteral steroids during an episode.

Table 31.9 Diagnostic Criteria for Kleine-Levin Syndrome

CRITERIA A–E MUST BE MET

A. The patient experiences at least two recurrent episodes of excessive sleepiness and sleep duration, each persisting for 2 days to 5 weeks.
B. Episodes recur usually more than once a year and at least once every 18 months.
C. The patient has normal alertness, cognitive function, behavior, and mood between episodes.
D. The patient must demonstrate at least one of the following during episodes:
E. Cognitive dysfunction.
F. Altered perception.
G. Eating disorder (anorexia or hyperphagia).
H. Disinhibited behavior (such as hypersexuality).
I. The hypersomnolence and related symptoms are not better explained by another sleep disorder, other medical, neurologic, or psychiatric disorder (especially bipolar disorder), or use of drugs or medications.

From Afolabi-Brown O, Mason II TBA. Kleine-Levin syndrome. *Pediatr Respir Rev.* 2018;25:9–13, Table 1, p 10.

Delayed Sleep–Wake Phase Disorder

Delayed sleep–wake phase disorder (**DSWPD**), a circadian rhythm disorder, involves a significant, persistent, and intractable phase shift in sleep–wake schedule (later sleep onset and wake time) that conflicts with the individual's normal school, work, and lifestyle demands. DSWPD may occur at any age but is most common in adolescents and young adults.

Etiology

Individuals with DSPD may start out as "night owls"; that is, they have an underlying biologic predisposition/circadian-based "eveningness" chronotype that results in a propensity for staying up relatively late at night and sleeping until late in the morning or early afternoon, and in extreme cases, a complete "day-night reversal." Although these patients struggle to get up in time for school or work, they usually revert to their preferred sleep schedule on weekends, holidays, and summer vacations. The underlying pathophysiology of DSWPD is still unknown, although some theorize that it involves an intrinsic abnormality in the circadian oscillators that govern the timing of the sleep period.

Epidemiology

Studies indicate that the prevalence of DSWPD may be as high as 7–16% in adolescents and young adults.

Clinical Manifestations

The most common clinical presentation of DSWPD is sleep-initiation insomnia when the individual attempts to fall asleep at a "socially acceptable" desired bedtime and experiences very delayed sleep onset (often after 1-2 AM), accompanied by daytime sleepiness. Patients may also report extreme difficulty arising in the morning even for desired activities, with pronounced confusion on waking *(sleep inertia)*, and caregivers often complain of the need for multiple reminders or even the complete failure to awaken the adolescent in time to attend school. Sleep maintenance is generally not problematic, and no sleep-onset insomnia is experienced if bedtime coincides with the preferred sleep-onset time. Patients may also develop "secondary" psychophysiologic insomnia as a result of spending prolonged time in bed attempting to fall asleep. School tardiness and frequent absenteeism with a decline in academic performance often occur, and there may be school-related disciplinary action (i.e., suspension, truancy label) or a need to justify home-based schooling/tutoring that motivate families to seek help. It is important to recognize that there may also be issues related to family dynamics and comorbid anxiety, depression, or learning disabilities that provide a motivation to avoid attending school and perpetuate the sleep schedule problems, as well as reducing adherence to interventions.

Treatment

The treatment of DSWPD usually has three components, all directed toward the goals of shifting the sleep–wake schedule to an earlier, more desirable time and maintaining the new schedule. The initial step involves shifting the sleep–wake schedule to the desired earlier times, usually with gradual (i.e., in 15-30 minute increments every few days) alternating advancement of rise time in the morning and bedtime in the evening. More significant phase delays (i.e., larger difference between current sleep onset and desired bedtime) may require *chronotherapy,* which involves delaying bedtime and wake time by 2-3 hours every 24 hours "forward around the clock" until the target bedtime is reached. Because melatonin secretion is highly sensitive to light, exposure to light in the morning (either natural light or a "light box," which typically produces light at around 10,000 lux) and avoidance of evening light exposure (especially from screens emitting predominantly blue light, such as computers and laptops) are often beneficial. Exogenous oral melatonin supplementation may also be used; larger, mildly sedating doses (5 mg) are typically given 30 minutes before bedtime, but some studies have suggested that physiologic doses of oral melatonin (0.3-0.5 mg) administered in the afternoon or early evening (5-7 hours before the habitual sleep-onset time or 2 hours before the desired bedtime) may be more effective in advancing the sleep phase.

SLEEP HEALTH SUPERVISION

It is especially important for pediatricians to screen for and recognize sleep disorders in children and adolescents during routine healthcare encounters. The well-child visit is an opportunity to educate parents about normal sleep and to teach strategies to prevent sleep problems from developing (primary prevention) or becoming chronic, if problems already exist (secondary prevention). Developmentally appropriate screening for sleep disturbances should take place in the context of every well-child visit and should include a range of potential sleep problems; Table 31.10 outlines a simple sleep screening algorithm called the "BEARS." Because parents may not always be aware of sleep problems, especially in older children and adolescents, it is also important to question the child directly about sleep concerns. The recognition and evaluation of sleep problems in children require both an understanding of the association between sleep disturbances and daytime consequences (e.g., irritability, inattention, poor impulse control) knowledge of risk factors for the wide variety of sleep disorders (e.g., obesity, positive family history, medications), and familiarity with the developmentally appropriate differential diagnoses of common presenting sleep complaints (difficulty initiating and maintaining sleep, episodic nocturnal events). An assessment of sleep patterns and possible sleep problems should be part of the initial evaluation of every child presenting with behavioral or academic problems, especially ADHD.

Effective preventive measures include educating parents of newborns about normal sleep amounts and patterns. The ability to regulate sleep begins to develop in the first 8-12 weeks of life. Thus it is important to recommend that parents put their 2-4 month old infants to bed "drowsy but awake" if they want to avoid dependence on parental presence at sleep onset and foster the infant's ability to self-soothe. Other important sleep issues include discussing the importance of regular bedtimes, bedtime routines, and transitional objects for toddlers, and providing parents and children with basic information about healthy sleep practices, recommended sleep amounts at different ages, and signs that a child is not getting sufficient sleep.

The cultural and family context within which sleep problems in children occur should be considered. For example, bed-sharing of infants and parents is a common and accepted practice in many racial/ethnic groups, and these families may not share the goal of independent self-soothing in young infants. *Anticipatory guidance* needs to balance cultural awareness with the critical importance of "safe sleep" conditions in sudden infant death syndrome prevention (i.e., sleeping in the supine position, avoidance of bed-sharing but encouragement of room-sharing in the first year of life) (see Chapter 423). On the other hand, the institution of cosleeping by parents as an attempt to address a child's underlying sleep problem (so-called reactive cosleeping), rather than as a conscious family decision, is likely to yield only a temporary respite from the problem and may set the stage for more significant sleep issues.

EVALUATION OF PEDIATRIC SLEEP PROBLEMS

The clinical evaluation of a child presenting with a sleep problem involves obtaining a careful medical history to assess for potential medical causes of sleep disturbances, such as allergies, concomitant medications, and acute or chronic pain conditions. A developmental history is important because of the increased risk of sleep problems in children with neurodevelopmental disorders. Assessment of the child's current level of functioning (school, home) is a key part of evaluating possible mood, behavioral, and neurocognitive sequelae of sleep problems. Current sleep patterns, including the usual sleep duration and sleep–wake schedule, are often best assessed with a **sleep diary,** in which a parent (or adolescent) records daily sleep behaviors for an extended period (1-2 weeks). A review of sleep habits, such as bedtime routines, daily caffeine intake, and the

Table 31.10 BEARS Sleep Screening Algorithm

The BEARS instrument is divided into five major sleep domains, providing a comprehensive screen for the major sleep disorders affecting children 2-18 yr old. Each sleep domain has a set of age-appropriate "trigger questions" for use in the clinical interview.
B = Bedtime problems
E = Excessive daytime sleepiness
A = Awakenings during the night
R = Regularity and duration of sleep
S = Snoring

	DEVELOPMENTALLY APPROPRIATE TRIGGER QUESTIONS		
	TODDLER, PRESCHOOL (2-5 YR)	**SCHOOL-AGE (6-12 YR)**	**ADOLESCENT (13-18 YR)**
1. Bedtime problems	Does your child have any problems going to bed? Falling asleep?	Does your child have any problems at bedtime? (P) Do you any problems going to bed? (C)	Do you have any problems falling asleep at bedtime? (C)
2. Excessive daytime sleepiness	Does your child seem overtired or sleepy a lot during the day? Does your child still take naps?	Does your child have difficulty waking in the morning, seem sleepy during the day, or take naps? (P) Do you feel tired a lot? (C)	Do you feel sleepy a lot during the day? In school? While driving? (C)
3. Awakenings during the night	Does your child wake up a lot at night?	Does your child seem to wake up a lot at night? Any sleepwalking or nightmares? (P) Do you wake up a lot at night? Do you have trouble getting back to sleep? (C)	Do you wake up a lot at night? Do you have trouble getting back to sleep? (C)
4. Regularity and duration of sleep	Does your child have a regular bedtime and wake time? What are they?	What time does your child go to bed and get up on school days? Weekends? Do you think your child is getting enough sleep? (P)	What time do you usually go to bed on school nights? Weekends? How much sleep do you usually get? (C)
5. Snoring	Does your child snore a lot or have difficulty breathing at night?	Does your child have loud or nightly snoring or any breathing difficulties at night? (P)	Does your teenager snore loudly or nightly? (P)

C, Child; P, parent.

sleeping environment (e.g., temperature, noise level), may reveal environmental factors that contribute to the sleep problems. Nocturnal symptoms that may be indicative of a medically based sleep disorder, such as OSA (loud snoring, choking or gasping, sweating) or PLMs (restless sleep, repetitive kicking movements), should be elicited. Home video recording may be helpful in the evaluation of potential parasomnia episodes and the assessment of snoring and increased work of breathing in children with OSA. An overnight sleep study (PSG) is not routinely warranted in the evaluation of a child with sleep problems unless there are symptoms suggestive of OSA or PLMs, unusual features of episodic nocturnal events, or unexplained daytime sleepiness.

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