CHAPTER

14

Infant Assessment and Development

A newborn's abilities and behaviors are linked closely to breastfeeding. Therefore, an understanding of newborn reflexes and characteristics is important when assessing breastfeeding. The lactation consultant can identify and help parents learn to watch and interpret their babies' behaviors. In particular, babies signal to their mothers through hunger cues. Patterns of behavior, growth, sleeping, crying, and digestion vary from one baby to another. Certain infant conditions may require a change in your approach to assisting a mother. A complete medical history and assessment of the mother and infant will help you identify situations that may affect lactation.

Key Terms

Acrocyanosis
Alveolar ridge
Approach behaviors
Asymmetry
Average baby
Avoidance behaviors
Bauer's response
Bifurcated or bifid
Bovine IgG
Buccal pads
Candidiasis
Caput succedaneum
Cephalhematoma
Clavicle
Cleft lip
Cleft palate
Colic
Constipation
Cosleeping
Cow's milk allergy
Dancer hand position
Diaper rash
Diarrhea
Down syndrome
Erythema toxicum
Flexion
Fontanel
Food sensitivity
Frenulum
Frenum
Gastroesophageal reflux (GER)
Gastroesophageal reflux disease (GERD)
Grooming
Hirschsprung's disease
Hunger cues
Hydration
Hypertonic
Hypotonic
Infant acne
Intravenous
Lactase
Lactase deficiency (lactase non-persistence)
Lactose overload
Leukocytes
Macular
Molding
New Ballard Scale (NBS)
Palate
Periosteum
Peristalsis
Placid baby
Projectile vomiting
Prone
Pyloric stenosis
Rapid eye movement (REM)
Reflexes
Rooting
Sling
Spitting up
Sucking
Sudden infant death syndrome (SIDS)
Sudden unexplained infant death (SUID)
Supine
Swaddling
Thrush
Turgor
Uvula
Ventral
Voiding
Yeast infection

Assessment of the Newborn

A newborn's first assessment will be documented by means of an Apgar score, which ranges from 0 to 10 (see **Table 14-1**). The Apgar score is performed at 1 minute of life and again at 5 and 10 minutes. The score rates five components: heart rate, respiratory effort, muscle tone, reflex irritability, and color, each of which is given a score of 0, 1, or 2. The score offers a quick status of the newborn and the response to resuscitation if needed (American Academy of Pediatrics [AAP], 2008). Scores are influenced by drugs, trauma, congenital anomalies, infections, hypoxia, hypovolemia, and prematurity. If you work with newborns in a hospital, Apgar scores are an intrinsic part of the baby's information. If you work with the baby after hospital discharge, be aware that Apgar scores have less relevance. However, low 5-minute scores, with other markers, may identify infants at risk of developing seizures. It also gives you a snapshot of a baby who may have had a challenging transition at birth with ensuing feeding difficulties.

Generally, your initial contact with a breastfeeding mother would include an assessment of her baby. This guideline applies especially when there is concern about poor weight gain, food intolerance, irritability, lethargy,

TABLE 14-1 Apgar Score

Five factors are used to evaluate the baby's condition, and each factor is scored on a scale of 0 to 2, with 2 being the best score.

1. Activity and muscle tone
2. Pulse (heart rate)
3. Grimace response (medically known as "reflex irritability")
4. Appearance (skin coloration)
5. Respiration (breathing rate and effort)

or sucking difficulties. To perform the assessment, the baby should be completely undressed and lying on a flat firm surface. Evaluate the infant's posture, skin, head, oral structure, **clavicle**, **reflexes**, color, elimination, and **hunger cues**. Be alert for any areas on the baby's body that cause pain or discomfort.

If you are unfamiliar with assessing newborns, you will find the **New Ballard Scale (NBS)** helpful in assessing the normal newborn (see **Table 14-2**). This gestational assessment tool evaluates the tone of the infant's total body, wrist, biceps muscle, knee joint, shoulder girdle, and pelvic girdle. "Girdle" refers to the bones that encircle the shoulder and pelvis. A detailed description and free online illustration of the scale are available at www.ballardscore.com. Chapter 24 covers preterm infants, and Chapter 26 discusses a variety of infant medical conditions.

Posture

Babies favor the fetal position, and healthy, full-term newborns generally hold their arms and legs in moderate **flexion**. Their fists are closed and usually held near their face. When awake, the infant resists having the extremities extended and may cry at attempts to do so. As babies mature, they remain in the fetal position less often and will spend more time comfortably in semi-extension.

Observing the baby's body tone will give you clues about potential problems. When held in the **ventral** (abdominal) position, normal infants lie on their abdomen, draped over the examiner's hand, and alternate between trying to bring their head up and putting it down again. At extreme positions, a baby's body tone may be too loose (**hypotonic**) or too rigid (**hypertonic**).

Babies whose mothers have taken antidepressants in the selective serotonin reuptake inhibitor (SSRI) class may exhibit neonatal behavioral syndrome. This syndrome is characterized as one or more of the following signs and symptoms: jitteriness, irritability, lethargy, hypotonia, hypertonia, hyperreflexia, apnea, respiratory distress, vomiting, poor feeding, or hypoglycemia (Kocherlakota, 2014; Leibovitch et al., 2013). Note that these babies can exhibit either hypotonia or hypertonia.

Hypotonia

A hypotonic infant has very low body tone and tends to "droop" over the examiner's hand. The extremities are in extension, and there is minimal resistance to passive movement. The baby appears floppy, sluggish, and flaccid (see **Figure 14-1**). A hypotonic baby may have difficulty staying latched to the breast because of a weak suck. He or she may find it difficult to maintain intraoral negative pressure, even on the examiner's finger. The infant frequently nurses with the shoulders elevated to just beneath the ears in an effort to support the neck and chin. In the ventral position, the hypotonic baby lays over the examiner's hand with the head hanging down, unable to bring it up.

Hypotonia is a marker for certain syndromes and neurologic disorders. In fact, ineffective sucking and hypotonia are often symptoms of an underlying problem, not the problem itself. It may be associated with prematurity, **Down syndrome**, autism spectrum disorder (ASD), Prader-Willi phenotype of fragile X syndrome, or botulism infection.

Hypertonia

A hypertonic infant has very rigid body tone. With hypertonia, the baby is often in hyperextension, arching away from the breast and the mother (see **Figure 14-2**). The mother may report that her baby is difficult to comfort, pulls away from contact, and does not snuggle into her chest or neck. Instead, her baby leans back and away from her.

Many hypertonic babies cannot tolerate anyone handling them and prefer to interact from a safe distance. They are often very alert and squirmy, and they will hold their heads erect from a **prone** (face-down) position or on the shoulder. When held in the ventral position, a hypertonic baby will be virtually straight, lifting both the head and buttocks and maintaining them on a horizontal plane. Hypertonia is associated with neurologic damage or disorders, respiratory syncytial virus (RSV) infection, and prenatal drug exposure (including cocaine and methamphetamine).

Skin

A healthy newborn's skin is warm and dry, with a pink or ruddy appearance. The ruddiness is a result of increased concentration of red blood cells in the blood vessels, coupled with minimal subcutaneous fat deposits. Small moles and birthmarks are not uncommon. Large congenital moles, while rare, are more likely to develop into skin cancer.

Birthmarks may be simple, such as small red dots or "stork bites," which usually fade away within a year or so. The baby may have pigmented birthmarks, a cluster of pigment cells, with colors ranging from tan to brown, gray to black, and even blue. Mongolian spots are large blue

TABLE 14-2 Ballard Score Maturational Assessment of Gestational Age

MATURATIONAL ASSESSMENT OF GESTATIONAL AGE (New Ballard Score)

NAME _____ DATE/TIME OF BIRTH _____ SEX _____

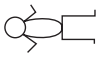
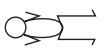
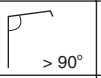
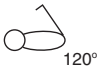
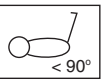
HOSPITAL NO. _____ DATE/TIME OF EXAM _____ BIRTH WEIGHT _____

RACE _____ AGE WHEN EXAMINED _____ LENGTH _____

APGAR SCORE: 1 MINUTE_____ 5 MINUTES_____ 10 MINUTES_____ HEAD CIRC. _____

EXAMINER _____

NEUROMUSCULAR MATURITY

	–1	0	1	2	3	4	5	RECORD SCORE HERE
Posture								
Square window (wrist)	 > 90°	 90°	 60°	 45°	 30°	 0°		
Arm recoil		 180°	 140°–180°	 110°–140°	 90°–110°	 < 90°		
Popliteal angle	 180°	 160°	 140°	 120°	 100°	 90°	 < 90°	
Scarf sign								
Heel to ear								

PHYSICAL MATURITY

	Sticky, friable, transparent	Gelatinous, red, translucent	Smooth, pink, visible veins	Superficial peeling and/or rash, few veins	Cracking, pale areas, rare veins	Parchment, deep cracking, no vessels	Leathery, cracked, wrinkled
Skin							
Lanugo	None	Sparse	Abundant	Thinning	Bald areas	Mostly bald	
Plantar surface	Heel-toe 40–50 mm: –1 < 40 mm: –2	> 50 mm, no crease	Faint red marks	Anterior tranverse crease only	Creases anterior two-thirds	Creases over entire sole	
Breast	Imperceptible	Barely perceptible	Flat areola, no bud	Stippled areola, 1–2 mm bud	Raised areola, 3–4 mm bud	Full areola, 5–10 mm bud	
Eye/Ear	Lids fused loosely: –1 tightly: –2	Lids open; pinna flat, stays folded	Slightly curved pinna, soft, slow recoil	Well-curved pinna, soft but ready recoil	Pinna formed and firm, instant recoil	Thick cartilage, ear stiff	
Genitals (male)	Scrotum flat, smooth	Scrotum empty, faint rugae	Testes in upper canal, rare rugae	Testes descending, few rugae	Testes down, good rugae	Testes pendulous, deep rugae	
Genitals (female)	Clitoris prominent, labia flat	Clitoris prominent, labia minora small	Clitoris prominent, labia minora enlarged	Labia majora and minora equally prominent	Labia majora large, labia minora small	Labia majora cover clitoris and labia minora	

MATURITY RATING

Score	Weeks
–10	20
–5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

RECORD SCORE HERE

GESTATIONAL AGE (weeks)

By dates_____

By ultrasound_____

By exam_____

Ballard JL, Khoury JC, Ellers-Walsman BL, & Lipp R. New Ballard score, expanded to include extremely premature infants. *Journal of Pediatrics*. 1991:119(3):7. Reprinted with permission from Elsevier.

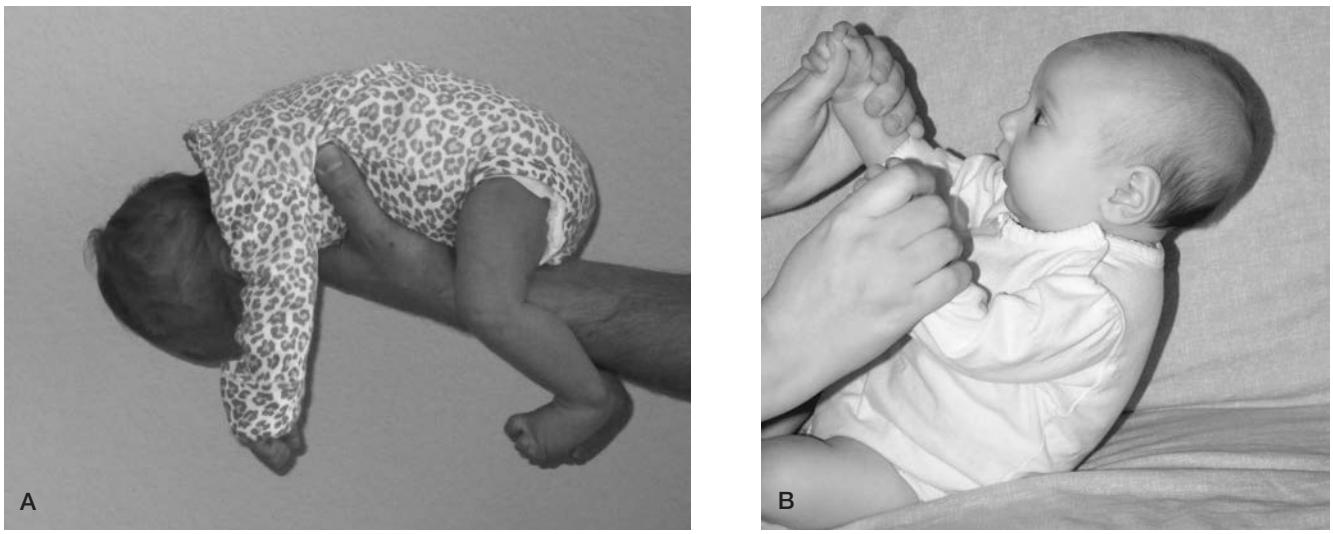


FIGURE 14-1 Hypotonic baby (left) and baby with good muscle tone (right).

to gray pigmented birthmarks usually found on the lower back and buttocks of newborns. They occur most often in dark-skinned infants and usually fade away within a few years.

Vascular birthmarks, which are due to abnormal blood vessel development, include port wine stains and hemangiomas and may be associated with syndromes and glaucoma (Kanada et al., 2012). Disfiguring or debilitating conditions may be treated with laser or steroid therapies (Tollefson & Frieden, 2012). A hemangioma near or on the infant's lips or nose may affect breastfeeding (see Color Plate 14). The mother may need help with alternative feeding arrangements until treatment is obtained.

FIGURE 14-2 Hypertonic baby who arches away from the mother.

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Lanugo

Lanugo is the Latin word for "down," meaning the fine small hairs found on some plants. In newborns, lanugo describes the fine, downy hair covering the body. It usually appears in utero at about 5 months' gestation and is shed at 7 to 8 months' gestation. Lanugo is most abundant on preterm babies who are born at 5 to 6 months' gestation (Blackburn, 2013).

Hydration

Hydration can be assessed by evaluating the **turgor** (resiliency) of the baby's skin. Turgor is the normal strength and tension of the skin, caused by outward pressure of the cells and the fluid that surrounds them. The baby's chest, abdomen, or thigh is a good area on which to test skin turgor. When gently grasped between your finger and thumb, the skin should spring back to its original shape when the tissue is released. It should not leave an indentation, fold, or wrinkled appearance. Loose skin that slowly returns to a position level with the tissue next to it is a sign of dehydration (Moses, 2013). The baby's skin may be dry, flaky, or peeling, especially by the end of the first or second week after birth. This appearance is normal and not a sign of dehydration.

Color

Skin color will vary depending on the baby's ethnic origin. A significant increase in the newborn's bilirubin level creates a yellowing in the skin color from jaundice, also called hyperbilirubinemia (see Color Plate 15). You can assess for jaundice in natural light by pressing the baby's skin with your index finger and noting the color when you lift your finger.

For a quick estimation, some caregivers use a method referred to as the "rule of fives" to estimate bilirubin levels in the infant. Jaundice becomes visible in the sclera (white portion of the eye) when the bilirubin level reaches approximately 5 mg/dL. Continuing down the body, the level increases progressively from the face to the feet by approximately 5 mg/100 mL. Jaundice to the level of the shoulders correlates to a bilirubin level of 5 to 7 mg/dL. Between the shoulders and umbilicus, levels will range from 7 to 10 mg/dL. Between the umbilicus and knees, levels are in the range of 10 to 12 mg/dL. Bilirubin levels are greater than 15 mg/dL below the knees.

Progression of color occurs only when the bilirubin level is rising. When it begins to fall, the skin color fades gradually in all affected areas at the same time (AAP, 2004). If you observe jaundice in an infant, refer the parents to the baby's primary healthcare provider immediately so that levels can be measured precisely with a blood test. Chapter 23 provides an in-depth discussion of jaundice and its implications.

Acrocyanosis **Acrocyanosis** describes a bluish tinge to the newborn's hands and feet (see Color Plate 16). It may be present after birth because of poor peripheral circulation, especially if the child experiences exposure to cold (Stanford School of Medicine, 2014). The bluish color should disappear after a few days. Parents often need reassurance that this condition is normal and not a sign that their baby is cold.

Erythema Toxicum

Erythema toxicum is a pink to red **macular** area with a yellow or white center (see Color Plate 17). It is the most common skin eruption in newborns, occurring in as many as 70 percent of infants. Erythema toxicum has no apparent significance and requires no treatment (Tarang & Anupam, 2011). It is common on the newborn's trunk or limbs and is temporary. It may be present at birth but usually appears during the second or third days after birth and then disappears within about 1 week.

Infant Acne

Infant acne resembles adolescent acne. It appears on the face, primarily on the nose, forehead, and cheeks (see Color Plate 18). The appearance changes depending on whether the baby is hot, cool, crying, or quiet. In most cases, infant acne starts at about 2 weeks of age and disappears at 8 to 10 weeks. It is believed to be the result of sebaceous gland stimulation by maternal or infant hormones (Lewis, 2014b). If a baby's newborn acne does resolve on its own, the baby's healthcare provider can rule out any underlying adrenal or endocrine factors.

Mottling

Mottling (cutis marmorata) is a white and reddish coloration of the skin on the baby's trunk and extremities (see Color Plate 19). This condition is a vascular response to cold and usually clears when the skin is warmed. Some babies' skin may mottle easily for several weeks, months, or even into early childhood. No treatment is needed (Lewis, 2014b).

Milia

Milia are very small "whiteheads" that are actually keratin deposits within the dermis (see Color Plate 20). As many as half of all newborns exhibit milia. They usually occur on the forehead, cheeks, nose, and chin but may also occur on the trunk and in the diaper area (Zuniga & Nguyen, 2013). Milia usually resolve by the end of the first month.

Diaper Rash

Diaper rash appears as a small, reddened, pimple-like rash. Frequent diaper changes, careful washing, air drying (even leaving the diaper off a while), and over-the-counter ointments or creams aid in healing. A diaper rash that does not clear up with appropriate treatment may be a **yeast infection**. Yeast infection diaper rashes tend to be raised, larger red patches and look more like welts than small red dots. Any diaper rash that does not clear quickly should be checked by a healthcare provider to rule out a bacterial or yeast infection (Shin, 2014).

Cradle Cap

Cradle cap (seborrheic dermatitis) is a thick, scaly dandruff mostly found on the scalp (see Color Plate 21) and sometimes on the face, ears, neck, and even in the diaper area. It usually occurs within the first 6 weeks of life. Cradle cap looks unattractive and can be distressing to parents. It may be caused by overactive sebaceous glands, although a yeast infection should also be ruled out (Das & Das, 2014). Cradle cap is self-limiting and goes away as the baby gets older. The physician may prescribe an antifungal shampoo if regular cleansing does not help. The baby should be evaluated for immunodeficiency in the event of unresolved scaling accompanied by diarrhea and low weight gain or failure to thrive.

Head

The newborn's head is large, accounting for approximately one-fourth of total body size. The skull bones are soft and pliable. They remain unfused at birth to accommodate the infant's descent through the birth canal during second-stage labor. After birth, the head may appear asymmetric because of the overlap of skull bones, referred

to as **molding**. Severe molding may cause temporary difficulty with latch. You can help the mother position her baby so that no pressure is put on the baby's head. Laid-back (reclined) or side-lying positions may be most comfortable.

Caput Succedaneum

Caput succedaneum is a collection of fluid between the newborn's skin and cranial bone (see **Figure 14-3**). It usually forms during labor on the presenting area of the head in the cervical opening. The longer the head is engaged during labor, the greater the swelling can be. This condition occurs in 20 to 40 percent of vacuum extractions (Volpe, 2008). There may be red or bruised discoloration, and the baby may be sensitive to pressure on the affected area. Swelling begins to subside soon after birth. Vacuum extraction and the resulting caput have been associated with bald spots (alopecia) in a few cases (Lykoudis et al., 2007). Severe caputs and cephalhematomas (discussed below) are associated with feeding difficulties (Genna, 2008).

Cephalhematoma

A **cephalhematoma** is a pool of blood between the bones of the head and the **periosteum**, the covering of the bone (see Color Plate 22). The resultant swelling may begin to form during labor and slowly become larger in the first few days after birth. It may take up to 6 weeks to resolve completely. Cephalhematoma is usually a result of trauma, often from an extended second stage of labor, forceps, or vacuum extraction (Doumouchtsis & Arulkumaran, 2008; Goetzinger & Macones, 2008). Because the area may be sensitive to touch, the mother will want to nurse in a position that avoids contact with her baby's head. Be aware that bruising increases the risk for feeding difficulties and for jaundice as the blood is reabsorbed into the child's blood vessels.

Fontanel

The **fontanel** is a space between the bones of an infant's skull that is covered by tough membranes. The posterior fontanel closes at about 2 months. The anterior fontanel remains soft until the baby reaches about 18 months. Increased brain pressure may cause a fontanel to become tense or to bulge. The fontanel of a dehydrated infant may be soft and sunken, especially when in the **supine** position.

Facial Asymmetry

Facial **asymmetry** may result from injury to the nerves from birth trauma. If the baby's tongue is not centered in the mouth as a result, the mother can position her nipple over the center of the baby's tongue rather than the center of the mouth. Some mothers find that these babies respond well to feeding in the clutch or football hold position.

Facial asymmetry may also occur in utero during development when the infant's face is wedged against his or her own body or the uterus. The asymmetry usually resolves over several days following birth, depending on the severity. Many parents find that babies with facial asymmetry respond well to chiropractic care (International Chiropractic Pediatric Association, 2014) or to physical or occupational therapy.

Eyes

Most babies' eyes are grayish blue at birth, with the final eye color developing at 6 to 12 months of age. Sometimes babies will have broken capillaries in the sclera resulting from the birth; these usually resolve within the first 10 days postpartum. In addition, some infants may demonstrate swelling of the eyelids, which typically recedes by a few days after birth. Jaundice can cause a yellow staining in

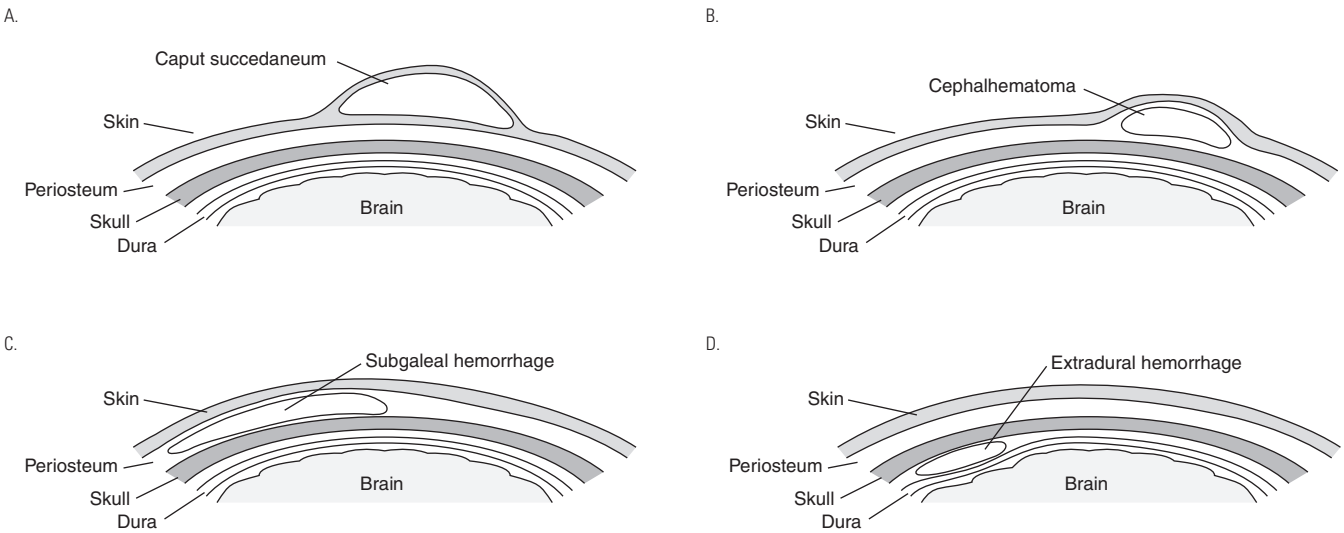

FIGURE 14-3 Common hematomas of the newborn scalp.

the sclera (the white portion) of the eye that appears when the baby's bilirubin level exceeds 5 mg/dL.

Neck

The neck surrounds the infant's esophagus and trachea. The epiglottis is the cartilage that overhangs the trachea and closes during swallowing to prevent food from entering the trachea (see **Figure 14-4**). An infant's neck is very short. Because it is too weak to provide head support, the newborn's head needs to be supported at all times. Supporting the baby's neck and shoulders at feedings will keep the mother from pushing on the child's head, which can be counterproductive. It may help to describe to the mother that her hand is like the baby's "second neck." She can support the neck and shoulders and gently scoop the baby toward her with the palm of her hand. This avoids pressure on the head while still supporting the head's weight (La Leche League International, 2013).

Torticollis A baby whose head is continually turned to the side, usually to the right, may have torticollis—literally, "twisted neck" (see **Figure 14-5**). Torticollis in infants is caused by a shortening of the muscle that extends from the base of the ear down to the clavicle. The cause may be the baby's position or lack of space in the womb, birth trauma, or low amniotic fluid. Rarely, torticollis can be a marker for serious problems, so the baby needs to be seen by the primary care practitioner for assessment. Congenital torticollis has been found to be a significant risk factor for later neurodevelopmental conditions (Schertz et al., 2013).

A baby with torticollis may only be comfortable breastfeeding with his or her head turned to the side. Placing the baby in the side-sitting position (also called football or clutch hold) for feedings can provide better control over the infant's neck position. Some children with torticollis may feed well in the cradle hold for one side and not the other. In such a case, the mother can scoot the child over to the other breast without changing the angle of the neck. She can also try nursing lying down, with the bed providing postural support. The mother can try other nursing positions as her baby's range of motion improves through physical therapy or chiropractic care.

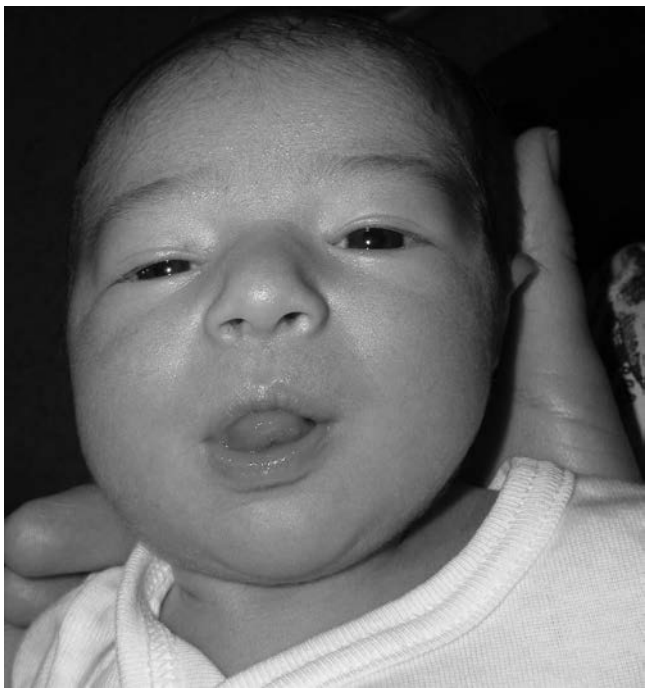

FIGURE 14-5 Baby with torticollis.

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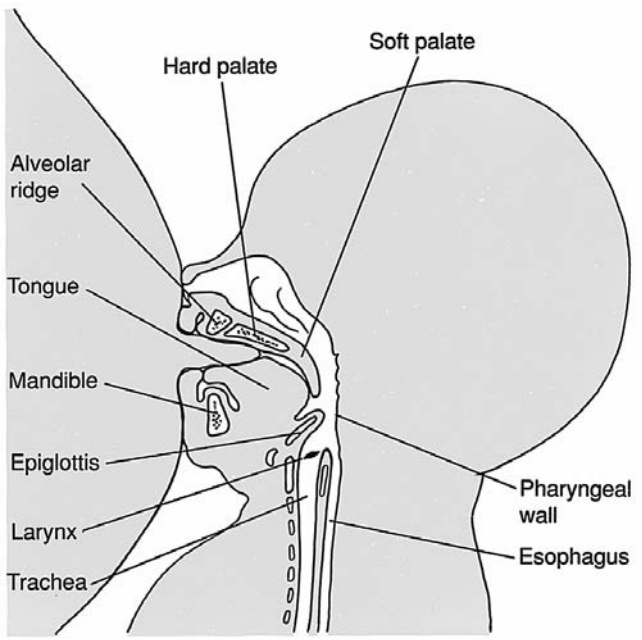

FIGURE 14-4 Swallowing anatomy.

Jaw

The baby's jaw (mandible) is the part of the head that moves for feeding. All babies are born with degrees of receding jaws. Achieving a deep latch can be challenging when a baby's jaw is severely recessed or very small (micrognathia). A severely receding or small jaw is a marker for a variety of genetic conditions, including Pierre Robin sequence (Vipulananthan et al., 2014). As the baby grows, the jaw comes forward. See Chapter 26 for more discussion of infant conditions. Bottle feeding interferes negatively with oral facial development (Carrascoza et al., 2006) and later dental development (Moimaz et al., 2014).

Oral Structure

Visual inspection of the mouth is an important element of an infant assessment. Look for gum lines that are smooth and a **palate** that is intact and gently arched. The tongue should be able to extend over the lower **alveolar ridge** (gum line) and up to the middle of the baby's mouth when it is open wide.

Lips

A baby's lips close around the breast and form a seal to create negative pressure. When assessing a baby's lips, look for friction blisters, which are typically seen on the midline of the top lip. Known as "sucking blisters," they can be signs that the baby is not generating enough negative pressure to maintain latch. The baby compensates by using the lip muscles (orbicularis oris) to compress the breast. If you observe sucking blisters in a newborn, ask the mother if the baby was born with the blister or whether it developed after birth. Babies can be born with lip blisters from sucking on their hands in the womb. If it occurred after birth, check the baby's latch to determine if assistance is needed.

The most noticeable defect involving the lips is a **cleft lip**. A baby may have a cleft lip combined with a cleft in the hard or soft palate, or a cleft lip with normal palatal development. A baby may also have a **cleft palate** with no lip defect. Chapter 26 discusses clefts in more depth.

Lip tone is an important consideration in breastfeeding. Tight, pursed lips are a marker for impaired intraoral pressure in the baby—a frequent occurance in preterm infants. Soft, flaccid lips with a poor seal and little resistance can be a sign of low muscle tone. This type of deviation occurs in babies with neurologic issues, such as Down syndrome, and in babies who have been affected by maternal drugs and medications or birth trauma such as facial nerve injury (Werner et al., 2011). Be aware that the philtrum—the midline space between the upper lip and the nose—has a slight dip. A flat philtrum can be a marker for neurologic issues, especially fetal alcohol syndrome.

Tongue

In breastfeeding, the baby's tongue draws the breast into the mouth and forms a groove or trough. Suckling draws a bolus of milk through the trough toward the back of the mouth where it is swallowed. Observe the size and shape of the baby's tongue for any anomalies that could affect troughing or movement, especially if the mother complains of pain with breastfeeding. Assess whether the tongue is short or humped, unusually thick or thin, or long or abnormally large. Macroglossia (large tongue) is a marker for genetic disorders, including Down syndrome and Beckwith-Wiedemann syndrome. It is also associated with the low muscle tone found in children with neurologic damage.

Alveolar Ridge (Gum Line)

The baby's alveolar ridge should be smooth and uniform. Occasionally, a baby will be born with a very bumpy gum line, from which it appears teeth are about to erupt. These bumps may be white or yellowish gingival cysts ("Epstein pearls"), a benign condition. Epstein pearls may also occur on the palate. These cysts resolve a few weeks or months after birth, and no treatment is required (Lewis, 2014a). Rarely, a baby will be born with a baby tooth already erupted (natal tooth) or with a tumor on the gum pad (Eghbalian & Monsef, 2009).

Lingual Frenulum

The lingual **frenulum** is the skin under the tongue. It tethers the tongue to the floor of the mouth and controls the tongue's motion. Frenula can vary in position, thickness, and length. A tongue that cannot extend over the alveolar ridge may be due to **ankyloglossia**—a tight frenulum, also referred to as tongue-tie (see Color Plate 23). Ankyloglossia, a midline defect, may restrict movement of the tongue in several ways. Anterior restriction (tethering to the tip of the tongue) may cause the classic heart-shaped appearance when crying. Mid-tongue and posterior restriction may be more subtle. It is also possible to have a sublingual tongue-tie, referred to as "hidden."

Ankyloglossia is estimated to occur in 2.8 to 10.7 percent of infants (Edmunds et al., 2011) and seems to be more common in males (Hong et al., 2010; Ricke, 2005). There may also be a familial link (Han et al., 2012). Breastfeeding difficulties are common in conjunction with this condition. A tight frenulum can make it difficult for the baby to stay attached to the breast during feeding and may result in poor milk transfer and low weight gain (Garbin et al., 2013). Be alert to the possibility of a tight frenulum as the cause of chronic nipple soreness, cracked and bleeding nipples with "positional stripe" bruising or scabbing, slow weight gain, long feedings, low milk production, mastitis, or plugged ducts.

Clipping the frenulum (frenotomy or frenulotomy) releases the lingual frenulum and usually improves tongue movement. Clipping is an in-office procedure in which a small cut is made at the anterior portion of the frenulum (see **Figure 14-6**). This enables the baby's tongue to extend adequately to produce a good latch and milk transfer (Buryk et al., 2011).

Breastfeeding-supportive providers have observed the negative effects of ankyloglossia on breastfeeding for many years. Since the publication of the seminal study on this condition (Ballard et al., 2002), the volume of medical research literature has exploded on the topic. Infants with a tight frenulum are significantly more likely to be exclusively bottle fed by 1 week of age (Ricke et al., 2005). Breastfeeding improves dramatically in most infants who have frenotomies, with parental satisfaction high and few complications reported (Edmunds et al., 2011, 2012; Geddes et al., 2008; Kumar & Kalke, 2012; Steehler et al., 2012). Improvements are more significant (86 percent) when the procedure is performed within the first week of life compared with 74 percent after the first week (Steehler et al., 2012).

Ankyloglossia can be detected prenatally through ultrasound imaging as early as 22 weeks' gestation (Allen &

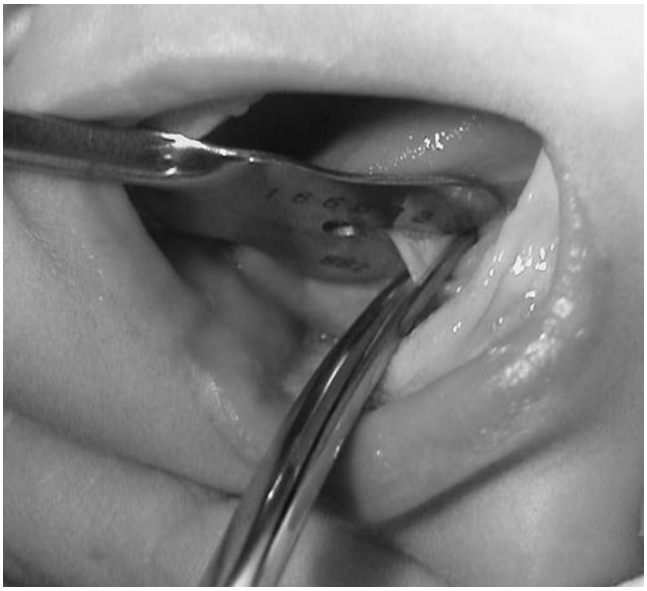

FIGURE 14-6 Frenotomy procedure.

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Spadola, 2013). Ultrasound provides visual understanding of an infant's compensation when the ability to maintain a latch and suck is compromised. Milk intake, milk transfer, LATCH scores, and mothers' pain scores improve significantly after the babies' frenula are clipped. Prior to the procedure, babies either compress the tip of the nipple or compress the base of the nipple with the tongue; these issues are resolved or lessened after frenotomy (Geddes et al., 2008).

Ankyloglossia occurs in stages and varies in terms of its severity, including its effects on both form and function of the child's mouth. Types 1 and 2 can be resolved by clipping (frenotomy or frenulotomy). More severe cases (types 3 and 4) may require frenuloplasty, a more invasive procedure that involves a V-shaped cut and stitches. Infant latch has been shown to improve significantly after treatment for posterior ankyloglossia, with positive breastfeeding outcomes (O'Callahan et al., 2013).

When you work with families whose babies have tight frenula, educating the parents empowers them to seek the appropriate help. A list of healthcare providers in your community who are knowledgeable about evaluating and treating tongue-ties is a useful resource. Encourage the family to share the results of their child's evaluation and treatment with their primary care provider. Such sharing helps raise awareness and support in the medical community for treating ankyloglossia and other oral anomalies. Resources for healthcare providers include a protocol on neonatal ankyloglossia developed by the Academy of Breastfeeding Medicine (ABM, 2009).

Frenum

The labial **frenum** is the fold of skin that anchors the upper lip to the top gum (see Color Plate 24). A large frenum results in a gap between the two top front teeth, although it does not usually interfere with the infant's latch. Some babies' frena are so prominent that it is difficult for them to flange the upper lip; in such cases, their mothers may report nipple compression and discomfort while breastfeeding. Clipping and treatment are usually done for aesthetic reasons. Clinicians report good results in having labial frena clipped when their constriction interferes with latch (Kotlow, 2010, 2011). Laser treatment is increasingly the method of choice for both labial (maxillary) frenum and lingual frenulum release because it prevents bleeding and offers faster healing (De Santis et al., 2013; Junqueira et al., 2014; Reddy et al., 2014).

Buccal Pads

Buccal pads inside the cheeks (also called fat pads or sucking pads) add to the thickness of the cheek wall (see **Figure 14-7**). They help decrease the space within the infant's mouth, thereby increasing negative pressure and facilitating milk transfer. Buccal pads may not be present in an infant who is malnourished or born preterm. When working with a thin or preterm baby with feeding difficulties, you can place your gloved finger inside the mouth and your thumb on the outside of the cheek to feel the thickness of the fat pads (Wilson-Clay & Hoover, 2013). When the pads are very thin, your fingers will almost touch.

To facilitate breastfeeding in such cases, it may be necessary to position the infant at the breast in such a way that the mother can use her finger against the baby's cheeks to compensate for the lack of fat pads, using the **Dancer hand position** (see Figure 15-6 in Chapter 15). As the baby grows, the size of the fat pads diminishes as the cheek muscles become stronger and provide more stability.

FIGURE 14-7 Buccal pads.

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Palates

The roof of the mouth contains a hard palate and soft palate. The hard palate is located in the front of the mouth; the soft palate lies behind it, in line with the end of the upper alveolar ridge. The condition and shape of the palate can become a factor in establishing breastfeeding. When observing the palate, note whether it has a smooth slope or is highly vaulted, grooved, or bubble shaped. If the palate is high, explore under the tongue for a tight frenulum. Some high palates may be caused by the baby's tongue being unable to reach the roof of the mouth to spread the palate during uterine development. Sometimes a palate is grooved, high, or channeled because of extended intubation with preterm or ill babies. Usually, however, high palates occur naturally.

A high, arched, or bubble palate can sometimes cause the mother's nipple to "catch" in the groove and therefore not elongate for breastfeeding. This type of palate makes it more difficult for the tongue to compress the breast tissue adequately in order to feed effectively. Mothers whose infants have such palates often complain of nipple soreness, long feedings, and an unsatisfied infant who needs to nurse frequently. Small protein-filled cysts (Epstein pearls), like those sometimes found on the gum lines, may also occur on the palate. They are not a cause for concern because they typically resolve spontaneously after birth.

When an infant has a cleft lip, the condition is immediately obvious to everyone. Frequently, infants with cleft lips also have cleft palates. Occasionally, however, an infant may have a cleft of the soft palate that escapes initial diagnosis. Infants with a cleft of the soft palate may choke and gag while nursing. Milk can escape from the baby's nose when letdown occurs and stridor or wheezing may be heard. Changing positioning at the breast is often helpful to assess this kind of cleft palate.

Some infants may have submucosal clefts, in which skin covers a cleft of the hard or soft palate. In this condition, a notched "V" shape may be observed on the hard palate. These babies often have a **bifurcated** (**bifid**, or split in two parts) **uvula** (see **Figure 14-8**). Submucosal clefts and bifid uvulas are markers for a variety of genetic disorders, with differing rates of severity (Shprintzen, 2008). Babies with submucosal clefts may not feed effectively, resulting in low weight gain. Submucosal clefts are frequently not diagnosed until speech impediments are seen. Other markers are Eustachian tube dysfunction, hearing loss, and swallowing difficulties (Oji et al., 2013; ten Dam et al., 2013). See Chapter 26 for more information on breastfeeding an infant who has a cleft of the lip, palate, or both.

Thrush

Thrush is a yeast infection often characterized by white patches that cannot be removed without causing bleeding (see Color Plate 25). This kind of infection may occur between the baby's gums and lips, on the inside of the cheeks, and on the tongue. It is thick and patchy, not the thin, uniform white coating usually found on an infant's tongue. Thrush, which is most frequently caused by the organism Candida albicans, is also known as **candidiasis**. The infection may appear on the mother's nipples as well as in the baby's mouth, making it imperative that both mother and baby receive treatment at the same time. See the discussion in Chapter 17 on yeast as a cause of nipple pain.

FIGURE 14-8 Bifurcated uvula.

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Clavicle

The clavicle (collarbone) can be a source of discomfort for a newborn. An injured clavicle is a common birth trauma, usually identified during the baby's initial examination. In some cases, however, it may escape detection until later. In response to the damage, the baby may restrict the use of the injured arm and resist breastfeeding in a position that places pressure on the fractured area. For example, a baby with a fractured left clavicle may be uncomfortable feeding at the right breast in the cradle hold. An x-ray will confirm the fracture. Treatment typically consists of immobilizing the arm by pinning it in a shirt or blanket. A fractured clavicle heals quickly, usually within 2 months, and without special care (Wall et al., 2014). After healing, there may be a callus on the clavicle, which will disappear as the baby grows.

Chest

To assess the chest, observe it while the infant is breathing. Labored breathing—evidenced by marked retractions or observable indentations in the chest—may be a symptom of respiratory or cardiac problems. If you work with a baby who exhibits this type of breathing, the baby needs to be assessed by a physician right away.

Nipple appearance on the baby's chest is a sign of maturation. The more preterm the baby is, the flatter the nipple bud will be. Supernumary nipples may be present either bilaterally or unilaterally and may be mistaken for moles. As discussed in Chapter 7, the infant breast may be swollen and even leak "witch's milk," a fluid caused by transplacental transfer of maternal hormones (Jain et al., 2013). This fluid disappears within the first 3 weeks after birth.

Reflexes

Reflexes in the newborn are present until the central nervous system has matured. They serve as a form of communication that tells us much about what the baby needs. Some reflexes are protective, such as blinking or gagging. Other reflexes indicate a need for more or different interaction (Lewis, 2014b). The Moro (or startle) reflex results when the infant is exposed to a loud noise, causing the infant's legs to draw up and arms to fling out. The grasp reflex is initiated by touching the palm of the baby's hand. If left unassisted after birth, the grasp reflex would help the baby move to the breast.

Arching indicates a need for different positioning or a pause from activity. It resembles the positioning of a hypertonic infant (Figure 14-2). If pressure exerted on the back of the head pushes the baby's face into a surface, as against the breast during a feeding, the baby may arch backward. Pressure on the soles of the baby's feet will elicit spontaneous crawling efforts and extension of the baby's head, referred to as **Bauer's response**. When positioning for a feeding, be careful not to press the baby's feet against the back or side of the couch or chair, pressure that could cause the baby to arch away from the breast.

Rooting

A full-term healthy newborn has many reflexes that aid breastfeeding (see **Table 14-3**). **Rooting** is at the forefront of these reflexes (Widstrom et al., 2011). Lightly stroking the baby's cheek will cause the baby's head to turn in the direction of the stimulus. The mouth will open and the tongue will come forward, as illustrated in **Figure 14-9**. Gently touching the baby's upper lip causes the mouth to open. The mother can initiate the rooting reflex by brushing her nipple against her baby's cheek, stimulating the baby to turn toward her breast and search for the nipple. She can also gently brush the baby's nose or philtrum (the midline spacing between the nose and mouth) to encourage a deeper, asymmetrical latch with the baby's head tilting back slightly.

TABLE 14-3 Gestational Development of Newborn Reflexes

Nutritive Sucking	
9 weeks	Move mouth and lower face
12 weeks	Swallow
18–24 weeks	Nonnutritive suck
32–34 weeks	Nutritive suck and swallow
Associated Reflexes and Responses	
26–27 weeks	Gag reflex with: tongue protrusion, head and jaw extension, contraction of the pharynx
28 weeks	Phasic bite—rhythmic opening and closing of the jaw in response to gum stimulation
28 weeks	Transverse tongue response—movement of the tongue toward the side of stimulation when its lateral surface is touched
32 weeks	Rooting reflex—searching response (progressively toward the side of facial stimulation)
40 weeks	Tongue protrusion response—protrusion when anterior tongue is touched (inhibited as infant grows)

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Sucking

An object placed far enough back into the baby's mouth near the juncture between the hard and soft palate will elicit

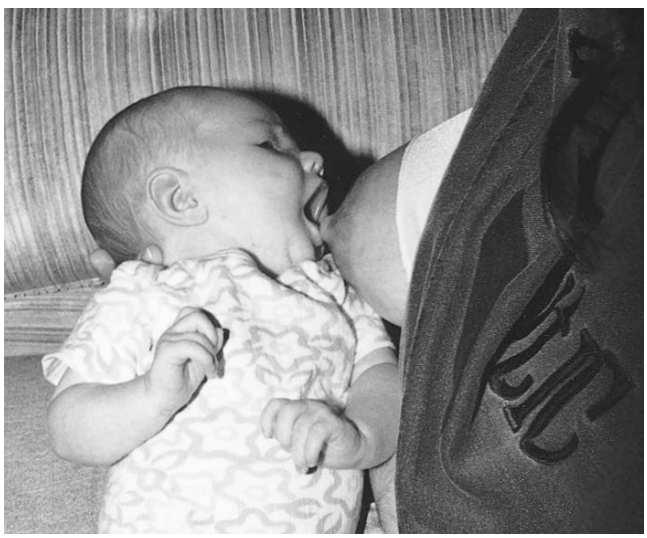

FIGURE 14-9 Rooting for the nipple is a feeding readiness signal from the baby.

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sucking. Babies demonstrate two types of **sucking**. A high-flow nutritive suck, characterized by a long, deep suck–swallow–breathe pattern, elicits about one suck per second. A low-flow nonnutritive suck elicits about two sucks per second. It is characterized by a light suck, almost a flutter, with short jaw excursions and little or no audible swallowing. Chapter 16 provides a detailed discussion of sucking.

Digestion

Babies exhibit their own unique growth and activity patterns. Patterns of digesting food and expelling waste are equally individualized. Encourage parents to learn these characteristics to become familiar with their baby's digestive patterns and particular needs. Patterns of digestion need to take into account the baby's disposition, eating and sleeping patterns, and body temperature. A change in pattern can alert parents to a problem or illness before it becomes serious. If the parents notice a change, encourage them to consider the baby's overall pattern before contacting the caregiver. This will help them determine whether the current issue represents one small change in their baby's habits or a more significant change. The parents also should observe skin color, changes in breathing, or other signs of illness such as glassy eyes or abdominal cramping. Four functions that occur during digestion—burping, spitting or vomiting, **voiding**, and stooling—are discussed in the following sections.

Burping

Breastfed babies may need to be burped even though they usually do not take in as much air as bottle-fed babies. Babies who suck vigorously may gulp air when they nurse. If the mother watches for hunger cues and begins a feeding before her baby becomes ravenous, her baby will cry less, resulting in less air in the stomach. Burping increases comfort by decreasing gas pains and reducing **spitting up**. Gentle patting or rubbing helps air bubbles coalesce and rise to the top of the baby's stomach to be expelled. If a baby consistently spits up after nursing, the mother may not be taking enough time for burping.

There are several ways to help the baby release swallowed air. The mother can rock her baby in her lap and gently rub her baby's back. Another method is to hold the baby against her shoulder and massage or pat in the middle of the back with a firm pressure from the bottom up. She can also lay her baby on his or her stomach across her lap, turn her baby's head to one side so that the nose is free, and gently rub the back from the bottom up.

Holding babies at a 45-degree angle after feedings will help bring up air before being laid down for sleep. A baby **sling**, infant seat, or swing can accomplish this positioning. If the baby has been crying, the mother can try to burp the baby before putting him or her to the breast. A vigorous feeder will need to nurse before becoming upset so as to cut down on the amount of air intake.

Spitting Up

The passage between the baby's stomach and mouth is very short. The muscle valve at the upper end of the stomach (the cardiac sphincter, or lower esophageal sphincter) is not as efficient as it will be later in life. As a result, babies spit up quite often during the early months. Some infants spit up more than others do. Frequent spitting up could be a sign of overfeeding or overactive milk production. If the mother waits too long between feedings, the baby may be upset and gulp air with the milk. Mucus in the baby's stomach can also cause spitting up, especially directly after birth and when the baby has an upper respiratory infection.

Although spitting up is messy and inconvenient, it is not usually a reason for concern. Because cow's milk protein intolerance and nicotine can cause spitting up, however, the mother may want to consider adjustments in her lifestyle and diet. Her baby will benefit if she quits smoking or at least reduces the number of cigarettes smoked. She can burp her baby more often both before and during a feeding. More frequent feeding may also help to reduce spitting up. Occasionally, if the mother experiences an overproduction of milk, limiting the baby to one breast per feeding may help. Make this recommendation only after a complete feeding assessment to ascertain that the mother has overproduction.

Projectile Vomiting

Spitting up differs from vomiting in terms of the force with which the baby expels milk. The baby may dribble milk out with every burp or may regurgitate with some force. A violent expulsion of milk is considered **projectile vomiting** and requires a physician's attention. Even breastfed babies can experience gastroenteritis or stomach flu. Babies become dehydrated much faster than older children or adults. Thus, if a baby vomits more than twice in a 4-hour period, the parents need to contact their medical provider immediately.

If a baby several weeks old suddenly begins vomiting or if vomiting becomes progressively worse with a decreasing number of wet diapers, the baby may have **pyloric stenosis**. With pyloric stenosis, the outflow valve of the baby's stomach does not open satisfactorily to permit the contents of the stomach to pass. The condition seems to be most common in firstborn white male infants.

Infant exposure to macrolides (a class of antibiotics that includes erythromycin, azithromycin, clarithromycin, and roxithromycin) prenatally and postnatally through breastmilk is associated with pyloric stenosis (Honein & Cragan, 2014; Lund et al., 2014). Projectile vomiting is

also associated with the use of the steroid prostaglandin for cyanotic congenital heart disease (Perme et al., 2013). These side effects of other medications demonstrate the importance of taking complete histories on both the mother and the baby.

A sudden onset of vomiting can also indicate an obstruction of the intestines or a strangulated hernia. Both of these conditions require immediate medical evaluation and may result in surgery. Your role in supporting the family at that point changes to helping the mother protect her milk production until the baby is able to directly breastfeed again. See Chapter 25 for more information on the lactation consultant's role with a baby who is ill or hospitalized.

Gastroesophageal Reflux

Some infants spit up only occasionally, while others seem to spit up all the time. Spitting up multiple times in one day can be a sign of **gastroesophageal reflux (GER)**. GER is a backflow of the contents of the stomach into the esophagus. It often occurs when the lower esophageal sphincter fails to close or is soft so that it does not stay securely closed. The acidic gastric juices may produce burning pain in the esophagus. Reflux is a common physiologic occurrence in infancy. It is age related, with reduced frequency as the baby grows. GER resolves in most infants by the time they start walking (Smith et al., 2013).

Note that GER is distinct from **gastroesophageal reflux disease (GERD)**, which is a medical diagnosis. GERD is defined as GER that is associated with persistent symptoms or complications, including esophagitis, low weight gain, failure to thrive, and respiratory disorders (Vandenplas, 2014; Vandenplas et al., 2012). Always be diligent to refer parents to their baby's healthcare provider immediately if a baby's symptoms do not improve with coping strategies.

Identifying Gastroesophageal Reflux Infants with reflux may spit up several times after a feeding. Some may spit up even during a feeding. Silent reflux may also occur, a condition in which the stomach contents fail to come all the way back up. In such a case, the infant does not spit up but may experience burning and discomfort. Infants who are breastfed experience a more rapid resolution of GER compared with artificially fed infants (Campanozzi et al., 2009).

Food allergy can contribute to GERD, **colic**, or **constipation** in infancy. Infants with these conditions often respond to a maternal dairy elimination diet or a non-bovine-based formula if supplemented (Paddack et al., 2012). Weaning to one of these formulas, as is often suggested by care providers, is not appropriate. GER is associated with, and sometimes induced by, **cow's milk allergy** (Borrelli et al., 2012; Semeniuk et al., 2012; Vandenplas et al., 2012). If a mother tells you her baby has reflux or if you see signs consistent with GER, cow's milk allergy could be a factor. The offending protein may come either from the mother's diet or from supplemental formula. The use of antireflux medications is now associated with the development of food allergies, leading researchers to urge caution in prescribing these medications for infants (DeMuth et al., 2013; Trikha et al., 2013).

Effects on the Infant The constant regurgitation of milk into the esophagus can cause severe irritation or pain for the infant. Some infants with GER learn to limit their intake after associating a full stomach with the pain that accompanies reflux. Frequent spitting up and limited intake can lead to poor weight gain. If an infant with reflux has been self-limiting intake because of discomfort, the mother's milk production may be low because the baby removes only small amounts of milk at each feeding. Therefore, the infant with no or slow weight gain whose mother has limited milk production may experience an exacerbation of symptoms when the mother attempts to increase her milk production. Other infants with reflux may display signs of discomfort that look like hunger signs and so may actually be overfed, with excessive weight gain of 2 or more ounces per day. Because of this possibility, it is important to look for signs of reflux in any infant whose weight gain is outside the normal range in either direction.

Regurgitating human milk is not as irritating as regurgitating formula. Because infants digest human milk more quickly than infant formulas, they absorb more milk in the same amount of time. For these reasons, and because of the many health risks of artificial feeding, it is not appropriate to switch a breastfed infant to formula as a treatment for GER.

Coping Strategies Infants who experience GER need to be fed in an upright position so that gravity can help the milk stay down. Holding the baby upright after a feeding will also help keep the milk down. In addition, these babies benefit from smaller, more frequent feedings. Another strategy is to nurse from only one breast at a feeding, provided the mother has adequate milk production. All these actions will help limit the amount of milk the infant takes in at a feeding, yet ensure that the child gets the fatty hindmilk and is able to digest and retain more calories.

As another measure to counteract GER, parents might try putting the infant to sleep on an incline and using a pacifier after feedings. Like many interventions, these measures have mixed results (Jung et al., 2012; Neu et al., 2012). However, they are worth a try, especially in view of the increased effort to avoid medications. Carriers, seats, and positions that avoid pressure on the abdomen but keep the trunk supported and extended are preferred when the child has GER. This may mean limiting the use of car seats to car riding only. Burping positions can be limited to ones that avoid pressure on the baby's stomach. Some parents find relief from infant massage and chiropractic care.

Mothers may be told they can mix their milk with cereal or a commercial thickener (such as Simply Thick) to see if the thicker fluid will stay down better. It is almost impossible to thicken a mother's milk with rice cereal because the enzymes in human milk begin digesting starches almost immediately. When milk is thickened, some families have compensated for the slowness of feeding by using bottle nipples with larger holes, which defeats the purpose of thickening. Furthermore, the fact that the milk is not spit up does not mean that the reflux and pain have been treated effectively. Many women will abandon breastfeeding if they are told they must express their milk and feed it by bottle to provide thickening. The use of thickeners was associated with necrotizing enterocolitis in over 22 infants (Beal et al., 2012; Woods et al., 2012). Whether it is manufacturing contamination or the xanthan gum itself is still being researched.

Having an infant with reflux can be very stressful for parents. They sometimes feel that their baby is colicky all day long. In some cases, the baby may be upset only at feeding time, which can feel like personal rejection to the mother. From a counseling standpoint, parents need validation that reflux is stressful and that caring for their child is draining. Acknowledge the parents' grief that their baby is not the pleasant, cooing, cuddly baby they had envisioned. Reassuring them that they are not bad parents can help them move forward and enjoy the moments when their baby is content. Support from other parents, friends, and relatives helps alleviate the sense of isolation parents may feel. Colic symptoms usually decrease in the second half of the first year of life and subside by the child's first birthday.

Medications In the case of severe reflux, the physician will need to be more involved in the child's care. For some infants, reflux can be severe enough to require medication. Some medications used for reflux decrease the acid level in the infant's stomach. Others encourage the infant's stomach to pass the milk more quickly into the intestines. Overprescribing of antireflux medications is a concern and many babies prescribed these drugs do not meet the diagnostic criteria for GERD (Quitadamo et al., 2014; Vandenplas, 2014). Most physicians will usually try medications before resorting to a more invasive test such as a barium swallow, endoscopy, pH probe, or x-ray exam. These tests are indicated when the baby has poor weight gain or does not respond to medications.

Elimination

Elimination patterns are significant indicators of a baby's intake. Keeping a diary of feedings, voids, and stools for the first week or two postpartum helps parents identify and assess patterns in their new baby's behavior. It also builds parents' confidence that exclusive breastfeeding provides sufficient nourishment for their baby. If concerns arise about intake, the diary provides a helpful record for medical care providers. There is wide variability in stooling and voiding among infants in the early days after birth, especially when there are differences in breastfeeding routine.

Voiding

Color of a healthy newborn's urine ranges from pale yellow to clear. Newborns have small, frequent voids, with most voids in full-term babies occurring when they are awake. In the first week of life, the baby should have an increasing number of voids daily. Many hospitals correlate the number of voids and stools to the number of days old the baby is, up to day 4 or 5. By 4 or 5 days of age, the baby should be voiding at least 6 times in 24 hours.

Urate Crystals Pink (copper or "brick dust") stains that appear with urination are urate crystals, whose presence indicates excess uric acid (see Color Plate 26). Urate crystals generally are not significant in the first 1 to 3 days of life. Assessment of the baby's hydration status is necessary if the stains appear after this time, however.

Stooling

A breastfed baby's stools differ greatly from those of a formula-fed baby. The newborn's first stools are a black, tarry meconium, usually passed within the first 24 to 36 hours (see Color Plate 27). Transitional stools are greenish black to greenish brown as the meconium gives way to brown and then to a golden or mustard yellow color when the baby is approximately 48 to 72 hours old (see Color Plate 28). The texture may range from watery to seedy yellow to a toothpaste consistency. There is no strong odor to the stools of a breastfed infant.

Infants in the first month of life should have a minimum of three or more soft, yellow, runny stools each day. An infant who has fewer than three stools in a 24-hour period may not be getting enough to eat and will need to be weighed, examined, and monitored for adequate intake. Encourage parents to become familiar with their baby's stooling patterns. Every baby's digestive system, and thus the pattern for expelling waste, is individual to that particular baby. One study found that the median number of stools per day is 6 in the first month of life and that stooling frequency is higher in breastfed infants (Tunc, 2008).

Babies' bowel habits change with age. A mother may find that at around 4 to 6 weeks of age, her baby will begin going for longer periods between bowel movements. Frequency of elimination in older breastfed infants can range from a baby having several stools every day to stooling only once every 3 days. Both patterns are acceptable. Stooling may decrease to once a day in the second month

TABLE 14-4 Stool Patterns of a Breastfed Baby

Characteristics	Normal Stool	Variations	Possible Causes
Color	A newborn's stool is black, brown, or green in the first 3 days. This is meconium. Later, color ranges from brown or green to mustard yellow.	Unexplained color changes. Black, brown, or red spots.	Mother's or baby's diet. Mother's cracked nipples (possible bleeding—there is no harm to the baby). Bleeding from baby's rectum. If no known cause, the mother should consult the physician.
Consistency	Ranges from a toothpaste-like texture to a liquid with curds.	Very watery.	Foods in diet other than mother's milk, antibiotics, or illness.
		Hard pellets.	Foods in diet other than mother's milk, insufficient fluids, or baby tense or ill.
		Mucous.	Newborn mucus, cold, congestion, or allergy to mother's or baby's diet.
		Fibrous.	Bananas and cereal present in the baby's diet.
Odor	Very little, not unpleasant.	Unpleasant.	New foods in addition to mother's milk, antibiotics, or illness.
Frequency	Ranges from 1 with every feed to 4 a day under 1 month of age. Decrease in frequency after the first month of life.	Sudden change in frequency. Watch carefully and look for other symptoms.	Foods, maturity, or illness.
Volume	Varies with frequency. More frequent stools means less volume per diaper.	Any sudden change. Watch carefully and be alert to other symptoms.	Foods, maturity, or illness.
Ease of expulsion	Easy and semicontrolled with some straining by the baby.	Flows out continually.	Foods other than mother's milk, illness, or antibiotics.
		Very difficult with extreme straining.	Foods other than mother's milk or insufficient fluids.

of life, a pattern that could continue until supplemental foods are started. The characteristics of healthy breastfed stools are described in **Table 14-4**, along with variations and their possible causes.

Infrequent Stooling When an infant is not stooling appropriately in the first month of life, the clinician needs to do a complete feeding assessment. Infrequent stooling in the first month may be due to insufficient milk intake. A baby who is voiding but not stooling or gaining weight may not be feeding frequently enough or may be feeding ineffectively. Such a child may not be receiving enough high-fat hindmilk, especially if the mother is limiting the frequency or duration of feedings. Infrequent stooling sometimes is the parents' first indication of low milk production. Stooling frequency usually corrects itself with additional feeding or longer feedings to ensure that the infant receives more hindmilk. This intervention works when the mother has adequate milk production and the baby is able to transfer milk well.

Infrequent stooling could be caused by **Hirschsprung's disease**, a condition in which a part of the infant's intestines lacks proper innervation and the stool cannot pass easily beyond that point. Symptoms in infants include difficult bowel movements, poor feeding, poor weight gain, and a large, bloated abdomen from the impacted stool and gas. Early diagnosis is important to prevent serious complications, including enterocolitis and colonic rupture (Mabula et al., 2014). Breastfed infants with this condition may escape detection until the parents add solid foods to their diet and their stools become more bulky and solid. Although this is a rare condition, any exclusively breastfed infant who is gaining adequate amounts of weight but not stooling frequently needs careful evaluation and monitoring. Cow's milk allergy has been shown to both mimic and influence Hirschsprung's disease (Ikeda et al., 2011; Umeda et al., 2013).

Constipation Constipation is rare in breastfed infants. Lack of a daily bowel movement and straining at stool-

ing are normal aspects of toileting and not signs of constipation. In infants, constipation is diagnosed by stool consistency and not by frequency. A soft stool indicates that the infant is not constipated. Constipated stools are molded and firm to the touch like pellets or marbles. In young infants, nursing more frequently will resolve most infrequent stooling. Maternal iron supplements have been reported anecdotally to contribute to an infant's constipation. If this is the case, discontinuing these supplements for a few days may return the child's digestive system to normal.

Constipation sometimes occurs when solid foods are added to the baby's diet. If the baby is receiving large amounts of cereal, it can be stopped or decreased for several days until normal stooling is reestablished and then reintroduced in smaller amounts less frequently. Adding more fruits and vegetables and, when the baby is old enough, yogurt, oatmeal, or prune juice may help. Parents should not treat their infant with suppositories without consulting the baby's healthcare provider.

Diarrhea It is important to recognize the difference between diarrhea and the typically loose stool of a breastfed baby. A mother who has been supplementing with formula and then returns to exclusive breastfeeding may mistakenly believe her baby has diarrhea. A mother whose previous children were not breastfed might also need to recognize the difference. Likewise, grandmothers or other caregivers who are unfamiliar with breastfeeding may worry that a normal breastmilk stool is diarrhea.

With **diarrhea**, the stool is much looser than normal, is very watery, and may be greenish and very foul smelling. It may indicate the beginning of an illness or a reaction to antibiotics taken by either the mother or the baby. If diarrhea is suspected, urge the mother to continue breastfeeding. Diarrhea removes valuable intestinal bacteria that aid in the digestion of food. Such bacterial colonization can be restored with human milk feedings.

When a baby exhibits diarrhea, the mother should contact the baby's caregiver immediately because babies can become dehydrated very quickly. Human milk is not a dairy product; it is a clear fluid that provides all the electrolytes a baby needs. Mothers should therefore continue breastfeeding and avoid supplementing with any electrolyte solution.

Infant Communication

A full-term, nonmedicated human baby is exquisitely wired and very competent to breastfeed. Respecting the baby's innate ability to nurse capitalizes on the child's neurobehaviors and is empowering to mothers. Lactation consultants can help mothers understand, interpret, and respect their babies' communication so they respond accordingly. Attachment is important for developing maternal feelings. Women with anxiety or fear of attachment have higher rates of depression than those with feelings of security and attachment (Monk et al., 2008; Ponizovsky & Drannikov, 2013). There is also a correlation between maternal depression and early breastfeeding cessation (Dias & Figueiredo et al., 2014; Lindau et al., 2014).

Smiling is an important development in babies that appears to be dependent on interaction. Social smiling emerges out of attentive engagement with an interactive caregiver (Parlade et al., 2009). The concept of mutually responsive orientation, in which parental responsiveness elicits responses from infants, is associated with the development of self-regulation and self-representation (Kochanska et al., 2008). Lactation consultants can teach parents to recognize infant signals and give positive feedback when they respond appropriately to their babies' cues. Smiling and other developmental milestones are addressed in Chapter 18.

Approach and Avoidance Behaviors

Infants exhibit specific behavior that indicates a willingness to be approached. This so-called approach behavior is integrated, stable, balanced, exploratory, and self-regulated. The signals illustrated in **Figure 14-10** are characteristic of a more mature infant. Conversely, infants display **avoidance behavior** that indicates a desire to withdraw, as shown in **Figure 14-11**. Recognizing these behaviors will help parents know how to respond to their baby. **Tables 14-5** and **14-6** describe infant approach and avoidance behaviors.

FIGURE 14-10 An infant exhibiting approach behavior.

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FIGURE 14-11 An infant exhibiting avoidance behavior.

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Hunger Cues and Stages of Alertness

Many infant **approach behaviors** signal an interest to breastfeed. For example, hunger cues may indicate hunger, thirst, or a need to be comforted at the breast. The infant will give cues the same way, regardless of the reason. An interest in feeding depends on the baby's level of alertness, as described in **Table 14-7**. Teaching hunger cues to parents will help them know when their baby is ready to nurse. If parents wait until their baby cries to initiate feeding, the baby will already be exhibiting the final sign of hunger. Pointing out hunger cues during a breastfeeding assessment will help the mother recognize what to look for.

Knowing When to Initiate a Feeding

Hunger cues may be evident when the baby is in a light sleep, drowsy, and quietly alert. The baby will begin to

TABLE 14-5 Infant Approach Behaviors

Behavior	Description
Tongue extension	The infant's tongue either is extended toward a stimulus or it repeatedly extends and relaxes.
Hand on face	The infant's hand or hands are placed onto his face or over his ears and are maintained there for a brief period.
Sounds	The infant emits undifferentiated sounds. At times, it may sound like a whimper.
Hand clasp	The infant grasps his own hands or clutches his hands to his own body. His hands each may be closed and touch each other.
Foot clasp	The infant positions his feet against each other, foot sole to foot sole. Or he folds his legs in a crossed position with his feet grasping his legs or resting on them.
Finger fold	The infant interweaves one or more fingers of each hand.
Tuck	The infant curls or turns his trunk or shoulders, pulls up his legs, and tucks his arms. He uses the examiner's hands or body to attain tuck flexion.
Body movement	The infant adjusts his body, his extremities, or his head into a more flexed position. He may turn to the side or attempt to attain a tonic neck response.
Hand to mouth	The infant attempts to bring his hand or fingers to his mouth. He does not have to be successful.
Grasping	The infant makes grasping movements with his hands. He may grasp either toward his own face or body, in midair, toward the examiner's hands or body, or toward the side of the bassinet.
Leg and foot brace	The infant extends his legs and/or feet toward an object in order to stabilize himself. He may push against the examiner's body or hands, the surface he is on, or the sides of the bassinet. Once touching, he may flex his legs or he may restart the bracing.
Mouthing	The infant makes mouthing movements with his lips or jaws.
Suck search	The infant extends his lips forward or opens his mouth in a searching fashion, usually moving his head at the same time.
Sucking	The infant sucks on his own hands or fingers, clothing, the examiner's fingers, a pacifier, or other object that he has either obtained himself or that the examiner has inserted into his mouth.
Hand holding	The infant holds onto the examiner's hand or finger with his own hands. He may have placed them there himself, or the examiner may have positioned them there. The infant then actively holds on.
"Ooh" face	The infant rounds his mouth and purses his lips or extends them in an "ooh" configuration. This may be with his eyes open or closed.
Locking visually	The infant locks onto the examiner's face or an object or sight in the environment. He may lock on and/or auditorily above or to the side of the examiner's face and maintain his gaze in one direction for observable periods. The sound component of an environmental stimulus may contribute to his locking.

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TABLE 14-6 Infant Avoidance Behaviors

Behavior	Description
Spit up	The infant spits up, with more than a passive drool. However, the amount of vomit may be quite minimal.
Gag	The infant appears to choke momentarily or to gulp or gag. Swallowing and respiration patterns are not synchronized. This is often accompanied by at least mild mouth opening.
Hiccough	The infant hiccoughs.
Bowel movement grunting or straining	The infant's face and body display the straining often associated with bowel movements. He emits the grunting sounds often associated with bowel movements.
Grimace, lip retraction	The infant's lips retract noticeably. His face is distorted in a retracting direction.
Trunkal arching	The infant arches his trunk away from the bed or the mother's body.
Finger splay	The infant's hands open strongly, and the fingers are extended and separated from each other.
Airplane	The infant's arms either are fully extended out to the side at approximately shoulder level or the upper and lower arm are at an angle to each other and are extended out at the shoulder.
Salute	The infant's arms are fully extended into midair, either singly or simultaneously.
Sitting on air	The infant's legs are extended into midair, either singly or simultaneously. This may occur when the infant is lying flat on his back or upright.
Sneezing, yawning, sighing, or coughing	The infant sneezes, yawns, sighs, or coughs.
Averting	The infant actively averts his eyes. He may momentarily close them.
Frowning	The infant knits his brows or darkens his eyes by contracting his muscles.
Startle	The infant's limbs jerk once, occasionally followed briefly by a slight amount of jitteriness and possibly crying.

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wriggle, and tightly closed eyes may exhibit **rapid eye movement (REM)**. Cues progress to passing one or both hands over the head, bringing a hand to the mouth (**Figure 14-12**), and making sucking motions. If the cheek or mouth is touched at this stage, the baby will begin to root. Soon, more vigorous sucking begins. The baby then will settle back into a less active state.

TABLE 14-7 The Six Infant States

Infant State	Description
Deep sleep	Characterized by limp extremities, a placid face, quiet breathing, no body movement, and no rapid eye movement (REM). The baby lies very still, with an occasional twitch or sucking movement. He cannot easily be aroused.
Light or active sleep	Resistance in the extremities when moved, mouthing or sucking motions, body movement, and facial grimaces. The baby is awakened more easily and is likely to remain awake if disturbed. Most of the baby's sleep is spent in this state, with less regular breathing and rapid eye movement (his eyes flutter beneath the eyelids). Although he may stir and move about, he can return to sleep if left undisturbed.
Drowsy	The baby is aroused easily and may drift back to sleep. His eyes may open and close intermittently, and he may murmur, whisper, yawn, and stretch.
Quiet alert	The baby looks around and interacts with others. This is an excellent time to breastfeed. The baby is extremely responsive. His body is still and watchful, his eyes are bright, and his breathing is even and regular.
Active alert	The baby moves his extremities and plays. He is even more attentive, being wide-eyed, with rapid and irregular breathing. He may become fussy and is more sensitive to the discomfort of a wet diaper or excessive stimulation.
Crying	The baby is agitated and needs comforting.

FIGURE 14-12 An infant exhibiting hunger cues.

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The baby may exhibit hunger cues several times in the span of 20 to 30 minutes. If these signals remain unheeded, the baby could become frustrated and cry. Conversely, the baby might become exhausted and fall back asleep without having received any nourishment. A missed feeding opportunity can have consequences for the next feed. This pattern is common in infants who are born prematurely, health compromised, or fed by the clock or ignored.

Crying can cause a newborn's motor functions to appear disorganized. It may take several minutes for the infant to settle enough to breastfeed. Some infants may be unable to breastfeed at all until they have slept again for a while. In either case, the mother has missed a feeding opportunity. If she needs to wake her baby for a feeding, she should do so when the baby is drowsy or in a light sleep. Most babies move from deep sleep to light sleep in approximately 20- to 30-minute cycles.

Infant Behavior Patterns

The first few weeks of a baby's life are a series of adjustments for everyone. For parents, it is a period when love, patience, and understanding for their infant are most important. Because newborns totally rely on their mothers to meet their needs, a mother may spend nearly all of her time and energies during the first month caring for her baby. She may feel physically drained and emotionally frustrated by the infant's helplessness. At the same time, she may enjoy the closeness and warmth of their growing relationship.

Infants' dispositions and patterns of sleeping and eating can affect the nourishment they receive. First-time mothers sometimes become concerned about their babies' dispositions. It helps them to know that babies experience a variety of behavior patterns, ranging from easygoing and undemanding to active and fussy. Studies show that an infant's temperament is inborn. Understanding the various behavior patterns, dispositions, and sleeping and eating patterns will help you offer appropriate suggestions. It may take some time for parents to discover all the variations and subtle nuances.

Average Baby

Exclusively breastfed newborns typically nurse between 8 and 12 times in 24 hours. Nursing more frequently is very normal because intake is small (Bergman, 2013). Babies sometimes cluster their feedings so that they blend into one another, with few distinctions between starting and stopping. Newborns usually sleep from 12 to 20 hours per day, possibly with one or two longer periods of sleep balanced by one or two fussy periods. Fussy periods typically occur in the early evening. Usually responsive when handled, the **average baby** is generally quiet, alert, and listening while awake. Some babies learn self-soothing by sucking on a fist or displaying some other type of comfort measure.

Easy Baby

Some babies have a breastfeeding pattern typical of an average baby, consisting of approximately 8 to 12 feedings in 24 hours. However, they have longer sleep periods and are less demanding, with relatively little or no fussiness. Mothers often refer to these babies as being "so easy." This mother may need to make a conscious effort to give her baby the tactile stimulation and attention needed for emotional growth and physical development. Having an undemanding baby may allow her more free time, and she will want to take care not to overexert herself physically as a result. She can be encouraged to devote time to her baby even in the absence of many bids for attention.

Placid Baby

Some babies demonstrate placid behavior and request as few as 4 to 6 feedings in 24 hours. The mother will need to be alert for possible undernourishment. A **placid baby** sleeps as much as 18 to 20 hours per day and is usually quietly alert and tranquil when awake. Despite making few demands for attention, the infrequent feedings do not indicate a lack of hunger. The infant may wake, feel hungry and need to nurse, yet not cry or demonstrate specific hunger cues. Rather, the infant soon falls back asleep and later wakes again and repeats the same pattern. The result can be an undernourished baby.

Lack of attention and stimuli for a placid baby can lead to poor emotional nourishment. The mother may not meet the infant's needs for nourishment because the baby does not know how to give the necessary cues. With such vital physical and emotional needs going unfulfilled, the baby may become withdrawn and lethargic. Mothers often describe a placid baby as being "such a good baby" who does not

cry and sleeps through the night. You can discreetly ask the mother of a "good" baby about breastfeeding and elimination patterns. These babies may be slow weight gainers.

The mother of a placid baby must take care to meet her baby's needs without receiving the necessary cues. She can use a monitor or place a noise device in the crib, such as a safe rattle, bell, or squeaky toy, to alert her to movement in the crib. A placid baby will benefit from being carried in a sling or baby carrier and being kept close to the mother and other family members, even without bids for attention. The mother can take advantage of natural waking by picking up her baby to nurse. Parents of a placid baby should avoid pacifying techniques such as pacifiers, cradles, or swings. Babies who pacify themselves through thumb sucking can be encouraged to satisfy their sucking needs at the breast instead.

Active and Fussy Baby

Active, fussy babies may nurse more frequently than the average baby, perhaps because of a greater need for comforting. Such a baby may seem insatiable at the breast and impatient for the milk to let down. The baby will sleep fewer hours than average. When awake, he or she will be active and frequently unable to self-calm. In addition, there may be several periods of inconsolable crying during the day. The baby may overreact to freedom and stimulation and will need gentle, slow, and soothing movements from caregivers as a calming measure. The mother can keep her fussy baby warm and use **swaddling** to avoid startling. She and other family members can hold the baby often, close to their bodies.

An active, fussy baby may respond well to nursing, dozing, and playing at the breast for generous periods. The greater need to be comforted at the breast, combined with increased milk intake, may result in frequent spitting up from being overly full. Nursing on only one breast at a feeding would allow leisurely sucking on a drained breast to reduce the amount of milk to a level the baby can handle. Air swallowed because of over-eagerness at feedings may require that the baby be burped often. Some of these babies do well when carried in a sling and held upright after nursing (see **Figure 14-13**). When using a baby sling, parents are cautioned to make sure the baby's face is visible and is not pressed tightly against the wearer.

FIGURE 14-13 Parents can wear their baby in a sling for comforting.

Infant Growth

Lactation consultants regularly assess several factors in infant growth as part of their routine duties. Note the infant's weight gain since the last weight check. Also look at the rate of weight gain since the baby's lowest weight (rather than birth weight). Record the baby's growth in length and head circumference. Monitor signs of adequate intake in relation to weight gain, including alertness, skin turgor, moist mucous membranes, and adequate output.

Caloric Intake

The calorie content of human milk depends on its fat content, given that half of the energy content of milk comes from the fat. Fat content varies between women, the time of day, the fullness of the breast, and between breasts. Most women report one breast makes more milk than the other. See Chapter 9 for the discussion on normal milk production and infant intake ranges.

Healthy, full-term infants self-regulate their food intake, provided no arbitrary scheduling or time limits are imposed on feeding. Giving babies water can affect their caloric intake because the volume makes them feel full. Sterile water has no calories, and sugar (dextrose) water (D_5W) has only a limited amount of energy—6 kcal/29.57 mL (1 oz). Over the course of the day, the baby takes in the amount of milk needed for growth. Calorie content of the milk is an issue only when caring for preterm babies or babies with illness, low weight gain, failure to thrive, or disorders. See Chapter 24 for a discussion of these babies.

Babies utilize breastmilk very efficiently, and breastfed infants have a leaner body mass than artificially fed infants. The lower caloric (energy) intakes by breastfed infants

explain their lower percentage of body fat beginning at 5 months (Dewey, 2007). Compared with formula-fed infants, breastfed infants' energy intake is lower throughout their first year (Hester et al., 2012). Energy needs per day decrease as the baby gets older. Artificially fed infants have higher sleeping metabolic rates, higher rectal temperatures, and higher heart rates than breastfed infants. This may account for the differences in energy intake and expenditure rates. The link between formula feeding and obesity is explored in Chapters 9 and 10.

Weight Gain

Newborns initially may lose as much as 7 percent of birth weight because of a loss of fluids and the passage of meconium. Excessive **intravenous** fluids received during labor can cause a fluid shift to the infant that artificially increases initial birth weight (Mulder et al., 2010). Infants who experience fluid shifts typically void large amounts of urine in the first 24 hours of life and can lose more weight than a baby born without intravenous interventions. Exposure to medications during labor can depress the baby's central nervous system and lead to fewer feedings in the first days of life—another factor that will affect weight gain in the early days.

A weight loss of more than 7 percent of birth weight indicates a need for evaluation and possible assistance with breastfeeding. By day 3, a full-term infant usually does not continue to lose weight. The baby's weight should stabilize by the end of the first week, and birth weight should be regained by 10 to 14 days after birth. Infants who are not back to birth weight by this time require evaluation. **Table 14-8** presents monthly weight ranges and

TABLE 14-8 Typical Infant Weight Gain

Range of Weekly Infant Weight Gain				
Girls Grams	**Boys Grams**	**Month**	**Girls Ounces**	**Boys Ounces**
175–325	225–350	1	6.2–11.5	7.9–12.3
200–300	225–350	2	7.1–10.6	7.9–12.3
150–225	175–225	3	5.3–6.2	6.2–7.9
100–200	150–200	4	3.5–7.1	5.3–7.1
100–150	100–150	5	3.5–5.3	3.5–5.3
75–125	75–125	6	2.6–4.4	2.6–4.4
75–125	75–125	7	2.6–4.4	2.6–4.4
50–100	75–100	8	1.8–3.5	2.6–3.5
50–100	50–75	9	1.8–3.5	1.8–2.6
50–75	50–100	10	1.8–2.6	1.8–3.5
50–100	50–75	11	1.8–3.5	1.8–2.6
50–75	50–75	12	1.8–2.6	1.8–2.6
Infant Weight Range				
Girls Kilograms	**Boys Kilograms**	**Month**	**Girls Pounds/Ounces**	**Boys Pounds/Ounces**
2.3–4.4	2.3–4.6	Birth	5.1–9.11	5.1–10.1
3.0–5.7	3.2–6.0	1	6.9–12.9	7.1–13.3
3.8–6.9	4.1–7.4	2	8.6–15.3	9.0–16.4
4.4–7.8	4.8–8.3	3	9.11–17.3	10.9–18.4
4.8–8.6	5.4–9.1	4	10.9–19	11.14–20.1
5.2–9.2	5.8–9.7	5	11.8–20.4	12.12–21.6
5.5–9.7	6.1–10.2	6	12.1–21.6	13.8–22.8
5.8–10.2	6.4–10.7	7	12.12–22.8	14.1–23.9
6.0–10.6	6.7–11.1	8	13.3–23.6	14.12–24.8
6.2–11.0	6.9–11.4	9	13.11–24.4	15.3–25.1
6.4–11.3	7.1–11.8	10	14.1–24.14	15.11- 26.0
6.6–11.7	7.3–12.1	11	14.9–25.12	16.1–26.11
6.8–12.0	7.5–12.4	12	15.0–26.8	16.5–27.3

Reproduced from 2006 World Health Organization Growth Charts.

weekly weight gain ranges for infants through the first year based on the World Health Organization (WHO) growth charts. It is important to recognize that growth patterns vary from one baby to the next.

Artificially fed infants exhibit higher weight for age than breastfed infants, who follow the WHO standard for growth (Van Dijk & Innis, 2009). Artificially fed babies weigh an average of 600–650 grams more than breastfed babies. From 6 to 12 months, formula-fed infants tend to weigh more than breastfed infants. They consume a higher volume and more energy-dense milk in early life, leading to faster growth and programming a greater risk of long-term obesity (Hester et al., 2012).There do not appear to be significant height differences between adults who were breastfed or artificially fed.

Obesity

Assessing infant growth is of key interest in view of the obesity epidemic among youth, as discussed in Chapter 10. Artificial feeding is a predictor of obesity in both infancy and adulthood. The role of nutrition early in life is increasingly recognized as contributing to growth and metabolic changes in later life. See Chapters 9 and 10 for discussion on artificial feeding, the gut microbiome, and the role of metabolic programming for lifelong health.

Growth Charts

Infant growth charts are frequently printed by formula companies with their logos and given to healthcare providers. These documents are based principally on 1977 growth charts from the U.S. National Center for Health Statistics (NCHS). The original charts were based on one ethnic and demographic group of primarily formula-fed infants. As a consequence, they are not reliable for charting growth in breastfed babies. Charts released by the Centers for Disease Control and Prevention (CDC) in 2000 also exhibited notable differences between the typical growth pattern of breastfed infants and the expected growth curve.

The CDC now recommends the use of the WHO growth charts for all infants until the age of 2 years. The 2006 WHO growth charts are the best indicator of growth for breastfed infants. The growth charts, which are printed in Appendix B, are based on the growth of exclusively or predominantly breastfed children (WHO, 2006). Data was compiled at seven international study centers to develop these international growth charts for infants and children through 5 years of age.

Sleeping Patterns

All babies require a great amount of sleep and the specific amount of sleep each baby needs varies. Some babies sleep as few as 8 hours in a 24-hour period; others sleep as many as 20 hours per day. Understanding her baby's typical sleep patterns will help a mother adapt to her child's unique needs. The factors that cause variations among babies' sleep patterns may be developmental, environmental, or nutritional in nature. For example, overtiredness or overstimulation can cause fretfulness before and during sleep. Sounds, lights, the temperature of the room and bedding, and low humidity (which causes difficulty in breathing) can all affect (and sometimes interfere with) sleep. Furthermore, nucleotides in human milk exhibit significant circadian rhythms that could explain the "hypnotic" response in the infant nursing at night (Sánchez et al., 2009).

Babies who sleep separated from their mothers may wake at night to seek nourishment and physical contact. The absence of the mother's body warmth and skin contact can make it more difficult for the baby to fall asleep and sleep undisturbed. A baby may also have trouble sleeping if the mother consumes too much caffeine because this substance passes through her milk. Developmental factors that affect sleep are discussed in Chapter 18.

Encouraging the Baby to Sleep

Many parents voice concerns about their babies' sleep habits. You can help a mother determine whether she has realistic expectations for her baby. Perhaps she can keep a written record for several days of her baby's sleep patterns over a 24-hour period, including even 5-minute naps. Gaining a better understanding of her baby's behavior can help her relax and not allow sleep to be such an important goal. If the mother feels she is not getting enough sleep, you can encourage her to sleep when her baby does, especially in the early postpartum period. If she returns to work or school, the mother can retire early in the evening and take her baby to bed with her. Or, during the night, her partner can bring the baby to bed for nursing, allowing her to stay in bed.

Establishing a bedtime ritual can be enjoyable for both parents and baby. A routine helps the baby associate the ritual with going to sleep at an established time every night. Quiet, soothing activities directly before bedtime—such as a bath, story, rocking, and nursing—prepare the baby for sleep. Parents can warm the baby's sleeping area with a heating pad or hot water bottle and remove it right before laying the baby down. Flannel sheets can help keep the infant from waking because of the initial coolness of cotton sheets.

If a baby sleeps for longer periods during the day than at night, parents can try waking the baby more frequently during the day to discourage longer sleep periods. This practice enables the mother to nurse more often and helps the baby's rhythm come into harmony with the rest of the family.

Breastfeeding Issues with Sleep

An older baby who is well nourished is usually able to sleep for long periods at night. Nursing frequently

during the day will accomplish this goal. Nursing directly before bedtime ensures a full stomach and helps soothe the baby. If the mother nurses while lying in the middle of the bed, she can then move her baby to the crib when he or she is in a deeper sleep. Some mothers keep the baby in their bed until morning or until after the next feeding. See the discussion of cosleeping in the next section.

When the baby wakes in the middle of the night to nurse, avoiding stimulation will facilitate a return to sleep. Placement of a nightlight near the baby's bed eliminates the need to turn on a bright light. A soiled diaper can be changed before nursing on the second breast so the baby can nurse back to sleep undisturbed. Keeping the baby and mother warm will help both of them return to sleep more easily. For some babies, nighttime feedings account for as much as 20 percent of their total 24-hour intake (Kent et al., 2006). Babies who do not wake to nurse at night typically feed more in the morning.

Cosleeping

The cultural expectation in many industrialized countries is that babies should sleep through the night and that independence (separation) is desirable. This notion is at odds with human babies' biological need to be close to their parents for safety and development (Gettler & McKenna, 2011; McKenna et al., 2007). Human babies have an intense biological need to be close to their mothers, including at night. Many parents opt for a family bed shared by mother, father, and baby to meet this need. **Cosleeping** helps babies fall asleep more easily, and babies wake easily when moved (**Figure 14-14**). Cosleeping is also helpful with a baby who wakes frequently during the night.

FIGURE 14-14 Mother cosleeping with baby.

Cosleeping infants become aroused more often and in greater synchrony with their mothers than do separate sleepers. This relationship suggests that cosleeping may reduce the risk of **sudden infant death syndrome (SIDS)**. More frequent arousals also promote nighttime breastfeeding. Mothers who cosleep with their babies nurse them 3 times more frequently than do mothers whose babies sleep in a separate room (Gettler & McKenna, 2011). Bed sharing was associated with a longer duration of breastfeeding in another study (Huang et al., 2013).

The AAP (2012) recognizes the need for closeness to facilitate breastfeeding and recommends that mothers and babies sleep in proximity to each other. At the same time, an expanded statement released by the AAP Task Force on SIDS advises against parent–infant bed sharing and supports the generic use of pacifiers (AAP, 2011). The ABM (2008) issued revised guidelines for safe cosleeping in response to the AAP's statements (see **Figure 14-15**).

Contrary to popular thinking, exclusively breastfeeding mothers were found to get more nighttime sleep than mothers feeding formula during the first month after birth. The breastfeeding mothers averaged 30 minutes more sleep, and measures of sleep fragmentation did not differ between the two groups (Doan et al., 2014). Mothers who routinely sleep with their infants receive more total hours of sleep than do those who routinely sleep separately, just not in one block of time (Mosko et al., 1997). Moreover, routine bed sharing mothers evaluate their sleep more positively than do solitary sleeping mothers. As an alternative to sharing their bed with their child, some parents use a crib, or cosleeper, that attaches to their bed. The AAP does not recommend for or against bedside sleepers. For more information on this topic, see the discussion of responsive parenting in Chapter 20.

Prevalence of Cosleeping

Cosleeping was the cultural norm until the 20th century. Sweeping cultural changes in the United States brought mechanistic, scientific, and behavioristic models of child development that defined "normal" behavior based on bottle-feeding babies. Cosleeping is more common in Western culture today, mirroring most non-Western cultures where an infant and mother remain together continually, both day and night. The warmth and familiar smell of the mother comforts the infant when sleeping in the parents' bed (referred to as cosleeping). The infant can nuzzle at the breast and nurse ad lib, and the mother is not required to leave her bed to nurse her hungry infant. Thus, the mother is able both to get the sleep she needs and to meet her infant's needs.

Concerns About Cosleeping

Some parents worry that it is emotionally unhealthy for an infant to share a bed with the parents or that

Precautions for cribs and adult beds:

- Use a firm mattress to avoid suffocation.
- Have no gaps between the mattress and the frame.
- Keep bedding tight around the mattress.
- Avoid strings or ties on baby's and parents' nightclothes.
- Avoid soft items such as comforters, pillows, featherbeds, stuffed animals, lamb skins, and bean bags.
- Keep the baby's face uncovered to allow ventilation.
- Put the baby on his or her back to sleep.
- Do not overheat the room or overdress baby.
- Do not place a crib near window cords or sashes.

Additional precautions for cribs:

- When baby learns to sit, lower the mattress level to avoid falling or climbing out.
- When baby learns to stand, set the mattress level at its lowest point and remove crib bumpers.
- When baby reaches a height of 35 inches or the side rail is less than three-quarters of his or her height, move the baby to another bed.
- Crib bumpers, if used, should have at least six ties, no longer than six inches.
- Hang crib mobiles well out of reach and remove when baby can sit or reach.
- Remove crib gyms when baby can get up on all fours.

Additional precautions for cosleeping:

- Parents pull back and fasten long hair.
- Do not use alcohol or other drugs, including over-the-counter or prescription medications.
- Have no head/foot board railings with spaces wider than allowed in safety-approved cribs.
- Use no bed rails with infants less than 1 year.
- Do not allow siblings or pets in bed with a baby less than 1 year old.
- Do not cosleep in a waterbed.
- Avoid placing bed directly alongside furniture or a wall.

Additional precautions regarding infant sleep:

- Do not sleep with baby on sofas or overstuffed chairs.
- Do not put baby to sleep alone in an adult bed.
- Do not place baby to sleep in car or infant seats.
- Obese mothers who are not breastfeeding avoid cosleeping.
- Refrain from cosleeping if mother smoked during her pregnancy or if mother or partner currently smoke.

FIGURE 14-15 Creating a safe infant sleep environment.

Adapted from Donohue-Carey, P. Solitary or shared sleep: what's safe? Mothering. 2002;114:44-47. Updated 2009 by Patricia Donohue-Carey.

this habit may be difficult to break once formed. Some fear the mother could inadvertently roll over onto the infant while she is asleep. Most infants worldwide sleep with their parents. Some cultures have high rates of bed sharing and low rates of SIDS, and others have high rates of bed sharing and high rates of SIDS (AAP, 2011). It has become a cultural norm in the United States for infants to sleep separated from their parents, not a biological norm.

Parents who cosleep with their infant can evaluate their sleep environment and make it as safe as possible for their baby. Both parents should feel comfortable with the decision to cosleep with their baby and be committed to following appropriate safety precautions. While no one sleep environment is guaranteed to be risk free, there are ways of reducing risks in both cribs and adult beds. Rigidly admonishing parents who cosleep fails to respect their responsiveness to their babies. A more reasonable approach is to recognize the need to increase infant sleep safety while protecting breastfeeding.

Sudden Unexplained Infant Death

The title of sudden infant death syndrome (SIDS) has been expanded in recent years to **sudden unexplained infant death (SUID)**. It describes deaths in infants less than 1 year of age that occur suddenly and unexpectedly, and the cause of death is not immediately obvious prior to investigation (Shapiro-Mendoza, et al., 2014). About half of these SUIDs are attributed to SIDS, the leading cause of SUID. The three most frequently reported causes of death in infants 0 to 12 months are SIDS, unknown cause, and accidental suffocation/strangulation in bed. For example, in the United States in 2011, 1910 deaths were reported as SIDS, 869 as cause unknown, and 624 as accidental suffocation and strangulation in bed (CDC, 2014).

SIDS describes the sudden death of an infant younger than 1 year of age that remains unexplained after an autopsy, examination of the death scene, and review of the clinical history. SIDS occurs in all socioeconomic, racial, and ethnic groups. African American and Native American babies are 2 to 3 times more likely to die of SIDS than Caucasian babies. Most SIDS deaths occur when a baby is between 2 and 4 months of age, with 90 percent of all SIDS deaths occurring before the child reaches 6 months of age. Most babies who die of SIDS appear to be healthy prior to death. Sixty percent of SIDS victims are male and 40 percent are female (CDC, 2014). Research suggests that brainstem abnormalities and genetic variations may contribute to SIDS (Casale et al., 2013; Machaalani & Waters, 2014).

Breastfeeding reduces the risk of SIDS by approximately 50 percent at all ages throughout infancy (Vennemann et al., 2009). A baby who is not breastfed may be at greater risk, both because of the lack of immunologic protection and because of differences in breathing and arousal patterns (Hauck et al., 2011). Breastfed infants arouse more easily from active sleep at 2 to 3 months of age. Given that this age coincides with the peak incidence of SIDS, this behavior may represent a protective mechanism of breastfeeding. The position in which the mother places her baby for sleep is a major factor in the risk of SIDS. Placing the baby in a supine position (on his or her back) rather than in a prone position (on his or her stomach) substantially reduces the incidence of SIDS. Breastfeeding mothers

who cosleep predominantly put their infants on their backs to facilitate reaching the breast. SIDS rates have declined by more than 50 percent in the United States since 1994, when the "Back to Sleep" public information campaign began.

Risks for SIDS increase when parents smoke, put the baby to sleep in the prone position, and do not breastfeed. Sleeping prone and maternal smoking are two significant risk factors for SIDS. An estimated one-third of SIDS deaths could be prevented if mothers did not smoke during pregnancy (Dietz et al., 2010). Another risk factor is the baby's inhalation of passive smoke. Parents who smoke around their baby need to be educated about the dangers to their baby.

Small-at-birth infants who sleep in a separate room are at increased risk for SIDS compared with similar infants who sleep in the same room with their parents (Blair et al., 2006). Keeping the baby in the parents' room (room sharing) may reduce the risk of SIDS by as much as 50 percent (Mitchell & Thompson, 1995; Tappin et al., 2005). Children who cosleep in their parents' room have lower cortisol levels, which translates to lower tension and stress (Waynforth, 2007). Sofas are not safe sleep surfaces for an infant. Sleeping on sofas increases the risk of SIDS and comprises almost 13 percent of infant sleep-related deaths (Rechtman et al., 2014). Bed sharing should be avoided if parents consume alcohol, smoke or take drugs, or if the infant is born preterm (Blair et al., 2014).

The AAP Task Force on SIDS states that using a pacifier to go to sleep may be protective against SIDS and recommends that all babies be put to sleep with pacifiers. This recommendation, however, is based on studying babies who typically used pacifiers and were more at risk for SIDS if they did not use one. Breastfed babies who suck to sleep at the breast do not fit that profile.

Crying and Colicky Behavior

Crying is an infant's first language, used to communicate distress and to elicit help from caregivers. In response to her baby's cry, the mother's heart beats louder, her blood pressure increases, and the temperature increases in her breasts. The sound of a crying infant is disturbing and aggravating (see **Figure 14-16**)—a sound designed to ensure that the newborn receives the attention he or she needs. Crying is meant to get attention! The decibel level of a baby's cry is actually higher than street noise and can be 20 decibels louder than normal speech. **Table 14-9** describes several combinations of temperament that can affect a baby's disposition. See Chapter 15 for a discussion of the baby who is fussy at the breast.

The crying pattern for a preterm infant is different from that of a full-term infant (Manfredi et al., 2008). Preterm infants have a different rhythm, pause, and inhalation-exhalation pattern. Their cry is a full octave higher than that of a full-term infant, signaling a greater urgency. Crying for a preterm infant requires great effort, which can cause distress and lower blood oxygenation. Preterm infants have been found to fuss and cry more frequently when they reach term-adjusted age (Shinya et al., 2014).

FIGURE 14-16 A crying infant needs to be settled before being put to the breast.

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Parental Reactions to Crying

New parents envision a baby who smiles, coos, and snuggles, not one who is fussy and cries. As a consequence, they may worry that crying is a reflection of their parenting. You can help them recognize that babies fuss and cry because of their needs, not because of the parents' actions. Encourage parents to focus on the positive attributes of this behavior—that a fussy baby is very alert, responsive to the environment, and a good communicator—rather than considering their baby to be difficult or spoiled.

Mothers are vulnerable to reacting negatively to their crying baby. During pregnancy, the mother was in control and was the center of attention. Now it may seem that the baby has both the attention and the control. When others stare at the parents of a crying baby or make rude or personal comments, the parents may feel out of control or judged. Many times the problem lies in the parents' expectations of what parenting will be like.

Parents are often advised not to pick up their crying infant and are encouraged to let the child "cry it out." (See Chapter 20 for a discussion of such "baby training" and its impact on breastfeeding.) In reality, infant crying is a powerful communication tool used by the baby to interact with the external environment. In a cause-and-effect relationship, babies learn that crying elicits

TABLE 14-9 Influences on Baby's Disposition

Baby's Disposition	Mother's Disposition	Probable Outcome
Easy baby	Responsive mother	This is a predictable and cuddly baby whose mother is in tune with him. The mother feels good about her parenting based on the positive interactions with her baby.
Easy baby	Restrained mother	This baby is not very demanding, and such behavior may lead the mother to feel somewhat unnecessary. The mother initially may not develop comfort skills, believing they are unnecessary. She may divert her energies elsewhere, and her baby may, in time, exhibit more fussy behavior.
High-need baby with good attachment-promoting behaviors	Responsive mother	The mother cannot ignore the needs of her baby and responds to him. She is rewarded with occasional satisfied responses from her baby. She will continue to explore alternative responses until she finds one that reaches her baby. Because of his mother's responsiveness, the baby will also fine-tune his attachment-promoting skills, resulting in a parent–child relationship of mutual sensitivity.
High-need baby with poor attachment-promoting skills	Responsive mother	This type of baby often is referred to as slow to warm up. He shows little or no effort to respond to or be comforted by his mother's efforts. The mother's nurturing responses are fine-tuned by her baby's responses. When the baby's responsiveness is lacking, this may seriously jeopardize the mother–baby relationship. In some situations, it is helpful for the mother to seek assistance from a professional who is trained in interaction counseling.
High-need baby	Restrained mother	This situation places the mother–baby relationship at risk. Often, the mother has been advised to let the baby cry it out or to not spoil him. Continued lack of response to his needs will lead this baby to one of two outcomes. He will intensify his high-need behaviors, or he will give up. The baby who gives up essentially shuts down his communication and withdraws into himself. He is prone to attach to objects rather than persons.

Adapted from Sears W, Sears M. *The Fussy Baby Book: Parenting Your High-Need Child from Birth to Age Five*. New York: Little Brown & Company; 1996.

parental response to meet their needs. This enhances attachment to the parents, develops trust more readily, and reduces crying. In contrast, babies repeatedly left to cry alone learn that their needs will not be met. Failing to understand or respond to infants' messages can compromise their care as well as parental effectiveness, thereby undermining the budding relationship between parents and their baby.

Mothers who are restrained in their response to crying abandon breastfeeding earlier and have infants who cry more overall. They may perceive infant fussiness as dissatisfaction with breastfeeding and conclude that supplementing with formula or cereal will provide a solution. Short breastfeeding duration or formula use from birth is significantly associated with low nurturance levels and high anxiety levels. Longer breastfeeding duration is associated with mothers responding to and following infant cues (Brown & Arnott, 2014). Educating parents that crying is a baby's method of communicating with the world will help prevent mothers from giving up on breastfeeding prematurely.

The Effect of Crying on the Infant

Crying increases the newborn's heart rate and blood pressure, which in turn increases intracranial pressure. Poorly oxygenated blood flows back into circulation rather than into the lungs. Large fluctuations in blood flow increase cerebral blood volume and decrease cerebral oxygenation, increasing the risk of respiratory difficulty.

Metabolically, crying leads to increased glucose expenditure, which, in the immediate postpartum period, could result in hypoglycemia. Crying also increases gastric distention and may result in a very discontented baby because of gas pain. In addition, crying raises infants' levels of cortisol, a stress hormone. Continually elevated stress hormone levels are believed to contribute to infant illness (Mörelius et al., 2009; Shah et al., 2012). Crying also decreases the absorption of inhalant medications, which preterm babies frequently receive (Iles et al., 1999). Babies who have been crying have difficulty breastfeeding. They are often unable to organize themselves and their behavior for a period after the crying spell.

Identifying the Cause of Crying

A baby's cry usually indicates some form of physical discomfort. As parents become accustomed to their baby, they will learn to distinguish among different types of cries. An infant's cry may indicate hunger, pain, or a reaction to the external environment. Too often, a mother immediately assumes that hunger is the cause and may blame low milk

production or the quality of her milk for her baby's fussy disposition. If the baby has nursed recently and does not appear to be hungry, you can encourage parents to investigate other causes for crying. As parents become better acquainted with their baby's particular communication, they will learn to distinguish the causes of the crying.

Crying from Hunger

In the early weeks after birth, it is common for the baby to require frequent feedings and to sleep for short, frequent periods. The mother will learn to recognize a hunger cry as she tunes into her baby's pattern of sleeping and waking. She can consider how recent and long the previous feeding was, her baby's hunger cues and general disposition, and whether her baby can be soothed easily or with difficulty.

A newborn may cry from hunger approximately 1½ to 2 hours or more after a feeding. A hunger cry may be more prevalent in the evening hours when the mother's milk production seems lowest and the environment feels harried. Because of this, it is common for babies to cluster their feedings in the early evening. Mothers who respond to hunger cries by nursing their babies will most likely have more contented babies. These babies will cry less frequently than those whose mothers maintain a strict feeding schedule and disregard their babies' cries. You can teach mothers to recognize and respond to hunger cues rather than waiting until the baby cries.

Crying from Body Discomfort

Wet or soiled diapers by themselves may not be sufficient to cause crying. However, when the diaper cools, the drop in temperature can cause discomfort, thus making the baby more responsive to stimulation and more likely to cry for other reasons. Babies also may cry from excessive heat. First-time parents tend to overdress a new baby even on the hottest summer day, fearing that the child may become chilled. In warm weather and cold weather alike, healthy, full-term babies can be dressed in the same type of clothing that an adult would wear.

Even when temperature is controlled, babies may cry when they are undressed and lose the warm, secure feeling of clothing and blankets. A baby who is especially sensitive to this effect may benefit from swaddling. The texture of the cloth that touches the child's body is important. For example, plastic or rubber is more irritating than soft toweling or blanketing. Other skin irritations such as heat rash or **diaper rash** can be a cause of a baby's cries. A baby may also find comfort in close skin-to-skin contact with the parents. The mother or father can lie with the baby in bed or a bathtub.

A baby may cry from internal discomfort such as gas or overfullness. A baby who is constantly fussy during feedings may need to bring up a bubble of air. Parents can help the baby pass gas in the intestines by using the techniques for comforting a colicky baby described later in this chapter. Additionally, some babies take in more milk than they are able to handle. Such overfeeding causes pressure, which in turn can produce discomfort. Nursing long enough for the baby to drain one breast before offering the other one will help avoid ingesting excessive amounts of milk at a feeding.

Crying from External Stimuli

When parents have tended to the physical needs of their baby and the child continues to cry, they will want to look for an external cause for the crying. Babies may startle and cry in reaction to sudden movement, touch, smell, light, noise, or excessive handling. This factor often accounts for the initial fussiness babies demonstrate when transitioning from hospital to home. Constant soft, soothing noise can be an effective comfort measure. The steady movement of being rocked is comforting, as is the motion of a car ride. Recreating the sounds and feeling of the womb comforts a newborn.

Some babies respond well to swaddling, which reduces the amount of movement the baby can make and, therefore, the amount of stimulation experienced from movement. Confining the arms and legs prevents the infant from startling and provides a feeling of warmth, security, and constant touch stimulation. Although this practice may increase the time a baby sleeps and decrease time spent crying, it does not necessarily do so at the expense of time spent quietly awake. Swaddling should be done with the baby's legs together in normal flexion to prevent hip dysplasia (Loder & Skopelja, 2011). Swaddling and putting a baby down to sleep in a prone position increases the risk of SIDS. Parents should be wary of commercial swaddlers and wearable blankets because injuries and deaths have been reported with these. SIDS researchers recommend that parents discontinue swaddling as soon as an infant's earliest attempts to roll over are observed (McDonnell & Moon, 2014).

Parents learn quickly what their baby prefers. Some babies dislike being swaddled and will cry or squirm when they are wrapped or held too tightly. Such a baby may push away from the breast when held too closely and may prefer a position that allows body movement. The mother can lie on her side to nurse while lightly supporting the baby from behind with her hand or a pillow. She could also lower her breast while leaning above her reclining infant.

Figure 14-13 shows a comforting technique of "wearing" the baby in a sling. This practice provides the infant with the secure feeling of swaddling, with the added benefit of closeness to the person who wears the sling. Infant deaths have occurred in slings, either by compression of the baby into a forward-flexed position or by direct suffocation. Thus, it is important that the parent keep the baby upright and the baby's head clear of the material (Madre et al., 2013).

A baby receives important information about the surrounding world through touch. A mother whose touch is tentative and light may irritate the baby. With a firm touch, a mother communicates that she is confident, which allows her baby to relax and trust her. Gently stroking the baby's body during a feeding—called **grooming**—increases the mother's prolactin level. Such quiet, gentle touching does not usually interfere with feedings. However, poking or jiggling the baby during nursing could make it difficult for the baby to relax and result in crying.

Overhandling by well-meaning adults can cause a baby to cry as a plea to "please leave me alone!" Sometimes babies may prefer to lie quietly in their cribs and will react unhappily when picked up. This occurs especially if the baby has been overstimulated by lights, noise, interruptions to nursing or napping, and the attention of too many visitors. Some babies become agitated when they are tired and might cry themselves to sleep.

If parents have ruled out hunger and discomfort, their baby may settle after a few minutes. Focusing on the cues their baby gives in response to their parenting approach will help them know how to proceed. If their baby is responding positively to a technique, it can be encouraged. If their baby exhibits withdrawal or avoidance behaviors, they will want to try a new approach.

Colicky Behavior

Much of the extreme infant fussiness that occurs is actually colic-like behavior rather than true colic. The term "colic" derives from the Greek word *kolikos*, an adjective derived from kolon, meaning "large colon." In defining colic, duration is more significant than frequency. Colic is classically defined by the "rule of threes," characterized by inconsolable crying for which no physical cause can be found that lasts more than 3 hours per day, occurs at least 3 days per week, and continues for at least 3 weeks. The baby experiences spasmodic contractions of the smooth muscle, causing pain and discomfort (Wessel et al., 1954). Symptoms typically subside by 16 weeks of age in the majority of infants.

Colicky behavior is quite different from the pattern of one or two fussy periods a day experienced by most infants. A crying infant who is willing to be soothed by going to the breast usually does not have colic. A colicky baby exhibits unexplained fussiness, fretfulness, and irritability. The baby appears to suffer from severe discomfort during the colicky period, with cries that are piercing, explosive attacks. A rumbling sound may be audible in the baby's gut. Excessive flatulence (gas) and apparent abdominal pain may cause the baby's legs to draw up sharply into the abdomen, or the baby's body to stiffen and twist. The baby may awaken easily and frequently and appear intense, energetic, excitable, and easily startled—with clenched fists and a facial grimace. Continuous crying can cause the baby to swallow air and further aggravate the discomfort.

The exact cause of colicky behavior has not been determined medically. In fact, researchers do not even agree about the true incidence of colic. Colic studies have not differentiated well between bottle-fed and breast-fed infants. Colic does seem to be more common when infants are fed solid foods while they are younger than 3 months of age.

Some theories relate colic to stress and tension in the mother and child during pregnancy and lactation. Colic has been found in higher proportions in families with less education, smoking mothers, domestic violence, impaired bonding, hostility, and postpartum depression (Yalçin et al., 2010). Others believe the cause to be an immature digestive and intestinal system or allergies.

Immature Gastrointestinal and Neurologic Systems

Compared with other young mammals, a human baby is born in an extremely immature state—essentially neurologically incomplete. At 1 month, the infant's stomach capacity is ⅒ the size of an adult stomach. Moreover, a newborn has only minimal gastric glands that secrete digestive enzymes. The muscle layers surrounding the newborn's stomach and intestines are thin and weak, and the intestines lack the ridges and hairlike filaments that help process food.

Colicky infants may have more permeable intestinal linings (Saavedra & Dattilo, 2012). In these children, **peristalsis** (wavelike rhythmic contractions of smooth muscle) may be irregular, faint, forceful, or spasmodic. Additionally, lack of muscle tone can cause food to move up out of the stomach as well as down into the intestines. The colons of colicky infants may contract violently during feedings. Whereas the colon in normal infants takes several hours to empty, for some colicky infants, the colon may empty very quickly.

Hormones

Babies have high levels of progesterone at birth, which helps relax the muscles of their intestines. The progesterone level drops 1 to 2 weeks after birth, which may account for the increase in colic symptoms at that time. Infants with colic-like behavior have high levels of motilin—a digestive hormone that stimulates muscle contractions—from the first day of life. Human milk has high levels of many enzymes that are necessary for digestion and therefore may aid in reducing the intensity of colic in some infants. Cholecystokinin (CCK), a digestive hormone abundant in milk, has been shown to be present in lower levels in infants suffering from colic. Cortisol, the stress hormone, is also thought to be a factor

in the development of colic. A possible self-reinforcing loop of stress may lead to crying and to more stress.

Intrauterine and Birth-Related Factors

Preterm infants and those born small for gestational age have higher risks for colic (Milidou et al., 2014). Increased excitability and fussiness are seen in infants whose mothers were hypertensive (high blood pressure) or who experienced distress during pregnancy. To relieve infant colic, many parents seek help from chiropractic care, massage therapy, acupuncture, or craniosacral therapy.

Drugs

Prenatal maternal abuse of heroin, marijuana, barbiturates, or cocaine can result in colic-like behavior in the infant. If you work in a hospital setting, medical office, or clinic, you are likely to encounter these mothers and their babies. Infants of substance abusers often exhibit signs of nervous system instabilities. Symptoms may not appear until a week or more after birth. They can include excitability, trembling, restlessness, ravenous appetite, jitteriness, hyperactivity, shrill scream, feeding problems, and either hypertonia or hypotonia. See Chapter 11 for more information on the effects of street drugs on the newborn.

Nicotine

There is a clear correlation between infant fussiness and parental intake of nicotine. Exclusive breastfeeding is protective against colic, including for infants of smoking mothers. Infants of smokers are more excitable and hypertonic than other infants. They require more careful handling, show more signs of stress and abstinence, and have more difficulty with self-regulation.

Food Sensitivity

An infant who reacts to something in the mother's diet is typically calm at the start of a feeding and then begins to pull off the breast, stiffens his or her body, cries, and then reattaches. The infant may repeat this pattern several times during the feeding. Symptoms can be continuous or can start after a feeding. It is rare for symptoms of a **food sensitivity** to show up before 3 weeks. See **Figure 14-17** for signs of food sensitivity.

Avoiding exposure to food allergens in the infant's diet before the age of 3 to 6 months is protective against becoming sensitized or developing food hypersensitivity. Exclusive breastfeeding to the age of 6 months provides the necessary protection. Weaning age may influence the development of sensitization to food allergens or food hypersensitivity (Venter, 2009). Maternal dietary intake during pregnancy does not appear to have an effect. Infants diagnosed with food allergy by the age of 2 years received solids at less than 16 weeks of age and were less likely to be receiving breastmilk when cow's milk protein was first introduced into their diet (Grimshaw et al., 2013).

- A stuffy or drippy nose without any other sign of having a cold
- Frequently pulling off the breast and arching and crying while feeding
- An itchy nose
- A red, scaly, oily rash on the forehead or eyebrows, in the hair, or behind the ears
- Eczema
- A red rectal ring
- Fretful sleeping or persistent sleeplessness
- Frequent spitting up or vomiting
- Diarrhea or green stools, perhaps with blood in them
- Wheezing
- Colic-like symptoms and behaviors

FIGURE 14-17 Signs of food sensitivity in the infant.

Cow and Soy Milk Intolerances

Cow's milk protein is a common cause of intolerance in infants. Almost all mammal milks contain immunoglobulin G (IgG). Mothers of colicky babies have higher levels of **bovine IgG** in their milk than the level found in the milk of noncolicky babies (Clyne & Kulczycki, 1991). Levels in human milk range from 0.1 to 8.5 mg/mL compared with 0.6 to 128 mg/mL in cow's milk formulas. The highest levels in formula are in the powdered form and the lowest levels are in concentrate. Bovine IgG levels can be so high or the half-life so long that trials of 2 to 7 days on a diet free of cow's milk may not be long enough to produce positive results in a colicky child. A 14-day trial may be necessary to obtain valid results. There is no bovine IgG in soy or amino acid formulas.

Colic-like behavior in breastfed infants is sometimes thought to be due to cow's milk protein intolerance. A mother who suspects that her baby is intolerant to cow's milk might try eliminating dairy foods from her diet for 2 weeks. If cow's milk is the cause of her infant's colic-like behavior, she may see some improvement in 48 hours. Full resolution of the symptoms could take several days. The mother can then reintroduce dairy slowly into her diet. Ideally, she will start with hard cheeses or yogurt the first week, add soft cheeses in the second week, butter and ice cream in the third week, and cow's milk in small quantities in the fourth week. If her baby becomes fussy or other symptoms return, the mother can once again reduce her intake of dairy products. In a completely

milk-free diet, the mother takes in no milk, whey, casein, or sodium caseinate. Consumption of lactose is acceptable because it is a sugar and not a cow's milk protein. Caution mothers who use a dairy elimination diet to read food labels because casein is used as a binder in many processed foods.

Other Factors in the Mother's and Infant's Diets

Removal of possible sources of intolerance may provide relief to a colicky baby. First, the mother should feed the baby only her milk. Even vitamins, fluoride, and iron supplements can be a source of discomfort. Babies who receive antibiotics may be at a greater risk for developing food allergies. Antibiotics are linked to leaky gut syndrome, a condition in which the intestinal lining first becomes inflamed, and then thin and porous. Proteins that are not completely digested may cross from the intestines into the bloodstream. **Leukocytes** attack such proteins and lead to an antigen–antibody reaction, which manifests itself as an allergic reaction on subsequent exposure to that protein.

Babies usually are not bothered by foods in their mothers' diets. A mother with a highly sensitive baby may want to monitor her food intake. Medications, vitamin supplements, caffeine, high-protein foods, milk, wheat, chocolate, eggs, and nuts are all potential sources of discomfort to an intolerant baby. Many mothers report that foods that make them gassy (e.g., cabbage, beans, and broccoli) also make their babies gassy, especially in the early days after birth. Because colicky babies can become food-intolerant children, there may be some validity to the theory of allergy as a cause of colic-like behavior.

Lactose Overload

You may encounter a mother who says her baby is "lactose intolerant." This is a misconception propagated by superficial media and formula companies with "lactose-free" products to sell. Lactose is the sugar in human milk, and it is crucial for brain development. Approximately 20 percent of lactose passes undigested into the large intestine, where it promotes the proliferation of healthy bacteria (Mikkelsen, 2014). **Lactase** is the enzyme that breaks down lactose.

Colic-like symptoms can occur when a baby consumes an unbalanced amount of foremilk and hindmilk, receiving too much lactose and too little fat. In addition, gut lining damage from the infant receiving cow's milk protein may compromise lactase production (De Koker et al., 2014). Or, the increase in the amount of lactose may be too rapid for the lactase to break down the lactose, resulting in **lactose overload** symptoms. An infant with lactose overload may produce green, frothy, loose, and frequent stools. Poor weight gain, a bloated abdomen, and a great deal of gas are also symptoms and are very similar to the symptoms of food intolerance.

Lactose overload can result from an overactive letdown, overabundant milk production, or insufficient hindmilk intake. The amount of lactose in human milk is not dependent on the mother's diet. Although the amount of lactose is the same in both foremilk and hindmilk, fat concentrations are low in foremilk and high in hindmilk. An infant who receives an unbalanced feeding gets a higher percentage of lactose in comparison with the percentage of fat. The excess lactose then ferments in the baby's gut, which can lead to gassiness and fussiness.

A mother who places limits on her baby's time at the breast may end a feeding from one breast before letdown has occurred or before her baby has been able to obtain the amount of hindmilk needed. This practice results in the baby ingesting a larger ratio of foremilk on the first breast and then filling up on foremilk again on the second breast. Fat intake varies between feedings, and the emptier the breast, the higher the fat content. Thus, allowing the baby to remain on a breast long enough to drain it will ensure adequate fat intake. Some babies may need to nurse repeatedly on the same breast before they switch to the other breast. See Chapter 9 for more discussion on milk composition.

If the mother has overabundant milk production, she might try nursing on one breast for several feedings before switching. This should be recommended only after a full feeding assessment that includes before- and after-feeding (ac/pc) weights measured on a digital scale. This intervention may be combined with pumping residual milk. For example, a baby might present with the markers for overabundant milk production, but when ac/pc weights are done, the baby will have had an intake of only 2 or 3 ounces. In this case, the fussy behavior may be unrelated to nursing. If the mother were to down-regulate her milk production in this instance, breastfeeding could be harmed.

Lactose overload should not be confused with lactose intolerance. Lactose intolerance occurs when a person does not produce enough lactase—the enzyme required to digest lactose—and therefore cannot digest lactose. Thus, lactose intolerance is a result of insufficient lactase, not a condition in and of itself. As people age, their bodies begin to produce less lactase. Up to 70 percent of the world's population has **lactase deficiency**, or **lactase nonpersistence**. This is indicative of the body's maturation as a child matures and weans from human milk. It is rare for children to have primary lactase deficiency before 3 years of age, even in populations with genetic propensities for it, such as Asians, South Americans, and Africans (De Koker et al., 2014). This is also reflective of the biologically normal ages for weaning.

Treatment of Colic-like Symptoms

Treatments for colic over the years have ranged from folk remedies to prescription medication. Successful calming techniques for fussiness include holding, breastfeeding, walking, and rocking. Mothers of infants with a diagnosis of colic may not regard breastfeeding as an effective method of infant comforting. In fact, a diagnosis of colic correlates with a shorter duration of full breastfeeding. Giving anticipatory guidance to parents about infant feeding, colic, and recommended breastfeeding duration may be helpful in ensuring that they maintain breastfeeding as long as possible.

One theory holds that colic indicates an overreactive nervous system. According to this hypothesis, a colicky baby tenses easily and reacts with discomfort to most stimuli, including parental handling. The mother may interpret her baby's crying and pushing away as a sign of rejection. She needs to learn that these reactions do not indicate rejection, but rather the need for soothing. Babies are better able to self-regulate when parents establish regularity and uniformity in their daily care. Predictability improves the baby's sleep-wake rhythm, thereby avoiding overtiredness and excessive crying (Blom et al., 2009).

Many parents seek help from chiropractic care, massage therapy, or craniosacral therapy. Referral by the family's primary care provider to occupational or physical therapy may also be helpful in reducing maternal distress by addressing the baby's symptoms. Chiropractic care involves gentle pressure to relieve nerve compression that impairs the affected system. The majority of parents find an improvement in symptoms. Massage has relaxing effects on both the baby and parent, enhances mother–infant interaction and infant sleep, and lowers levels of stress hormones. Massage on preterm babies in the neonatal intensive care unit is linked to greater weight gain, earlier discharge, and increased developmental scores.

See **Figure 14-18** for one effective technique for infant massage. Sometimes the baby will cry throughout the massage but be calm by the end. Other infants may respond immediately. Many resources for infant massage abound on the Internet, through community classes, and in the form of books. Resources from the International Association of Infant Massage (IAIM, 2014) can be helpful for parents.

- Hold the naked baby on the parent's lap, supine, with the baby's head resting on the parent's knees.
- Gently massage the baby's stomach, shoulders, head, hands, and feet.
- Turn the baby over and massage the back.
- Hold and soothe the baby against the parent's shoulder until the crying ceases.

FIGURE 14-18 Technique for infant massage.

Many cultures promote home remedies such as chamomile, catnip, fennel, dill, and anise for colic symptoms (Humphrey, 2003). An herbal tea containing chamomile, vervain, licorice, fennel, and balm mint is reportedly effective, but the volume necessary for treatment limits its usefulness (Crotteau et al., 2006). Fennel oil has also historically been used (Gori et al., 2012). Caution parents to discuss their options with their baby's caregiver before they use any over-the-counter, herbal, or folk remedy. Such treatments may even be dangerous. Japanese star anise, used for colic, has resulted in infant poisoning (Madden et al., 2012). Prescription medication is available for relieving colic symptoms. Dicyclomine, an anticholinergic agent used to treat the symptoms of irritable bowel syndrome, relieves muscle spasms in the gastrointestinal tract. Some caregivers prescribe simethicone (Mylicon) drops for colic due to gas or cimetropium bromide (Savino et al., 2014). Other parents use homeopathic preparations.

A new trend for the treatment of infantile colic is the use of probiotics, medicine's most recent "hammer looking for a nail" (Bennett, 2014). After several small industry-funded trials, a large cohort was studied. Researchers concluded that treatment with Lactobacillus reuteri (the probiotic) did not reduce crying or fussing. It was also ineffective in improving infant sleep, maternal mental health, family or infant functioning, or quality of life (Sung et al., 2014). Although interventions can be of limited value, some parents find one that works much better for their baby, while others keep a repertoire handy for this purpose. When crying stops temporarily, parents cannot necessarily assume the cause is clear. **Table 14-10** identifies some interventions parents may wish to try. One of the techniques, shown in **Figure 14-19**, is for the mother to place her baby across her lap. If all measures used to comfort the baby fail, the parents should consult their baby's caregiver to rule out a medical condition. The potential harm associated with diagnosis and treatment is likely to surpass any harm from the colic. Families will benefit from reassurance, family social support, and the tincture of time (Bennett, 2014).

Supporting the Parents of a Colicky Baby

When a baby experiences colic-like symptoms, parental stress and concern naturally increase. Colic seems severe enough to some parents that they visit the hospital emergency department. Parents of a colicky baby will need support, frequent contact, and reassurance. Depending

TABLE 14-10 Measures for Comforting a Colicky Baby

Holding techniques	"Wear" the baby around the house in a cloth baby sling, walking and dancing in a soothing manner (make sure the baby's breathing is not blocked).
	Hold the baby upright against the parent's shoulder near the neck.
	Place the baby on his or her stomach across the parent's lap or knees.
	Carry the baby against the parent's hip.
	Lay the baby face down on the parent's chest.
	Lay the baby face down on the inside of the parent's forearm with the baby's head held in the crook of the parent's arm. The pressure on the stomach feels good, and the parent can use the free hand to pat and rub the baby's back.
	Pick up the baby as soon as he or she starts to fuss. This will decrease the length of time the baby is fussy and prevent it from escalating.
Sounds and motion	Provide a steady noise from a vacuum, clothes dryer, music, humming, or tapes of the mother's heartbeat.
	Play a recording of the baby's own cry.
	Speak closely and softly in whispers.
	Position baby to look at the mother's and father's face.
	Provide an unexpected distraction to startle the baby to cease crying.
	Take the baby for a car ride to provide soothing, rhythmic motion.
	Bounce, swing, rock, and walk in slow, rhythmical movements.
Security and warmth	Place the baby in a warm bath.
	Check for any rashes that could indicate reaction to the fiber or detergent in clothing or blankets.
	Swaddle the baby to provide closeness and security, or unswaddle him or her if the blanket seems too constricting.
	Check the diaper for dampness and keep the baby warm with sweaters or blankets.
	Place a warmed hot water bottle against the baby's stomach area to help him or her release tension and thereby encourage the passing of gas.
	Fold the baby's legs up to his or her stomach in a bicycle motion to help eliminate gas.

on their reading level and desire, you can suggest appropriate resources to assist them in caring for their colicky child. Many Internet and parenting support forums are available. Breastfeeding support groups and online meetings can also provide a support network to help families get through this very intense and difficult beginning to their baby's life.

The mother of a colicky baby may experience frustration and guilt for resenting her child. Physical exhaustion is common from constantly trying to soothe and comfort a crying baby. A baby may sense the mother's emotional state and be comforted immediately when another person picks the child up. This can further add to the mother's feelings of guilt and inadequacy. She may feel that her baby is rejecting her and that she is the cause of her baby's colic-like behavior. During this time, the mother will need a great deal of emotional support. It is not surprising that mothers of colicky babies often experience postpartum depression and insecure maternal attachment (Hiscock et al., 2014; Radesky et al., 2013).

Caring for an infant with unexplained, persistent crying is one of the most stressful and common concerns for new parents. Interaction between parents and their colicky infant is compromised, and tension can further aggravate a baby's colicky condition. The mother will need an avenue for venting her anger and frustration. She will benefit from the support of someone who is receptive, caring, and reassuring. Parents may need to take a break and spend some time away from the baby when necessary to keep their perspective. Encourage them to seek help if they feel they cannot cope with their baby's crying. Home-based healthcare intervention and support, when available, helps reduce parenting stress and improves interactions between parents and their infants.

Support for parents is especially critical in preventing a reaction of shaking the baby in frustration. Parents and caregivers need to be educated about the causes and dangers of shaken baby syndrome and know to never shake or handle the baby roughly. Shaking can cause brain damage, blindness, and death (CDC, 2012).

FIGURE 14-19 Placing the baby on his or her stomach across the parent's lap can help relieve colic symptoms.

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Summary

Infant assessment is a significant part of the lactation consultant's role in caring for breastfeeding families. Recognizing deviations from normal in the infant's body, posture, skin, head, and reflexes provides important clues about the child's condition. Assessment of the infant's oral structure and elimination patterns will help the lactation consultant determine whether changes are needed in the breastfeeding approach.

As a lactation consultant, you have the opportunity to educate parents about normal baby behavior. Many parents will have never been around babies or even held a baby until they hold their own child. Your experience with many healthy babies at different developmental stages will help you educate parents about normal healthy infant behavior. Teaching parents how to recognize and interpret infant signals helps them tune into their baby's needs. As parents learn about normal infant behavior, growth, sleeping, crying, and digestion patterns, they become proficient in interpreting their own babies' behaviors.

What You Learned—At a Glance

Elements of newborn assessment

- Body tone can indicate possible congenital anomalies or the need for assistance with positioning for feedings.
- Skin turgor indicates adequate hydration from milk transfer.
- Severe caput succedaneum or cephalhematoma can lead to feeding difficulties or jaundice.
- Facial asymmetry or torticollis is a marker for potential latch and sucking difficulty.
- Low fat buccal pads indicate a possible need to assist with latch.
- Short tongue, tight frenulum or frenum, or other inability to extend the tongue over the alveolar ridge could interfere with latch and cause nipple damage.
- High palate or palatal defects such as a cleft of the soft palate, a submucosal cleft, or a bifurcated (bifid) uvula could interfere with latch or sucking.
- Fractured clavicle or sensitivity from forceps or vacuum can cause feeding discomfort or impairment.
- Nutritive and nonnutritive sucking indicate whether the baby is receiving milk.

Digestion

- Burping decreases gas pain and reduces spitting up.
- When a baby spits up, the amount, frequency, and force indicate possible need for a change in breastfeeding management.
- Spitting up multiple times in one day can be a sign of GER.
- GERD is associated with esophagitis, low weight gain, failure to thrive, and respiratory disorders.
- Monitoring voids and stools indicates adequate nourishment.
- Recognizing normal stool consistency helps mothers rule out constipation or diarrhea.

Infant communication and behavior

- Infants communicate through approach and avoidance behaviors.
- Hunger cues are most evident when the baby is in a light sleep, drowsy, and quietly alert.
- If hunger cues are unheeded, the baby may cry or fall back asleep.
- Breastfeeding management may need to accommodate the infant's behavior pattern, which ranges from easy-going and undemanding to active and fussy.

- Knowing how to stimulate a sleepy or undemanding baby and comfort a fussy baby will help mothers ensure the baby's adequate nourishment.

Infant growth

- Healthy, full-term infants self-regulate their food intake.
- Newborns may lose up to 7 to 10 percent of birth weight due to passage of meconium and urine.
- Weight loss over 10 percent is outside normal limits and requires intervention.
- Heavy maternal load of intravenous fluids is associated with faster and greater weight loss.
- Weight should stabilize by the end of the first week, and birth weight should be regained by 10 to 14 days.
- WHO growth charts indicate normal weight patterns in breastfed babies.

Sleep

- The AAP recommends that mothers and babies sleep in proximity to each other.
- Guidelines are available for parents to create a safe environment for cosleeping.
- Breastfeeding reduces the risk of SIDS by approximately 50 percent.
- Sleeping prone and maternal smoking are risk factors for SIDS.

Crying and colicky behavior

- Infants' crying is a form of communication to elicit parental response to meet their needs.
- A newborn may cry from hunger approximately 1½–2 hours or more after a feeding.
- Some babies settle when swaddled or carried in a sling.
- A colicky baby has severe abdominal discomfort, piercing cries, and explosive attacks.
- Infants born preterm and small for gestational age have higher risks for colic.
- Prenatal maternal abuse of heroin, marijuana, barbiturates, or cocaine can cause colic-like behavior.
- Parental intake of nicotine can cause infant fussiness.
- Cow's milk protein accounts for 30 percent of colic-like behavior in breastfed infants.
- Babies usually are not bothered by foods in their mothers' diets.
- Consuming an unbalanced amount of foremilk and hindmilk can create colic-like symptoms.
- Infant massage may help relieve colic symptoms.

References

Academy of Breastfeeding Medicine (ABM). Clinical protocol #6: Guideline on co-sleeping and breastfeeding revision. March 2008. http://www.bfmed.org

Academy of Breastfeeding Medicine (ABM). Clinical protocol #11: Guidelines for the evaluation and management of neonatal ankyloglossia and its complications in the breastfeeding dyad. 2009. http://www.bfmed.org/Resources/Protocols.aspx

Allen LM, Spadola AC. Prenatal detection of ankyloglossia in a 22-week fetus. *J Ultrasound Med*. 2013;32(6):1063-1065.

American Academy of Pediatrics (AAP), Subcommittee on Hyperbilirubinemia. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. *Pediatrics*. 2004;114(1):297-316.

American Academy of Pediatrics (AAP). Policy statement: The Apgar score. *Pediatrics*. 2006;117(4):1444-1447. Reaffirmed November 2008 in *Pediatrics*. 2009;123(5):1421-1422.

American Academy of Pediatrics (AAP). Task Force on Sudden Infant Death Syndrome, Moon RY. SIDS and other sleep-related infant deaths: expansion of recommendations for a safe infant sleeping environment. *Pediatrics*. 2011;128(5):e1341-e1367.

American Academy of Pediatrics (AAP). Policy statement on breastfeeding and the use of human milk. *Pediatrics*. 2012;129(3):e827-e8412005a;115(2):496-506.

Ballard JL, et al. Ankyloglossia: assessment, incidence, and effect of frenuloplasty on the breastfeeding dyad. *Pediatrics*. 2002;110(5):e63.

Beal J, et al. Late onset necrotizing enterocolitis in infants following use of a xanthan gum-containing thickening agent. *J Pediatr*. 2012;161(2):354-356.

Bennett WE Jr. Probiotics and infant colic. *BMJ*. April 2014;348:g2286.

Bergman NJ. Neonatal stomach volume and physiology suggest feeding at 1-h intervals. *Acta Paediatrica*. 2013;102(8):773-777.

Blackburn ST. *Maternal, Fetal, & Neonatal Physiology: A Clinical Perspective*. 4th ed. Maryland Heights, MO: Elsevier Saunders; 2013.

Blair P, et al. Sudden infant death syndrome and sleeping position in pre-term and low birth weight infants: an opportunity for targeted intervention [published online ahead of print May 24, 2005]. *Arch Dis Child*. 2006;91(2):101-106.

Blair PS, et al. Bed-sharing in the absence of hazardous circumstances: Is there a risk of sudden infant death syndrome? An analysis from two case-control studies conducted in the UK. *PLoS One*. 2014;9(9):e107799.

Blom MA, et al. Health care interventions for excessive crying in infants: regularity with and without swaddling. *J Child Health Care*. 2009;13(2):161-176.

Borrelli O, et al. Cow's milk challenge increases weakly acidic reflux in children with cow's milk allergy and gastroesophageal reflux disease. *J Pediatr*. 2012;161(3):476-481.

Brown A, Arnott B. Breastfeeding duration and early parenting behaviour: the importance of an infant-led, responsive style. *PLoS One*. 2014;9(2):e83893.

Buryk M, et al. Efficacy of neonatal release of ankyloglossia: a randomized trial. *Pediatrics*. 2011;128(2):280-288.

Campanozzi A, et al. Prevalence and natural history of gastroesophageal reflux: pediatric prospective survey. *Pediatrics*. 2009;123(3):779-783.

Carrascoza K, et al. Consequences of bottle-feeding to the oral facial development of initially breastfed children [published online ahead of print September 21, 2006]. *J Pediatr* (Rio J.) 2006;82(5):395-397.

Casale V, et al. Investigation of 5-HTT expression using quantitative real-time PCR in the human brain in SIDS Italian cases. *Exp Mol Pathol*. 2013;94(1):239-242.

Centers for Disease Control and Prevention (CDC). Injury Prevention & Control: Traumatic Brain Injury. Heads Up: Prevent Shaken Baby Syndrome. March 9, 2012. www.cdc.gov/concussion/HeadsUp/sbs.html

Centers for Disease Control and Prevention (CDC). About sudden unexpected infant death and sudden infant death syndrome. September 29, 2014. http://www.cdc.gov/sids/aboutsuidandsids.htm

Clyne P, Kulczycki A. Human breast milk contains bovine IgG: relationship to infant colic? *Pediatrics*. 1991;87:439-444.

Crotteau C, et al. Clinical inquiries: what is the best treatment for infants with colic? *J Fam Pract*. 2006;55(7):634-636.

Das A, Das NK. Cradle cap. *Indian Pediatr*. June 2014;51(6):509-510.

De Koker CE, et al. The differences between lactose intolerance and cow's milk protein allergy. *J Fam Health Care*. January-February 2014;24(1):14-18, 20.

DeMuth K, et al. Relationship between treatment with antacid medication and the prevalence of food allergy in children. *Allergy Asthma Proc*. 2013;34(3):227-232.

De Santis D, et al. Lingual frenectomy: a comparison between the conventional surgical and laser procedure. *Minerva Stomatol*. August 1, 2013. [Epub ahead of print]

Dewey K. Nutrition, growth and complementary feeding of the breastfed infant. In Hale T, Hartmann P. (eds.), *Hale & Hartmann's Textbook of Human Lactation*. Amarillo, TX: Hale Publishing; 2007; 415-423.

Dias CC, Figueiredo B. Breastfeeding and depression: Asystematic review of the literature. *J Affect Disord*. September 2014; 171C:142-154.

Dietz PM, et al. Infant morbidity and mortality attributable to prenatal smoking in the U.S. *Am J Prev Med*. 2010;39(1):45-52.

Doan T, et al. Nighttime breastfeeding behavior is associated with more nocturnal sleep among first-time mothers at one month postpartum. *J Clin Sleep Med*. March 2014;10(3):313-319.

Doumouchtsis SK, Arulkumaran S. Head trauma after instrumental births. *Clin Perinatol*. 2008;35(1):69-83, viii.

Edmunds J, et al. Tongue-tie and breastfeeding: a review of the literature. *Breastfeed Rev*. March 2011;19(1):19-26. Review.

Edmunds J, et al. Tongue-tie. *J Hum Lact*. 2012;28(1):14-17.

Eghbalian F, Monsef A. Congenital epulis in the newborn: review of the literature and a case report. *J Pediatr Hematol Oncol*. 2009;31(3):198-199.

Garbin CP, et al. Evidence of improved milk intake after frenotomy: a case report. *Pediatrics*. 2013;132(5):e1413-e1417.

Geddes D, et al. Frenulotomy for breastfeeding infants with ankyloglossia: Effect on milk removal and sucking mechanism as imaged by ultrasound [published online ahead of print June 23, 2008]. *Pediatrics*. 2008;122(1):e188-e194.

Genna CW. *Supporting Sucking Skills in Breastfeeding Infants*. Sudbury, MA: Jones and Bartlett; 2008.

Gettler LT, McKenna JJ. Evolutionary perspectives on mother-infant sleep proximity and breastfeeding in a laboratory setting. *Am J Phys Anthropol*. 2011;144(3):454-462.

Goetzinger KR, Macones GA. Operative vaginal delivery: current trends in obstetrics. *Women's Health* (Lond). 2008;4(3):281-290.

Gori L, et al. Can estragole in fennel seed decoctions really be considered a danger for human health? A fennel safety update. *Evid Based Complement Alternat Med*. 2012;2012:860542.

Grimshaw KE, et al. Introduction of complementary foods and the relationship to food allergy. *Pediatrics*. 2013;132(6):e1529-e1538.

Han SH, et al. A study on the genetic inheritance of ankyloglossia based on pedigree analysis. *Arch Plast Surg*. 2012;39(4):329-332.

Hauck FR, et al. Breastfeeding and reduced risk of sudden infant death syndrome: a meta-analysis. *Pediatrics*. 2011;128(1):103-110.

Hester SN, et al. Is the macronutrient intake of formula-fed infants greater than breast-fed infants in early infancy? *J Nutr Metab*. 2012;2012:891201.

Hiscock H, et al. Preventing early infant sleep and crying problems and postnatal depression: a randomized trial. *Pediatrics*. 2014;133(2):e346-e354.

Honein MA, Cragan JD. Balancing competing risks: perinatal exposure to macrolides increases the risk of infantile hypertrophic pyloric stenosis. *Evid Based Med*. August 2014. pii: ebmed-2014-110015

Hong P, et al. Defining ankyloglossia: a case series of anterior and posterior tongue ties. *Int J Pediatr Otorhinolaryngol*. 2010;74(9):1003-1006.

Huang Y, et al. Influence of bedsharing activity on breastfeeding duration among U.S. mothers. *JAMA Pediatr*. 2013;167(11):1038-1044.

Humphrey S. *The Nursing Mother's Herbal*. Minneapolis, MN: Fairview Press; 2003.

Ikeda K, et al. Importance of evaluating for cow's milk allergy in pediatric surgical patients with functional bowel symptoms. *J Pediatr Surg*. 2011;46(12):2332-2335.

Iles R, et al. Crying significantly reduces absorption of aerosolised drug in infants. *Arch Dis Child*. 1999;81(2):163-165.

International Association of Infant Massage (IAIM). 2014. http://www.iaim.net

International Chiropractic Pediatric Association (ICPA). Advancing the family wellness lifestyle. 2014. http://www.icpa4kids.org

Jain S. "Witch's milk" and 99mTc-pertechnetate uptake in neonatal breast tissue: an uncommon but not unexpected finding. *Clin Nucl Med*. July 2013;38(7):586-587.

Jung WJ, et al. The efficacy of the upright position on gastroesophageal reflux and reflux-related respiratory symptoms in infants with chronic respiratory symptoms. *Allergy Asthma Immunol Res*. 2012;4(1):17-23.

Junqueira MA, et al. Surgical techniques for the treatment of ankyloglossia in children: a case series. *J Appl Oral Sci*. 2014;22(3):241-248.

Kanada KN, et al. A prospective study of cutaneous findings in newborns in the United States: correlation with race, ethnicity, and gestational status using updated classification and nomenclature. *J Pediatr*. August 2012;161(2): 240-245.

Kent J, et al. Volume and frequency of breastfeedings and fat content of breast milk throughout the day. *Pediatrics*. 2006;117(3):e387-e395.

Kochanska G, et al. Mother-child and father-child mutually responsive orientation in the first 2 years and children's outcomes at preschool age: mechanisms of influence. *Child Dev*. 2008;79(1):30-44.

Kocherlakota P. Neonatal abstinence syndrome. *Pediatrics*. 2014;134(2):e547-e561. Review.

Kotlow LA. The influence of the maxillary frenum on the development and pattern of dental caries on anterior teeth in breastfeeding infants: prevention, diagnosis, and treatment. *J Hum Lact*. 2010;26(3):304-308.

Kotlow L. Diagnosis and treatment of ankyloglossia and tied maxillary fraenum in infants using Er:YAG and 1064 diode lasers. *Eur Arch Paediatr Dent*. 2011;12(2):106-112. Review.

Kumar M, Kalke E. Tongue-tie, breastfeeding difficulties and the role of Frenotomy. *Acta Paediatrica*. 2012;101(7):687-689.

La Leche League International (LLLI). How do I position my baby to breastfeed? February 11, 2013. http://www.llli.org

Leibovitch L, et al. Short-term neonatal outcome among term infants after in utero exposure to serotonin reuptake inhibitors. *Neonatology*. 2013;104(1):65-70.

Lewis ML. A comprehensive newborn exam: part I. General, head and neck, cardiopulmonary. *Am Fam Physician*. September 2014a;90(5):289-296.

Lewis ML. A comprehensive newborn exam: part II. Skin, trunk, extremities, neurologic. *Am Fam Physician*. September 2014b;90(5):297-302.

Lindau JF, et al. Determinants of exclusive breastfeeding cessation: identifying an "at risk population" for special support. *Eur J Pediatr*. October 14, 2014.

Loder RT, Skopelja EN. The epidemiology and demographics of hip dysplasia. *ISRN Orthop*. October 10, 2011;2011:238607.

Lund M, et al. Use of macrolides in mother and child and risk of infantile hypertrophic pyloric stenosis: nationwide cohort study. *BMJ*. 2014;348:g1908.

Lykoudis E, et al. Alopecia associated with birth injury. *Obstet Gynecol*. 2007;110(2 Pt 2):487-490.

Mabula JB, et al. Hirschsprung's disease in children: a five year experience at a university teaching hospital in northwestern Tanzania. *BMC Res Notes*. 2014;7:410.

Machaalani R, Waters KA. Neurochemical abnormalities in the brainstem of the sudden infant death syndrome (SIDS). *Paediatr Respir Rev*. September 19, 2014.

Madden GR, et al. A case of infantile star anise toxicity. *Pediatr Emerg Care*. 2012;28(3):284-285.

Madre C, et al. Infant deaths in slings. *Eur J Pediatr*. December 18, 2013. [Epub ahead of print]

Manfredi C, et al. High-resolution cry analysis in preterm newborn infants. *Med Eng Phys*. 2008;31(5):528-532.

McDonnell E, Moon RY. Infant deaths and injuries associated with wearable blankets, swaddle wraps, and swaddling. *J Pediatr*. 2014;164(5):1152-1156.

McKenna J, et al. Mother-infant cosleeping, breastfeeding and sudden infant death syndrome: what biological anthropology has discovered about normal infant sleep and pediatric sleep medicine. *Am J Phys Anthropol*. 2007;45(suppl):133-161.

Mikkelsen A. Children's hypersensitivity to cow's milk. Public health aspects and impact on families. Public Health Epidemiology Unit. Institute of Medicine Sahlgrenska Academy at University of Gothenburg. Gothenburg, Sweden; 2014.

Milidou I, et al. Gestational age, small for gestational age, and infantile colic. *Paediatr Perinat Epidemiol*. 2014;28(2):138-145.

Mitchell EA, Thompson JMD. Co-sleeping increases the risk of SIDS, but sleeping in the parents' bedroom lowers it. In Rognum TO, ed. *Sudden Infant Death Syndrome: New Trends in the Nineties*. Scandinavian University Press: Oslo; 1995:266-269.

Moimaz SA, et al. Longitudinal study of habits leading to malocclusion development in childhood. *BMC Oral Health*. August 2014;14:96.

Monk C, et al. The relationship between women's attachment style and perinatal mood disturbance: implications for screening and treatment. *Arch Women's Ment Health*. 2008;11(2):117-129.

Mörelius E, et al. Stress at three-month immunization: parents' and infants' salivary cortisol response in relation to the use of pacifier and oral glucose. *Eur J Pain*. 2009;2:202-208.

Moses S. Family Practice Notebook. Skin turgor. June 1, 2013. http://www.fpnotebook.com/ER/Exam/SknTrgr.htm

Mosko S, et al. Maternal sleep and arousals during bedsharing with infants. *Sleep*. 1997;201(2):142-150.

Mulder PJ, et al. Excessive weight loss in breastfed infants during the postpartum hospitalization. *J Obstet Gynecol Neonatal Nurs*. 2010;39(1):15-26.

Neu M, et al. A review of nonsurgical treatment for the symptom of irritability in infants with GERD. *J Spec Pediatr Nurs*. 2012;17(3):177-192.

O'Callahan C, et al. The effects of office-based frenotomy for anterior and posterior ankyloglossia on breastfeeding. *Int J Pediatr Otorhinolaryngol*. 2013;77(5):827-832.

Oji T, et al. A 25-year review of cases with submucous cleft palate. *Int J Pediatr Otorhinolaryngol*. July 2013;77(7):1183-1185.

Paddack A, et al. Food hypersensitivity and otolaryngologic conditions in young children. *Otolaryngol Head Neck Surg*. 2012;147(2):215-220.

Parlade M, et al. Anticipatory smiling: linking early affective communication and social outcome [published online ahead of print October 31, 2008]. *Infant Behav Dev*. 2009;32(1):33-43.

Perme T, et al. Prolonged prostaglandin E1 therapy in a neonate with pulmonary atresia and ventricular septal defect and the development of antral foveolar hyperplasia and hypertrophic pyloric stenosis. *Ups J Med Sci*. 2013;118(2):138-142.

Ponizovsky AM, Drannikov A. Contribution of attachment insecurity to health-related quality of life in depressed patients. *World J Psychiatry*. 2013;3(2):41-49.

Quitadamo P, et al. European pediatricians' approach to children with GER symptoms: survey of the implementation of 2009 NASPGHAN-ESPGHAN guidelines. *J Pediatr Gastroenterol Nutr*. 2014;58(4):505-509.

Radesky JS, et al. Inconsolable infant crying and maternal postpartum depressive symptoms. *Pediatrics*. 2013;131(6): e1857-e1864.

Rechtman LR, et al. Sofas and infant mortality. *Pediatrics*. 2014;134(5):e1293-1300.

Reddy NR, et al. Clipping the (tongue) tie. *J Indian Soc Periodontol*. 2014;18(3):395-398.

Ricke L, et al. Newborn tongue-tie: prevalence and effect on breast-feeding. *J Am Board Fam Pract*. 2005;18(1):1-7.

Saavedra JM, Dattilo AM. Early development of intestinal microbiota: implications for future health. *Gastroenterol Clin North Am*. 2012;41(4):717-731.

Sánchez CL, et al. The possible role of human milk nucleotides as sleep inducers. *Nutr Neurosci*. 2009;12(1):2-8.

Savino F, et al. Looking for new treatments of infantile colic. *Ital J Pediatr*. June 2014;40:53.

Schertz M, et al. Long-term neurodevelopmental follow-up of children with congenital muscular torticollis. *J Child Neurol*. 2013;28(10):1215-1221.

Semeniuk J, et al. Serum interleukin—4 and tumor necrosis factor alpha concentrations in children with primary acid gastroesophageal reflux and acid gastroesophageal reflux secondary to cow's milk allergy. *Adv Med Sci*. 2012;57(2):273-281.

Shah P, et al. Breastfeeding or breast milk for procedural pain in neonates. *Cochrane Database Syst Rev*. 2012;12:CD004950.

Shapiro-Mendoza CK, et al. Classification system for the Sudden Unexpected Infant Death Case Registry and its application. *Pediatrics*. 2014;134:e210-e219.

Shin HT. Diagnosis and management of diaper dermatitis. *Pediatr Clin North Am*. 2014;61(2):367-382.

Shinya Y, et al. Preterm birth is associated with an increased fundamental frequency of spontaneous crying in human infants at term-equivalent age. *Biol Lett*. August 2014;10(8).

Shprintzen R. Velo-cardio-facial syndrome: 30 years of study. *Dev Disabil Res Rev*. 2008;14(1):3-10.

Smith CH, et al. Proton pump inhibitors for irritable infants. *Can Fam Physician*. February 2013;59(2):153-156.

Stanford School of Medicine. Newborn Nursery at LPCH. Acrocyanosis. 2014. http://newborns.stanford.edu/PhotoGallery/Acrocyanosis1.html

Steehler MW, et al. A retrospective review of frenotomy in neonates and infants with feeding difficulties. *Int J Pediatr Otorhinolaryngol*. September 2012;76(9):1236-1240.

Sung V et al. Treating infant colic with the probiotic *Lactobacillus reuteri*: double blind, placebo controlled randomised trial. *BMJ*. 2014;348:g2107.

Tappin D, et al. Bedsharing, roomsharing, and sudden infant death syndrome in Scotland: a case-control study. *J Pediatr*. 2005;147(1):32-37.

Tarang G, Anupam V. Incidence of vesicobullous and erosive disorders of neonates. *J Dermatol Case Rep*. 2011;5(4):58-63.

ten Dam E, et al. Age of diagnosis and evaluation of consequences of submucous cleft palate. *Int J Pediatr Otorhinolaryngol*. June 2013;77(6):1019-1024.

Tollefson MM, Frieden IJ. Early growth of infantile hemangiomas: what parents' photographs tell us. *Pediatrics*. 2012;130(2):e314-320.

Trikha A, et al. Development of food allergies in patients with gastroesophageal reflux disease treated with gastric acid suppressive medications. *Pediatr Allergy Immunol*. 2013;24(6):582-588.

Tunc V. Factors associated with defecation patterns in 0-24-month-old children. *Eur J Pediatr*. 2008;167(12):1357-1362.

Umeda S, et al. Impact of cow's milk allergy on enterocolitis associated with Hirschsprung's disease. *Pediatr Surg Int*. 2013;29(11):1159-1163.

van Dijk C, Innis S. Growth-curve standards and the assessment of early excess weight gain in infancy. *Pediatrics*. 2009;123(1):102-108.

Vandenplas Y. Management of paediatric GERD. *Nat Rev Gastroenterol Hepatol*. 2014;11(3):147-157.

Vandenplas Y, et al. Gastrointestinal manifestations of cow's milk protein allergy and gastrointestinal motility. *Acta Paediatrica*. November 2012;101(11):1105-1109.

Vennemann M, et al. Does breastfeeding reduce the risk of sudden infant death syndrome? GeSID Study Group. *Pediatrics*. 2009;123(3):e406-e110.

Venter C. Factors associated with maternal dietary intake, feeding and weaning practices, and the development of food hypersensitivity in the infant. *Pediatr Allergy Immunol*. 2009;20:320-327.

Vipulananthan N, et al. Primary aerodigestive presentations of Pierre Robin sequence/complex and predictive factors of airway type and management. *Int J Pediatr Otorhinolaryngol*. October 2014;78(10):1726-1730.

Volpe J. *Neurology of the Newborn*. 5th ed. Philadelphia: WB Saunders; 2008.

Wall LB, et al. Incidence and prognosis of neonatal brachial plexus palsy with and without clavicle fractures. *Obstet Gynecol*. June 2014;123(6):1288-1293.

Waynforth D. The influence of parent-infant cosleeping, nursing, and childcare on cortisol and SIgA immunity in a sample of British children. *Dev Psychobiol*. 2007;49(6):640-648.

Werner EF, et al. Mode of delivery in nulliparous women and neonatal intracranial injury. *Obstet Gynecol*. December 2011;118(6):1239-1246.

Wessel M, et al. Paroxysmal fussing in infancy, sometimes called "colic." *Pediatrics*. 1954;114:421-434.

Widström AM, et al. Newborn behaviour to locate the breast when skin-to-skin: a possible method for enabling early self-regulation. *Acta Paediatrica*. 2011;100(1):79-85.

Wilson-Clay B, Hoover K. *The Breastfeeding Atlas*. 5th ed. Austin, TX: Lactnews Press; 2013.

Woods CW, et al. Development of necrotizing enterocolitis in premature infants receiving thickened feeds using SimplyThick®. *J Perinatol*. 2012;32(2):150-152.

World Health Organization (WHO). *WHO Multicentre Growth Reference Study Group: WHO child growth standards*. Geneva: World Health Organization; 2006. http://www.who.int/childgrowth/standards/en

Yalçin SS, et al. Why are they having infant colic? A nested case-control study. *Paediatr Perinat Epidemiol*. 2010;24(6):584-596.

Zuniga R, Nguyen T. Skin conditions: common skin rashes in infants. *FP Essent*. 2013;407:31-41.