

## States of the Term Newborn

State, also known as state of consciousness, powerfully influences the way infants respond at any given time. A state is a group of characteristic behaviors and physiologic changes that recur together in a regular pattern (Brazelton & Nugent, 1996; Wolff, 1966).

Characteristic behaviors seen in individual states include:

- Body activity
- Eye movements
- Facial movements
- Breathing pattern
- Level of response to external and internal stimuli

In addition to the different characteristic behaviors that occur with each state, physiological changes in heart rate, blood flow, muscle tone, and EEG patterns also occur. In the term infant who is not monitored, caregivers rely on characteristic behaviors to clinically assess the infant's state. In term infants, state can readily be determined by using only characteristic behaviors.

Each state is organized into a pattern that differs from any of the other states. States are divided into sleep and awake states (Table 2).

**Table 2. Sleep and Awake States**

Sleep States	Awake States
Quiet sleep	Drowsy
Active sleep	Quiet alert
	Active alert
	Crying

### Significance of Infant States

States provide a framework for observing and understanding ways in which infants interact with their caregivers. States are important in infant growth and development and in helping caregivers understand newborn behavior.

In each state, infants respond in a unique and predictable manner—not chaotically, but in an organized pattern. States allow infants to control how much and what kind of input they receive from their environments. Sleepy infants affect their parents differently than alert or crying infants do. Infants who have long periods of wakefulness will have more frequent opportunities to interact with their parents than infants who sleep most of the time.

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**Figure 1. Quiet Sleep** (also called deep sleep)



Quiet sleep is restorative and anabolic. It is associated with an increase in cell mitosis and replication, lowered oxygen consumption, and the release of growth hormone. The threshold to sensory stimuli is very high during quiet sleep; only stimuli that are very intense and disturbing can arouse infants.

### Characteristics

<i>Body Activity</i>	Nearly still, except for occasional startle or twitch.
<i>Eye Movements</i>	None.
<i>Facial Movements</i>	None, except for occasional sucking movement at regular intervals.
<i>Breathing Pattern</i>	Smooth and regular.
<i>Level of Response</i>	The infant's threshold to stimuli is very high; only very intense and disturbing stimuli will arouse the infant.
<i>Caregiving</i>	<p>Caregivers trying to feed an infant who is in quiet sleep will probably find the experience frustrating. The infant will be unresponsive.</p> <p>Feeding will be a more pleasant experience if nurses and parents respect the infant's cycles and needs by waiting until the infant moves to a higher, more responsive state.</p> <p>Even if caregivers use disturbing stimuli, chances are the infant will arouse only briefly, then become unresponsive as he or she returns to quiet sleep.</p>

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**Figure 2. Active Sleep** [also called light sleep or rapid eye movement (REM)sleep]



Active sleep is associated with processing and storing of information and has been linked to learning. It accounts for the highest proportion of newborn sleep and usually precedes waking.

### Characteristics

<i>Body Activity</i>	Some body movements.
<i>Eye Movements</i>	Rapid eye movements (REM), fluttering of eyes beneath closed eyelids.
<i>Facial Movements</i>	May smile and make brief fussy or crying sounds.
<i>Breathing Pattern</i>	Irregular.
<i>Level of Response</i>	<p>In active sleep, infants are more responsive to internal stimuli (such as hunger) and external stimuli (such as handling) than they are in quiet sleep.</p> <p>When stimuli occur, infants may remain in active sleep, return to quiet sleep, or arouse.</p>
<i>Caregiving</i>	Due to brief fussy or crying sounds during this state, caregivers who are not aware that these sounds normally occur may try to feed infants before they are ready to eat.

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**Figure 3. Drowsy**



From the drowsy state, infants may return to sleep or awaken further.

### Characteristics

<i>Body Activity</i>	Variable activity level with mild startles interspersed from time to time. Movements usually smooth.
<i>Eye Movements</i>	Eyes occasionally open and close, are heavy-lidded or slit-like.
<i>Facial Movements</i>	May have some facial movements. Often none, and face appears still.
<i>Breathing Pattern</i>	Irregular.
<i>Level of Response</i>	Infants react to sensory stimuli, although their responses are delayed. A change to quiet alert, active alert or crying after stimulation is frequently noted.
<i>Caregiving</i>	To awaken infants, caregivers can provide something for infants to see, hear, or suck to arouse them to a more alert state.  If infants are left alone without stimuli, they may return to a sleep state.

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**Figure 4. Quiet Alert**



During this state, infants are most attentive to their environment, focusing their attention on any stimuli that are present: nipple, voice, face, or moving objects.

### Characteristics

<i>Body Activity</i>	Minimal.
<i>Eye Movements</i>	Eyes brighten and widen.
<i>Facial Movements</i>	Attentive appearance.
<i>Breathing Pattern</i>	Regular.
<i>Level of Response</i>	During this state, infants are most attentive to the environment, focusing attention on any stimuli present.
<i>Caregiving</i>	<p>In the first few hours after birth, many newborns experience a period of intense alertness before going into a long sleeping period.</p> <p>As infants become older, they spend more and more time in this state.</p> <p>Providing something for infants to see, hear, or suck will often maintain a quiet-alert state or help them enter a quiet-alert state from either a drowsy or active-alert state.</p> <p>Infants in this state provide much pleasure and positive feedback to parents and other caregivers.</p> <p>This is often a good time to feed the infant, especially if the mother is breastfeeding on an ad lib schedule.</p>

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**Figure 5. Active Alert**



During active alert, infants' eyes are open, but their eyes and faces are not as bright as in quiet alert. Infants have more body activity in active alert than they do in quiet alert.

### Characteristics

<i>Body Activity</i>	Variable activity level with mild startles interspersed from time to time. Movements usually smooth.
<i>Eye Movements</i>	Eyes are open, with dull, glazed appearance.
<i>Facial Movements</i>	May have some facial movements. Often none, and face appears still.
<i>Breathing Pattern</i>	Irregular.
<i>Level of Response</i>	Infants react to sensory stimuli, although responses are delayed. With stimulation, the infant may change to quiet alert or crying.
<i>Caregiving</i>	<p>Infants may have periods of fussiness and become increasingly sensitive to disturbing stimuli (hunger, fatigue, noise, excessive handling).</p> <p>Infants may become more and more active and may change to a crying state.</p> <p>Fatigue or caregiver interventions often interrupt this state, allowing infants to return to a drowsy or sleep state.</p>

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**Figure 6. Crying**



Crying is the infant state that presents the greatest challenge to the caregiver. This state is characterized by intense crying for at least 15 seconds.

### Characteristics

<i>Body Activity</i>	Increased motor activity. Skin color darkens or changes to red or ruddy.
<i>Eye Movements</i>	Eyes may be tightly closed or open.
<i>Facial Movements</i>	Grimaces.
<i>Breathing Pattern</i>	More irregular than in other states.
<i>Level of Response</i>	Infants are extremely responsive to unpleasant external or internal stimuli.
<i>Caregiving</i>	<p>Crying is:</p> <ul style="list-style-type: none"><li>• A communication signal.</li><li>• A response to unpleasant stimuli from the environment.</li><li>• A response to internal stimuli such as fatigue, hunger, or discomfort.</li></ul> <p>Crying tells the caregiver that the infant's limits have been reached.</p> <p>Sometimes infants can console themselves and return to active or quiet alert, drowsy, or a sleep state; at other times, they need help from caregivers.</p>

# Understanding the Behavior of Term Infants

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### State Modulation

An important component of infant states is state modulation, which allows the infant to adapt to and interact with his or her environment by controlling sensory input and responses to caregivers and the environment. State modulation (Barnard, 1999) is the ability of the infant to:

- Make smooth transitions between states.
- Cycle between sleep states (see page 11).
- Arouse when appropriate (e.g., for feeding or playing).
- Sustain sleep states. (Barnard, 1999)

State modulation allows the infant to:

- Adapt to his or her environment by controlling sensory input and responses to the environment.
- Use state behaviors to guide caregiving.
- Modify social interactions. (Barnard, 1999)

During the early months of life, an important role of caregivers is to help the infant with state-modulation activities. An infant who is having difficulty with state modulation has problems regulating sensory input and responses (Barnard, 1999). Infants who cannot turn stimulation on or off may miss important input or become overloaded by stimuli. Problems with state modulation may originate from

the infant or environment (Table 3).

Although states may seem like a continuous spectrum from quiet sleep to crying, each state is qualitatively specific with its unique internal organization of physiologic and behavioral characteristics and level of central nervous system control.

Most infants flow smoothly between states, as if moving up and down a ladder one step or occasionally two steps at a time (Barnard, 1999; Nursing Child Assessment Training, 1978). However, not all infants flow smoothly between states. Some infants tend to jump from one state to another. These infants always seem to be sleeping or crying and spend little time in other states.

Caregivers can aid with state modulation by helping an infant to become alert [see the reading “Infant Behaviors, Reflexes and Cues”] or by soothing the infant.

### Factors Influencing Infant State

Infant states are influenced by internal physiologic needs, external environment, stressful events, and pathologic conditions (Table 4) (Hack, 1987).

**Table 3. Illustrative Infant and Environmental Factors That Affect State Modulation**

Infant Factors	Environmental Factors
Temperament	Noise
Immaturity	Vibration
Pain	Light
Stress	Temperature
Maternal substance abuse	Caregiver actions
Illness	

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**Table 4. Factors Influencing Infant State**

<b>Factor</b>	<b>Stimuli</b>	<b>Effect of Stimuli</b>
Touch	Soothing and swaddling	Reduces activity during active alert and crying
	Handling (rubbing, stroking, holding)	Induces awakeness and activity
	Pain	Increases awakeness and activity; inactive infants most sensitive to pain
Visual factors	Pictures, objects, faces	Induces quiet alert in drowsy, crying, or active-alert infants; quiet alert prolonged by interesting visual stimuli
Light/Dark	Light	Reduces active sleep; reduces level of activity in fussy or crying babies
	Dark	Increases quiet sleep
Auditory factors (sound)	Variations in sound	Increases activity
	Rhythmic sound	Reduces activity; more sleep, less crying
	Continuous sound	Reduces activity in crying and fussy babies; less active sleep, more quiet sleep
Proprioceptive factors (sensations related to movement of the body)	Putting to shoulder and rocking in an upright position	Induces quiet alert in sleeping, active-alert, and fussy babies
Environmental temperature	Decreases	Increases motor activity; decreases quiet sleep
	Increases	Increases sleep

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*Figure 4 continued*

Sucking	Sucking on a pacifier or own finger or hand	Induces quiet alert in active-alert and crying infants; inhibits head movements and peripheral vision
Stressful events	Circumcision	Increases fussy crying; shorter time to fall asleep; increases quiet sleep; effects may last several days
	Repeated awakenings	Longer wakefulness; more sleep after the deprivation period; fussiness
Internal physiologic needs	Hunger	Increases activity, active alert, and crying
	Satiety	Quiets, induces sleep
	Need to stool	Waking activity
Pathologic conditions	Coma	Complete absence of state cycles and definable sleep
	Asphyxia	Poor sleep-cycle development and state modulation; decreases active sleep; increases quiet sleep
	Hydrocephalus or microcephalus	Increases amounts of wakefulness with less sleep; poor or absent sleep-state organization
	Maternal preeclampsia with intrauterine growth restriction	Poor sleep-state organization; disorganized quiet sleep with irregular respirations
	Jaundice	Decreases quiet-awake periods; increases sleep-cycle duration and active sleep
	Down syndrome	Increases awakenings; decreases active sleep

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Figure 4 continued

Pathologic conditions ( <i>cont.</i> )	Biochemical disturbances (hypoglycemia, hypocalcemia, hypernatremia)	Hyperirritability or decreased wakefulness
Drugs	Meperidine (Demerol) and barbiturates	Decreases wakefulness, visual alertness, and active-sleep spontaneous behaviors
	Diazepam and barbiturates	Increases a state that looks like quiet sleep; decreases active sleep
	Heroin, methadone, and other opiates	Reduces quiet sleep; alters sleep cycles; increases irritability, hyperactivity, and wakefulness
	Cocaine and crack	Increases irritability; rapid fluctuations in states; altered sleep patterns

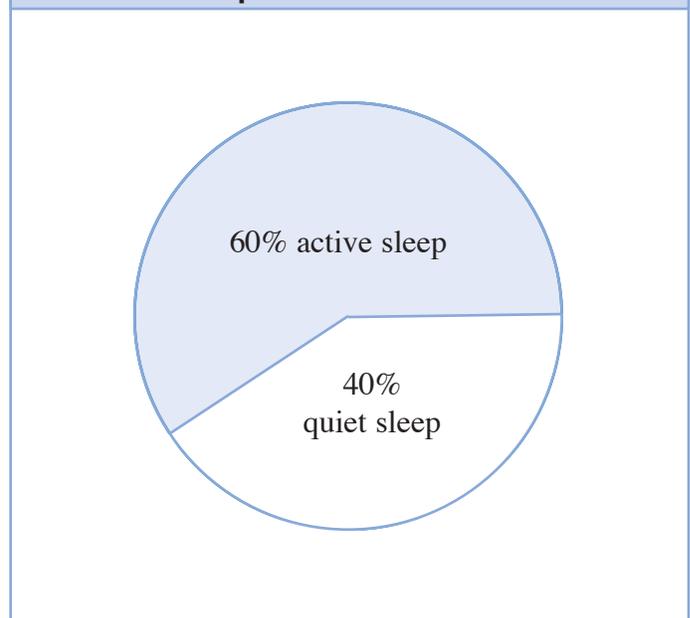
*Adapted from Hack, 1987.*

### Sleep Cycles

Periods of active sleep and quiet sleep alternate in a fixed pattern. A sleep cycle is the time from a period of active sleep, through a period of quiet sleep, to the beginning of the next active sleep period (Barnard, 1999). Infants spend approximately 60% of sleep time in active sleep and 40% in quiet sleep (Figure 7) (Barnard, 1999; Nursing Child Assessment Training, 1978).

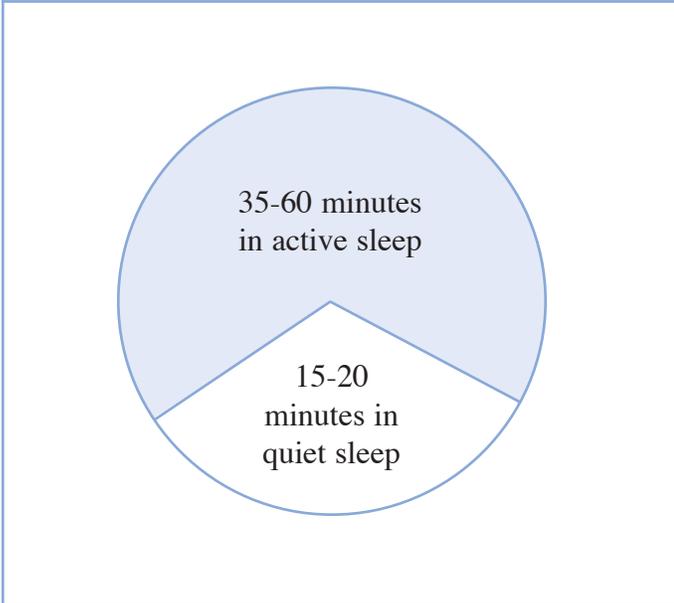
The average length of a sleep cycle in term infants is 50-80 minutes. During a sleep cycle, infants spend 35-60 minutes in active sleep and 15-20 minutes in quiet sleep (Figure 8) (Barnard, 1999; Nursing Child Assessment Training, 1978). For example, a sleep cycle might last 60 minutes, with infants spending 15 minutes in quiet sleep and the remaining time in active sleep. At the end of a sleep cycle, infants either begin another sleep cycle or start to arouse.

**Figure 7. Periods of Active Sleep and Quiet Sleep in the Term Infant**



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**Figure 8. Minutes of Active Sleep and Quiet Sleep in a Sleep Cycle of the Term Infant**



### Sleep and Awake Patterns

As newborns grow and mature, their sleep and awake patterns change (Table 5 on next page). The total amount of sleep per 24 hours does not change significantly over the first year. The major change is in the organization of sleep and in consolidation of sleep into nighttime hours, with increased awake time during the day.

Development of sleep and awake states during infancy reflects central nervous system (CNS) maturation and is important for growth, development, and learning. With maturation of the CNS, the infant is able to increasingly inhibit smooth muscle movements, reduce generalized responses, improve habituation, and develop increased attention ability. Quiet periods become longer during both sleep and

awake, and the states become more organized (Holditch-Davis, 1998).

### Co-Sleeping

Co-sleeping, where the infant is in the same bed or room with parents, is the focus of recent research and is controversial. Because of the risk of suffocation and injury, the American Academy of Pediatrics (AAP) opposes co-sleeping where the infant is in the same bed with adults. The Consumer Product Safety Commission (CPSC) and National Institute of Child Health and Human Development (NICHD) also do not support co-sleeping. The AAP acknowledges that the CPSC opposes bed sharing by an infant and an adult but recognizes that a significant portion of the U.S. population practices bed sharing between mother and infant to facilitate breastfeeding and that it is common for the father to also be in the bed.

Advocates of same-bed sharing cite benefits for breastfeeding, cultural continuation, close infant monitoring, and other potential physiological benefits being studied. Co-sleeping advocates advise against co-sleeping for families who smoke.

The information about sleep states in this module is based on research with infants who are in separate beds (i.e., are not co-sleeping).

In 2000, the AAP Task Force on Infant Sleep Position and Sudden Infant Death Syndrome (SIDS) concluded that there was insufficient evidence to conclude that bed sharing under carefully controlled conditions is clearly either hazardous or safe. Table 6 on page 14 presents highlights from the AAP guidance on co-sleeping.

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**Table 5. Changes in Sleep and Awake Patterns During Early Infancy**

- The infant sleeps 14 hours per day by 1 month.
- The total amount of sleep decreases to about 13 hours per day by 12 months.
- Decrease in sleep is accompanied by a steady increase in the amount of wakefulness.
- Awake times during daytime hours increase as the infant is able to put together two or more sleep cycles.
- The duration of individual sleep periods increases.
- The infant consolidates sleep periods into nighttime hours.
- The percentage of active sleep decreases, and the percentage of quiet sleep increases.
- Increased length of sleep at night is not related to the initiation of solid foods.

*Adapted from Barnard, 1999.*

### Assessment of Infant States

Learning to identify the state of an infant is a skill that most nurses find relatively easy to acquire with a little practice. Nurses can practice state identification with infants in the delivery, nursery, or postpartum areas.

Initially, nurses will need to make a conscious effort to assess an infant's state. They will need to ask themselves the following:

- In what state is the infant as I approach the bassinet and before the infant is handled?
- How does the infant's state change while being touched, diapered, and/or bathed?
- In what state is the infant while the mother or father is holding or feeding the infant, or when the infant is returned to the bassinet?

- Does the infant seem to move smoothly from one state to another, or does the infant jump from a sleep state, to crying, to drowsy?

With a little experience, identification of an infant's state becomes an automatic response so whenever the nurse is working with an infant, she or he can anticipate the way the infant may respond and what activities may be most appropriate with the infant at that time.

### Video Clips and Cases

Return to the online module "Understanding the Behavior of Term Infants" to view videos and cases related to this reading.

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**Table 6. Guidance on Co-Sleeping from the American Academy of Pediatrics**

In 2000, the AAP Task Force on Infant Sleep Position and Sudden Infant Death Syndrome (SIDS) concluded that there was insufficient evidence to conclude that bed sharing under carefully controlled conditions is clearly either hazardous or safe. This table presents highlights from the AAP guidance on co-sleeping.

- As an alternative to bed sharing, parents may consider placing the infant's crib near the parents' bed to allow for more convenient breastfeeding and parent contact.
- Mothers who choose to have their infants sleep in their beds to breastfeed should follow these guidelines:
  - Ensure that the infant is in a nonprone sleep position.
  - Avoid soft surfaces and loose covers.
  - To prevent entrapment, position the bed away from the wall and other furniture and avoid beds that present entrapment possibilities, such as two side-by-side mattresses.
- Adults other than parents, children, or siblings should avoid bed sharing with an infant.
- Parents who choose to bed share with their infant should not smoke or use substances such as alcohol or drugs that may impair their arousal.
- Overheating should be avoided. The infant should be lightly clothed and should not feel hot to the touch. The bedroom temperature should be kept comfortable for a lightly clothed adult.
- Some daily tummy time while the infant is awake and observed is recommended to encourage development and to help prevent flat spots on the occiput. To help prevent positional plagiocephaly, caregivers may place the infant to sleep with the head to one side for a week or so and then change to the other. Periodically changing the infant's orientation to outside activity (e.g., the door of the room) will encourage the infant to change head position.
- Devices to maintain sleep position or to reduce the risk of rebreathing are not recommended, because none has been tested sufficiently to show efficacy or safety.
- Electronic cardiac and respiratory monitors may be of value for home monitoring of selected infants who have extreme cardiorespiratory instability. However, there is no evidence that such home monitoring decreases the incidence of SIDS.

*Adapted from AAP, 2000.*