Figure 35-1a  (A) If at all possible, let a young child sit in the parent's lap during assessment and care. (B) During transport, the child must be appropriately restrained.
Figure 35-1b  (A) If at all possible, let a young child sit in the parent's lap during assessment and care. (B) During transport, the child must be appropriately restrained.
Table 35-1  Anatomic and Physiologic Characteristics of Infants and Children

<table>
<thead>
<tr>
<th>ANATOMIC AND PHYSIOLOGIC DIFFERENCES COMPARED TO ADULTS</th>
<th>POTENTIAL IMPACT ON ASSESSMENT AND CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tongue proportionately larger</td>
<td>More likely to partially obstruct the airway</td>
</tr>
<tr>
<td>Smaller airway structures</td>
<td>More easily blocked</td>
</tr>
<tr>
<td>Abundant secretions</td>
<td>Can block the airway</td>
</tr>
<tr>
<td>Deciduous (baby) teeth</td>
<td>Easily dislodged; can block the airway</td>
</tr>
<tr>
<td>Flat nose and face</td>
<td>Difficult to obtain good face mask seal</td>
</tr>
<tr>
<td>Head heavier relative to body and less-developed neck structures and muscles</td>
<td>Head may be propelled more forcefully than body, creating a higher incidence of head injury</td>
</tr>
<tr>
<td>Fontanelle and open sutures (soft spots) palpable on top of young infant’s head</td>
<td>Bulging fontanelle can be a sign of intracranial pressure (but may be normal if infant is crying); sunken fontanelle may indicate dehydration</td>
</tr>
<tr>
<td>Thinner, softer brain tissue</td>
<td>Susceptible to serious brain trauma</td>
</tr>
<tr>
<td>Head larger in proportion to body</td>
<td>Head tips forward when supine, causing flexion of neck, making neutral alignment of cervical spine and airway difficult</td>
</tr>
<tr>
<td>Shorter, narrower, more elastic (flexible) trachea</td>
<td>Can close off trachea with hyperextension of neck</td>
</tr>
<tr>
<td>Short neck</td>
<td>Difficult to stabilize or immobilize</td>
</tr>
</tbody>
</table>

Source: Author: Andrew Stern, NREMT-P, MPA, MA
Table 35-1 (continued) Anatomic and Physiologic Characteristics of Infants and Children

<table>
<thead>
<tr>
<th>ANATOMIC AND PHYSIOLOGIC DIFFERENCES COMPARED TO ADULTS</th>
<th>POTENTIAL IMPACT ON ASSESSMENT AND CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal breathers</td>
<td>Reliant on diaphragm to breathe; difficult to evaluate breathing</td>
</tr>
<tr>
<td>Faster respiratory rate</td>
<td>Muscles easily fatigue, causing respiratory distress</td>
</tr>
<tr>
<td>Newborns/infants typically nose breathers</td>
<td>Nasal obstruction can impair breathing</td>
</tr>
<tr>
<td>Larger body surface relative to body mass</td>
<td>Prone to hypothermia</td>
</tr>
<tr>
<td>Softer bones</td>
<td>More flexible, less easily fractured; traumatic forces may be transmitted to, and injure, internal organs without fracturing ribs or other bones</td>
</tr>
<tr>
<td>More flexible ribs</td>
<td>Traumatic forces may be transmitted to chest cavity without fracturing ribs; lungs easily damaged with trauma</td>
</tr>
<tr>
<td>Spleen and liver more exposed</td>
<td>Injury likely with significant force to abdomen</td>
</tr>
</tbody>
</table>

Source: Author: Andrew Stern, NREMT-P, MPA, MA
Table 35-2  Normal Vital Sign Ranges: Infants and Children

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Normal Pulse Rate (beats per minute, at rest)</th>
<th>Normal Respiration Rate (breaths per minute, at rest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>120 to 160</td>
<td>30 to 50</td>
</tr>
<tr>
<td>Infant 0–5 months</td>
<td>90 to 140</td>
<td>25 to 40</td>
</tr>
<tr>
<td>Infant 6–12 months</td>
<td>80 to 140</td>
<td>20 to 30</td>
</tr>
<tr>
<td>Toddler 1–3 years</td>
<td>80 to 130</td>
<td>20 to 30</td>
</tr>
<tr>
<td>Preschooler 3–5 years</td>
<td>80 to 120</td>
<td>20 to 30</td>
</tr>
<tr>
<td>School age 6–10 years</td>
<td>70 to 110</td>
<td>15 to 30</td>
</tr>
<tr>
<td>Adolescent 11–14 years</td>
<td>60 to 105</td>
<td>12 to 20</td>
</tr>
</tbody>
</table>

**NOTE:** A high pulse in an infant or child is not as great a concern as a low pulse. A low pulse may indicate imminent cardiac arrest. Blood pressure is usually not taken in a child under 3 years of age. In cases of blood loss or shock, a child’s blood pressure will remain within normal limits until near the end, then fall swiftly.
### Table 35-2  Normal Vital Sign Ranges: Infants and Children (continued)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Systolic:</th>
<th>Diastolic:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschooler 3–5 years</td>
<td>Approx. 80 plus 2 × age</td>
<td>Approx. 2/3 Systolic</td>
</tr>
<tr>
<td>School age 6–10 years</td>
<td>Average 99 (78 to 116)</td>
<td>Average 65</td>
</tr>
<tr>
<td>Adolescent 11–14 years</td>
<td>Average 105 (80 to 122)</td>
<td>Average 69</td>
</tr>
<tr>
<td></td>
<td>Average 114 (88 to 140)</td>
<td>Average 76</td>
</tr>
</tbody>
</table>

**NOTE:** A high pulse in an infant or child is not as great a concern as a low pulse. A low pulse may indicate imminent cardiac arrest. Blood pressure is usually not taken in a child under 3 years of age. In cases of blood loss or shock, a child’s blood pressure will remain within normal limits until near the end, then fall swiftly.
Figure 35-2  A comparison of child and adult respiratory passages.

- Child has smaller nose and mouth.
- In child, more space is taken up by tongue.
- Child's trachea is narrower.
- Cricoid cartilage is less rigid and less developed.
- Airway structures are more easily obstructed.
Figure 35-3a  (A) When an infant or young child is supine, the head will tip forward, obstructing the airway. (B) To keep the airway aligned, place a folded towel under the shoulders.
Figure 35-3b  (A) When an infant or young child is supine, the head will tip forward, obstructing the airway. (B) To keep the airway aligned, place a folded towel under the shoulders.
Figure 35-4  A comparison of infant, child, and adolescent/adult blood volumes.

9-pound newborn:
Blood volume equals less than a 12-oz (335 mL) can of a soft drink

60-pound child:
Blood volume equals about a 2-liter bottle of a soft drink

125-pound adult:
Blood volume equals about two 2-liter bottles of a soft drink
### Table 35-3  Developmental Characteristics of Infants and Children (continued)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Characteristics</th>
<th>Assessment and Care Strategies</th>
</tr>
</thead>
</table>
| Newborns and infants birth to 1 year | - Newborns typically have minimal stranger anxiety and do not mind being separated from their parents. Older infants often fear separation.  
- Infants are used to being undressed but like to feel warm, physically and emotionally.  
- The younger infant follows movement with his eyes.  
- The older infant is more active, and is developing a personality.  
- Infants do not want to be “suffocated” by an oxygen mask. | - Have the parent hold the infant while you examine him.  
- Be sure to keep him warm—warm your hands and stethoscope before touching the infant. As infants can easily become hypothermic, keep the ambulance compartment warm and the child properly covered during cool or cold weather.  
- It may be best to observe breathing from a distance, noting the patient’s work of breathing, the level of activity, and skin color.  
- Examine the heart and lungs first and the head last. This is perceived as less threatening to the infant and therefore less likely to start him crying.  
- A pediatric nonrebreather mask may be held near the face to provide “blow-by” oxygen. |
| Toddlers 1 to 3 years | - Toddlers do not like to be touched or separated from their parents.  
- Toddlers may believe that their illness is a punishment for being bad.  
- Unlike infants, they do not like having their clothing removed.  
- They frighten easily, overreact, and have a fear of needles and pain.  
- Toddlers may understand more than they communicate.  
- They begin to assert their independence.  
- They do not want to be “suffocated” by an oxygen mask.  
- Toddlers do not like to be restrained. | - When appropriate, have a parent hold the child while you examine him.  
- Assure the child that he was not bad.  
- Remove an article of clothing, examine the area, and then replace the clothing. Do your best to respect the child’s modesty.  
- Examine in a trunk-to-head approach to build confidence. (Touching the head first may be frightening.)  
- Explain what you are going to do in terms the toddler can understand (taking the blood pressure becomes a squeeze or a hug on the arm).  
- Assert control over the situation, but give the toddler the opportunity to make some decisions: “Which arm would you like me to check your blood pressure on?”  
- Restrain only when necessary. Restrain well when indicated. |
<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>CHARACTERISTICS</th>
<th>ASSESSMENT AND CARE STRATEGIES</th>
</tr>
</thead>
</table>
| Preschool 3 to 6 years | • Preschoolers do not like to be touched or separated from their parents.  
   • They are modest and do not like their clothing removed.  
   • Preschoolers may believe that their illness is a punishment for being bad.  
   • Preschoolers have a fear of blood, pain, and permanent injury.  
   • They are curious, communicative, and can be cooperative.  
   • They do not want to be “suffocated” by an oxygen mask. |
|                    | (© Michal Heron)                                                                  | • When appropriate, have a parent hold the child while you examine him.  
   • Respect the child’s modesty. Remove an article of clothing, examine the area, and then replace the clothing.  
   • Have a calm, confident, reassuring, respectful manner. Beware of teasing a child. Often children do not understand sarcasm.  
   • Be sure to offer explanations about what you are doing.  
   • Allow simple decision making. Allow the child the responsibility of giving the history.  
   • Explain as you examine.  
   • If desired, hold a pediatric nonrebreather mask near the face to provide “blow-by” oxygen. |
| School age 6 to 12 years | • This age group cooperates but likes their opinions heard.  
   • They fear blood, pain, disfigurement, and permanent injury.  
   • School-age children are modest and do not like their bodies exposed. |
|                    | (© Michal Heron)                                                                  | • Allow simple decision making. Allow the child the responsibility of giving the history.  
   • Explain as you examine.  
   • Present a confident, calm, and respectful manner.  
   • Respect the child’s modesty. |
Table 35-3 (continued)  Developmental Characteristics of Infants and Children (continued)

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>CHARACTERISTICS</th>
<th>ASSESSMENT AND CARE STRATEGIES</th>
</tr>
</thead>
</table>
| Adolescent 12 to 18 years        | • Adolescents want to be treated as adults.  
   • Adolescents generally feel that they are indestructible but may have fears of permanent injury and disfigurement.  
   • Adolescents vary in their emotional and physical development and may not be comfortable with their changing bodies.  
   • Adolescents are influenced highly by their peers. | • Although they wish to be treated as adults, they may need as much support as children.  
   • Present a confident, calm, and respectful manner.  
   • Be sure to explain what you are doing.  
   • Respect modesty. You may consider assessing adolescents away from their parents. Have the physical exam done by an EMT of the same sex as the patient if possible.  
   • Avoid causing embarrassment in groups. Be sensitive to the adolescent’s dignity. |

(© Index Stock)
Figure 35-5  Treat the adolescent with respect.
Figure 35-6  The pediatric assessment triangle. (Used with permission of the American Academy of Pediatrics)
Figure 35-7a  For basic life support, check the (A) brachial pulse or (B) femoral pulse in an infant.
Figure 35-7b  For basic life support, check the (A) brachial pulse or (B) femoral pulse in an infant.
Figure 35-8a  (A) Capillary refill—press. (B) Capillary refill—release.
Figure 35-8b  (A) Capillary refill—press. (B) Capillary refill—release.
Figure 35-9  Take blood pressure in patients older than 3 years of age.
Figure 35-10  There are special areas to consider during pediatric assessment.

- Head is large for body size. Collisions often produce head injuries. "Soft spots" in infants.
- Mouth. Foreign objects obstructing airway.
- Listen for sounds of breathing, be alert for wheezing.
- Pelvis. Check for instability in trauma.
- Nose and ears. Blood, clear fluids—or both—indicate possible skull fracture.
- Neck. Cervical-spine injuries since head is so heavy.
- Chest. Check closely for even expansion.
- Abdomen. Rigid or tender areas, distention.
Scan 35-1  The Pediatric Physical Examination  (1) Examine the head. Look for bruising or blood or clear fluid draining from the nose or ears. Palpate gently for soft or spongy areas, skull irregularities, or crepitus (feeling of grinding bone fragments). Check the fontanelle in infants.
Scan 35-1 (continued)  The Pediatric Physical Examination  (2) Check the eyes. The pupils should be equal in size and reactive to light.
Scan 35-1 (continued)  The Pediatric Physical Examination  (3) Examine the neck. Check for the position of the trachea, swollen neck veins, stiffness, tenderness, or crepitus.
Scan 35-1 (continued)  The Pediatric Physical Examination  (4) Examine the chest. Check for bruising, equal chest rise and fall, and crepitus. Watch for signs of breathing difficulty.
Scan 35-1 (continued)  The Pediatric Physical Examination  While examining the chest, be aware of the contents of the thorax.
Scan 35-1 (continued)  The Pediatric Physical Examination  (5a) Auscultate for breath sounds over all lung fields.
Scan 35-1 (continued)  The Pediatric Physical Examination  (5a) Auscultation sites.

1. Apical
2. Axillary
3. Posterior
Scan 35-1 (continued)  The Pediatric Physical Examination  (6) Examine the abdomen. Check for bruising, tenderness, or guarding. Look for swelling that may indicate swallowed air.
Scan 35-1 (continued) The Pediatric Physical Examination  
(6b) Divide the abdomen into quadrants and examine each one, while remembering which organs are located in each quadrant.

RIGHT UPPER QUADRANT
- Liver
- Diaphragm
- Stomach
- Spleen
- Pancreas

LEFT UPPER QUADRANT
- Duodenum
- Gallbladder

RIGHT LOWER QUADRANT
- Ureters
- Bladder
- Femoral artery
- Femoral vein

LEFT LOWER QUADRANT
- Large intestine
- Small intestine
- Femoral artery
- Femoral vein
Scan 35-1 (continued)  The Pediatric Physical Examination  (7) Examine the pelvis for tenderness, swelling, bruising, or crepitus. If the patient complains of pain, injury, or other problems in the genital area, assess for bruising, swelling, or tenderness in that area.
Scan 35-1 (continued)  The Pediatric Physical Examination  (8) Examine the extremities. Evaluate pulses, sensation, and warmth. Look for unequal movement.
Scan 35-1 (continued)  The Pediatric Physical Examination  (9) If you have immobilized an extremity, check the patient's capillary refill and peripheral pulses and compare them with the other arm or leg.
Scan 35-1 (continued)  The Pediatric Physical Examination  

(10) Examine the back. Assess for tenderness, bruising, and crepitus. If the child requires immobilization, the back can be checked while the child is being log rolled onto the spine board.
Figure 35-11 Special considerations apply to the treatment of many pediatric medical and trauma emergencies.

- Maintain an open airway.
- Provide supplemental oxygen.
- Care for shock.
- Support ventilations as needed.
- Protect from hypothermia.
Scan 35-2  Inserting an Oropharyngeal Airway in a Child  (1) Oropharyngeal airways come in a variety of sizes.
Scan 35-2 (continued)  Inserting an Oropharyngeal Airway in a Child  (2) Size the airway by measuring from the corner of the mouth to the tip of the earlobe
Scan 35-2 (continued) Inserting an Oropharyngeal Airway in a Child (3) Use a tongue depressor to hold the tongue in position. Insert the airway with the tip pointing downward, toward the tongue and throat—the same position it will be in after insertion.
Scan 35-2 (continued)  Inserting an Oropharyngeal Airway in a Child  (4) The oropharyngeal airway in position.
Scan 35-3  Inserting a Nasopharyngeal Airway in a Child  (1) Nasopharyngeal airways come in a variety of sizes.
Scan 35-3 (continued)  **Inserting a Nasopharyngeal Airway in a Child**  (2) The airway should be about the thickness of the patient's little finger and should measure from the nostril to the tragus (cartilage at the front) of the ear.
Scan 35-3 (continued)  **Inserting a Nasopharyngeal Airway in a Child**  (3) The nasopharyngeal airway in position.
Figure 35-12a  For a severe airway obstruction in an infant, alternate (A) back blows with (B) chest thrusts.
Figure 35-12b  For a severe airway obstruction in an infant, alternate (A) back blows with (B) chest thrusts.
<table>
<thead>
<tr>
<th><strong>Table 35-4</strong> Pediatric Airway Clearance Sequences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHILD: 1 YEAR TO PUBERTY</strong></td>
</tr>
<tr>
<td>Conscious</td>
</tr>
<tr>
<td>Ask, “Are you choking?” Perform subdiaphragmatic abdominal thrusts.</td>
</tr>
<tr>
<td>Loses Consciousness during Procedure</td>
</tr>
<tr>
<td>Assist the patient to the floor. Begin 30 chest compressions. Open the airway. Remove any visible objects (no blind sweeps). Attempt to ventilate. If unsuccessful, reposition the head and attempt to ventilate again. If unsuccessful, continue CPR. If alone, call for help after 2 minutes.</td>
</tr>
<tr>
<td>Unconscious When Found</td>
</tr>
<tr>
<td>Establish unresponsiveness. Open the airway. Attempt to ventilate. If unsuccessful, reposition the head and attempt to ventilate again. If unsuccessful, perform CPR, attempting compressions to ventilations at a 30:2 ratio. Remove any visible objects from the airway (no blind sweeps). Continue CPR until ventilations are successful.</td>
</tr>
</tbody>
</table>
### Table 35-5  Artificial Ventilation

<table>
<thead>
<tr>
<th></th>
<th>PUBERTY AND OLDER</th>
<th>OVER AGE 1 TO PUBERTY</th>
<th>BIRTH TO 1 YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation Duration</td>
<td>1 second</td>
<td>1 second</td>
<td>1 second</td>
</tr>
<tr>
<td>Ventilation Rate</td>
<td>10 to 12 breaths/minute</td>
<td>12 to 20 breaths/minute</td>
<td>12 to 20 breaths/minute</td>
</tr>
</tbody>
</table>
Figure 35-13  You can deliver oxygen to an infant using the blow-by method.
Figure 35-14  Ventilation of a child using a pocket face mask.
Figure 35-15  Ventilation of a child using a bag-valve-mask device. If using one hand to squeeze the bag, achieve a good mask seal with the other hand by placing your fingers in an E-C configuration. The thumb and index finger form a C around the mask chimney whereas the other three fingers form an E along the child's jaw.
Figure 35-15 (continued)  Ventilation of a child using a bag-valve-mask device. If using one hand to squeeze the bag, achieve a good mask seal with the other hand by placing your fingers in an E-C configuration. The thumb and index finger form a C around the mask chimney whereas the other three fingers form an E along the child's jaw.
Figure 35-16a  Correct placement of a properly sized mask is necessary to ensure a good mask seal. (A) This shows correct placement of the mask. (B) This shows the mask placed on a child.
Figure 35-16b  Correct placement of a properly sized mask is necessary to ensure a good mask seal. (A) This shows correct placement of the mask. (B) This shows the mask placed on a child.
Figure 35-17  Signs of shock in an infant or child.

- Apathy or lack of vitality.
- Rapid respiratory rate.
- Rapid or weak and thready pulse.
- Altered mental status.
- Pale, cool, clammy skin.
- Absence of tears when crying.
- Falling blood pressure.
- Delayed capillary refill.
Figure 35-18  Signs of respiratory distress.

- Altered mental status
- Flared nostrils
- Pale or bluish lips or mouth
- Stridor, grunting
- Breathing rate greater than 60
- Retraction of muscles
- Wheezing, working hard at breathing or struggling to breathe
- Decreased muscle tone
- Poor peripheral perfusion
- Use of abdominal muscles
Figure 35-19  Infant receiving emergency care. (© Daniel Limmer)
### Table 35-6  High-Risk Mechanisms of Injury and Pediatric Injury Patterns

Transport to a trauma center with pediatric care capabilities if any of the following are identified:

<table>
<thead>
<tr>
<th>HIGH-RISK MECHANISM</th>
<th>TYPE OF INJURY TO PEDIATRIC PATIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>FALLS</td>
<td>Head and upper neck injury and fractures to upper and lower extremities from moderate falls, 5–15 feet. Head, neck, spine injury, abdominal and chest injury, and fractures of upper and lower extremities from high falls over 15 feet.</td>
</tr>
<tr>
<td>Over age 15: 20 feet (one story = 10 feet)</td>
<td></td>
</tr>
<tr>
<td>Under age 15: fall &gt; 10 feet or two to three times child’s height</td>
<td></td>
</tr>
<tr>
<td><strong>Note:</strong> Seriousness depends on (1) height of fall, (2) surface on which child fell, and (3) child’s age. (Infants may have serious head injury from falls of 3–4 feet from a changing table.)</td>
<td></td>
</tr>
<tr>
<td>AUTO CRASH</td>
<td>Serious head and neck injury, facial abrasions, and lacerations. Soft-tissue injury of the neck from shoulder belt used without lap belt or shoulder belt used on a too-small child. Internal abdominal injury from lap belt used without shoulder belt or lap belt improperly positioned over abdomen. Fracture of lower vertebrae and spinal cord damage from violent flexion at waist when lap belt is used without shoulder belt.</td>
</tr>
<tr>
<td>Improperly restrained/unrestrained passenger</td>
<td></td>
</tr>
<tr>
<td>Child struck by deployed air bag</td>
<td>Severe head and neck injury. Burns to the eye and face caused by the caustic powder released when air bag deploys.</td>
</tr>
</tbody>
</table>
Table 35-6 (continued)  High-Risk Mechanisms of Injury and Pediatric Injury Patterns

<table>
<thead>
<tr>
<th>HIGH-RISK MECHANISM</th>
<th>TYPE OF INJURY TO PEDIATRIC PATIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian or bicyclist struck with significant (&gt; 20 mph) impact</td>
<td></td>
</tr>
<tr>
<td>Child thrown onto hood/windshield or minimal distance on impact</td>
<td>Severe head injury, especially if thrown any distance, by force of high speed at impact. Multiple head, chest, abdominal, and leg injuries. Fracture of long bones, especially the femur. Internal injury and bleeding of the liver and/or spleen. (Kidney, liver—blows to right upper quadrant; spleen—blows to flank and torso.)</td>
</tr>
<tr>
<td>Child run over by car</td>
<td>Internal chest injury, often without obvious external damage. Internal abdominal injury, often without obvious external damage. Fractures of upper and lower extremities and the pelvis.</td>
</tr>
</tbody>
</table>
Scan 35-4  Immobilizing a Child Using a KED  (1) Open the KED and place padding on it to properly position and align the child’s head and body. Log roll the child onto the KED.
Scan 35-4 (continued)  **Immobilizing a Child Using a KED**  (2) Fold the side pieces inward to provide side padding and support and to allow visualization of the chest and abdomen. Since the torso straps will be rolled to the inside, secure the torso with tape. Fold the head flaps securely against the child's head and tape across the head and chin.
Figure 35-20  Child abuse injuries. (© Robert A. Felter, MD)
Figure 35-21  Children who have complicated medical problems are often dependent on various technologies. (© Family Voices)
Figure 35-22  Various emergencies may arise when a child has a tracheostomy. (© Fran Nadel, MD)