

Anatomical and Physiological Differences in Children

Infants and children possess important anatomical and physiological differences when they are compared with adults. This skill sheet will touch on some of the unique anatomical and physiological differences to consider when caring for infants and children. The younger the child, the more pronounced the differences.

Airway/ Respiratory



Narrower airways increase the risk of obstruction from:

- Swelling (inhalations burns or conditions such as croup)
- Foreign bodies (small toys or food)
- Nasal mucous (caused by infections such as RSV bronchiolitis)
- Large tongues with small mouths in infants
- External pressure inadvertently placed on the soft cartilage of the airway
- Funnel shaped larynx and trachea with the narrowest point being at the cricoid cartilage. The glottis sits high and is stiff.
- There is an increase in oxygen consumption due to a higher respiratory rate driven by a higher metabolic rate. The increased respiratory rate also contributes to increased water loss from the lungs.

- Infants and young children fatigue quickly due to their reliance on their diaphragm to create negative pressure and chest wall movement. The thoracic cage is soft, the chest wall is compliant and intercostal muscles are poorly developed.
- Infants are obligatory nasal breathers. Even if only partially blocked, increases resistance which can result in laboured breathing and difficulty feeding.
- Children have smaller and fewer alveoli, resulting in limited alveolar surface for gas exchange and more dead space in the airway. Infants must breathe faster to achieve adequate minute ventilation.

- Children are vulnerable to fluid loss due to evaporation from their large body surface area. They require greater fluid requirements to maintain an adequate circulating volume.
- Infants and young children increase their heart rate to increase their cardiac output due to their difficulty changing their stroke volume. Their heart is large in relation to body size and has less contractile efficiency.
- Small volumes of blood will constitute significant blood loss in small children. For example, a 100mL haemorrhage experienced by a 5kg child, represents the loss of approximately 10% of their total blood volume.
- Cardiac output and oxygen delivery in children are higher per kilogram than in adults. Anything that causes an increase in oxygen consumption or a decreased oxygen delivery can result in decompensation.
- Small veins and increased subcutaneous tissue. Vascular access in young children and infants can be difficult.
- There is increased workload for the cardiovascular system due to a higher metabolic rate.

Cardiovascular



Neurological



- Temperature regulation is not well developed. Exposure can result in hypothermia for neonates and infants. They are also susceptible to heat loss from the surface of their head when exposed.
- Young children have a higher centre of gravity, due to having larger heads in relation to body size. This makes children more susceptible to head injuries.
- The risk of falls is increased due to developing motor function.
- Haemorrhages and diffuse brain injury with head trauma more common in children due to having thinner cranial bones.
- The anterior fontanelle remains open until 12-18 months of age. The posterior fontanelle closes between 2-3 months of age.
- The brain develops at a rapid rate during infancy. This requires the maintenance of oxygen and glucose supply.

- Increased glucose requirements with poor glycogen stores. Neonates, infants and children can all rapidly develop hypoglycaemia and muscle fatigue.
- Reliance on others for fluid and nutrition. This can be particularly difficult for caregivers to meet the increased nutritional or fluid requirements of a sick child.
- Higher metabolic rate. This results in increased waste production and increased fluid and nutrition requirements.
- Cylindrical shaped abdomen. This results in poor protection for vital organs such as the liver and spleen.
- Proportionally longer intestinal length, resulting in greater fluid losses.
- Immature lower oesophageal sphincter tone until at least 1 month but may not develop until 12 months. This can result in regurgitation or posits of feeds.

Gastrointestinal /Endocrine



Renal



- Infants and children have greater fluid requirements and susceptible to more rapid fluid loss. They have a proportionately larger total body water volume.
- Immature tubular function can result in sodium wasting.
- Age-related differences in pharmacokinetics and pharmacodynamics exist, resulting in the slower excretion of some drugs.
- Decreased ability to concentrate urine, resulting in a loss of water.
- The expected urine output for an infant and child is 1-2mL/kg/hr. For an adolescent, urine output should be 0.5-1mL/kg/hr.



Musculoskeletal



- Infants lack muscle tone, power and coordination: they rely on the support and supervision of others to keep them stable and safe.
- Bones are soft until puberty, therefore bones will bend and break more easily. As bones are more flexible, serious internal injuries can be present without fractures present.
- As infants and children are still growing they have growth plates located between the middle and the end of the long bones. Fractures may occur that effect these growth plates and require specialist attention.
- Babies have more bones than adults. As they grow some bones fuse together.

Guide to Normal Vital Sign Parameters

Normal adult vital sign parameteres are very different to those of children. Its important to remember that normal observation ranges differ throughout the different age groups. In the table below we outline what these ranges are outlined as per the [Children's Early Warning Tool \(CEWT\)](#):

Age	< 1 year	1-4 years	5-11 years	>12 years
Respiratory rate (RR) (breaths/minute)	21-45	16-35	16-30	16-25
Heart rate (HR) (beats/minute)	100-159	90-139	80-129	60-119
Blood Pressure (systolic range)	75-119	80-124	85-129	90-149



ALERT

Abnormal assessment findings should be escalated to senior nursing and medical staff with appropriate emergency action taken as indicated. Refer to CEWT instructions for further details.

For further information:

[CHQ Nursing Standard: Clinical Assessment of the Paediatric Patient – Rapid Assessment / Primary and Secondary Survey / Vital Signs. \(QH only\)](#)

[Nursing Standard: Clinical Observations - Considerations in Children. \(QH only\)](#)

[Use of Children's Early Warning Tool \(CEWT\) \(QH Only\)](#)



References:

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- Providing care within the context of locally available resources, expertise, and scope of practice.
- Supporting consumer rights and informed decision making in partnership with healthcare practitioners including the right to decline intervention or ongoing management.

- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary.
- Ensuring informed consent is obtained prior to delivering care.
- Meeting all legislative requirements and professional standards.
- Applying standard precautions, and additional precautions as necessary, when delivering care.
- Documenting all care in accordance with mandatory and local requirements.

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