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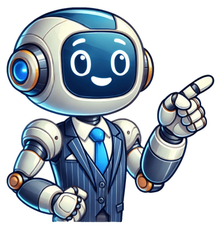

Awareness of the normal ranges for paediatric vital signs is valuable to understand a child's clinical picture and anticipate the need for escalation. Childrens physiology is different from adults, and hence, different values are required to determine whether a child falls within or outside the normal range. Paediatric vital sign values are categorised depending on age.1The Glasgow Coma Scale (GCS) is a widely used scoring system that provides a quick, practical way of assessing consciousness levels in response to various stimuli.2The GCS was modified to form the PGCS3,4suitable for use in children, though both are composed of the best response to three parameters: eyes, verbal, and motor.Vital SignsVital signs are a clinical measurement that reflect essential body functions, which include heart rate (HR), respiratory rate (RR), temperature and blood pressure (BP).PhysiologyChildren are not simply small adults and have different physiology from adults. From neonates to adolescents, children are still physically and cognitively developing. Consequently, paediatric vital signs are categorised according to age groups. The Paediatric Early Warning Sign (PEWS) is a well-adopted tool in many paediatric units to categorise vital signs in children.5Children are incredibly good at compensating; for example, they can maintain their blood pressure for longer during acute illness; hence, hypotension is a late sign in a sick child.6For this reason, other organ symptoms and signs can be used to assess circulation in children (such as reduced urine output (UO), mottled/ashen skin, pallor, cool peripheries, and altered mental state). For more detail on this, see the NICE traffic light system for identifying the risk of serious illness in children.7[caption id="attachment_17714" align="alignnone" width="412"] Image 1: A vital signs monitor, used for continuous monitoring of observations when required.[/caption]Heart RateChildrens resting heart rates are generally higher than adults the highest values being seen in neonates and decreasing with age. Children have a smaller heart, with a smaller stroke volume and a smaller amount of circulating blood volume than adults, which all increases as they continue to develop.Cardiac output (CO) is calculated by multiplying heart rate (HR) and stroke volume (SV). This helps explain the higher heart rate seen in younger children. For children to have adequate cardiac output, their heart rate must be higher than in adults.Respiratory RateA childs respiratory rate will decrease as their lungs develop. There is less space for the gaseous exchange of oxygen and carbon dioxide, hence a higher respiratory rate in younger children.Normal rangesThe normal values for children can be seen below in table 1.1BP (Systolic)AgeRR (breaths per min, 5th-95th centile)HR (beats per min, 5th-95th centile)5th Centile50th Centile95th CentileBirth25-50120-17065-7580-901051m25-50120-17065-7580-901053m25-45115-16065-7580-901056m20-40110-16065-7580-9010512m20-40110-16070-7585-9510518m20-35100-15570-7585-951052y20-30100-15070-8085-1001103y20-30-14070-8085-1001104y20-3080-13570-8085-1001105y20-3080-13580-9090-110110-1206y20-3080-13080-9090-110110-1207y20-3080-13080-9090-110110-1208y15-2570-12080-9090-110110-1209y15-2570-12080-9090-110110-12010y15-2570-12080-9090-110110-12011y15-2570-12080-9090-110110-12012y12-2465-11590-105100-120125-14014y12-2460-11090-105100-120125-140Adult 12-2460-11090-105100-120125-140Table 1: Normal ranges for paediatric vital signs.Adapted from the APLS Aide-Memoires for both boys and girls, from ALSG 6th Edition1PathophysiologyThere are many reasons why a childs vital signs could increase or decrease, falling outside of normal ranges.Heart RateIncreased: crying, anxiety, dehydration, fever, sepsis, pain, arrhythmias, anaphylaxis, IgE-mediated cows milk protein allergy (CMPA), use of medications like salbutamol. Research has shown a linear association between infant pulse rate and body temperature.8Decreased: normal physiological response (during sleep and in athletes), vasovagal episode, beta-blockers, heart block, hypothyroidism.Respiratory RateIncreased: may be caused by lung pathology (e.g. bronchiolitis, pneumonia), metabolic acidosis (e.g. hyperventilation in diabetic ketoacidosis (DKA) or panic attacks), anaphylaxis, and sepsis.9Decreased: may be caused by central respiratory depression from raised intracranial pressure (ICP), poisoning, hypothermia, encephalopathy, or imminent respiratory arrest.9TemperatureTemperatures should not be used as a predictor of sepsis,10however, a temperature 38.5 is a red flag. However, for historical fever, modalities of temperature measurement should be explored.Fever is a sign that an immune response is occurring. The level of fever, when interpreted in isolation, does not necessarily correlate to how sick the child is. However, the exceptions to this are:7A temperature >390C in infants 3-6 months oldA temperature >380C in babies 9 months old) or withdraws to touch5Flexion withdrawal from painWithdraws from nailbed pain4Abnormal flexion (decorticate)Flexion to supraorbital pain (decorticate)3Abnormal extension (decerebrate)Extension to supraorbital pain (decerebrate)2No responseNo response to supraorbital pain (flaccid)1Total scoreBest patient15Comatose client8 or lessTotally unresponsive3Table 2: Comparison of Adult GCS and PGCS, adapted from First Aid for free3and British Paediatric Neurology Association4*Pain in adults can be elicited by: fingertip pressure, trapezius pinch, or at the supraorbital notchAny child with GCS