SAMPLE CHAPTER

A GUIDE TO NEONATAL CARE- Handbook for health professionals: Julia Petty, Sheila Roberts and Lisa Whiting [eds]

Chapter 4- Assessment and screening of the healthy neonate

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Introduction

Assessment is an essential skill for any health professional working with neonates, which then forms the basis of any decision and subsequent intervention. It is important to ascertain and understand what normal assessment criteria are, so that any deviations can be noted, and appropriate intervention undertaken. Assessment should be individualised to the specific neonate, situation or condition, holistically considering all systems including the family, psychosocial needs and ethnic background. This section focuses on assessment of the healthy term neonate (Tables 4.1 to 4.4) at birth and thereafter, including screening (Figure 4.1; Tables 4.5 to 4.7).

Chapter learning objectives.

By the end of this chapter, you will:

- ✓ have gained an overview and understanding of the key principles of assessment relating to the 'expected' norms for a healthy term neonate.
- ✓ be able to explain methods used for routine neonatal screening.

Critical thinking points

- Consider how you would assess whether a neonate is 'healthy' or not, including neonates from all ethnic backgrounds with Black or brown skin tones.
- What are key factors that would determine the sound health and well-being of a neonate?

Signpost. Related topics: Assessment is a vital component of *any* aspect of care within this book. Assessment in the clinical setting (e.g., within the neonatal unit and hospital) is covered in Part 2, Chapter 10.

See the web companion for supplementary information on neonatal assessment including a summary of specific features of how to inclusively assess neonates with Black and brown skin tones from diverse ethnicities.

Assessment of the healthy neonate at birth

Most neonates are born at term gestation (37 to 41 weeks) and are healthy. However, assessment is necessitated to ensure that any events during pregnancy and / or birth have not affected the growing infant in any adverse way and to highlight any reason for further attention.

Table 4.1 Assessment of the newborn baby at delivery

Sign	**Score 0**	**Score 1**	**Score 2**
Heart rate	Nil	<100	>100
Respiratory effort	Absent	Gasping or irregular	Regular or crying
Muscle tone	Flaccid	Some tone	Active
Response to stimulation	None	Grimace	Cry or cough
Colour	Pallor	Cyanosis of mouth mucosa (lips, gums, tongue)	Pink mouth mucosa (lips, gums, tongue)

For 'Apgar' scoring, score 0, 1 or 2 for each sign to ascertain a total score between 0-10. Take this at 1, 5 and 10 minutes of age. Consider the Apgar score along with information in Table 4.2. Assessment will determine subsequent management, if necessary.
Importantly, when assessing for 'colour', the terms 'white', 'blue' and 'pink' should be avoided in relation to the skin particularly. This is due to the difficulty in assessing colour as an indication of oxygenation and perfusion in Black, Asian and ethnic minority newborns (National Health Service (NHS) Race and Health Observatory, 2023). If in doubt, pulse oximetry can be used. The 'Mind the Gap' resource is very useful to guide assessment of non-Caucasian skin tones (Mukwende et al, 2020).

Stop and think.

The five components that make up the traditional 'Apgar score' give practitioners a picture of whether the transition from intrauterine to extrauterine life has gone smoothly or if there is a cause for any concern, even if a formal 'score' is not assigned.

Table 4.2 Assessment of the healthy neonate at birth and thereafter:

Additional considerations

- Record the Apgar score routinely at 1 and 5 minutes for all births.
- Record the time from birth to the onset of regular respirations.
- Umbilical cord care at birth: If the baby is 'well,' delay cord clamping for 1 minute and give to parents for skin to skin holding. Ensure that a second clamp for double-clamping of the cord is available in all birth settings.
- Encourage skin-to-skin contact between parent and baby as soon as possible.
- In order to keep the baby warm and dry, cover him/her with a blanket or towel while maintaining skin-to-skin contact.
- Avoid separation of a mother and her baby during the first hour post-birth for the undertaking routine postnatal procedures, for example, weighing, measuring, and bathing, unless these activities are requested by the parents and/or medical staff, or are necessary for immediate care.
- Encourage breastfeeding as soon as possible after the birth, ideally within 1 hour.
- Record body temperature and birth weight soon after 1 hour.
- Undertake an initial examination / assessment to detect any major physical abnormalities and to identify any problems that require referral.

See chapter 10 for further detail.

- At each postnatal contact, ask parents if they have any concerns about their baby's general well-being, feeding or development. Review the feeding history and assess the baby's health, including general concerns, physical inspection, and observation. If there are any concerns, take appropriate further action.
- Be aware that if the baby has not passed meconium within 24 hours of birth, this may indicate a serious disorder and require medical advice.
- Conduct a complete examination of the baby within 72 hours of the birth.
- At six to eight weeks, assess the baby's social smiling and visual fixing and following.
- Measure weight and head circumference of the baby in the first week and at around eight weeks, and at other times, but only if there are concerns. Plot the results on the growth chart.
- Blood spot screening is undertaken at day 5, in line with the relevant newborn blood spot screening programme ( see Table 4.5) and specific country guidance (timelines may vary)
- Hearing screening is undertaken within 6 weeks, in line with the NHS newborn hearing screening programme ( see Table 4.6).
- Another complete examination of the baby at 6 to 8 weeks after the birth is undertaken (Public Health England newborn and infant physical examination [NIPE] screening programme). ( see Table 4.7).
- Ensure that any examination of the baby is undertaken with parental consent.

(Adapted from National Institute for Health and Care Excellence (NICE), 2017; 2021)

A systematic approach to assessment after birth

A systems-based approach can be used to assess the healthy neonate, to establish and ascertain expected normal features, i.e., not warranting referral or concern.

Table 4.3
Clinical assessment of the neonate

Adapted from Petty (2011), McDonald and Kaiser (2020) and Lomax (2021)
For '*normal*' ranges and parameters for vital signs refer to Table 4.4.

System	**Normal / expected assessment criteria.**
Airway and breathing (respiratory)	Effortless breathing which may be periodic, normal rate, bilateral chest movement, quiet chest sounds, no oxygen requirement, oxygen saturations within normal range (see Table 4.4). Using colour to assess oxygenation and perfusion should be done, as stated in Chapter 2 and Table 4.1, in line with the neonate's skin tone and ethnicity (Mukwende et al, 2020; NHS Race and Health Observatory, 2023).
Cardiovascular	Adequate heart rate / pulse and mean blood pressure (MBP) (see Table 4.4), capillary refill of less than 3 seconds, urine output of at least 1ml/kg/hour, mucous membranes (rather than skin) should be pink in colour, the skin should be warm, pulses palpable and heart rate within normal limits.
Developmental / behavioural and stress	No presence of pain or distress. Neonate is positioned appropriately - flexed limbs in mid-line, appears comfortable, relaxed and able to sleep for long periods.
Environmental / thermal control	Normal body temperature (36.5 -37.2 degrees Celsius) and appropriate environmental temperature according to age and gestation and birth weight.

Fluid status and balance	Adequate systemic perfusion and urine output (see above), normal / palpable fontanelles, palpable peripheral pulses, good skin turgor, normal blood sodium levels, specific gravity of urine 1.010 – 1.020, weight gain appropriate for age, equal fluid balance (in and out), ascertained by a hydration assessment.
Gastro-intestinal and nutritional status	Soft, non-tender abdomen, bowel sounds, nil/minimal regurgitation of feed from stomach which is clear mucous, bowels open and normal stool, no vomiting, tolerance of feeds if applicable.
The 3 Hs (metabolic adaptation)	Able to maintain adequate oxygenation, body temperature and blood glucose. Oxygenation and body temperature – see Table 4.4, blood glucose, > 2.5 mmols/l in first few hours, then 4-6mmols/l thereafter.
Immunological	Signs of infection, such as a pyrexia, are not evident.
Jaundice (hepatic)	Physiological jaundice, due to liver immaturity, is common: observe for signs of clinical jaundice / yellow colouring of the mouth mucosa and sclera of eyes. Serum or transcutaneous bilirubin is below treatment threshold (see Chapter xx for thresholds).
Muscular skeletal	Presence of well-toned and flexed posture with spontaneous movements. Legs able to adduct and abduct and move without 'clicking' or hindrance within the hip joint.
Neurological and sensory	Response to stimuli, such as pain perception, is present at birth. Neonate is alert, wakes when hungry and can feed. Normal / present reflexes are exhibited according to gestation and age.
Skin and general appearance	Expected skin appearance for gestation, e.g., well-formed in term neonates, good skin integrity with no or minimal dryness or flaking. Expected skin appearance and presentation for ethnicity – e.g., Mongolian blue spot may be present at top of buttocks in Asian and black babies. No excoriation present or signs of jaundice. Umbilical area clean and dry. Intravenous (IV) access, if present, sites should appear healthy with no signs of leakage or interstitial infiltration.
 The focus of the above guide is physical assessment. Family adjustment to birth and parenting, along with assessment of psycho-social needs, is covered in detail in Chapter 6.	

Stop and think.

While assessment, as applied to the *systems,* can help impart a systematic structure to the process, it should be considered within a holistic perspective. For example, any vital sign must be interpreted according to the individual neonate's condition and alongside clinical assessment.

Expected vital signs.

Taking observations of key vital signs is a fundamental assessment skill in neonatal care. It is important that neonatal norms are understood so that any deviation from this is identified.

Table 4.4 outlines the normal parameters across the developmental spectrum.

Table 4.4 An information guide to neonatal specific parameters and values (well neonates / children).

Heart rate: beats per minute (bpm)

age	awake	sleeping
neonate (preterm)	100-200bpm	120-180
neonate (term)	100-180	80-160
infant	100-160	75-160
toddler	80-110	60-90
preschooler	70-110	60-90
school	65-110	60-90

Blood pressure (mmHg)

age	systolic	diastolic
birth (12hr, <1kg)	39-59	16-36
birth (12 hr., 3kg)	50-70	24-45
neonate (96 hr.)	60-90	20-60
infant (6 month)	87-105	53-66
toddler (2 year)	95-105	53-66
school age	97-112	57-71
adult	112-128	66-80

N.B; In neonates, it is vital to consider the **mean arterial blood pressure (MABP)**. As a *general* guide, the gestational age in weeks should correspond with mean BP (e.g., a baby born at 40 weeks should have a MABP of 40mmHg).

Respiratory rates: breaths per minute (bpm)

preterm	40 - 80 bpm
term neonates	30 - 70
infants	30 - 60
toddlers	24 - 40
preschool	22 - 34
school/adult	18 – 30

Temperature (degrees Celsius)

Central (axilla)	36.6 – 37.2
Abdominal (probe)	36.6 – 37.2 (preterm) 35.5 – 36.5 (term)
Peripheral (foot)	34.6 – 36.2
Core-toe temperature gap	less than 2 degrees Celsius

Oxygen saturation (Sp02)

95 -100%

Perfusion

Capillary refill time	less than 3 seconds (Royal College of Nursing (RCN), 2017)
Urine output	minimum of 1 ml/kg/hour

Circulating blood volume

Neonates	85-90 mls/kg
Infants	75-80 mls/kg
Children	70-75 mls/kg
Adults	65-70 mls/kg

Tidal volumes (air volume per respiratory cycle)

Neonates	4 - 6 mls/kg
Children	6 - 10 mls/kg

Blood glucose

After transition at birth- > 2.5 mmols/l at birth (British Association of Perinatal Medicine (BAPM), 2024) and 4-6 mmols/l, after the newborn period and in children / adults.

Adapted from Royal College of Nursing (RCN, 2017) and Lapum et al (2015)

Stop and think.

Understanding the normal range of vital signs is important to serve as a baseline with which to compare assessed parameters and decide whether these require attention. All values are averages and should serve as a guideline in conjunction with the overall assessment of the individual neonate.

Screening in the neonate

Screening is an important area of healthcare and is necessary for the early identification of the risk of a neonate having certain disease(s); this enables timely and appropriate action to be taken, following a diagnosis. Antenatal screening via scanning or blood testing may have identified neonates at risk even prior to delivery. Such tests include screening for infectious diseases (hepatitis B, HIV and syphilis), inherited conditions (sickle cell, thalassaemia and other haemoglobin disorders), chromosomal conditions such as Down's, Edwards's and Patau's syndromes and physical anomalies at the 20-week scan. Tables 4.5 to 4.7 provide an overview to guide three main areas of screening in the neonatal period: bloodspot screening, hearing screening and examination of the newborn, respectively. The NHS National Screening Committee make appropriate recommendations for all areas of screening including both antenatal and postnatal tests.

Stop and think.

Screening identifies a risk of having or developing a disease. It is *not* a diagnosis.

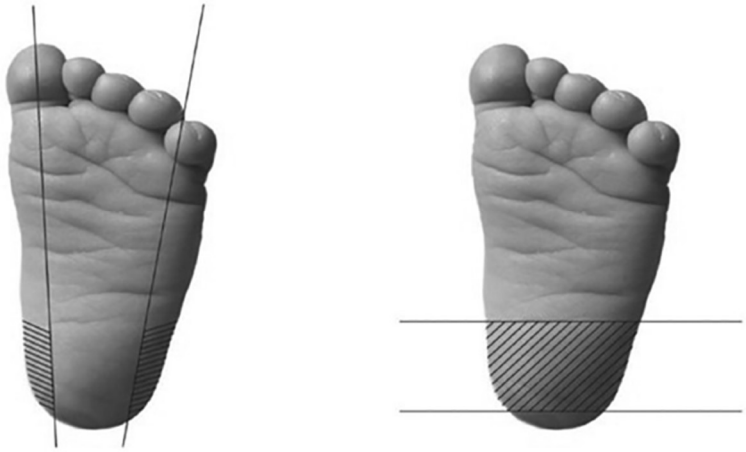
Screening overview	
HOW?	**WHY?**
Table 4.5 Neonatal bloodspot screening	
○ Follow the steps laid out in the National Guidance (Public Health England, 2021). ○ The routine blood spot sample (4 spots) should be taken on day 5 for all babies. Day of birth is day 0. ○ In exceptions, a sample can be taken between day 5 and day 8. ○ Ensure parents have access to the pre-screening booklet at least 24 hours before taking the sample. ○ Clean the heel, wash hands thoroughly and ensure the infant is comfortable. ○ Obtain the sample using an age-appropriate automated incision device, not a manual lancet. See Figure 4.1 for preferred puncture site. Allow the heel to hang down to assist blood flow. Skin puncture must be no deeper than 2mm. ○ Obtain four blood spots on the blood spot card, completed with infant's details. ○ Ensure consent is recorded as well as the actual test in the relevant documentation according to specific country guidance, or medical notes.	The following six recessive genetic, metabolic disorders are screened for: • Phenylketonuria (PKU) • Medium Chain Acyl Coenzyme A Dehydrogenase Deficiency (MCADD) • Maple syrup urine disease (MSUD) • Isovaleric acidaemia (IVA) • Glutaric aciduria type 1 (GA1) • Homocystinuria (HCU) In addition, the following conditions are also screened for: • Sickle cell disease • Cystic Fibrosis (CF). • Congenital hypothyroidism • Surveillance for maternal Human Immune deficiency virus (HIV) (anonymous testing, not individual diagnosis) Metabolic diseases such as PKU and congenital hypothyroidism are conditions, which, if untreated, can result in significant developmental delay

Full information on National guidance, see Public Health England (2021)

Stop and think.

All screening should be explained to the parents including the reasons for performing it and any subsequent actions that may be required.

Figure 4.1 Preferred sites for heel prick blood sampling in a neonate



Source: Public Health England (2021)

Table 4.6 Summary of neonatal hearing screening

HOW?	WHY?
○ ALL neonates should have hearing screening prior to discharge from hospital OR arranged in the community within 6 weeks (post-term corrected age). ○ The screen uses two tests called the Otoacoustic Emissions test (OAE) and the Automated Auditory Brainstem Response test (AABR). Both tests are painless.	• The aim is to identify any hearing loss that could go onto affect language acquisition in the developing infant / child. In turn, intervention is given as soon as possible to prevent a delay in this vital area of development. • Neonates who do not show strong responses will be referred for a full diagnostic assessment.

Full information on National guidance, see Public Health England (2016)

Stop and think. The implications of hearing loss in the at-risk neonate must be considered in line with future sensory outcomes.

Table 4.7 Checklist for physical examination of the neonate

WHEN?	WHY?
Physical examination should take place: o At birth o Within the first 24 hours o At 72 hours o At 6 weeks	To detect any conditions, anomalies or dysmorphic features that may need initial treatment and referral.

HOW? A full examination should include…….

- Appearance, including skin appearance, breathing, behaviour, activity, and posture.
- Head (including fontanelles), face, nose, mouth (including palate), ears, neck, and general symmetry of head and facial features.
- Eyes: opacities, red reflex and colour of sclera.
- Neck and clavicles, limbs, hands, feet, and digits; assessment of proportions and symmetry.
- Heart: position, heart rate, rhythm and sounds, murmurs, and femoral pulse volume.
- Lungs: respiratory effort, rate, and lung sounds.
- Abdomen: assessment of shape; palpation to identify any organomegaly; checking of condition of the umbilical cord.
- Genitalia and anus: completeness and patency and undescended testes in boys.
- Spine: inspection and palpation of bony structures; checking of skin integrity.
- Skin: Assessment of colour and texture as well as any birthmarks or rashes.
- Central nervous system: Muscle tone, behaviour, movements, and posture; checking of newborn reflexes, but only if concerned.
- Hips: symmetry of the limbs, Barlow and Ortolani's manoeuvres.
- Cry: assessment of sound.
- Weight: document.

(Full guidance: Public Health England (2013), Jones (2020), Lomax (2011))

Stop and think. The full guidance should be referred to for any screening. The above offers a summary and short synopsis only as an overview.

Standard precautions alert.

Wash hands thoroughly before and after examining / handling infants, for assessment purposes.

Check local variations and guidance alert.

The space below can be used to record any notes or local variations and practice points specific to your own unit.

See web companion for a glossary specific to this chapter.

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