Guideline

Women and Babies: Neonatal Early Assessment Program (NEAP)

Document No: RPAH_GL2013_019

Functional Sub-Group: Clinical Governance
Corporate Governance

Summary: The Neonatal Early Assessment Program (NEAP) on delivery ward consists of risk factor assessment and four sets of measurements within the first 6 hours after birth:
1. The first physical examination.
2. The first lower limb oxygen saturation.
3. Anthropometry (accurate weight, length and head circumference with percentiles)
4. Body fat (percentage) by air displacement plethysmography

National Standard: Standard 1 Governance for Safety and Quality in Health Care

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Publication (Issue) Date: January 2013

Next Review Date: January 2016

Replaces Existing Policy: N/A

Previous Review Dates: N/A

Note: Sydney Local Health District (LHD) and South Western Sydney LHD were established on 1 July 2011, with the dissolution of the former Sydney South West Area Health Service (SSWAHS) in January 2011. The former SSWAHS was established on 1 January 2005 with the amalgamation of the former Central Sydney Area Health Service (CSAHS) and the former South Western Sydney Area Health Service (SWSAHS).
In the interim period between 1 January 2011 and the release of specific LHN policies (dated after 1 January 2011) and SLHD (dated after July 2011), the former SSWAHS, CSAHS and SWSAHS policies are applicable to the LHDs as follows:
Where there is a relevant SSWAHS policy, that policy will apply
Where there is no relevant SSWAHS policy, relevant CSAHS policies will apply to Sydney LHD; and relevant SWSAHS policies will apply to South Western Sydney LHD.
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Neonatal Early Assessment Program (NEAP)

1 Introduction

The risks addressed by this policy:
Clinical risk of pathological, or neurological damage or death of babies as a result of physical abnormalities, cardiac defects, or neonatal hypoglycaemia going undetected and untreated.

The aims / expected outcome of this policy
Babies with physical abnormalities, cardiac defects, or increased risk of hypoglycaemia will be identified and appropriately managed.

2 Policy Statement

The goal of this policy is to appropriately identify infants:

(i) With physical abnormalities that have significant morbidity and/or mortality if not detected early, soon after birth.
(ii) With cardiac, respiratory, infective or metabolic defects that require immediate or planned intervention for optimal survival
(iii) With increased and/or high risk for neonatal hypoglycaemia. In these infants blood glucose levels (BGLs) will be measured and early feeding will be supported when possible. The therapeutic goal should be to not tolerate BGLs between intervention and pathological thresholds for longer than the effect of one feed, and to increase BGLs below pathological levels as a matter of urgency with intravenous glucose.

3 Principles / Guidelines

- The overarching principles are to ensure optimal care of the baby by: incorporating Baby Friendly Hospital Initiative (BFHI) guidelines to the mother pair ensuring safe, immediate post birth, skin-to-skin contact with early breast feeding within the first hour; competently examining the newborn for risk assessment; by streamlining care with least intervention.
- Background to the Neonatal Early Assessment Program (NEAP)
3.1 Introduction

Infants born at RPA Hospital undergo screening for early identification of abnormalities with potentially serious consequences or risk factors that indicate need for closer postnatal observation. These include

1) Neonatal Early Assessment Program (NEAP) in the Neonatal Assessment Room in delivery ward to establish baseline anthropometry and to identify risk factors and abnormalities that may have an immediate impact on the care or well-being of the baby.

2) Neonatal Later Assessment Program (NLAP), on the postnatal ward or at home, includes a more complete examination to detect abnormalities that are not apparent in the early period or require further testing at a later time period.

The Neonatal Early Assessment Program (NEAP) on delivery ward consists of risk factor assessment and four sets of measurements within the first 6 hours after birth:

1. Risk factor assessment and the first physical examination.
2. The first lower limb oxygen saturation.
3. Anthropometry (accurate weight, length and head circumference)
4. Body fat (percentage) by air displacement plethysmography

Neonatal Later Assessment Program (NLAP) on the postnatal ward or at home consists of four sets of measurements:

1. The late more comprehensive physical examination
2. The second lower limb oxygen saturation
3. The newborn screening blood test.
4. The hearing test (State-Wide Infant Screening Hearing (SWISH))

A Systems Approach to Early Neonatal Assessment

Combining these assessments into a systematic program before leaving the birthing environment enables a safer, faster, more accurate and timely assessment. The one assessment, rather than multiple interruptions, is least invasive for baby and mother. Risk factors or abnormalities are identified and appropriate early action implemented. Parents are encouraged to come to the assessment and understand and assist in measurement of their baby. In this way efficiency and communication are maintained and mother, baby and partner have an easy, uninterrupted entry to the postnatal ward.

Furthermore optimising immediate maternal skin-to-skin contact and early breast feeding (in accordance with the safe skin to skin guideline (insert HTML link)) within the first hour is prioritised for babies born by vaginal delivery and operative delivery. Secondary to this priority, the assessment of newborns following operative delivery will occur opportunistically on a case-by-case basis. Opportunities for assessment may include after the mother and baby are admitted to the postnatal ward, between discharge from recovery and admission to the postnatal ward, or between when the baby leaves theatre and when the baby is able to join the mother in recovery, if this time is longer than usual. The timing of NEAP assessment following operative delivery is subject to change after the policy is adopted.

3.2 Background

Early Risk Factor Assessment and Physical Examination

The overall goal of the early assessment is to identify risk factors for early neonatal problems that will require regular postnatal observations, as well as identifying congenital and acquired abnormalities which may have an immediate impact on the baby’s care and/or wellbeing.
Early Risk Factor Assessment

All babies should be reviewed for risk factors for the four main problem areas as identified on the ‘Women and Babies Newborn Care Plan and Observations Chart MR504 (NCPOC)’. These include

- Risk of hypoglycaemia
- Respiratory distress
- Trauma from instrumental delivery and
- Risk of infection

Assessment of risk of hypoglycaemia will include the anthropometric measurements and percentage body fat as outlined below. Babies identified with risk factors will need observations as outlined in the relevant RPAH guideline and on the NCPOC.

Early physical examination:

The goal of this examination is to identify obvious external anomalies, as well as other congenital and acquired problems that may have an immediate impact on the baby’s care or well-being. This would include (but not be confined to) problems such as respiratory distress, consequences of birth trauma (e.g bruising, sub-galeal haemorrhage, nerve palsy), cleft palate, imperforate anus, abnormal genitalia and other dysmorphology. The examination should include a complete ‘head to toe to back’ inspection of the baby as detailed below. The findings should be documented in the relevant section of the NCPOC.

Oxygen saturation screening:

Routine oxygenation saturation screening of well newborns has been shown to improve early diagnosis of congenital heart disease (CHD)\(^1\) with a low false positive rate and minimal impact on resources. About half of the babies with a low saturation screen (<95%) will have either congenital heart disease (~1/3\(^{rd}\)) or another important pathology including respiratory, infectious and metabolic problems (~2/3\(^{rd}\))\(^2\). Thus this is an important test of the well-being of a newborn. Saturation measurement within the first 4 to 6 hours of birth (early screen) has a lower accuracy for detection of CHD but greater sensitivity for non-cardiac pathology while screening after 24 hours (late screen) has greater sensitivity for detection of CHD, particularly left heart ductal dependent lesions. At RPAH, both early and late oxygen saturation screening will be performed in accordance with the existing protocol (HTML link to clinical guideline).

Anthropometry

Newborn measurement of weight, length, and head circumference reflects fetal nutrition and forms the basis on which future growth measurements are compared and important treatment decisions are made when measurements are plotted on growth curves.

Several small studies have examined the accuracy of length measurements in newborns and neonates\(^3\)\(^5\). The largest study (Wood et al\(^6\)) demonstrated inaccuracies in length measurements in a population-based, cross-sectional study of 602 term babies, assessed in this Department in 2010. Neonatal length was measured by standard clinical practice and by correct use of a length-board (gold standard) and measurements compared. Growth curve percentiles were used to plot length measurements. The difference from the ‘gold standard’ extended from -3.06 cm below to +2.67 cm above the gold standard. Neonates whose standard-practice length fell within 0.5 cm of the gold standard totalled 41% (241 neonates), while 59% (342) were > 0.5 cm. The change in length resulted in a change in the percentile range for 309 (53%) neonates on a standard growth curve percentile with implications for potentially erroneous clinical care.

Lipmanet al. argues that primary health-care providers are often cavalier about the need for precision of length measurements\(^7\). Educating health-care workers on the importance of length measurements could increase their motivation to obtain measurements using correct techniques\(^8\). The importance of length and thus the need for accuracy in measurement are two messages that should be translated into clinical practice.
Body composition - Fat measurement (fat mass, fat free mass and body fat %)

Accurately determining the nutritional status of newborns is a major public health problem. Furthermore, undernourished neonates that survive are at risk of long term health outcomes, including hypertension, stroke, type 2 diabetes, obesity and cardiovascular disease. Neonatal undernutrition or ‘wasting’ is a clinical diagnosis often characterised by diminished subcutaneous tissues and underlying muscles with loose wrinkled skin of the arms, thighs, elbows and knees. However, this clinical sign is not well recognised by a range of health providers.

Thus defining who is undernourished is problematic. Conventional approaches include the use of population based percentiles (<10th, 5th or 3rd percentiles) or customised growth charts. Population based charts rely on a large cross section of neonates and use weight for gestational age by sex. Customised charts account for more maternal variables, however there is not strong evidence to support their use at present. An alternative to birth weight is the use of body composition or body fat % (BF%).

The wasted, undernourished newborn is characterised by loss of the normal fat accretion in the last 4-6 weeks of pregnancy. As fat is used by the newborn as an alternative substrate to glucose for brain metabolism, BF% is a potentially very useful measure indicating degree of undernutrition and directly related to neonatal metabolic outcomes. The additional advantage is that it can distinguish the normal fat SGA from the low fat, undernourished SGA newborn and define the low fat AGA newborn at high risk of hypoglycaemia, currently not possible with any other methods.

Recently a new technology using air displacement plethysmography (ADP) has become available to non-invasively, accurately and quickly measure BF% in infants from birth to 6 months of age. ADP has been validated against the four-compartment model and biological and physical phantoms and is considered the criterion method for determining BF% in neonates.

Several studies have investigated the BF% as an indicator of neonatal nutritional status using ADP (also journal article, comparative study). We have shown that body fat is a better measure than customised charts for assessing neonatal morbidity and as good as population based charts. The advantage of this method is it is accurate, easy, reliable, non-invasive and acceptable to parents. The cut offs for low and high fat are shown in the flow chart. These were determined by significantly better Receiver Operator Curves (ROCs) for combined morbidity assessed by 3 pre-specified outcomes (temp <36.5C, prolonged hospital stay, poor feeding (2 of 3 objective criteria). The cut off was determined by the highest sensitivity balanced by the best specificity.

3.3 Method of education and training

Recent evidence from an RCT of Australian medical students who received a standard neonatology training program in newborn examination versus blended learning (additional online access to a baby check learning module PENSKE) demonstrated significantly higher scores for the blended learning group on standardised blinded assessment of newborn examination. Other studies support blended learning as a means of teaching and learning physical examination skills. Formalising training in the examination of the newborn may explain the improved quality of the newborn examination undertaken by video assessment of midwives compared with senior house officers (SHOs) in a randomised control trial in the UK. The educational value of a teaching method that is structured, skills-based, student-centred, small group and interactive (SCORPIO) was rated high or very high (100%) compared with problem-based learning and clerkship, each rated as 65%. The program was
enthusiastically received by the students and resulted in mastery of a range of core competencies necessary for care of the newborn\textsuperscript{34}.

We use the SCORPIO method of teaching\textsuperscript{35} which incorporates, firstly, ‘tell and show’ on how to perform each skill and then ‘do and feedback’ on correct and incorrect technique. This method has been shown to be effective in changing the behaviour of perinatal health providers and can be readily introduced with few resources\textsuperscript{36, 37}.

### 3.4 Who performs the NEAP?

A randomised controlled trial in the UK demonstrated that there was no statistical difference between resident medical officers (RMO) and community midwife examinations in appropriate referral rates to hospital or community or in inappropriate referral rates to hospital \textsuperscript{38}. However mothers were more likely to be satisfied with the newborn examination by a midwife than an RMO\textsuperscript{39} and discuss health-care issues more often than RMO\textsuperscript{33}. Midwives identified many benefits to themselves, to their profession and to the mothers as a result of developing their role in the examination of the newborn baby. The major benefit cited was improved job satisfaction, which was directly related to their ability to give continuity of care to mothers and babies\textsuperscript{33}.

- The goal therefore would be to expand our current mixed model of care.
- The NEAP assessment will be undertaken by trained midwives and other trained health providers and a second person who can be another health provider or the parent. The second person is required in order to measure the length accurately. This is then also used for entry into the algorithms for estimation of body fat % and lean mass. The later, more complete, ‘babycheck’ physical examination will be performed prior to discharge by RMOs, NNPs (neonatal nurse practitioners), or at home by midwives in the maternity discharge support program (MDSP).

### 3.5 When to perform the NEAP?

The NEAP assessment will be performed after adequate skin-to-skin and early breast feeding but within the first 6 hours of birth so that risk is assessed as early and efficiently as possible.

The NLAP assessment will be performed prior to discharge or at early follow up with the home MDSP midwife visit (see discharge policy).
3.6 How to perform the NEAP?

Figure 1: Overview

1. Neonatal Early Assessment Program
2. Login to Pea Pod to initiate air stabilisation
3. Place baby under warmer and undress fully for physical examination
4. Attach Pulse Oximeter Sensor, turn on unit, read oxygen saturation
5. Perform head to toe, front to back physical examination
6. Measure baby's head circumference
7. Measure baby's length with parent
8. Calibrate Pea Pod volume chamber → Include ID bands and cord clamp
9. Enter baby's data
10. Tare Pea Pod scales → Include ID bands and clamp on scale before AND AFTER weighing
11. Measure the baby
12. Print results, attach baby sticker and add to notes
13. Return the baby to the warmer and re-dress
How to perform the first physical examination:
The routine newborn assessment should include all aspects of the checklist on page 1 of the NCPOC. The schema below moves from head to toe, front to back (adapted from Queensland Maternity and Newborn Clinical Guidelines Program 61)\(^40\).

Remind parent/s that their baby will need a second examination that will include assessment of their eyes (red reflex test), heart, and hips.

Figure 2: Early Physical Examination of the Newborn Baby\(^41\)
Figure 3: Physical examination referral pathway

Review History

First Physical Examination
(undressed fully, under warmer)

Check especially:
- Heart
- Palate
- Genitalia
- Ano rectum for malformations

Normal

Abnormal

Remind parent/s that their baby will need a second examination that will include:
- eyes (red reflex test)
- heart
- hips

Refer immediately to RMO or NNP

Placenta to Histopathology
How to measure weight:
- The scales on the Pea Pod are used for accurate measurement of weight to the nearest gram.
- The newborn is bare weighed.
- The weight percentile is calculated using the Beeby electronic calculator on the computer in the NEAP room, or if unavailable the weight is plotted on New South Wales population-based birthweight percentile charts (less accurate).41

How to measure length:
- The length-board measurement, infantometer, has been shown to be the most reliable and accurate measurement of neonatal length5, 42, 43 and more recent designs have improved ease of use such as the Easy-Glide Bearing Infantometer (Perspective Enterprises, Portage, MI, USA).
- The neonate is placed supine and unclothed on the board and held gently with his or her body aligned and head in a neutral position. One person stands at the top of the length board and holds the baby’s head in contact with the headboard while another extends the left leg by placing the hand over the left knee, depressing the knee, straightening the leg and moving the footboard to touch the plantar surface of the foot at a right angle to the leg. Recheck that the head has not moved from the headboard before taking the measurement. The actual reading is marked by an arrow as there is an offset for greater ease of reading and accuracy.
- The length percentile is calculated using the Beeby electronic calculator on the computer in the NEAP room or plotted on New South Wales population-based birth length percentile charts41 (less accurate).
- The need for correct technique was confirmed by Lipman et al.3, who showed significant improvement in length accuracy after an intervention involving intensive training.

How to measure head circumference:
- Head circumference is measured using disposable paper circumference tapes at the maximum fronto-occipital circumference.
- Two reproducible measurements are required.
- The head circumference percentile is calculated using the Beeby electronic calculator on the computer in the NEAP room or plotted on New South Wales population-based birth head circumference percentile charts41 (less accurate).

How to perform oxygen saturation screening:
- Early oxygen saturation screening will be performed in accordance with the existing protocol (HTML link to clinical guideline)
- Perform early in assessment when infant is quiet.
- Place probe around one foot with light source and receiver on each side of foot. Secure with Coban tape. To ensure good blood flow to the foot, do not secure too tightly and do not hold the probe around the foot.
- Switch on oximeter and allow signal to stabilise. Read when stabilised and there is a good plethysmographic light pulse.
**How to measure body composition:**
This is performed in the NEAP room just after the measurement of length and weight using the PeaPod (CosMed, USA).

**Figure 4: Pea Pod Quick Reference User Guide**

- **Pea Pod Quick Reference User Guide**
- **Login to Pea Pod:** Username - NEAP  
  Password - ppsydney
- **Place an umbilical cord clamp and baby ID bands to match those worn by the baby in the volume chamber and tare/zero**
- **"Stabilisation of air circulation system" takes 5 minutes**
- **Taring volume chamber takes 2 minutes**
- **Enter baby's data**
- **Place a clean underlay on the scales and an umbilical cord clamp and baby ID bands to match those worn by the baby and tare/zero scales**
- **Remove clamp and ID bands from scale and weigh the baby**
- **Replace clamp and ID bands and re-tare/re-zero scales**
- **Remove clamp and ID bands from volume chamber and measure the baby**
- **Print results, attach baby sticker and add to notes**
- **Clean the Pea Pod with detergent wipes (do not exit software or turn off the Pea Pod)**
Figure 5: Anthropometry referral pathway

Anthropometry

Weight
(on Pea Pod machine)

Determine and document percentile position

< 5th percentile
"SGA"
Low birth weight (< 2500g)

OR

5th-90th percentile
"AGA"

> 90th percentile
"LGA"

Check if low fat%

Normal Fat %: Reassure parents

Low Fat%

Check if also high fat and examine for macrosomic features

No macrosomia: Reassure parents

Hypoglycaemia Protocol; Thermoregulation Protocol; Feeding policy
Placenta to Histopathology

Length
(length board, left leg, two people)

Determine and document percentile position

<1st percentile

Refer to RMO or NNP

Head circumference (disposable paper tape)

Determine and document percentile position

< 3rd percentile

Placenta to Histopathology

Refer to RMO or NNP in working hours

>97th percentile

Refer to RMO or NNP
Figure 6: Oxygen Saturation referral pathway

Oxygen Saturation Screening

- SpO₂ ≥ 95%
  - Routine clinical examination
- SpO₂ 90% - 94%
  - Midwife examines infant
- SpO₂ < 90%
  - Call Neonatal Team

  Clinical signs
  - Call Neonatal Team

  No clinical signs
  - Re-test 2 - 3 hours

  SpO₂ ≥ 95%
  - Routine clinical examination

  SpO₂ < 95%
  - Call Neonatal Team

Figure 7: Body fat % referral pathway

Body fat %
Measured by air displacement plethysmography in the Pea Pod

- Low body fat
  - Female: < 5.8%
  - Male: < 4.2%
  - Hypoglycaemia Protocol; Thermoregulation Protocol; Feeding policy
  - Placenta to Histopathology

- Normal body fat
  - 5.8% - 14.3%
  - No macrosomia: Reassure parents
  - Check for Macrosomia
  - Document in notes

- High body fat
  - > 14.3%
  - > 12.7%
  - Macrosomia: Refer immediately to RMO or NNP
  - Placenta to Histopathology
  - Document in notes
4 Performance Measures

Incident Information Management System

5 Definitions

Nil

6 References and Links


- Legislative Compliance: Organisation, Management and Staff Obligations – Governing Body and Management manual, Policy Number 2.7.1
- Code of Conduct – Governing Body and Management Manual, Policy Number 1.1

• Carr N and Foster P, 'Examination of the Newborn: The Key Skills; Part 1 the Eye', The Practising Midwife, 17 (2014), 26-29.
Appendix 1: Rationale for early physical examination

If any part of the examination is incomplete this requires documentation.

Important components of screening examination

- **A newborn with one anatomic malformation** should be evaluated for associated anomalies\(^\text{44, 45}\).

**Congenital cataract:** Incidence 3/10 000 live births. In the UK, in a National survey of infantile cataracts, a substantial proportion of children with congenital and infantile cataract were not diagnosed by 3 months of age, although routine ocular examination of all newborn and young infants is recommended\(^\text{46}\). Delayed diagnosis is associated with blindness. The authors found that: 39% the child’s carers suspected an eye defect before cataract was diagnosed; 33% of the 235 identified with infantile cataract were not examined until after one year of age. Correction of cataract in infancy is an important preventable cause of visual impairment and blindness in childhood. Research suggests surgical treatment of dense cataracts is needed within the first 3 months of life.
  - **Examination for cataract should occur in the newborn period and at 6-8 weeks with immediate referral to an ophthalmologist if positive findings.**

**Cleft palate:** Incidence is 1 in 1000 live births in white people, 3.6 in 1000 in Native American people, 2.1 in 1000 in Japanese people, and only 0.3 in 1000 in black people. Of clefting anomalies, cleft lip and palate (50%) is the most common cranio facial anomaly; isolated cleft palate (30%); isolated cleft lip (20%)\(^\text{47}\). A UK audit found delayed detection of cleft palate was not uncommon (28% after the first day), and the features of those more likely to be missed suggested digital examination only.
  - **Trainee doctors and midwives should be instructed to inspect visually using a light and tongue depressor, then digitally if sub mucous cleft palate is suspected\(^\text{48}\). Referral to a multidisciplinary cleft lip/palate team is indicated.**

**Disorders of sexual differentiation (DSD):** Incidence of genital malformations, excluding undescended testes, 4-5 per 1000 live births and ambiguous genitalia (assignment of sex impossible at birth) estimated at 1 per 4000 live births. The most common DSD is Congenital Adrenal Hyperplasia (CAH); Androgen Insensitivity Syndrome (AIS) is also common. However, not all children with these conditions are identified early\(^\text{49}\) despite evident abnormality at birth. A recent audit of 46 XY girls found that in the 11 children only 3 were suspected DSD at birth although 10 of 11 had at least 1 significant abnormality of their external genitalia (palpable gonads in the labio-scrotal folds or in the inguinal region, single urogenital opening, enlarged phallus). Median age presentation was 18 months (range 0 d-15y)\(^\text{49}\). The impact of delay is not only psychological (late diagnosis has been shown in Turner’s syndrome, 45 XO karyotype, to have a significant impact on psychological adjustment) but also some are autosomal recessive conditions with potential consequences for future pregnancies if the diagnosis is not made. Further, risk of malignancy increases as undescended testicular tissue remains undetected; often bilateral gonadectomy and vaginoplasty are required.
  - **Careful neonatal genital examination can identify children with disorders of sexual differentiation.**
  - **The impact of delay in diagnosis may have psychological impact and may also have potential consequences for future pregnancies (if autosomal recessive).**
  - **The presence of ambiguous genitalia is a medical emergency and pituitary and adrenal integrity must be established.**
  - **Early specialist endocrine involvement is necessary and needed and to monitor growth and development.**

**Ano-rectal malformations:** Despite routine physical examination postpartum in the UK, one in five neonates born with imperforate anus had a delayed diagnosis\(^\text{50}\) leading to a 10% incidence of perforation. In Sydney, Australia an audit of referrals found 32 % of ano-rectal malformations were missed in the first 24 hours post birth\(^\text{51}\).
  - **Thorough perineal examination with separation of the buttocks during the initial newborn examination is necessary to identify the presence of ano-rectal malformations.** \(^\text{50}\)