Newborn Observation Chart (NOC) incorporating the Newborn Early Warning Score (NEWS)

User Guide

February 2020

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Introduction and Background

In New Zealand (NZ) Early Warning Scores (EWS) for Adults, Paediatrics (PEWS: Paediatric Early Warning Score) and Maternity (MEWS: Maternity Early Warning score) are being introduced. Early warning systems for newborn infants are now being developed in many countries, with the recognition that there are often subtle and non-specific clinical signs that can progress to rapid deterioration in the newborn (Mortensen, Henrik & Ulriksen, Hinna, Schmolzer & Solevag 2017).

The Neonatal Encephalopathy (NE) Taskforce

The NE Taskforce was set up in November 2015 bringing together expert representatives from health care providers, clinicians, professional bodies, government agencies (including the Accident Compensation Corporation (ACC) and patient advocacy groups. The taskforce engages and works with these groups to design and establish an evidence-informed improvement programme to reduce the number and severity of avoidable NE cases in New Zealand.

They have been working to develop a standardised methodology that allows for early intervention and aims to reduce the severity of brain damage, producing better outcomes for children, their families and for ACC.

The NOC is a vital signs chart which has been developed to standardise the initial assessment and care of all newborns in New Zealand. The NOC will also provide a single view of clinical information and assist in recognising trends which may indicate a baby's condition has deviated from the norm. The NEWS has been developed to assist with the early recognition of clinical deterioration of infants who are at risk, with the aim of improving outcomes for these infants and to help us detect and reduce the severity of Neonatal Encephalopathy.

All mothers and babies require active ongoing assessment immediately following birth (Ministry of Health, 2012). Generally, the timing of this assessment is within two hours of the birth. Newborn assessment involves observation of the heart rate, respiratory rate, colour, airway integrity, tone and activity and the ability to breastfeed. The NOC/NEWS chart provides a nationally consistent chart on which to document this first newborn assessment.

Some babies are at a higher risk of neonatal complications (such as hypoglycaemia) and will require more frequent and more extensive assessment and observation. The NOC/NEWS chart provides nationally consistent risk identification and suggested frequency of assessment for these babies.

Canterbury District Health Board (DHB) and Counties Manakau DHB have been using newborn observation charts to support documentation of newborn assessment for some time. In response to an audit of retrieval rates of neonates from primary units and admission to the Neonatal Intensive Care unit, a standardised Newborn Observation chart and Newborn Early Warning Score (NOC/NEWS) was developed at Christchurch Women's Hospital in 2015. A subsequent audit of this chart found a sensitivity of 69% and specificity of 92% when comparing the maximum NEWS and NICU involvement. It also found that 33% of the babies who had a maximum score of 2+ on their newborn observation chart were actually those deemed as having no identified risk factors (Sapere Research Group 2019). This supports the rationale for using such a chart for *all* babies.

Usability

The NOC/NEWS follows the development and introduction of the Maternity Early Warning System within the maternity sector. With many clinicians already using and familiar with MEWS, this will facilitate easier implementation for NOC/NEWS. It is expected that introducing the NEWS will be an important step towards improving the quality of care for the newborn baby. The NEWS utilises the same colour coding as the MEWS, which has been carefully guided by human factors.

Trigger Thresholds

There has been a lack and variance in published normal ranges in biophysical variables. This in turn makes it difficult to determine response parameters for newborns that need observations (Roland, Madar, Connolly, 2010).

Hence, the trigger thresholds for the Newborn Observation Chart have been informed by:

1. Review of other international NEWS charts and found to be consistent
2. Consensus opinion
3. Newborn Observation Chart Audit
4. Numbered List

Use of the Newborn Observation Chart

- Newborn babies who are 35 weeks gestation and over
- To be completed for **ALL** babies for the initial newborn assessment (0-2 hours following birth) and for the second detailed newborn assessment (within 24 hours of the birth)
- At any time if there are concerns related to the newborns health.

At risk babies – identified following birth using the risk assessment section

- Will require more frequent assessment and additional observations
- May require observations for longer than 24 hours
- If NEWS score is still not normal at 24 hours then observations will continue. Type and frequency of observations will then be guided by the local neonatal team.

The Vital Signs which make up the Newborn Observation Chart

Core vital signs (6+1) included in the newborn observation chart for all babies are:

- respiratory rate
- work of breathing
- temperature
- heart rate
- colour (including jaundice)
- behaviour (including feeding behaviour)
- Parents can express any change or concern (+1)

These observations will generate a subtotal which may suffice for babies not identified with a risk factor. All of these 6+1 vital signs must be recorded each time to generate a newborn early warning score.

For those babies with a known risk, additional observations are recommended:

- oxygen saturation in air (some DHB's may choose to record this for all babies with the core vital signs)
- blood glucose,
- repeat lactate
- newborn scalp check (to identify sub galeal haemorrhage for babies born by instrumental birth).

The **score key** is placed in the centre of the chart for easy visual pick up and reading along the line.

The minimum vital signs that should be performed for all babies:

Two New Zealand documents provide guidance on the initial newborn examination done in the first 2 hours. The Well Child Tamariki Ora National Schedule (Ministry of Health (MOH) 2013) and the Consensus statement of the New Zealand College of Midwives (NZCOM) and The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) and MOH (2012) on Observation of the Mother and baby immediately after birth. A full newborn examination should take place in the first 48 hours – usually nearer 24 hours.

The newborn assessment undertaken between 0-2 hours is detailed in the Tamariki Ora well child schedule (MOH 2013) Cardio respiratory stability and transition from intrapartum physiology forms a component of this assessment which includes:

- the respiratory rate (counting for a full minute) and breathing effort.
- heart rate, central colour and perfusion.
- temperature.

Inspection/review for major anomalies such as cleft palate, anal atresia and syndromes forms another assessment component.

The NZCOM/RANZCOG statement identifies that ongoing assessment of the baby includes, but is not limited to reviewing:

- colour, heart rate, respiratory rate, temperature, airway integrity and overall condition
- tone and activity
- ability to breastfeed/feed.

It also addresses the importance of observation during the initial skin to skin period.

Explanation of Observations

Respiratory Rate

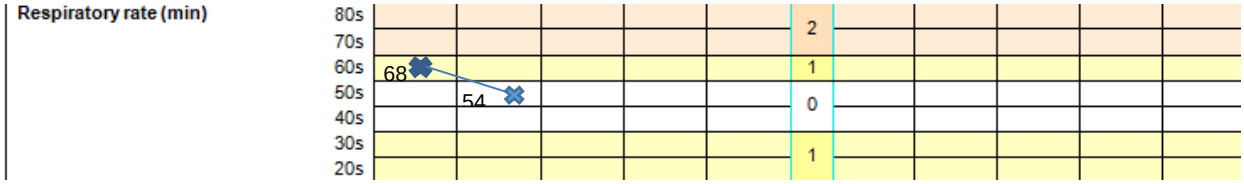
Respiratory rate is often the first and most sensitive vital sign that demonstrates deterioration in the condition of the baby. When tachypnoea in the newborn is present, there should be a strong suspicion of sepsis.

In the Sapere Research Group (2019) audit of the Newborn observation chart, respiratory rate made the biggest contribution to the score than any other observation.

Respiratory rate range for scoring in the colour zones according to severity:

- White = score 0 for respiratory rate 40-60 (Normal)
- Yellow = score 1 for respiratory rate 20- 39 or ≥61 - 70
- Orange = score 2 for respiratory rate in the ≥71 - 89

The baby's respiratory rate is counted over one full minute. The rate is documented by using a cross on the chart. Write the actual number next to the cross. Join the crosses to show the trend. Add to final score.



Example: respiratory rate is 68 per min then rechecked one hour later and is 54 per min.

68 is in the yellow zone which scores 1. When added to the other vital signs, the escalation pathway is referred to in order to determine what action should be taken.

Work of Breathing (WOB)

Increased work of breathing is where anything other than normal breathing is demonstrated. i.e. where the baby is using the diaphragm more dramatically or accessory muscles in the neck and between ribs to support breathing. Increased work of breathing occurs where there is increased airway resistance or decreased lung compliance and increased pressures are needed in order to generate a given tidal volume.

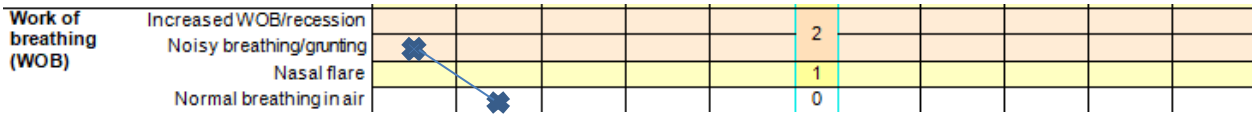
Grunting sound is made as the newborn inhales through partially closed vocal cords. Grunting 'splints open' the small airways and helps to maintain functional residual capacity in the alveoli. Grunting serves as a mechanism to improve oxygenation and ventilation (Karlsen 2013)

Nasal flaring is a sign of air hunger as the newborn tries to decrease airway resistance and increase airway diameter. (Karlsen 2013)

Any increased work of breathing may be a sign of respiratory distress.

- White = score 0 normal breathing in air
- Yellow = score 1 for presence of a Nasal flare
- Orange = score 2 for Noisy breathing/grunting *and/or* Increased WOB/recession

Place a cross in the appropriate corresponding square and join the crosses to demonstrate any trends. Add this score to final score.



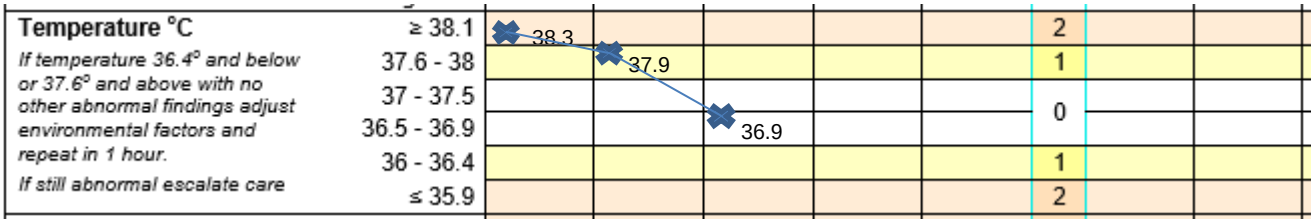
Example: Work of breathing (WOB) is initially recorded as Noisy breathing/grunting, which initially scores 2, on reference to the escalation pathway, this should trigger a review within 30 mins from a Neonatal team member. On rechecking, this has settled, and is now recorded as Normal breathing in air, scoring 0.

Note: If a baby scores 1 or 2 for respiratory rate or work of breathing, an oxygen saturation recording should be done with the set of observations. This contributes to the assessment and total score. It is important information to have for escalation call to paediatric / neonatal team.

Temperature

- 36.5- 37.5 = White score 0 (Normal)
- 36.0 - 36.4 = Yellow score 1
- 37.6 - 38.0 = Yellow score 1
- ≤35.9 = Orange score 2
- ≥ 38.1 = Orange score 2

Record the number next to the cross and join crosses to show trends. Add this score to final score.



Example: Initial temperature is 38.3, scores a 2. Environmental factors were adjusted, and temperature was rechecked. Temperature was 37.9 on rechecking, scoring 1. Discussion with the Midwife in charge and temperature rechecked again an hour later and temperature was 36.9, scoring 0.

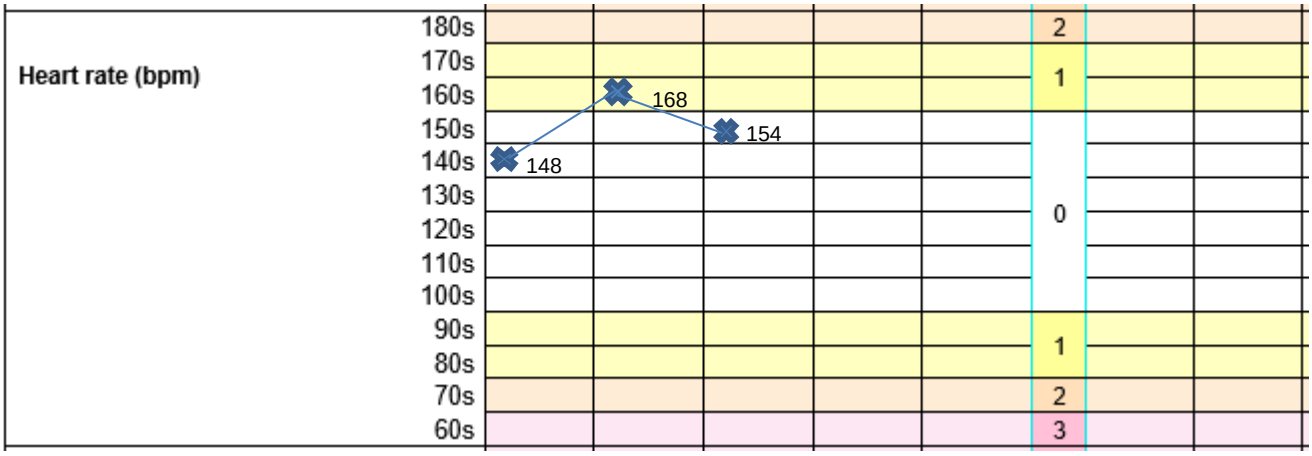
Note: If temperature is 36.4 °C or below or 37.6 °C and above, with no abnormal findings adjust environmental factors and repeat in 1 hour. If still abnormal escalate care.

Heart Rate

Record the baby's heart rate over one minute then mark with an 'x' (cross) and write the actual reading into the corresponding square.

- 100-159 beats per minute (bpm) = White score 0
- 80s-90s & 160s-170's = Yellow score 1
- 70s & 180s = Orange score 2
- 60s = Pink score 3

Join the crosses for the heart rate to demonstrate trends. Add this score to final score**.**

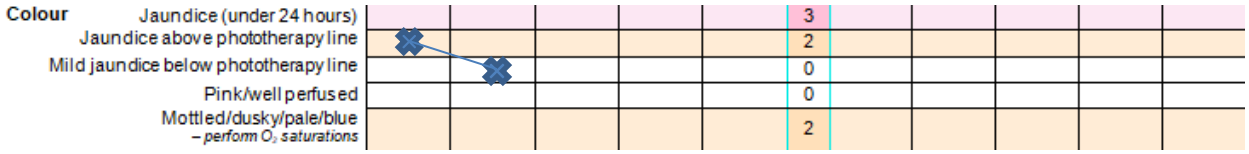


Colour

Determination of an infant's colour is an integral part of assessment and will indicate a need for assistance or not (O'Donnell, Omar, Kamlin, Davis, Carlin, Morley, 2007)

Pink/well perfused	= White score 0
Mild jaundice below phototherapy line	= White score 0
Jaundice above phototherapy line	**=** Orange score 2
Mottled/dusky/pale/blue	**=** Orange score 2
(Perform oxygen saturations if this occurs)	
Jaundice (under 24 hours)	= Pink score 3

Mark with an 'x' and join the crosses for colour to demonstrate trends. Add this score to final score

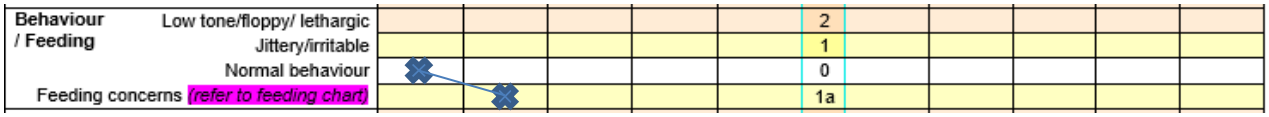


Example: Initial recording shows that baby is jaundiced and the SBR level is above the phototherapy line. This scores a 2 on the chart and on reference to the escalation pathway, this should trigger a review within 30 minutes by a member of the Neonatal team. The subsequent recording shows that the baby is showing mild jaundice and the SBR is below the phototherapy line. This scores a 0 and is considered normal.

Behaviour

Normal behaviour	= White score 0
Jittery/Irritable	= Yellow score 1
Feeding concerns/refer to feeding chart	= Yellow score 1
Low tone/floppy/lethargic	= Orange score 2

Mark with an ‘x’ (cross) the appropriate finding. Join the crosses to show trends. This score contributes to final score.



This section assesses baby’s general tone and activity and their most important function of feeding.

The **tone** of a baby is assessed by looking at their resting posture and how they respond to being picked up.

- A baby with low tone often has extended arms and legs at rest, will feel limp or floppy when picked up, and their head will need more support.
- Term babies should be in a flexed posture at rest.

Jittery movements occur symmetrically mostly in the upper limbs and stop on holding the limb. They occur more frequently in hypoglycaemic and hypocalcaemic babies.

Irritable babies are hard to console even with wrapping, rocking and feeding. Possible causes are mild birth asphyxia, sepsis, dehydration and pain from trauma. Check for pain from scalp bruising, forceps or vacuum extraction devices or fractured clavicle, especially if there was shoulder dystocia.

A baby, who has been asleep for more than 3 hours, is usually able to be woken if they have their nappy changed. A **lethargic** baby would appear to have little or no energy and is not able to be woken.

Feeding

A first feed is enhanced by skin-to-skin immediately after birth and is usual in the first hour. Some babies take longer than an hour to breastfeed. Skin to skin should be continued for longer than one hour in these situations. Reasons for not feeding in that time may be due to maternal medication, e.g. Opioids and benzodiazepines, prolonged length of labour, fetal distress and need for resuscitation especially CPAP for respiratory distress in the first 20-30 minutes. Hypoglycaemia and hypothermia may also affect feeding activity particularly in the transition period over the first 2-6 hours.

There is a large variation in the "normal" range of feeding in the first 2-3 days after birth which makes it difficult to determine (advise) when to be concerned.

Feeding is expected to be regular and frequent – at least 8-10 times a day in the first 48 hours. This stimulates lactation and is an important measure of wellbeing.

Red flags that would trigger a score for **feeding concerns** include:

A baby who:

- Is lethargic and too sleepy to feed
- Not had a first feed in the first hour, followed by no feed in the first 4 hours.
- Has an initial first feed, then not feeding for more than 6 hours.
- Regular feeding for 12-24 hours is then not interested for 6 hours. When a baby stops feeding after previously doing well, this can be a sign of early onset sepsis (within the first 48 hours), severe hypoglycaemia, and in rare circumstances intra-abdominal problems

- Has hypothermia, which may also increase the risk of hypoglycaemia
- Babies with risk factors identified, who are not feeding well, have more potential to show early signs of infection or develop hypoglycaemia

If a baby is not latching at the breast and effectively suckling, commencing expressing by hand and pump can stimulate lactogenesis. Colostrum that has been expressed and given to the baby should be recorded on the infant feeding record. Colostrum of less than 1 ml should be syringe fed. This should be recorded on an infant feeding record as feeding concerns – review hourly and expect progress to be made within 3 hours. It is recommended that an infant feeding record is used and that it specifically refers to the use of NOC/NEWS if there are concerns regarding feeding.

Consider the impact of maternal factors – eg; the reason for induction was poor growth at 37/38 weeks. It is recommended to plot the babies' weight on a GROW chart in the mother's notes. Some babies who run into difficulty have asymmetric growth and their birth weight plots at 9-25th centile, so are not initially in a NEWS risk group. If there are feeding concerns, then a blood glucose check may be warranted.

Signs of dehydration
These include: dry lips, frequent feeding without settling, elevated temperature or weight loss of more than 10% of their birth weight.

If any of these signs are picked up this demonstrates a late sign of poor feeding.

Usually urine output continues even when there is poor feeding or delayed lactation because the kidneys do not have the ability to concentrate the urine, plus it will be high if maternal fluids were generous in labour.

Bowel motion change in colour (away from black meconium) is a good indication that baby is swallowing colostrum and/or milk.

We recommend weighing babies on day 3 or around 72 hours (New Zealand (NZ) Newborn Clinical Network 2019)

There is good evidence that if weight loss is greater than 8%, that a delay in lactation is often present and the mother/baby should benefit from increased feeding support (New Zealand Newborn Clinical Network 2019, Flaherman, Li, Kusniewicz et al 2014, Noel-Weiss, Woodend, Peterson, et al 2011).

Risk factors for delayed lactation – See Appendix A

Parent expresses change or concern

Obtaining parents input to their baby's observations is important at each assessment.

This indicator, if ticked or marked with a cross immediately scores Orange = score 2. This score, as per the escalation pathway, would trigger a review within 30 minutes.

The parent should routinely be asked at each interaction if they have noticed any change in their baby's behaviour or condition and if they have any concerns. Consumer representative on the NE Taskforce reports that parents may not necessarily know what to be concerned about, so better to ask parents to voice any noticeable changes with their baby.

Oxygen Saturation screening

(only if your DHB chooses to perform as one of the vital signs)

Some DHB's require that all neonates have some form of oxygen saturation screening, be it a single measurement or a combination of pre and post-ductal saturations. If this is a requirement of your DHB, it must still be carried out as per DHB policy.

ALL BABIES NEWS SCORE SUBTOTAL

These 6 vital signs +1 (plus one for parental concern) are used to inform the subtotal newborn early warning score (NEWS). For babies with no other risk factors after doing a risk assessment at birth this 'All Babies' NEWS score is then used to direct management according to the local escalation pathway (see further information on this)

Escalation Pathway

EXAMPLE of an ESCALATION PATHWAY for Tertiary setting. The pink highlighted areas are the areas that should be locally determined.

Newborn Early Warning Score (NEWS) – ESCALATION PATHWAY		
1 1a	• Repeat in 1 hour, if unchanged notify person in-charge, eg. ACMM,, and discuss with Registrar/CNS-ANP/NP Reassess feeding as per feeding chart and discuss with snr MW. If no improvement escalate to Registrar/CNS-ANP/NP	**08:30-16:30 page: ####** **After hours page: ####**
2	Requires review by Neonatal/Paediatric Reg/CNS-ANP/NP within 30 minutes	
3+	Requires **immediate** Registrar/CNS-ANP review → **Consider emergency call to Neonatal Team (####)**	

The areas highlighted in **pink** are the areas where each DHB can modify the escalation pathway depending upon local policy, procedure and guidelines. The pink areas only indicate the text that is to be locally determined. It is not expected that this area remains highlighted once the local escalation pathway has been inserted.

Some areas do not have access to Neonatal staff in the first instance and may be sole midwife-run facilities. The escalation may be to an LMC or senior midwife, sometimes in another facility (Secondary or Tertiary), along with the devising of a plan of care. See on the following page an example of an escalation pathway for a Primary Unit with the areas that should be locally determined highlighted in **blue**:

Newborn Early Warning Score (NEWS) – ESCALATION PATHWAY		
1	• Repeat in 1 hour, if unchanged discuss with Neonatal team by phone.	Neonatal team 08:30-16:30 Call: ####
1a	• Reassess feeding as per feeding chart and discuss with LMC/snr MW, externally, if appropriate. If no improvement, escalate to Neonatal team in Secondary/Tertiary unit	After hours Call: ####
2	Discuss and devise plan with Neonatal team within 30 minutes and potentially initiate transfer to Secondary/Tertiary unit	
3+	**Immediate referral to Neonatal team, implement plan while awaiting retrieval.**	

The highlighted area shows where the local changes are to be made. It is not recommended that this area stays highlighted once the pathway has been agreed and inserted on the chart.

What doesn't change is the **timeline of escalation**:

For instance, a score of **1** would initiate a review in 1 hour **in every case,** and if no change, there would be a notification to the midwife in charge or in the case of a lone midwife in a primary unit, a phone call to another senior midwife in a Secondary or Tertiary unit or Neonatal Registrar to devise a plan.

1a score would trigger a re-assessment of feeding as per the feeding chart and discussion with the senior midwife on duty– It is recommended that an infant feeding record is used in conjunction with NOC/NEWS, as they are mutually supportive documents. If no improvement, escalate to a Registrar/CNS/ANP/NP for review. In the case of a Primary unit and a lone midwife situation, the midwife would discuss with either the LMC or senior midwife in the Secondary/Tertiary facility and devise a plan. If no improvement, escalation via a phone call to the Neonatal team in the Secondary/Tertiary facility is appropriate.

A score of **2** would mean the review should occur within 30 mins, **in every case**, by whichever of the highlighted resource is available in your facility. If in a Primary unit, this would trigger a call to a Neonatal Registrar to devise a plan of care and to determine if retrieval from the Primary unit and admission to the nearest Neonatal unit is indicated at this time.

A score of **3** indicates that the midwife should inform the midwife in charge and initiate an immediate call to a Neonatal Registrar/CNS or ANP for review, whichever is the most appropriate for your facility, **in every case**. In a Primary unit, this should happen along with arrangements to retrieve the baby urgently and admit to the nearest Neonatal unit, implementing an agreed plan whilst awaiting retrieval.

There is room for the inclusion of your local pager numbers and emergency neonatal team numbers so midwives/nurses don't have to deviate from the form to find the appropriate numbers to call.

Exemption from scoring

The exception to calculating a total NEWS score is when a newborn does not require all vital signs to be taken at one time. In this instance, enter 'EX' for 'exemption' into the score total box.

Some examples of when this exemption is acceptable:

- A blood glucose that is due at a different time from other vital signs may be done as an individual test and documented as EX. If measurement is abnormal, perform a repeat full set of vital signs and re-calculate NEWS.

- A repeat temperature where no other abnormal findings were found on previous NEWS and which is now in white zone

Single-parameter escalations still apply for these readings that are exempt for scoring – that is, any observations in the orange or pink zones still trigger an escalation at that level.

Using the Modifications box on the NOC/NEWS chart:

MODIFICATIONS

Vital sign *use abbreviation*	Accepted values and modified ENS	Date and time	Duration *hours*	Initial/surname /contact details
Colour	Jaundice above phototherapy line	11/11/19 – 11am	until phototherapy discontinued	D Ramoray #8933
Reason:	Baby undergoing phototherapy – having regular SBR checks			

There may be situations where clinically stable neonates have vital signs in the abnormal zone.

The NEWS score for a vital sign can be modified to prevent inappropriate or unnecessary escalation.

The user completing the NEWS score should review any modifications before calculating the total NEWS score.

Example:

A baby has jaundice that measures above the phototherapy line, which scores **2** on NEWS and would normally trigger a review within 30 minutes. However, this baby is already undergoing phototherapy and is going to have another SBR in 4 hours.

A modification is made, with clear instructions as to when it was commenced and when it should be discontinued, prompting a return to the regular escalation pathway for this vital sign.

Who can complete a modification?

As with other Early Warning score modifications, the modification box in the NOC/NEWS should only be completed by a member of the Neonatal team. Registrar, Advance Neonatal Practitioner (ANP) or Neonatal Nurse Practitioner (NNP).

Additional Observations for at risk babies

These are performed as determined by a risk assessment at birth or in response to deviation from normal in other vital signs. Further information regarding the risk assessment categories and rationale for inclusion are in **Appendix B.**

Example of Risk Assessment from NOC/NEWS chart

COMPLETE RISK ASSESSMENT BELOW FOR **ALL** BABIES

RISK ASSESSMENT	OBSERVATION REQUIREMENTS			
RISK Tick all boxes ☐ that apply	**MINIMUM REQUIRED NEWS OBSERVATIONS** (respiratory rate, work of breathing, temperature, heart rate, colour, behaviour, feeding)		**OXYGEN SATS MONITORING** To be performed on either foot until stable	**BLOOD GLUCOSE MONITORING**
☐ **All babies**	• At 0-2 and 24 hours post birth • At any time you or parent are concerned about baby		Perform if concerned about baby or as per DHB policy	Perform if signs or symptoms hypoglycaemia apparent
NOTE: prior to transfer (to a primary unit before 24 hours) a baby with risk factors must have a repeat NEWS of 0				
☐ **Intrapartum IV/IM opioid analgesia or General anaesthesia**	At 1 and 4 hours post birth		• At 1 and 4 hours with NEWS observations	Perform if signs or symptoms hypoglycaemia apparent
☐ **Maternal GBS/PROM with or without intrapartum antibiotics, or other sepsis risk (suspected or clinical chorioamnionitis, maternal temperature greater than 38°C, previous GBS baby)**	• At 1 and 4 hours post birth Then • 4 hourly for 24 hours	**+** if birth **less** than 4 hours post intra-partum antibiotics, stay for 6 hours		
☐ **Meconium exposure:** • all thick, OR • thin, only if apgar **less** than 9 at 5 minutes or resus needed				

- **Oxygen saturation in air**

Oxygen saturation Oxygen is transported to the tissues bound to the haemoglobin in red blood cells. Oxygen saturation is the percentage of haemoglobin carrying oxygen.

Pulse oximetry is the method used to estimate the oxygen saturation in the arterial blood.

Oxygen saturations are to be performed on the right hand or wrist (pre-ductal) during any resuscitation or respiratory support carried out at birth and then on either foot (post ductal) until stable, when performing monitoring after that time. Stable here means when the baby is calm and alert.

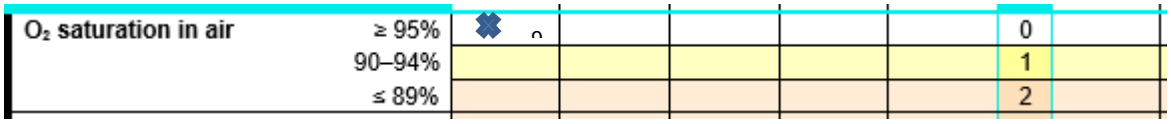
Infants with risk factors that warrant a NEWS may also have an underlying heart defect. Post-ductal measurements provide the most important information when screening for critical congenital heart disease (CCHD) (Cloete, Gentles, Bloomfield, 2020). A Cochrane review found no significant difference in screening accuracy when comparing measurements from the foot-alone (post-ductal) with measurements taken from both foot and the right hand (post- and pre-ductal) (Plana, Zamora, Suresh, Ewer 2018), Monitoring on either foot will provide measurements relevant for both NEWS (respiratory and/or infectious diseases) and for CCHD.

For healthy late preterm and term newborns, by 24 hours of life, oxygen saturation on room air at sea level ranges between 95.6 and 98.8% (median 97%).Abnormal oxygen saturation readings may indicate cardiac anomalies or pulmonary or infectious conditions. (Karlsen 2013)

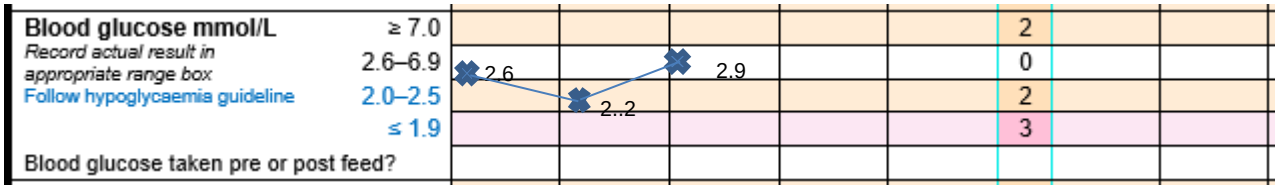
- Above or equal to ≥ 95% = White score 0
- 90-94% = Yellow score 1
- Less than or equal to ≤ 89% = Orange score 2

Oxygen saturations are required for all babies with an identified risk, or if a DHB requirement. The frequency and timing will vary dependent on the risk factors. e.g. If a baby had thick meconium exposure, record oxygen saturations at 1 & 4 hours. Whereas, if a baby is below the 9th centile on a growth chart, record the oxygen saturations once between 12 and 24 hours.

Document the numerical value for oxygen saturation in the relevant box of the chart alongside the cross 'x'. Join the crosses to show trends. Add this score to the final score.



- **Blood glucose mmol/L** 2.6- 6.9 = White score 0
  ≥7.0 = Orange score 2
  2.0-2.5 = Orange score 2
  ≤1.9 = Pink score 3



Record the blood glucose reading on the chart by marking with an 'x' (cross) and writing the value at the side of it.

Record if the blood glucose was taken pre or post feed by writing pre or post below the blood glucose reading.

A single blood glucose reading of ≤1.9 mmol/L triggers a pink colour code which scores 3 immediately. According to the escalation pathway this requires immediate review and advises considering an emergency call to the appropriate rapid response team.

The chart recommends if blood glucose readings are between 2.0- 2.5 mmol/L then to follow your local neonatal hypoglycaemia guideline.

Blood glucose will be recorded for at risk babies in the severe intrapartum fetal compromise group and extremes of weight i.e. below the 9th centile on growth or GROW chart, or above the 98th or 95th centile on growth or GROW chart. Also perform blood glucose testing if the infant's mother has/had diabetes. In addition, perform blood glucose testing if signs or symptoms of hypoglycaemia are apparent on any other baby without the above risk factors. These risk factors will be determined at birth and used to inform the risk assessment.

A blood glucose reading of < 2.6mmol/L on repeated occasions is associated with adverse neurodevelopmental outcomes (Boardman, Wusthoff, Cowan, et al 2013). In order to facilitate early

detection of low blood glucose, high risk groups are identified at birth who are at risk of having low blood glucose. Three hourly blood glucose testing is recommended from birth and before feeds, until a total of three consecutive results are 2.6 mmol/L or above (Alsweiler, Harding, Crowther, & Woodall, 2015).

These high risk categories include: maternal diabetes, especially if poorly controlled and requiring insulin. SGA (small for gestational age) infants, who are at an increased risk of hypoglycaemia and altered post-natal adaptation, including impaired thermoregulation and polycythaemia; which further increases the risk of hypoglycaemia (Watts, Roberts 1999)

- **Repeat lactate (mmol/L)**

Lactate is to be repeated if the baby has been identified at birth as at risk of neonatal encephalopathy with at least one factor indicative of severe intrapartum fetal compromise. This includes an initial cord lactate greater than 6.0mmol/L. Its elevation requires assessment for signs of neonatal encephalopathy. The behaviour section assists with this assessment.

A lactate measurement is used to help detect and evaluate the severity of hypoxia and poor tissue perfusion from a number of causes. The decreased amount of oxygen delivered to cells and tissues (hypoxia) results in cells using a less efficient means of energy production. This less efficient means of energy production results in the formation of lactic acid in the blood and the development of acidosis (low pH levels).

Your unit will most likely have a policy on when cord gases should be measured. The two important components are pH and lactate. Lactate is felt to be a better reflection of more sustained fetal distress.

> Examples are: Emergency Caesarean or instrumental delivery for fetal distress, need for active resuscitation with bag and mask usually > 2 minutes, fetal distress on CTG, meconium stained liquor, APGAR < 6 at 5 minutes.

The arterial lactate will be higher than the venous so it is important for both to be taken. Correlations have been demonstrated between umbilical artery lactate values and a range of markers of neonatal status, including Apgar scores, umbilical artery pH values and umbilical artery base excess values (Gjerris, Staer-Jensen , Jorgensen et al. 2008, Watt WF, Tan KH, Yeo GSH. 2002). Umbilical artery lactate values have been shown to be equivalent to arterial blood gas values in the prediction of a variety of adverse clinical and neonatal outcomes (Gjerris, Staer-Jensen , Jorgensen et al. 2008)

In an audit (Sapere 2018) of the pilot Newborn Observation Chart 41% of the fetal distress babies had a NEWS score of 2 or more during their stay.

- A repeat lactate reading is required with a NEWS assessment under severe intrapartum fetal compromise and is recommended at 3-4 hours of age with a blood glucose.
  It is recommended that both are measured on a blood gas machine or an Istat.

≤ 3.0 = White score 0
≥ 3.1 = Orange score 2

Record the actual result in the appropriate range box alongside the ‘x’ cross.

If the Lactate is 3.1mmol/l or above and no other findings then a score of 2 will trigger a review within 30 minutes. If it is accompanied by a low blood sugar or other clinical findings and the score is 3 or more an immediate review will be triggered.

Repeat lactate (mmol/L) *Record actual result in appropriate range box*	≥ 3.1	3.8				2		
	≤ 3.0		2.5			0		

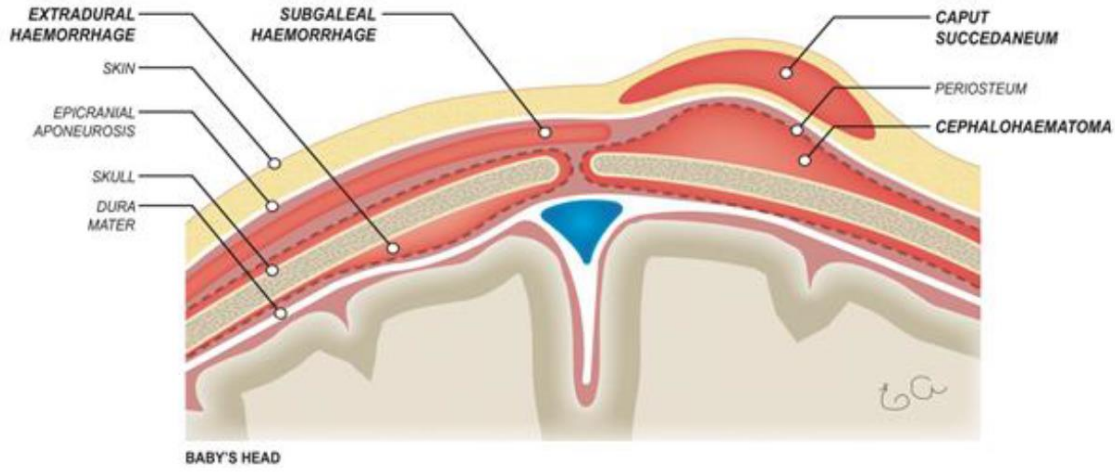
The clinical review will indicate the timing of further lactate levels and other investigations. In the audit of elevated lactate ≥ 3.1mmol/L , babies have been identified with signs of infection, anaemia from subgaleal haemorrhage and persistent hypoglycaemia.

- **Instrumental birth- vacuum and/or forceps (risk of Subgaleal Haemorrhage)**

Background

'A subgaleal haemorrhage (SGH) or subaponeurotic haemorrhage is a rare but life-threatening condition in a newborn baby. It is caused by rupture of the emissary veins, which are connections between the dural sinuses and the scalp veins. Rupture of these veins results in bleeding into the space between the galea aponeurotica and the periosteum, the subgaleal space. The subgaleal space is a layer consisting of loose connective tissue covering the entire cranial vault. This subgaleal space is not limited by sutures.

As a SGH is not limited to sutures, in contrast to a cephalohaematoma, and a large amount of blood, up to a baby's whole blood volume, can accumulate into the subgaleal space. Therefore, a SGH in the newborn can lead to serious hypovolemia and is recognised as a rare but life-threatening condition' (New Zealand Child & Youth Clinical Networks (NZCYCN) 2018)



Schematic drawing of the anatomical position of different swellings that can occur on a newborn head. Please note that a cephalohaematoma is not crossing suture lines. (New Zealand Child & Youth Clinical Networks 2018)

Incidence of subgaleal haemorrhage: 1: 2,000 normal vaginal births with an increase to 1:200 for vacuum assisted birth (Fakih 2014, NZCYCN 2018)

Mortality as a result of SGH has been described to be as high as 25% but earlier or better recognition has decreased mortality to 5-14% over recent years. The mean time to diagnosis of a SGH is 1-6 hours after birth (Colditz, Cartwright, Colditz 2015, NZCYCN 2018)

Enter the Head circumference at birth as shown:

Complete if vacuum, forceps or unsuccessful instrumental birth. Inspect and palpate the scalp.								**Head circumference (HC) at birth:**				35 cm
Newborn scalp check	No new bruising/swelling						0					
	Increasing swelling	✖					2					
	Fluctuant boggy mass						3					
	Repeat HC if required	**36** cm	cm	cm	cm	cm	2	cm	cm	cm	cm	cm

An increase in the head circumference from the measurement at birth, will score a 2 and will trigger a review within 30 mins, from the neonatal practitioner appropriate to your local escalation pathway.

Bleeding into the subgaleal space can lead to significant hypovolaemia, anaemia and coagulopathy. A newborn's estimated blood volume is 80mL/kg; therefore, blood loss of 48ml in a 3kg baby equals a loss of 20% of circulating volume (NZCYCN 2018).

Features (NZCYCN 2018)

- APGAR <7 at 5min without asphyxia
- Haemodynamic instability (increased HR, increased RR or WOB, pallor, prolonged capillary refill > 3 sec, metabolic acidosis, low BP)
- Anaemia, coagulopathy

Localised signs (NZCYCN 2018)

- Generalised scalp swelling, which is movable, fluctuant or ballotable, crossing suture lines, gravity dependent
- Examine the supine infant by lifting head forward and using both hands behind the occiput; feel for fluctuance, try to push any swelling forward and if it moves forward freely, this indicates SGH.
- Displacement of ears, peri-orbital oedema
- Increased head circumference (late sign as approximately 35 ml of blood is needed to increase head circumference by ~ 1 cm)
- A 1-cm increase in the depth of the subgaleal space may contain from 40mL to 260mL of blood.
- A fluctuant swelling localized to one skull bone (usually the parietal bone) is a cephalohaematoma and is benign. Pitting oedema suggests a caput succedaneum, also benign.

With progressive haemorrhage, elevation and displacement of the ear lobes, and puffiness of the eyelids (peri-auricular and periorbital oedema) follows. An irritable cry or signs of pain may be noted with handling. Serial head measurements may be useful although it should be noted that large blood loss can occur despite a relatively small increase in head circumference (estimated 38 ml per cm increase in head circumference) (RANZCOG 2015)

RISK ASSESSMENT

Instrumental birth – vacuum and/or forceps (risk for Subgaleal Haemorrhage)		
☐ **Any of the following:** • Total vacuum extraction time **less** than 20 minutes • Up to 3 pulls • No or 1 cup detachment • Attemped instrumental birth	• At 1 and 4 hours post birth • Head circumference at birth and repeat if head swelling occurs	Perform at 4 hours
☐ **Any of the following** • Total vacuum extraction time **more** than 20 minutes • More than 3 pulls • 2 or more cup detachments • Apgar < 7 @ 5 mins ☐ **At clinician's request**	• At 1, 2, 4, 6, 8, 12 hours post birth • Head circumference at birth and repeat if head swelling occurs • For IMMEDIATE Neonatal/Paed review if: – HR > 160 bpm – Resp > 60 or ↑ WOB	Perform at 2 and 4 hours or if concerned about baby

Additions to these risk factors are: if ventouse is performed <36 weeks, (contraindicated at < 34 weeks), double or triple instrumentation (if more than one type of instrument is used during the birth – eg, ventouse and forceps) **Maternal:** nulliparity. **Fetal:** haemophilia.

Vacca (2003) concluded that significant SGH is almost always preceded by a difficult vacuum extraction as evidenced by a prolonged extraction with excessive number or strength of pulls, multiple cup detachments, and/or completion of delivery with forceps.

Surveillance of neonatal head
Hats should be removed if one has been required for temperature control, so that changing head shape or size is noted (RANZCOG 2015). Concerns regarding neonatal behaviour (poor feeding, poor activity, pallor) should also be triggers to perform observations in these neonates. (RANZCOG 2015)
Intramuscular Vitamin K prophylaxis is highly recommended for these births (RANZCOG 2015).

RISK ASSESSMENT

- **Other risks/concerns (see Appendix B)**

☐ **Other risks/concerns,** *eg. limited antenatal care, poor feeding*	Observations required:	☐ NEWS, frequency:	☐ Other: .....
		☐ O_2 sats, frequency:	frequency: .....

If at any time whilst a newborn is under our care, another risk category is identified which is not currently recognised on the NOC/NEWS chart, this can be added here. The identification of the risk factor alone may instigate an escalation of concern to the neonatal/paediatric team. This in turn will determine if any or what observations may then be required and at what frequency.

Examples of other risk factors may be: limited antenatal care, infectious disease.

APPENDIX A

Risk Factors for Delayed Lactation

ANTENATAL FACTORS

- Antepartum haemorrhage
- Breast augmentation/Breast Surgery
- Breasts underdeveloped or have had limited changes during pregnancy
- Breast or nipple anatomy unusual
- BMI >=35
- Diabetes: Type 1 or 2 (on insulin)
- Gestational diabetes
- Gestational ovarian theca luteal cysts
- Hypertensive illness: Essential, PIH, Pre-eclampsia
- Luteal phase defects
- Maternal medications: Pseudoephedrine or serotonin re-uptake inhibitors
- Maternal mental health issues
- Pituitary issues
- Polycystic Ovarian Syndrome (PCOS)
- Primigravida
- Prolactin resistance
- Smoking/Recreational drugs/Alcohol
- Thyroid Issues

LABOUR AND DELIVERY FACTORS

- Analgesia/Anaesthesia – morphine, epidural, spinal, GA
- Caesarean section with no labour
- Induction of labour prior to 39 weeks (physiological hormonal disruption)
- Oxytocin augmentation
- Postpartum haemorrhage (>1000ml)
- Prolonged labour
- Retained Placenta

BABY FACTORS

- Any condition that reduces baby's ability to breastfeed effectively
- Birth pain/trauma from instrumental assisted birth
- Congenital conditions
- Neurological issues
- Respiratory Problems
- Unusual oral anatomy

POSTPARTUM FACTORS

- Delay longer than 2 hours in initiating breastfeeding or expressing from birth
- Mother-Baby separation

Mohrbacher, N. Breastfeeding Answers Made Simple, A Guide for Helping Mothers. Hale-publishing (2010)

APPENDIX B

RISK ASSESSMENT CATEGORIES

For some newborns, there are impacts from antenatal risk factors, in-utero growth and intrapartum events that increase the risk for term and near term newborns to show signs of compromise. The gestation group of babies 35-41+ weeks are mostly cared for on postnatal wards from birth. 8-9% of term infants 37 weeks or more are admitted to the neonatal unit, and they account for 50-55% of the admissions to NICU's. over half can be transferred back to postnatal after stabilising. These risk categories have also been informed by the introduction of other newborn early warning score systems such as Newborn Early Warning Trigger and Track (NEWTT) (British Association of Perinatal Medicine 2015).

Audit has shown that the babies who transfer from a secondary care facility to a primary facility before 6 hours of age have been identified at a higher potential for retrieval if they have been exposed to sepsis risk, meconium or fetal distress and are included in the NEWS risk factor group.

These sit alongside the NOC and are determined soon after birth. The appropriate category is ticked that represents the perinatal situation and then the observation requirements are set alongside.

The key risk factors for newborns needing higher levels of observation and care include:

- **Babies whose mothers have opiates < 6 hours before birth**
  Rationale: Increases risk of respiratory depression
- **Babies with risk factors for sepsis at any gestation**
  Rationale: Those at highest risk for postnatal sepsis include: prolonged rupture of membranes before delivery, maternal fever or signs of infection, known Group B strep status, and previous infant with Group B strep sepsis. Signs and symptoms usually develop in the first 24 hours. Intrapartum antibiotics reduce the risk when 2 or more doses are given.
- **Babies born with meconium liquor exposure**- all thick or particulate, or thin meconium where the 5 minute Apgar score is 8 or less, or needed resuscitation - any IPPV, CPAP for more than 5 minutes.

  Rationale: Meconium aspiration is more common with thick or particulate meconium (16-19% develop respiratory distress) or where the 5 minute Apgar score was <9 and there was a need for resuscitation. Symptoms are more likely in the first 6 hours.
- **Babies who experience severe intrapartum fetal compromise, including babies who have a cord lactate > 6.0**
  Rationale: these babies are at increased risk of respiratory distress, impaired transition and hypoglycaemia.

  The (Sapere 2018) audit showed that 41% of babies who were in the risk group of intrapartum compromise had a NEWS score of 2 or more postnatally, which justifies the need to monitor more closely.
- **Late preterm Infants: born at 35 and 36 weeks gestation**
  Rationale: transition and metabolic adaptation are compromised. They are at higher risk of temperature instability and hypoglycaemia. They are more likely to have poor feeding and have behaviour signs.

- **Babies at risk for hypoglycaemia**
  Including babies who are small for gestation age: weight < 9th% on customised charts or on the mothers GROW chart.
  babies born to mothers with diabetes and whose babies are large for dates > 98th%
  Rationale: Blood glucose < 2.6mmol/L on repeated occasions is associated with adverse neurodevelopmental outcome. A recent study in normal term newborns with continuous blood glucose monitoring identified the lowest 10% was 2.6mmol/L. High risk groups are identified for early detection.
  Includes maternal diabetes especially if poorly controlled and requiring insulin.
  SGA infants are at increased risk of hypoglycaemia, altered post-natal adaptation, including impaired thermoregulation and polycythaemia which further increases the risk of hypoglycaemia.

Other Risks concerns not covered above:

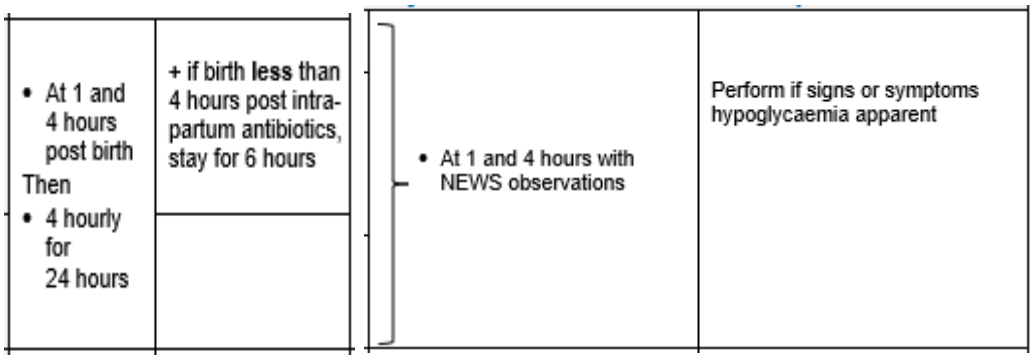
- This might include babies born where there has been limited antenatal care and results of scans and screening tests are unknown.
- Babies born before arrival at the birthing unit who were not planned home births, as these babies are often transferred by ambulance and have limited observation for a period.
- Babies with feeding concerns that develop in a baby with no other risk factors. Induction of labour for in-utero growth restriction. The baby's weight should be placed on the mothers GROW chart and compared with the antenatal prediction.
- Babies with asymmetric growth percentiles where the weight is 2 percentile lines lower than the length % – this is important when associated with other risks e.g. meconium and fetal distress. These babies appear wasted and have little subcutaneous tissue.
- Babies of mothers on beta blockers – Associated with hypoglycaemia and SGA

On the chart alongside each of these categories, some detail is given about what is meant for each risk and the appropriate observations and frequency that should be performed for each.

Example of Risk Assessments:

COMPLETE RISK ASSESSMENT BELOW FOR **ALL** BABIES

<table>
<tr><th colspan="2">RISK ASSESSMENT</th><th colspan="3">OBSERVATION REQUIREMENTS</th></tr>
<tr><th>RISK
Tick all boxes ☐ that apply</th><th colspan="2">MINIMUM REQUIRED NEWS OBSERVATIONS
(respiratory rate, work of breathing, temperature, heart rate, colour, behaviour, feeding)</th><th>OXYGEN SATS MONITORING
To be performed on either foot until stable</th><th>BLOOD GLUCOSE MONITORING</th></tr>
<tr><td>☐ All babies</td><td colspan="2">• At 0-2 and 24 hours post birth
• At any time you or parent are concerned about baby</td><td>Perform if concerned about baby or as per DHB policy</td><td>Perform if signs or symptoms hypoglycaemia apparent</td></tr>
<tr><td colspan="5">NOTE: prior to transfer (to a primary unit before 24 hours) a baby with risk factors must have a repeat NEWS of 0</td></tr>
<tr><td>☐ Intrapartum IV/IM opioid analgesia or General anaesthesia</td><td colspan="2">At 1 and 4 hours post birth</td><td rowspan="3">• At 1 and 4 hours with NEWS observations</td><td rowspan="3">Perform if signs or symptoms hypoglycaemia apparent</td></tr>
<tr><td>☐ Maternal GBS/PROM with or without intrapartum antibiotics, or other sepsis risk (suspected or clinical chorioamnionitis, maternal temperature <u>greater</u> than 38°C, previous GBS baby)</td><td rowspan="2">• At 1 and 4 hours post birth
Then
• 4 hourly for 24 hours</td><td>+ if birth less than 4 hours post intra-partum antibiotics, stay for 6 hours</td></tr>
<tr><td>☐ Meconium exposure:
• all thick, OR
• thin, only if apgar less than 9 at 5 minutes or resus needed</td><td></td></tr>
</table>



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