Newborn Pulse Oximetry Screening Training Package
NHS Lothian
April 2021

Save a life
1. **The pulse oximetry screening pathway for Lothian**
   The pathway used for pulse oximetry screening in Lothian

2. **Pulse oximetry screening learning outcomes for midwifery staff**
   Training is mapped to these learning outcomes

3. **Pulse oximetry screening learning outcomes for neonatal staff**
   Training is mapped to these learning outcomes, especially considering wider differential diagnoses of low saturations

4. **Pulse oximetry screening FAQ for staff**
   Ideally this document is circulated and read prior to any face to face training

5. **Parent information leaflet for babies born in hospital**
   Parents will receive this prior to screening (sometimes prior to birth)

6. **Parent information leaflet for babies born at home**
   Parents will receive this prior to birth at an antenatal appointment

7. **POS Business card (aide memoir)**
   A card with key points in the pathway to act as a prompt for POS

8. **POS training powerpoint presentation**
   Overview of POS for all staff

9. **POS for neonatal unit staff presentation**
   More detailed consideration of differential diagnoses and initial investigations aimed at NNU staff

10. **Sign in sheet for staff**
    Acts as a record of staff attending training

**There are also 2 training videos:**

1. *Pulse oximetry screening overview (13 mins)*

2. *How to use the Masimo Rad G pulse oximeter (3 mins)*
Asymptomatic Newborn NOT on the Neonatal Unit
Initial Pulse Oximetry Screen within 24 hours of birth
In hospital, aim for around 6 hours of age

INITIAL Pulse Oximetry Screen
Pre and Post Ductal Measurements

Negative Screen ‘Green’ Pathway
Both readings 95% or above AND difference 2% or less

Repeat Screen ‘Amber’ Pathway
Either reading 90 – 94% OR Difference 3% or more
Clinical assessment required

Positive Screen ‘Red’ Pathway
Either reading less than 90%

Symptoms Identified?
Yes

REPEAT SCREEN
Perform in 2 hours

Both readings 95% or above AND difference 2% or less

NEGATIVE SCREEN
Continue with routine postnatal care*

Either reading 90 – 94% OR Difference 3% or more

POSITIVE SCREEN
URGENT CLINICAL ASSESSMENT REQUIRED AND NNU ADMISSION

*At any point, if baby has symptoms or is unwell, they need an urgent clinical assessment, irrespective of the saturations

Dr Vix Monnelly

Date: March 2021, v1.1
After the training session, staff should:

- Understand the reason for performing pulse oximetry in all newborn babies
- Be able to measure pre ductal and post ductal saturations in a baby using the Masimo Rad-G pulse oximeter
- Be able to assign a baby to a pathway based on their pre and post ductal saturations and be able to escalate concerns relating to pulse oximetry screening appropriately
- Know where to record the POS on Trak
Pulse Oximetry Screening Training
Learning outcomes for neonatal practitioners and doctors

After the training session, staff should:

♥ Understand the reason for performing pulse oximetry in all newborn babies

♥ Be able to perform pulse oximetry screening by measuring pre ductal and post ductal saturations in a baby using the Masimo Rad-G pulse oximeter

♥ Know how to assign a baby to a pathway based on their pre and post ductal saturations and the difference between them, and when to escalate concerns about a baby relating to pulse oximetry screening

♥ Know where to record the POS on TRAK

Additional learning outcomes for staff working on the neonatal unit:

♥ Know which babies NNU medical staff are responsible for performing the POS, and when to perform this

♥ Be able to respond in an appropriate and timely manner when contacted by midwifery staff relating to pulse oximetry screening concerns

♥ Understand the wide differential diagnosis of a baby with borderline saturations or low saturations

♥ Know when an echocardiogram is indicated
NHS Lothian is introducing routine pulse oximetry screening of the newborn. This leaflet explains what this might mean for staff, babies and parents.

1. **What is Pulse oximetry screening?**

Pulse oximetry screening (POS) is a non-invasive test that identifies babies with low or borderline saturations. It involves measuring oxygen saturations in the baby’s right hand (pre-ductal measurement) **and** in either foot (post ductal measurement).

Once you have these 2 readings, assign the baby to a pathway. There is a full maternity POS guideline, and the pathway is available as part of this. There will also be laminated versions of the pathway stuck in the baby rooms in clinical areas. There are 3 options after an initial screen:

- **Green** – no further action needed
- **Amber** – borderline or differential saturations – needs clinical review and a repeat POS in 2 hours
- **Red** – low sats – needs urgent clinical review and neonatal unit admission

All POS are documented on TRAK. Under baby questionnaires there will be a new short ‘Pulse oximetry screening’ questionnaire to complete.

2. **Why is pulse oximetry screening being introduced?**

POS can detect critical heart problems in babies **before** they become very unwell. Early identification and treatment of these babies improves their outcomes dramatically and reduces their risk of death. POS identifies babies with low or borderline saturations, so it can also identify other important conditions in babies, such as lung problems and infection. Many of these other conditions also benefit from earlier identification as they also require treatment and so this is viewed as a positive.

3. **Which babies will have screening?**

All babies born at 34 weeks gestation or later will be offered POS. Preterm babies < 34 weeks would not have POS at 6 hours but would have it performed upon discharge from the neonatal unit.

4. **When should the baby have their pulse oximetry screening?**

Babies should have their saturations measured **within the first 24 hours after birth**.

- In the **hospital** setting, the pulse oximetry screen should take place at around **6 hours after birth**.
- Babies born at home after a **planned home birth** should have their pulse oximetry screening performed **within the first 24 hours**, at the first postnatal visit.
- Babies on the **neonatal unit** should have their POS performed shortly **before discharge**, along with their routine newborn examination.

Scan this QR code with a phone camera to take you to a short video demonstrating how to use the Masimo Rad G in a baby.
5. Who will perform the screening?
POS will become embedded as part of routine postnatal care. The professional responsible for performing POS is the person who is looking after the mother and baby.
- Mostly, this will be the midwives or midwifery care assistants, as most babies receive their postnatal care on postnatal wards.
- If a mother is on Labour Ward HDU (when the baby is 6 hours old), the midwife looking after the mother and baby would perform the POS.
- For babies born at home after a planned home delivery, the community midwife who performs the first postnatal visit after the birth would perform the POS.
- Any babies on the neonatal unit will have their POS performed by a member of neonatal unit staff.

6. What equipment is needed?
For POS, a specialised hand held pulse oximeter (the Masimo Rad-G) is being used. It comes with a reusable sensor - please do not throw this away! See the short video on how to use Masimo Rad G. The oximeter and sensor must be wiped clean before and after each use with equipment wipes (green clinnel wipes). There is a single patient use blue foam wrap which is attached to the sensor and then wrapped around the hand and foot to allow a clear reading to be obtained (blue side to baby).

7. What if parents do not want to have the screening?
POS is optional and parents can opt out. It would be important to understand why they did not want it, as it is quick and non-invasive and can provide additional reassurance. Any parents who decline screening should be flagged to neonatal / paediatric team for them to also discuss.

8. Are there any down sides to POS?
The potential aspects that cause worry are the additional time it takes to perform the POS, creating anxiety for parents and the possibility of delaying discharge or performing tests. Feedback from units already performing POS is that it takes much less time than first thought and the reassurance gained by staff definitely makes it worthwhile. In reality, additional anxiety caused to parents by POS has also not been reported, as they too like the reassurance provided. A small number of babies have their discharge delayed, usually by 1 or 2 hours and a small number of babies have extra tests and subsequently are found to be healthy. These babies are in the minority, and on balance it is felt that the benefits gained by identifying serious heart problems or other important conditions are outweighed by the extra tests some babies will have.

9. What if a baby looks unwell but their pulse oximetry screen is normal (green pathway)?
If a baby has symptoms or looks unwell, they need a prompt clinical review by a paediatric or neonatal practitioner, irrespective of whether their POS was negative or green pathway.

10. Parents want a 6 hour discharge but their baby is on the amber pathway – can they still go home?
Amber pathway means that the saturation levels are borderline. It would not be safe to send a baby home knowing their oxygen levels were borderline. Although 90% of cases of borderline saturations normalise within 2 hours, we must re-check the saturations to ensure they have normalised...
Newborn pulse oximetry screening test for babies born in the hospital
Information for parents

All babies born in NHS Lothian will have a routine pulse oximetry test within the first 24 hours after birth.

What does the test involve?
The test is very quick, taking less than 5 minutes in total and is completely harmless and painless. It involves measuring the oxygen level (sometimes called oxygen saturations) in your baby. We do this by wrapping a small sensor around your baby’s right hand. This sensor is connected to a machine called a pulse oximeter, which measures the oxygen levels by shining a light through the skin. This is repeated with the sensor placed on your baby’s foot. It is important to get both these readings for the test.

We aim to do the screening test when your baby is around 6 hours old. If this has not happened after 6 hours, please feel free to mention it to the team looking after you. It can be done later in the first 12 – 24 hours, but we aim to do it sooner than this where possible.

Why are we doing this screening test?
We are measuring oxygen levels in newborn babies to try to identify the small number of babies who have an unidentified serious heart defect. We know that these babies usually appear healthy at birth but often have lower oxygen levels. The test identifies babies with lower oxygen levels so we can check these babies very carefully to identify a possible heart defect before the baby becomes unwell.

Babies with other conditions such as breathing problems, infections and circulation problems can have lower oxygen levels too and the test may also identify these babies.

A doctor or specialist nurse will check all babies who have lower than usual oxygen levels to see if further tests or treatments are required. They will explain what is happening with your baby at each step.

What if my baby passes the test?
If your baby’s oxygen levels are within normal limits, no further pulse oximetry testing is necessary at this time. Your baby will continue with routine care before discharge, including their routine newborn examination (“baby check”).

Passing the test is very reassuring but does not always mean that there is no problem. A small proportion of babies (about 1 in every 8000) who pass the test may still have a serious heart problem- therefore it is still important for us to carry out the routine physical examination of your newborn. If you are concerned about your baby’s wellness at anytime, it is important that you contact your midwife, GP or NHS24.
What if my baby does not pass the test?
There are 2 reasons why your baby might not pass the test:

1. Their oxygen levels are low (less than 90%). This happens in about 3 babies in every 1000 (0.3%). These babies are deemed ‘test positive’ and will be seen by a doctor or specialist nurse used to looking after babies straight away. [See “What will happen if my baby is Test Positive?” section below].

2. More commonly, a baby will not pass the test first time but their oxygen levels will only be slightly low. This happens in about 3 in every 100 (3%) babies. This might cause some worry for you, but we know that the lungs of some babies adapt to being born at a slower rate than others – this is normal and these babies are healthy. Because we know this, if your baby’s oxygen levels are only slightly reduced in the first test and the baby appears healthy, then we will repeat the test a second time about 1 to 2 hours later. This is called a Retest.

What if my baby has a retest?
9 out of 10 babies will pass the Retest and these babies will be treated as healthy (Test Negative). It is important that your baby’s oxygen levels are normal before going home and so very occasionally this will lead to a slight delay in your discharge (1 to 4 hours).

Those who do not pass the Retest (Test Positive) will be seen by a doctor or specialist nurse used to looking after babies. [See “What will happen if my baby is Test Positive?” section below].

What will happen if my baby is Test Positive?
About 7 in every 1000 babies tested (0.7%) will be Test Positive (either after the first or second test). Your baby will need further investigations and will probably be admitted to the Neonatal Unit (NNU) for further assessment. This may make you worried but the doctor or nurse will explain what is happening.

Most babies will have blood tests and x-rays to try to find out the cause of the low oxygen levels. Some babies may also have an ultrasound of their heart called an ‘echocardiogram’ or ‘echo’ for short.

Of the babies admitted to the Neonatal Unit:

- 2 in every 10 will be healthy – these babies are usually in the NNU for less than 12 hours
- 7 in 10 will have a breathing problem or infection and most will benefit from the test by early diagnosis and treatment of a potentially serious illness
- 1 in 10 will have a heart problem and they will benefit from early diagnosis and treatment.
Newborn pulse oximetry screening test for babies born at home
Information for parents

All babies born in NHS Lothian will have a routine pulse oximetry test in the first 24 hours after birth.

What does the test involve?
The test is very quick, taking less than 5 minutes in total and is completely harmless and painless. It involves measuring the oxygen level (sometimes called oxygen saturations) in your baby. We do this by wrapping a small sensor around your baby’s right hand. This sensor is connected to a machine called a pulse oximeter, which measures the oxygen levels by shining a light through the skin. This is repeated with the sensor placed on your baby’s foot. It is important to get both these readings for the test.

We aim to do the screening test within the first 24 hours of your baby’s life. This is slightly different timing compared to babies born at hospital, who will have their oxygen levels measured within 6 hours, but is still within the accepted time where the screening test works well.

Why are we doing this screening test?
We are measuring oxygen levels in newborn babies to try to identify the small number of babies who have an unidentified serious heart defect. We know that these babies usually appear healthy at birth but often have lower oxygen levels. The test identifies babies with lower oxygen levels so we can check these babies very carefully to identify a possible heart defect before the baby becomes unwell.

Babies with other conditions such as breathing problems, infections and circulation problems can have low oxygen levels too and the test may also identify these babies.

What if my baby passes the test?
If your baby’s oxygen levels are within normal limits, no further pulse oximetry testing is necessary at this time. Your baby will stay with you at home. They should still have their routine newborn examination (“baby check”).

Passing the test is very reassuring but does not always mean that there is no problem. A small proportion of babies (about 1 in every 8,000) who pass the test may still have a serious heart problem- therefore it is still important for us to carry out the routine physical examination of your newborn. If you are concerned about your baby’s wellness at anytime, it is important that you contact your midwife, GP or NHS24.
What if my baby does not pass the test?

There are 2 reasons why your baby might not pass the test:

1. Their oxygen levels are low (less than 90%). This happens in about 3 babies in every 1000 (0.3%). These babies are deemed ‘test positive’. You will need to come to hospital urgently (e.g. in the same hour). Some babies may need to travel to hospital by ambulance. Your midwife will advise you if this is the case. In the hospital you will be seen by a doctor or specialist nurse straight away. [See “What will happen if my baby is Test Positive?” section below].

2. More commonly, a baby will not pass the test first time but their oxygen levels will only be slightly low. This happens in about 3 in every 100 (3%) babies. This might cause some worry for you, but we know that the lungs of some babies adapt to being born at a slower rate than others – this is normal and these babies are healthy. Because we know this, if your baby’s oxygen levels are only slightly reduced in the first test and the baby appears healthy, then the test will be repeated a second time about 1 to 2 hours later. This is called a Retest. You will probably need to come to hospital for the retest, as we are unable to guarantee that your midwife will be able to come back to perform the retest 1 – 2 hours later.

What if my baby has a retest?

9 out of 10 babies will pass the Retest and these babies will be treated as healthy (Test Negative). It is important that your baby’s oxygen levels are re-checked to make sure they are normal. You will need to come to hospital for the saturations to be re-checked. Those babies who do not pass the Retest (Test Positive) will be seen by a doctor or specialist nurse used to looking after babies. [See “What will happen if my baby is Test Positive?” section below].

What will happen if my baby is Test Positive?

About 7 in every 1000 babies tested (0.7%) will be Test Positive (either after the first or second test). Your baby will need to stay in hospital for further tests and you will be able to stay in hospital with them. Most babies will have blood tests and x-rays to try to find out the cause of the low oxygen levels. Some babies may also have an ultrasound of their heart called an ‘echocardiogram’ or ‘echo’ for short.

Of the babies admitted to hospital with a positive test:

- 2 in every 10 will be healthy – these babies are usually in the Neonatal Unit (NNU) for less than 12 hours
- 7 in 10 will have a breathing problem or infection and most will benefit from the test by early diagnosis and treatment of a potentially serious illness
- 1 in 10 will have a heart problem and they will benefit from early diagnosis and treatment.
Pulse Oximetry Screening Business Card
Aide Memoir

Front:

NEWBORN PULSE OXIMETRY SCREENING

Save a life

Back:

Newborn Pulse Oximetry Screening Pathway

- Measure Pre-ductal & Post Ductal Saturations
- Either reading 90 – 94%
- Either reading less than 90%
- Either reading or difference of 3%
- Clinical assessment (within 30 mins)
- NNJ ADMISSION to investigate cause
Pulse oximetry Screening Training Powerpoint

Pulse oximetry screening training for staff in NHS Lothian

Dr Vix Monnelly, on behalf of the POS implementation team

From 19th April 2021, all babies born in NHS Lothian, whether at home or in hospital, will be offered routine pulse oximetry screening within the first 24 hours of life.

This training session will cover
- Background to Pulse Oximetry Screening
- How to perform Pulse Oximetry Screening
- How to use the pathway
- Documentation (TRAK)

Background to Pulse Oximetry Screening

Pulse oximetry screening (POS) identifies babies with low saturations...
... and can identify babies with serious undiagnosed heart condition BEFORE they become unwell
- Earlier identification = better outcomes
- Earlier identification = less risk of death

What does POS involve?
- POS involves taking 2 saturation measurements (1st) in the right hand and (2nd) either foot of a baby
- These readings should be 95% or higher AND should be similar (within 2% of each other)

POS will be embedded into routine postnatal care of newborns

The professional responsible for the care of the baby is best placed to perform POS
POS will be embedded into routine postnatal care of newborns

<table>
<thead>
<tr>
<th>Location of baby</th>
<th>Person responsible for performing POS</th>
<th>Time of POS (age of baby in hours)</th>
</tr>
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<tbody>
<tr>
<td>Hospital (PPHN, IN, birth centre)</td>
<td>Midwife or Midwifery care assistant</td>
<td>Within first 24 hours, performed at first postnatal visit</td>
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<tr>
<td>Home (planned home birth)</td>
<td>Community midwife</td>
<td>Prior to RNLU discharge</td>
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<tr>
<td>Hospital (Neonatal unit)</td>
<td>Neonatal team</td>
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How to perform POS:
- Use Masimo Rad-G
- Wipe before and after use
- Use foam wrap
  - "Like to baby"
- Ensure 'spiky' waveform before recording saturations

Please do not throw away the re-usable sensor!

What next?....

Assign to a pathway:
- Green
- Amber
- Red

Green pathway — most babies!

Both readings 95% or above AND difference of 2% or less
- Negative screen
  - Green pathway

Amber pathway

- ~3% of all babies screened
- Amber pathway identifies babies with borderline saturations OR
- Differential saturations (difference 3% or more)
- All babies on the amber pathway need clinical assessment in a hospital and a repeat POS
Repeat screen pathway

There are only 2 options: Green or Red

Red pathway ~0.8% of all babies screened

- ~65 – 70 babies a year across Lothian
- Red pathway identifies:
  - New babies with LOH saturations
  - Babies with persistently borderline
    (differential saturations
- All babies on the red pathway need urgent clinical assessment in hospital
- Need investigation to find cause

Clinical assessment

- All amber and red pathway babies
- If in hospital:
  - Alert neonatal or paediatric practitioner
- If at home (home birth):
  - Attend RHCP/EMD (Edinburgh)
  - or
  - Sph Children’s ward (West Lothian)

Document on TRAK

- Select baby on TRAK
- Under baby questionnaires, select Pulse Oximetry Screening

TRAK – Initial screen

TRAK – Repeat screen

- Mostly same information as initial screen
- Pathway – only 2 options
- Must click the ‘Add’ button
Finally

1 in 8000 babies will have a normal pulse oximetry screen and will have a congenital heart problem.

Which pathway?

Summary: Pulse Oximetry Screening

- Measure pre-ductal and post-ductal sats in **all babies**
- 6 hours after birth, if born in hospital
- Within 24 hours of birth if home birth
- Most babies on red pathway will have an underlying reason
- This screening will save lives of babies in NHS Lothian

Newborn pulse oximetry screening

Save a life
Pulse oximetry Screening for NNU staff

Powerpoint

Background
- Critical congenital heart defects (CCHD) affects 2 – 2.5 per 1000 live births (Jaukt 2012)
- CCHD leading cause of infant death
- Antenatal detection rates range from 33 – 62% (MOD 2016 report)
- Clinical examination does not identify many babies with CCHD
- Up to 1/3 babies with CCHD sent home with undiagnosed heart condition

Background – Role of pulse oximetry screening (POS)
- Pulse oximetry screening (POS) is acceptable, simple, non-invasive and highly specific for CCHD
- Can also detect other (important) pathology
- Cost-effective within NHS setting
- Reduces cardiac-related mortality
- More than 50% units in UK are undertaking POS (Jaukt et al 2020)

POS – benefits versus harms

Benefits of Introducing Pulse Oximetry Screening
- Timely identification of infants with duct-dependent CCHD (with reduced mortality)
- Avoidance of life-threatening cardiac decompensation at home
- Identification of other non-cardiac causes of hypoxia benefiting from treatment
- Avoiding additional costs from more serious complications

Harms of Introducing Pulse Oximetry Screening
- Parental anxiety
- Separation of babies from mothers
- Unnecessary admission to neonatal unit
- Additional testing, costs of tests / treatments / transportation

*Datos de la imagen: Data from DHF, 2020

Benefits vs harms of POS
For every 10,000 babies screened:
- 9960 (99.6%) will neither be harmed nor benefit
- 15 (0.15%) will definitely benefit
- 13 (0.13%) benefit will outweigh the harm
- 9 (0.1%) will be harmed (delayed discharge and/or unnecessary investigations)

[Based on UK data from Pulse Oximetry Study, 2014]
**Who?**

<table>
<thead>
<tr>
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<td>Prior to NNU discharge</td>
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**What next?....**

Assign to a pathway:
- Green
- Amber
- Red

**The POS pathway**

- Traffic light system
- Assign a baby to one of 3 pathways:
  - Green
  - Amber
  - Red
- Amber and Red require a clinical review

**Green pathway – most babies!**

- Initial Pulse Oximetry Screen (Pre and Post-Ductal Measurements)
  - Both readings 95% or above AND difference of 3% or less
    - Negative screen, GREEN PATHWAY

**Amber pathway**

- 3% of all babies screened
- Amber pathway identifies babies with borderline saturations OR
- Differential saturations (difference 3% or more)
- ALL babies on the amber pathway need Critical assessment in a hospital and a repeat POS
Repeat screen pathway

Red pathway ~0.8% of all babies screened

Clinical assessment

Red pathway babies...

Red pathway differential diagnosis

Red pathway babies...Initial NNU management?

Dr Vix Monnelly

Date: March 2021, v1.1
Summary: Pulse Oximetry Screening

- Measure pre-ductal and post-ductal sats in all babies
- 6 hours after birth, if born in hospital
- Within 24 hours of birth if home birth
- Most babies on red pathway will have an underlying reason
- This screening will save lives of babies in NHS Lothian
Pulse oximetry Screening Training Log
[Insert Ward]

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<th>Date</th>
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