

PULSE OXIMETRY SCREENING NNU GUIDELINE

This guideline is intended for use by neonatal unit staff. There is a full and comprehensive maternity POS guideline intended for use by midwifery staff.

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1. BACKGROUND

Pulse oximetry screening (POS) in newborns is an effective, non-invasive and acceptable method of detecting critical congenital heart disease (CCHD) before symptoms or signs arise¹. Early identification and treatment of newborn babies with CCHD before acute cardiovascular collapse improves patient outcomes and reduces mortality².

POS also identifies other important conditions in babies which present with low saturations or a difference in saturations, like infection, pneumothorax and pulmonary hypertension. Many of these conditions benefit from earlier identification as they also require treatment^{1,3}.

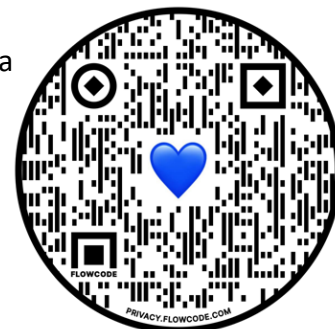
All babies in NHS Lothian 34 weeks gestation or above will be eligible for routine pulse oximetry screening. The majority of babies having POS will be managed by midwives and midwifery care assistants and will have normal saturations (Green pathway). The neonatal team will only be involved in a minority of babies who are on the amber and red pathways.

- All newborn infants 34 weeks' gestation or above should be offered POS
 - For babies in hospital, POS is performed at 6 hours of life by the midwife looking after the baby
 - For babies born at home, POS is performed within the first 24 hours of life, at the first community midwife check after birth.
- Any baby admitted to the neonatal unit, if 34 weeks' gestation or above, will have a POS performed prior to discharge from the neonatal unit (see section 7)
- No infant should leave hospital without having pulse oximetry screening, unless the parents have declined screening after a fully informed discussion and their reasons are fully documented in the medical notes.

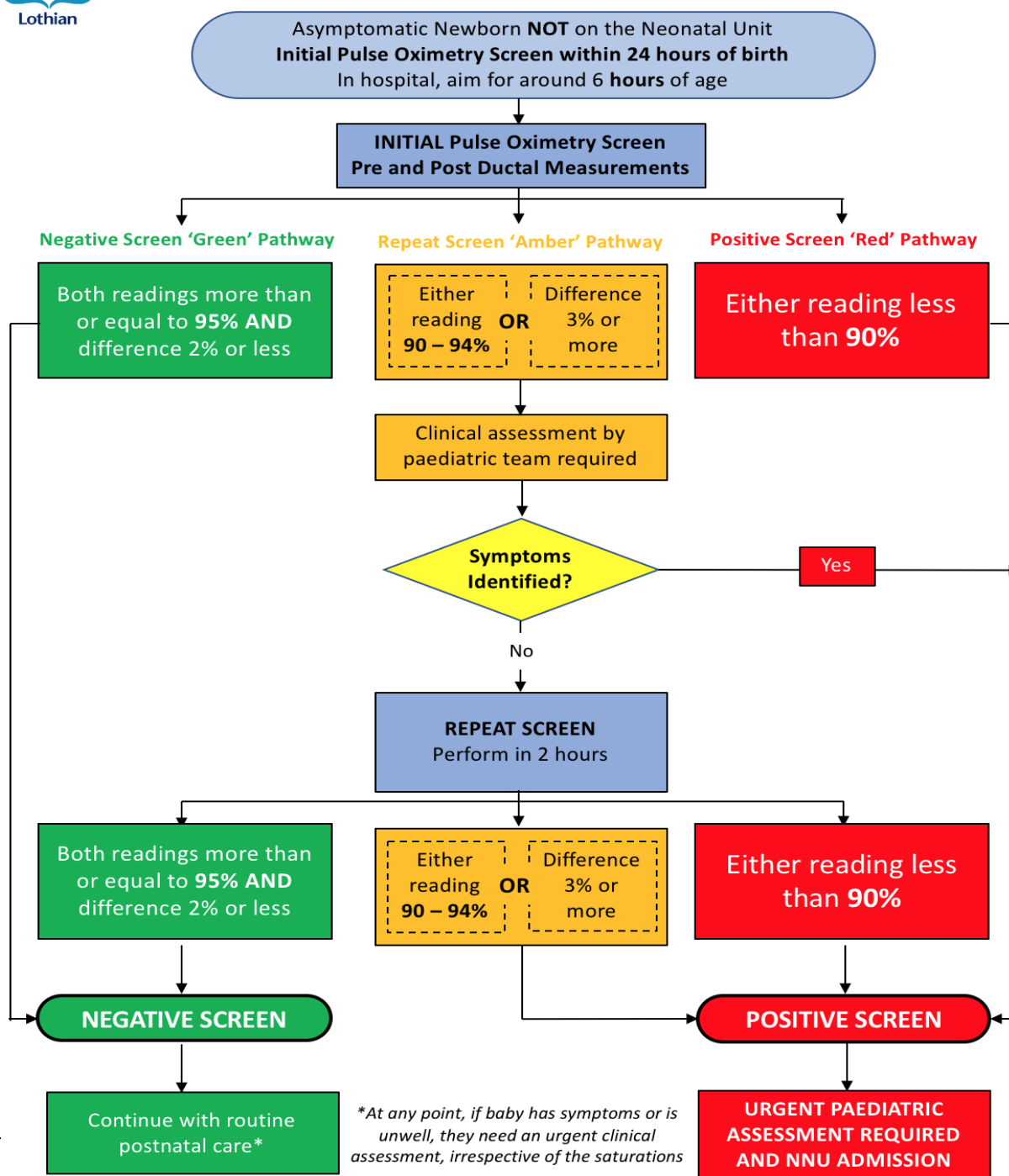
- The attending neonatal consultant should be made aware of any baby on the red pathway.

2. PATHWAY FOR POS

- POS involves measurement of pre and post ductal saturations with a Masimo Rad G handheld pulse oximeter.
- Scan this QR code to take you to a short video on how to use the Masimo Rad G pulse oximeter.
- The sensor is REUSABLE. Please do not discard.
- The blue foam wrap is single patient use.



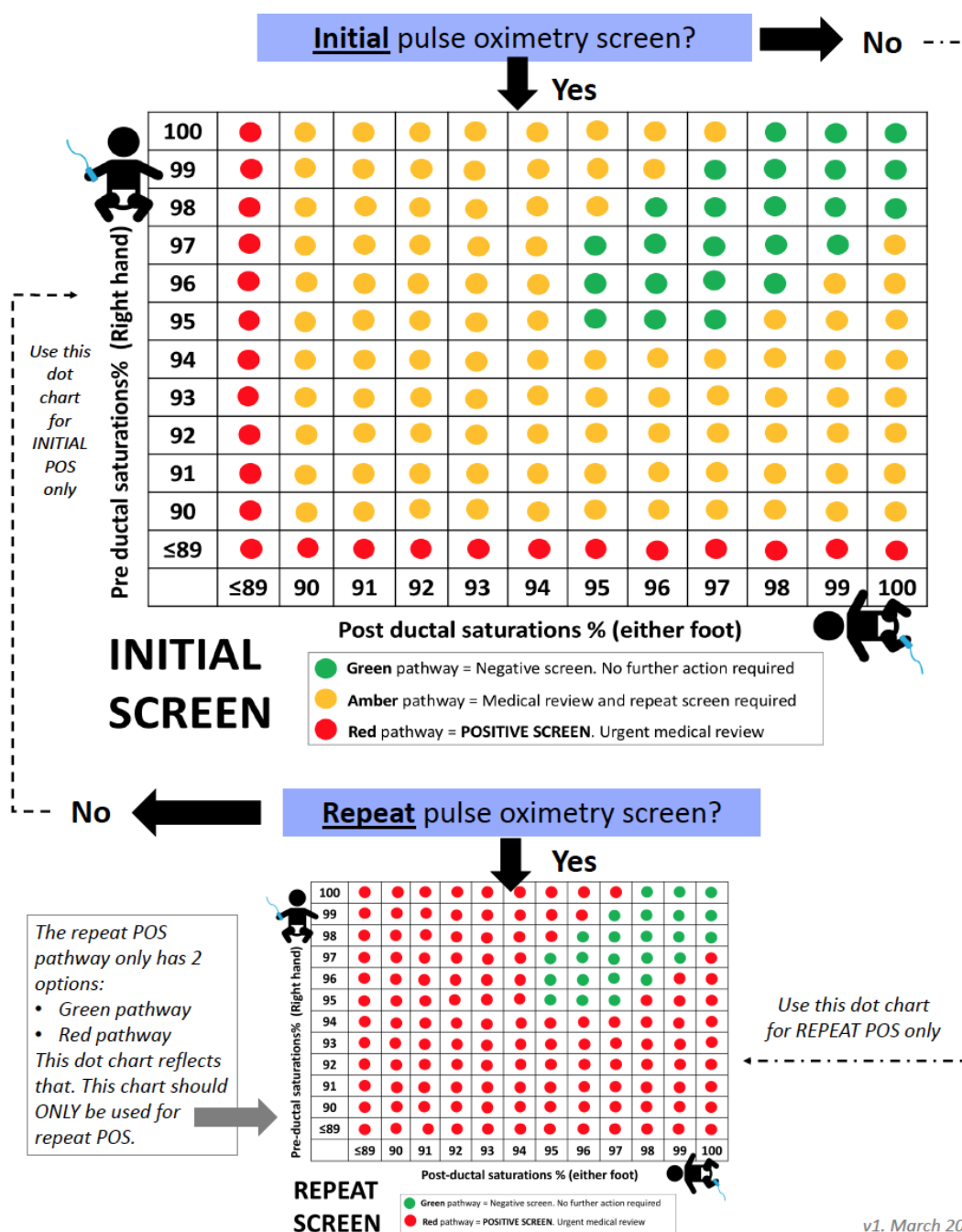
NHS Lothian Newborn Pulse Oximetry Screening Pathway



- Based on the pre and post-ductal values and the difference between the 2 measurements, the baby is assigned to a colour pathway. See flowchart above.
 - Green (= negative screen). Most babies will fall into this category.
 - Amber (needs a clinical review and, if well, a repeat POS in 2 hours)
 - Red (= positive screen, needs urgent clinical review and NNU admission)
- The dot chart below can help allocate a baby to the correct pathway based on their saturations



Newborn Pulse Oximetry Screening



3. CIRCUMSTANCES WARRANTING NEONATAL REVIEW IN HOSPITAL

There are 3 circumstances in hospital when neonatal staff will be contacted:

- i. Baby on amber pathway
- ii. Baby on red pathway
- iii. Parent declining POS

(i) **Baby on the Amber pathway:**

- 3% of all babies will have borderline or differential saturations (difference 3% or more)
- 90% will have normalised when re-checked 2 hours later
- **All amber pathway babies must have a clinical review**, ideally within 30 minutes or sooner if acuity permits.
- It is not necessary to re-check the saturations at this review, unless there are clinical concerns about the baby.
- If the baby is clinically well and there are no risk factors for infection, the baby can remain with mum and have a repeat POS 2 hours after the initial screen.
- The baby does not need to go on a NEWS chart **if they are well**, as this will commit them to being in hospital for 12 hours of normal NEWS.
- If there are clinical concerns or signs suggestive of an underlying pathology (eg, tachypnoea, grunting and borderline saturations) the baby should be admitted to NNU for further monitoring and investigations as deemed appropriate (See section below on initial NNU investigation and management)

Either reading 90 – 94%	OR	Difference 3% or more
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After a repeat POS, there are only 2 potential pathways: Green or red. If the saturations remain borderline or differential, the baby cannot be allocated the amber pathway again. This automatically diverts to the red pathway (see below).

(ii) **Baby on the Red Pathway (positive screen):**

- Approximately 0.8% of all babies having POS will screen positive
- There are 2 ways that a baby is assigned to the red pathway:
 - Saturations <90% at POS
 - Amber pathway (borderline or differential saturations) on initial **and** repeat POS
- All babies on the red pathway must have **an urgent clinical review**, within 10 minutes unless a life-threatening emergency warrants your presence.
- **It is necessary to re-check the saturations at this review** because babies on the red pathway are automatically admitted to NNU for continuous saturation monitoring and for consideration of further investigations, therefore before separating mum and baby it is important to re-confirm the low saturations (See section below on initial NNU investigation and management)
- **The consultant should be informed of any baby on the red pathway who is admitted to NNU**

Either reading less than 90%

(iii) Parent declining POS

Pulse oximetry screening is opt out, non-invasive and quick, but every parent has the right to decline screening tests. If the parent expresses reservations or declines, it is important to understand why:

- Attend and discuss in a timely manner
- Ensure that they have received and read the parent information leaflet
- Use this when discussing with parents
- Be explicit about the benefits, the non-invasive nature of the test and the reassurance that a negative screen provides
- If parents still decline, document fully in notes of baby

4. BABIES ADMITTED TO THE NEONATAL UNIT

(a) DIFFERENTIAL DIAGNOSES

Most of the babies admitted with low saturations via the pulse oximetry pathway will not have an underlying cardiac cause for this. More than half will have a respiratory cause, around 20% will have a transitional circulation and only 6-8% will have a cardiac cause. The investigations and management of the baby reflect the wide differential diagnosis.

In studies assessing POS, the most common alternative diagnoses were:

- Congenital pneumonia
- Meconium aspiration
- PPHN
- Pneumothorax
- Culture negative sepsis
- GBS sepsis
- Cardiac causes
 - Transposition of the great arteries (TGA)
 - Critical pulmonary stenosis
 - Interrupted aortic arch (IAA)
 - Total anomalous pulmonary venous connection (TAPVC)
 - Hypoplastic left heart syndrome (HLHS)

Because the benefit from early detection of CCHD is predominantly the prevention of acute collapse and death, the following lesions are key targets for pulse oximetry screening:

- Hypoplastic left heart / single ventricle
- Pulmonary atresia with intact ventricular septum
- TGA
- IAA
- TAPVC
- Coarctation of the aorta
- Aortic stenosis
- Tetralogy of Fallot

(b) INITIAL NNU INVESTIGATIONS AND MANAGEMENT

The investigations should be aimed at excluding or confirming the above, but there is no definitive list of investigations, and these should be tailored to the individual case, taking into consideration whether the saturations are borderline or low, and the trend (ie, are they improving) over time.

It would be reasonable to consider a blood gas and a CXR in babies with low saturations as a minimum, and to assess their response to oxygen.

A baby on the red pathway does not automatically warrant an echocardiogram.

When to request an echocardiogram?

As the majority of babies admitted via the red pathway of POS will not have cardiac pathology, routine echocardiography in all babies is not advised. Requesting of an echocardiogram should be a consultant decision.

There are 2 scenarios when an echocardiogram is advised:

1. Baby has no other reasonable explanation for their hypoxia (after investigation)
2. There are other indicators suggestive of cardiac lesion, such as a murmur or poor perfusion/weak pulses

The urgency with which the echocardiogram is performed is dependent on whether the baby is well or unwell.

The well baby who needs an echo:

- Mon – Fri during working hours, request an echo on TRAK and phone cardiology secretaries to let them know that NNU has requested an echo [See Cardiology Referrals pathway below]. Ensure the request details include details of the pulse oximetry screen, as well as any other important clinical information.
- For babies at SCRH – an echocardiogram will aim to be performed within 24 hours of the request Mon-Fri during normal working hours
- For babies at SJH – at present there is not the capacity to perform echocardiograms in SJH therefore the baby will require transfer to SCRH for an echo. The echo should be requested on trak as above by the team at SJH, who also should liaise with the cardiology department regarding timing of the echo [insert ext no] and the transport arranged to ensure the baby is in Edinburgh before the allocated time of the echo.
- At a weekend, there is not the capacity to perform routine echocardiography. A request should be made for an echo on trak and the cardiology department phoned on Monday morning at 9am [insert ext no]. **The baby should not be sent home before they have had their echo, unless explicitly discussed with a cardiology consultant.**
- If there are clinical concerns about the baby at any time, discuss with the consultant cardiologist on call.

The unwell baby who needs an echo:

If the baby is becoming critically unwell with suspected congenital heart disease there should be urgent discussion with on call cardiology, consideration of a prostin infusion and potential transfer to Glasgow for further assessment.

(c) PERFORMING POS ON THE NNU

Any baby who is admitted to NNU before 6 hours of life will not have their POS performed. It should be performed very shortly before discharge from NNU. This includes all babies who were born very preterm, as well as those who are late preterm or term who are admitted from labour ward or before 6 hours of life.

It is the responsibility of the neonatal unit medical team, usually the HDU team as this is where most babies who are being discharged will be, to ensure POS has been undertaken for EVERY baby prior to discharge.

Use the Masimo Rad G hand held pulse oximeter to perform the POS. Do not use the Nellcor saturation monitors, as the calibration is different and in order to ensure data is comparable for all POS the same oximeter should be used.

The equipment is reusable, with the exception of the blue foam wrap, which is single patient use. The blue side goes to the baby.

Measure pre and post ductal saturations and assign the baby to a pathway (green, amber or red). See the QR code earlier in the guideline

Document the POS in the baby's TRAK record, under baby questionnaires. There is a questionnaire entitled 'Pulse Oximetry Screening'. There is a free text box; please type 'baby on NNU' or other brief information to explain why the POS did not occur at the usual time. This will be helpful for audit purposes.

5. HOMEBIRTH PATHWAY AND PULSE OXIMETRY SCREENING

POS occurs within the first 24 hours after birth in babies born at home by planned home birth.

There are 3 possible outcomes of POS at home, and 2 involve returning to hospital:

- Green pathway- most babies - no further saturation screening required.
- Amber pathway – a repeat screen is required in 2 hours.
 - In Edinburgh the baby should attend the **Emergency Department** at the Royal Hospital for Children and Young People on the Little France campus
 - In West Lothian the baby should attend **Children's ward at St John's Hospital, Livingstone.**
- Red pathway – The family need to attend hospital for further assessment, monitoring and investigations
 - **If the baby is unwell, advise to call 999 ambulance**

- In Edinburgh the baby should attend the **Emergency Department** at the Royal Hospital for Children and Young People on the Little France campus
 - On arrival, the baby will be triaged by ED, assessed and a decision made about the most appropriate location for admission. This will usually be admission to the neonatal unit. You may be called about these babies. If in doubt, escalate to the neonatal consultant.
- In West Lothian the baby should attend Children's ward at St John's Hospital, Livingstone.
 - On arrival, the baby will be seen and assessed by a paediatric doctor or ANNP.

6. REFERENCES:

1. Ewer AK, Middleton LJ, Furnston AT, et al. Pulse oximetry screening for congenital heart defects in newborn infants (PulseOx): a test accuracy study. *Lancet*. 2011;378(9793):785-794. doi:10.1016/S0140-6736(11)60753-8
2. Abouk R, Grosse SD, Ailes EC, Oster ME. Association of US State Implementation of Newborn Screening Policies for Critical Congenital Heart Disease With Early Infant Cardiac Deaths [published correction appears in JAMA. 2018 Sep 25;320(12):1288]. *JAMA*. 2017;318(21):2111-2118. doi:10.1001/jama.2017.17627
3. Singh A, Rasiyah SV, Ewer AK. The impact of routine pre-discharge pulse oximetry screening in a regional neonatal unit. *Arch Dis Child Fetal Neonatal Ed*. 2014;99(4):F297-F302. doi:10.1136/archdischild-2013-305657
4. Cawsey MJ, Noble S, Cross-Sudworth F, Ewer AK. Feasibility of pulse oximetry screening for critical congenital heart defects in homebirths. *Arch Dis Child Fetal Neonatal Ed*. 2016 Jul;101(4):F349-51.