Introduction and who guideline applies to:

This guideline is aimed at all Health care professionals involved in the care of newborn infants at Leicester Royal Infirmary, Leicester General Hospital and in the community.

Key Points

- Eligible infants for screening are 34\textsuperscript{+0} weeks gestation and above who are not on the neonatal unit continuously monitored
- Pre and post ductal saturation should be obtained within 4-8 hours using the suitable monitor available
- The flow chart in appendix 1 should be used to determine which babies have a negative screen, need a repeat screen and which babies have a positive screen
- Those babies with positive screens should have a medical assessment by the neonatal team (middle-grade doctor or senior ANNP) to determine further management.
- Babies will be admitted to NNU if after clinical assessment it is felt they require interventions due to low saturations.

Related UHL documents

<table>
<thead>
<tr>
<th>Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwives performing the Newborn Infant Physical Examination</td>
</tr>
<tr>
<td>Postnatal Ward Handbook</td>
</tr>
<tr>
<td>Guidelines for Performing the Full Examination of the Newborn</td>
</tr>
</tbody>
</table>
Background

Hypoxaemia is a common presentation of congenital heart disease. Pulse oximetry screening can improve detection rate of CCHD before discharge. In addition, other non-cardiac conditions can also be detected. This has been demonstrated in randomized controlled trials (grade A).

Many hospitals and some countries have already introduced routine screening. At the moment this is not part of the newborn screening programme in the UK. At present precise screening pathways vary but all show benefit.

Aims

This guideline is written to provide clear guidance on eligibility criteria for this screening tool, how to perform oximetry and interpret results.

The guideline also clarifies the documentation and logistics surrounding this screening test.

Guidance:

Process of performing pulse-oximetry:

Please refer to the flow chart in Appendix 1a in conjunction with the following section:

Screening consent

Verbal consent needs to be obtained when the test is performed.

Which babies are eligible for this screening test?

All babies that are born at 34+0 weeks gestation and above (unless baby admitted to NNU and requiring continuous monitoring eg congenital anomaly)

Where should the check be performed?

The default for performing the check should be the delivery suite or birthing centre for hospital births. Checks can also be performed on the postnatal wards or neonatal unit.

Who will be responsible for doing the test?

In most circumstances midwives and nursery nurses will perform the test.

For home-births and the Melton birth centre midwives will perform the test.

However other trained health-care professionals e.g. doctors, advanced neonatal nurse practitioners, neonatal nurses may perform the test if required.
When should the check be performed?

The check should be performed within the first 8 hours of life prior to discharge from delivery suite or the birthing centre. It is ideal to perform this between 2-4 hours of age to allow for normal adaptation and reduce the incidence of false positive test result due to slow adaptation.

Pulse oximetry should be carried out on all babies transferring into SMBC ward who are < 72 hours of age and have not had a NIPE or pulse ox at birth that were born within UHL only, including Home births.

All babies should have a pulse-oximetry screening check done before discharge from delivery suite.

Exclusions

The presence of the following risk factors will exclude the baby from newborn pulse oximetry screening:

- Presence of a suspected cardiac lesion from the fetal anomaly scans
- Suspected or confirmed congenital infection
- Dysmorphism in the newborn suggestive of chromosomal or genetic aberrations particularly the trisomies
- Abnormal cardiovascular screen as part of the newborn physical examination (note we routinely perform the newborn examination after 24 hours in UHL at present).
- Symptomatic newborn with a history of tachypnea, cyanosis and or poor feeding at the time of doing the initial pulse-oximetry screen (this does **not** apply to repeat screening).

Special circumstances:

NNU

Most admissions to the neonatal unit will not be eligible for pulse-oximetry screening because:

- Prematurity <34+0 weeks gestation
- Medical need for continuous saturation monitoring (see exclusion criteria)

As a failsafe when the newborn check is done and entered onto the baby notes/NIPEsmart system the clinician should check that the pulse-oximetry screening status is correct.
Community and St Mary’s Birth Centre (refer to Appendix 1b)

Due to logistics of attending the home birth the pulse-oximetry screen should be done by the midwife attending the delivery just prior to departing. Pulse oximetry screens should be carried out at St Mary’s Birth centre between 4 and 8 hours of age.

If a repeat is needed or if the pulse-oximetry check is abnormal then arrangements will need to be made to transfer the mother and infant to delivery suite at Leicester Royal Infirmary by ambulance.

If the pulse-oximetry check is abnormal the midwife on delivery suite will contact the neonatal unit to make them aware, unless the baby is symptomatic in which case the transferring midwife should pre-warn the neonatal and delivery suite teams of the baby’s condition in preparation for arrival at the hospital.

This should be the course of action regardless of whether the mother is booked outside of UHL as the pulse-oximetry screen cannot differentiate between cardiac and respiratory disease and immediate assessment is more important.

The midwife will need to record the pulse-oximetry results on the sticker provided and inserted on the baby results page of the postnatal booklet and also on to the NIPE smart system.

How is the check performed?

Equipment:

The test must be performed using the suitable monitor available. The monitors are located in the following areas:

<table>
<thead>
<tr>
<th>Leicester Royal Infirmary:</th>
<th>Leicester General Hospital</th>
<th>Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal Unit – 2 monitors (includes 1 contingency)</td>
<td>Neonatal unit -2 monitors (includes 1 contingency)</td>
<td>Melton Birth Centre: 1 monitor</td>
</tr>
<tr>
<td>Delivery Suite – 1 monitor</td>
<td>Ward 30 – 1 monitor</td>
<td>Community teams: 6 monitors (one for each homebirth pack)</td>
</tr>
<tr>
<td>Birth Centre – 1 monitor</td>
<td>Delivery suite – 1 monitor</td>
<td></td>
</tr>
<tr>
<td>Ward 5 – 1 monitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ward 6 – 1 monitor</td>
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</tbody>
</table>

The cable is NOT SINGLE PATIENT USE and so must not be disposed of but cleaned with a alcohol/Distel wipe before and after use.

There are spare cables on NNU, Melton Birth Centre and the community office.
Where to check saturations:

Saturations should be checked pre and post ductally in all babies. The result of both tests should be recorded on the NIPEsmart system or in the notes and the Performa completed as a failsafe.

<table>
<thead>
<tr>
<th>Preductal Saturations: check on the right hand or wrist</th>
<th>Post ductal saturations: any other limb e.g. foot</th>
</tr>
</thead>
</table>

Whilst conducting the pulse-ox test the midwife or nursery nurses should report any worrying features that may indicate cardiovascular or respiratory disease to the on call Neonatal practitioner. Examples of these are:

- Cyanosis or dusky appearance
- Tachypnoea (rapid breathing)
- Shallow breathing
- Grunting
- Recession
- Pallor
- Sweaty
- Floppy

If they have a concern then a midwife needs to be informed who should review the infant so that appropriate and timely medical assessment and intervention take place.
Interpreting the saturations results

<table>
<thead>
<tr>
<th>Negative Screen</th>
<th>Asymptomatic infant</th>
<th>No action needed routine newborn care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Both readings more than or equal to <strong>95%</strong> and difference less than OR equal to <strong>2%</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requires a repeat screen</th>
<th>Asymptomatic infant</th>
<th>Repeat screen in two hours time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Either reading 90-94% inclusive or difference &gt;2% (i.e. 3% and above)</td>
<td>Make sure baby is adequately warm and feet not cold.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Positive Screen</th>
<th>Symptomatic infant</th>
<th>Urgent medical assessment by middle-grade doctor, senior ANNP or consultant.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At any time saturations &lt;90% (either reading)</td>
<td>Admission to the neonatal unit for further assessment and management guided by clinical condition and differential diagnosis.</td>
</tr>
<tr>
<td></td>
<td>Repeat screen: Either reading 90-94% inclusive or difference &gt;2% (i.e. 3% and above)</td>
<td></td>
</tr>
</tbody>
</table>

Documentation of the pulse-oximetry result

Results should be written on the baby check page of the postnatal booklet as well as in the red book.

All pulse oximetry results must be recorded in the NIPEsmart system. Appendix 3 shows screen-shots from this system. Training on the use of this will be provided.

If for any reason a baby is not eligible for pulse-oximetry screening or consent is not given then this needs to be documented on NIPEsmart.

**Please ensure the pulse oximetry is completed and entered onto NIPE before the baby is transferred to the ward (2-4 hrs of age). If the baby requires a repeat test this MUST be handed over to the midwife in charge and documented clearly in the notes.**

To facilitate use of the algorithms in appendix 1 and to act as a failsafe to identify positive results that will require further data collection use the sticker described above.
References

Ewer et al: Pulse oximetry screening for congenital heart defects in newborn infants

Mahle et al: role of pulse-oximetry in Examining Newborns for Congenital Heart
Disease: A scientific statement from the American Heart Association and American

Thangaratinam S et al. Pulse-oximetry screening for critical congenital heart defects
in asymptomatic newborn babies: a systematic review and metanalysis. Lancet
2012; 379: 2459-64.

Claire Evans, Jill Walker. Public Health England NIPE: Newborn Pulse Oximetry
Screening Pilot Implementation feasibility study. Information for Trusts. December
2015.

Evidence Criteria

<table>
<thead>
<tr>
<th>Evidence according to RCPCH</th>
<th></th>
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<tbody>
<tr>
<td>Grade A</td>
<td>At least 1 randomised controlled trial addressing specific recommendation</td>
</tr>
<tr>
<td>Grade B</td>
<td>Well conducted clinical trials but no randomised trial on specific topic</td>
</tr>
<tr>
<td>Grade C</td>
<td>Expert committee report or opinions</td>
</tr>
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</table>

Audit Standards

All eligible babies should have a pulse-oximetry screen done in the first 8 hours of life and
the result recorded on NIPE smart

Any baby with a positive screen (red) should be reviewed within 1 hour by one of the
neonatal team

Guideline development:

<table>
<thead>
<tr>
<th>New Guideline</th>
<th>May 2015</th>
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<tbody>
<tr>
<td>Neonatal and Maternity Governance</td>
<td>May 2015</td>
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<tr>
<td>Neonatal Guidelines Meeting</td>
<td>February 2018</td>
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<tr>
<td>Neonatal and Maternity Governance (ratified)</td>
<td>March 2018</td>
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<tr>
<td>Neonatal Guidelines Meeting</td>
<td>January 2021</td>
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<td>Neonatal Governance Meeting (ratified)</td>
<td>March 2021</td>
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DEVELOPMENT AND APPROVAL RECORD FOR THIS DOCUMENT

<table>
<thead>
<tr>
<th>Author / Lead Officer:</th>
<th>J Behrsin</th>
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</thead>
<tbody>
<tr>
<td>Job Title:</td>
<td>Consultant Neonatologist</td>
</tr>
<tr>
<td>Reviewed by:</td>
<td>J Behrsin</td>
</tr>
<tr>
<td>Approved by:</td>
<td>Maternity Service and Neonatal Governance Group</td>
</tr>
<tr>
<td>Date Approved:</td>
<td>21.03.18</td>
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REVIEW RECORD

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<tr>
<th>Date</th>
<th>Issue Number</th>
<th>Reviewed By</th>
<th>Description Of Changes (If Any)</th>
</tr>
</thead>
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<tr>
<td>Feb 2018</td>
<td>V2</td>
<td>J Behrsin</td>
<td>No longer a pilot so references to that taken out</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Timing of check changed to allow for earlier testing</td>
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</table>

DISTRIBUTION RECORD:

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<th>Name</th>
<th>Dept</th>
<th>Received</th>
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<tbody>
<tr>
<td>6.15</td>
<td>All Midwives, Obstetricians and Neonatologists</td>
<td>Maternity</td>
<td></td>
</tr>
<tr>
<td>March 2018</td>
<td>All Midwives, Obstetricians and Neonatologists</td>
<td>Maternity</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1a: Newborn Pulse Oximetry Flowchart (inpatient births)

Newborn ≥34+0 weeks gestation*
Pre-discharge pulse oximetry screen: normally between 2-4 hours of age

* For infants requiring admission to NNU only those that would otherwise not be continuously monitored are included in this process

Pulse Oximetry Screen: Pre and Post Ductal Measurements

Negative Screen Pathway
Both readings more than or equal to 95% and difference less than OR equal to 2%

Repeat Screen Pathway
Either reading 90% - 94% OR difference greater than 2%

Positive Screen Pathway
Either reading less than 90% OR Symptomatic

Clinical assessment by health care professional required

Symptoms Identified?

Yes

No
REPEAT SCREEN
Perform in 2 hours

Symptoms Identified?

Yes

No

NEGATIVE SCREEN
Continue with Healthy Child Programme

POSITIVE SCREEN
URGENT PAEDIATRIC MEDICAL ASSESSMENT REQUIRED

For infants requiring admission to NNU only those that would otherwise not be continuously monitored are included in this process.

Must be completed before the baby leaves delivery suite or birthing centre.

NB: Paper copies of guidelines may not represent the most recent version (see Badgernet or Sharepoint).
Appendix 1b: Newborn Pulse Oximetry Screening Flowchart for Community / SMBC

Newborn ≥34+0 weeks gestation*
Pre-discharge pulse oximetry screen: normally between 4-8 hours of age

Pulse Oximetry Screen: Pre and Post Ductal Measurements

Negative Screen Pathway
Both readings more than or equal to 95% and difference less than OR equal to 2%

Repeat Screen Pathway
Either reading 90% - 94% Or difference greater than 2%

Clinical assessment by midwife performing the screen

Positive Screen Pathway
Either reading less than 90% OR Symptomatic

Symptoms Identified?
Yes
Admit to LRI by ambulance

No

Admit baby to LRI by ambulance
Plan REPEAT SCREEN
Perform in 2 hours by delivery suite midwife

Both readings more than or equal to 95% and difference less than OR equal to 2%

NEGATIVE SCREEN
Continue with Healthy Child Programme

Either reading 90% - 94% Or difference greater than 2%

POSITIVE SCREEN
URGENT PAEDIATRIC MEDICAL ASSESSMENT REQUIRED

Either reading less than 90% OR Symptomatic

Must be completed before leaving the home – ideally at 4-8 hours

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Appendix 3: NIPEsmart pulse-ox data input