

Local Guideline



John Hunter
Children's Hospital
CHILDREN, YOUNG PEOPLE AND FAMILIES



Health
Hunter New England
Local Health District

PAEDIATRIC OXIMETRY & PATIENT SafetyNet™ SYSTEM

Sites where Local Guideline applies	JHCH Wards
This Local Guideline applies to:	
Adults	No
Children up to 16 years	Yes
Neonates – less than 29 days	No
Target audience	Nursing and medical staff caring for paediatric patients
Description	This guideline outlines the equipment and procedure used for patient safety net monitoring.

[Go to Guideline](#)

Keywords	Masimo, monitoring, oximetry, radical, pager, Patient SafetyNet,
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Replaces existing document?	Yes
Registration number and dates of superseded documents	6.8, November 2011

Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:

See Reference Section on page 16

Local Guideline note	This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s require mandatory compliance. If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients health record.
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PURPOSE AND RISKS

Patient safety can be compromised with incorrect oximetry probe use or conditions that can affect monitoring accuracy (eg. movement, light).

The Masimo Patient SafetyNet™ is designed to notify nursing staff by pager when the monitored patient observations change. This reduces the risk of a deteriorating patient going unnoticed and ensures they receive appropriate timely care.

These risks are minimised by:

1. Utilising the correct probe/equipment for patient age/condition
2. Minimising sources of artifact
3. Having monitored patients admitted to patient SafetyNet™ and understanding use of pager

Risk Category: Clinical Care & Patient Safety

GLOSSARY

Acronym or Term	Definition
FiO2	Fraction of inspired oxygen (%)
PO2	Partial Pressure of Oxygen
PaO2	Partial pressure of oxygen in arterial blood
SaO2	Oxygen saturation
SPOC	Standard Paediatric Observation Chart

GUIDELINE

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

CONSIDERATIONS

Pulse oximetry is a useful non-invasive method of monitoring cardiorespiratory status. It measures the arterial oxygen saturation of haemoglobin, i.e. the average amount of oxygen bound to each haemoglobin molecule, as well as the heart rate. It does have limitations however, and must not be used to replace astute clinical observation.

PRECAUTIONS

- Pulse oximeters are calibrated using data compiled by exposing healthy volunteers to decreasing FiO₂ to yield SaO₂ ranging from 100 to 75%. However values under 70% were not clinically obtained and therefore are considered unreliable¹.
- Readings may be affected by sources of artefact such as hypoperfusion, coldness of the extremity, movement, shivering or poor probe placement.
- Probe sites must be changed at least fourth hourly to prevent compression and burns from the probe.
- Oximetry does not measure PaO₂, overreliance on pulse oximetry can delay detection of clinically significant hypoxemia. A large decrease in PO₂ will not produce a significant fall in SaO₂ until the steeper portion of the oxygen hemoglobin dissociation curve is encountered at a PO₂ of approximately 60 to 70 mmHg (NORMAL 80 – 100 mmHg). This is particularly important in patients receiving supplemental oxygen. As an example, a fall in PaO₂ in such a patient from 140 to 65 mmHg would be required before a significant decrease in oxygen saturation is detected.









NOTE:



- Acceptable oximetry parameters can be different for every child depending on underlying conditions e.g. chronic lung disease, cystic fibrosis cardiac conditions.
- Oxygen saturations should remain above 95% unless altered calling criteria is documented on the standard Paediatric observation chart (SPOC).

OUTCOMES

- Early detection of hypoxia.
- Prevent complications from incorrect use of equipment.
- Prevent inaccurate readings by correct placement of probe.
- Equipment kept clean and in good order.
- Infection prevention and control implemented.

EQUIPMENT TABLE

Weight of Child	Product and Code	Description
	Masimo™ Radical – 7	
	Masimo™ Rad - 57	
	Masimo™ Rad - 87	
	RD rainbow® 20-pin Patient Cables MD20 - 1.5 – 1.5ft length MD20 – 05 – 5ft length MD20 – 12 – 12ft length	
<3kg or > 40kg 3-20kg	Rainbow® Adhesive Sensors Single Patient Use RD SET Neo -Neonatal/Adult RD SET Inf – Infant	
Weight 10 kg – 50 kg	Paediatric Rainbow® Direct Connect Reusable Sensor - 3ft cable (Rad 57) rainbow® DCI-dc3 Sensor	
Weight: >30kg	Adult Rainbow® Direct Connect Reusable Sensor - 3ft cable (Rad 57) rainbow® DCI-dc3 Sensor	
10 - 50 kg	RD SET DCI-P Pediatric SpO ₂ Reusable Sensor	

<p>Weight: >30kg</p>	<p>Recommended monitoring site: ear lobe or pinna.</p> <p>Reusable sensors must be repositioned every 4 hours.</p> <p>RD SET TC-I</p>	
	<p>If Masimo™ sensor adhesive requires further support to ensure sensor remains in place use 2.5 cm Elastoplast™.</p> <p>Only use a single layer of Elastoplast™ to reinforce Masimo™ sensor adhesive. Do not stretch tape during application.</p>	

PROCEDURE – Continuous Oximetry

1. Choose the appropriate probe for size/age of the child. See equipment table above. Single use probes provide probe choice guidelines on the packaging. Reusable probes may be used for intermittent readings and should be placed on the digit or hand/foot until a consistent waveform and subsequent reading is obtained.
2. Explain procedure to the parent and child.
3. Remove any nail polish, and ensure probe site is clean and dry.
4. When selecting a sensor site priority should be given to an extremity free of blood pressure cuff or intra-vascular infusion line.
5. Apply the sensor to a finger or toe, or side of the foot/hand, making sure that the opposing light sensors are properly aligned i.e. directly opposite each other. Note that disposable sensors should not be used on the side of the foot unless used on a baby under 3 kg.
6. Plug in the oximeter and turn it on.
7. Plug sensor into lead.



8. Under no circumstances is the lead to the oximeter to be removed from the pulse oximeter machine as they are very expensive and easily lost.
9. Ensure the waveform is uniform and smooth. See Interpretation of Waveforms below. Readings are not considered accurate during periods of movement or poor signal, which will appear as an erratic waveform.
10. The sensor site should be changed every 4 hours to ensure that the skin integrity is not compromised by pressure or heat from the probe.
11. Adhesive sensors may be reused on the same patient if the emitter and detector windows are clear and the adhesive sticks to the skin. Masimo™ sensors may have the adhesive rejuvenated by wiping with 70% isopropyl alcohol and allow drying before reapplication.
12. Particularly active children may require further support to ensure sensor remains in place. 2.5 cm Elastoplast™ may be used in a single layer. Do not stretch during application and observe sensor site hourly for blood flow restriction.
13. Do not use rigid tapes such as leucoplast™ or micropore™. A small piece of hyperfix™ may be applied distally to the sensor lead for anchorage.
14. Record oximetry reading hourly or as clinically indicated.
15. If continuous monitoring is required, ensure the alarm parameters are set appropriately for the age and condition of the child.
16. Clean the equipment with large alcohol wipes after use.

PROCEDURE: Intermittent Oximetry

1. As above but turn off oximeter between readings unless continuous monitoring is clinically required.
2. For non-disposable probes, clean the probe and lead with alcohol wipes between patients to ensure infection prevention. For patients at high risk of infection, use only disposable probes.
3. Wrap and store the lead and probe carefully to prevent breakage. Plug the oximeter in to charge whilst not in use, ensuring there are no trip hazards.

NURSING RESPONSE TO SAO₂ READINGS

An oximetry reading:

- 95% in room air is desirable unless an altered calling criterion is documented on the SPOC.
- 90-95% indicates a need for increased observation and report to the nurse in charge as per SPOC zone protocol.
- < 90% requires a rapid response as per SPOC zone protocol.

The response to the SaO₂ reading is dependent:

- On the child's normal baseline observation. Children with chronic illnesses such as congenital heart disease, chronic obstructive pulmonary disease, pulmonary hypertension, cystic fibrosis and broncho-pulmonary dysplasia should be assessed individually as their oxygen requirements may be different. An altered calling criterion will need to be documented on the SPOC if a child's stable baseline observations are outside the accepted values.
- On work of breathing and heart rate and not just a decrease in SaO₂ alone.

SOURCES OF ARTIFACT ⁴

Improper probe placement

Due to partial detachment of the probe, light from only one of the two light-emitting diodes may pass through the tissue, resulting in either a falsely elevated or depressed reading.

A similar problem can occur in infants and small children, because the small size of fingers or other tissues may result in differences in the path length of one light source compared to that of the other. These problems can be minimized by ensuring that the probe is properly attached with the light sources and detectors opposite each other.

The choice of probe site

Placement of the sensor on the same extremity as a blood pressure cuff or arterial line can cause erroneous readings and should be avoided. The choice of probe site may also affect accuracy; finger probes appear more accurate than forehead, nose, or earlobe probes during low perfusion states.

Motion artefact

A poor signal-to-noise ratio will cause signal artefact. This most commonly results from motion due to shivering, seizure activity, and pressure on the sensor.

Ambient light

Intense daylight, fluorescent, incandescent, xenon, and infrared light sources have been reported to cause inaccurate pulse oximetry readings.

Electromagnetic radiation

Radio frequency emissions from magnetic resonance imaging (MRI) scanners may interfere with pulse oximetry. In addition, second- and third-degree burns beneath pulse oximeter probes have been reported in patients undergoing MRI studies [13].

Other sources of electromagnetic radiation, such as cellular phones and electrocautery devices, can also interfere with pulse oximeters.

Hypoperfusion

Pulse oximetry readings can be falsely low due to signal failure in the setting of hemodynamic instability or poor limb perfusion.

Hypothermia

Hypothermia may interfere with pulse oximetry because of the associated peripheral vasoconstriction.

Anemia

Oximetry readings may be affected by profoundly decreased hemoglobin concentration.

Skin pigmentation

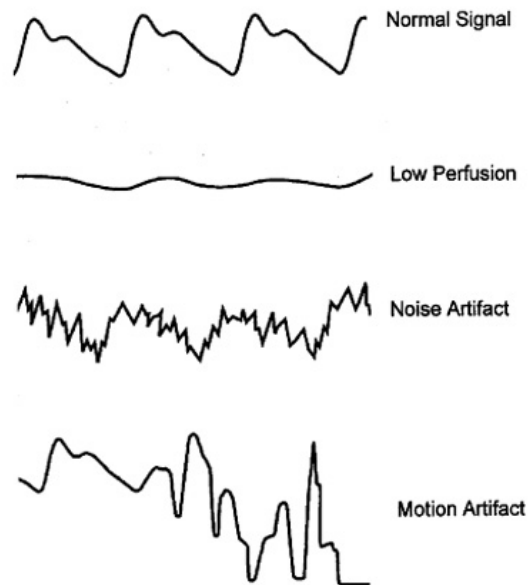
In theory, skin pigmentation should have no effect, since it should absorb at a constant level and be subtracted out as part of the background in the SaO₂ calculation. This includes altered pigmentation due to hyperbilirubinemia.

However, an increased incidence of both signal detection errors and readings erroneously elevated by 4 percent or more have been described in African- American patients. In addition, erroneously low pulse oximetry readings were reported in a child with bronze baby syndrome.

Nail polish

The use of nail polish can potentially affect pulse oximeter readings.

INTERPRETATION OF WAVEFORMS⁵



PATIENT SAFETYNET™ SYSTEM

DESCRIPTION

Patient SafetyNet™ (PSN) is a monitoring system that notifies the patient's nurse by pager if and when their patient's observations have moved outside the set parameters. The nurse will have the patient's pulse and saturation displayed on page if outside set parameters or alert nurse if there is no signal available. The page will only be alarmed if observations are outside parameters for more than a 5 second period.

INDICATIONS FOR USE

Any patient who requires monitoring should be admitted to the system and Patient SafetyNet™ used.

Depending on patient circumstances the Patient SafetyNet™ monitoring may be withheld at the discretion of the individual nurse in consultation with the team leader for that shift.

Team Leader will discuss with team at beginning of shift which patients will go onto Patient SafetyNet™.

The individual nurse will be responsible to ensure their patients are admitted to the system and are allocated to relevant nurse's page for that shift. Review of allocation should also be done throughout the shift. (E.g. new admissions, changes to existing patient conditions)

ADMISSIONS OF PATIENT TO THE PATIENT SAFETYNET™ SYSTEM

Use Designated Patient SafetyNet™ computer for patient admission.

- Click on bed number of patient on computer screen
- Click on Admit Patient



- Put patient **Bed Number** in **Label** field (e.g. BED12)
- Put name of patient in appropriate fields
- Put **MRN** in **Room** Field
- Select Alarm limits as per “Between the Flags”
- Observation Sheets (if number outside these parameters please discuss with patient’s doctor and document in medical record)
- Select Approve.
- Select appropriate pager that nurse will be carrying in Primary Pager Field
- Select Team Leader pager as Secondary Page
- Click on Admit Patient

Patient Information	
Label:	RM 100
First:	John
Last:	Smith
M.I.:	
Room:	100



- The box for that patient should now be highlighted in

Green


PAGER USE

- At the beginning of each shift it is the individual nurse’s responsibility to ensure that their pager is working.
- To check pager is working the nurse can disconnect the patient cable at saturation probe end and wait 5 seconds. The page should alert nurse with a Beep or Vibration and display “No Transmission”.
- If this does not work the nurse should check with the team leader that the patient is allocated correctly. If the pager is allocated correctly the pager may be incorrectly set for no alert. Go to pager instructions to check setting and then re-check by disconnecting patient again.
- If the system is still not working call Biomedical Engineering for assistance.
- If unable to use system and unable to get help, revert to using oximeter as stand-alone unit.


ATTENDING TO PAGER ALERT

- When the patient is successfully admitted onto the Patient SafetyNet™ system and an alert is sent to the pager, the allocated nurse **must go to the bedside** and push **Alarm Silence** on the Masimo™ machine **and assess patient**.
- If the patient alarm is not silenced the Patient SafetyNet™ system will continue to send alerts to the nurse's pager.
- After two un-responded alerts the system will escalate the alert and the team leader pager will be alerted.

TO SET ALERT

- Press  twice to enter Alert Menu







- Use arrows < > to move along vibrate/ alert option
- Press  to confirm alert choice



TO VIEW / READ MESSAGE



- Press  to read message

TO CLEAR / DELETE SINGLE MESSAGE

- Open message – Press 
- Press 
- Scroll across to “delete message”
- Press 
- Press  to confirm

TO CLEAR / DELETE ALL MESSAGES:

All messages must be viewed in order to bulk delete.

- Scroll across to “delete all”
- Press 
- Press  to confirm.

DISCHARGE OF PATIENT FROM PATIENT SAFETYNET™ SYSTEM

Select patient box on Masimo™ screen. Click on Discharge Button.



MEAL BREAKS OR LEAVING UNIT

- The nurse will need to hand Pager to an appropriate nurse staying on the unit when leaving patient area.
- On completion of shift pagers should be exchanged with relevant staff member on next shift or placed back on PSN computer at Nurse's Station.

OXIMETER MALFUNCTION OR NOT TRANSMITTING

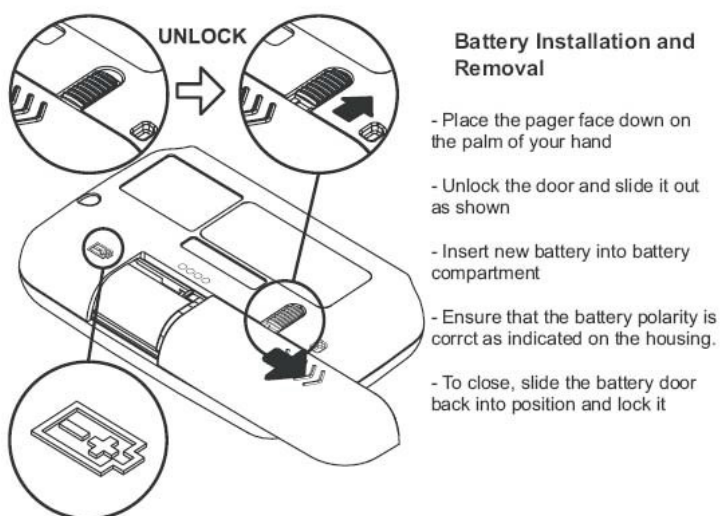
See NUM if available.

Otherwise Notify Biomedical engineering on ext 13144 ASAP

UPDATES OR SOFTWARE ISSUES FOR PATIENT SAFETYNET™

Updates will be attended to by Masimo™ Australia via remote access after discussion with NUM. If required, further education will be provided.

BATTERY INSTALLATION AND REMOVAL



Staff Preparation

It is mandatory for staff to follow relevant: “Five moments of hand hygiene”, infection control, moving safely/safe manual handling, documentation practices and to use HAIDET for patient/carer communication: **H**and hygiene **A**cknowledge, **I**ntroduce, **D**uration, **E**xplanation, **T**hank you or closing comment.

IMPLEMENTATION, MONITORING COMPLIANCE AND AUDIT

- This document will be available on Policy, Procedure and Guideline Directory.
- New staff to wards will be educated re Patient Safety Net system
- There is no need to audit this practice due to not being invasive.
- Related IIMS will be investigated.

REFERENCES

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- Massimo. (2008). Patient SafetyNet supplemental alarm system: Operator's manual. V. 1.5.0.0. Irvine CA, USA.
- [Massimo Radical 7 Pulse Oximeter Product Information](#)

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FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.