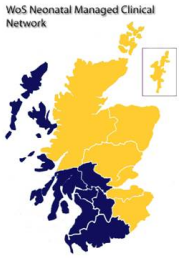
MCN for Neonatology

West of Scotland

Neonatal Guideline



Saturation Limits

This guideline is applicable to all medical and nursing staff caring for neonates in the West of Scotland.

Introduction
Oxygen is a highly reactive molecule which is essential for life but potentially toxic in excess in preterm infants. The development of Chronic Lung Disease of Prematurity (CLD) and Retinopathy of Prematurity (ROP) are probably influenced by multiple factors but there is evidence that oxygen exposure may play a part in both, as well as in the causation of other disorders in the preterm infant[1,2].

Clinical and methodological concerns
Oxygen saturation guidance in neonatal medicine is complicated by the fact that targets for preterm infants need to be different from those for more mature infants. In the early weeks after birth, avoidance of hyperoxia in preterm infants is important. By the time those same infants are approaching term and beyond, concerns about hyperoxia are diminishing while avoiding the potentially harmful effects of hypoxia on pulmonary hypertension, growth and neurodevelopment are becoming increasingly important.

Interpretation of published data is complicated by variable technical specifications utilised by different oximeters in various studies, especially signal averaging times[3]. Oximeter settings employed for specific research studies may have been modified for the purposes of clinical trials.

The partial pressure of oxygen (pO_2) in arterial blood reflects the molecular concentration of oxygen in tissues and is probably the optimal measure of oxygenation when attempting to reduce the risk of ROP. The flattening of the oxy-haemoglobin dissociation curve at higher saturation values means that pulse oximetry has limitations when detecting hyperoxia. These aspects were taken into account by the committee preparing the National Institute for Health and Care Excellence (NICE) guideline on respiratory care for babies born preterm and agreed that 'SpO_2 should remain the first-line method for continuous monitoring of oxygen saturation levels in preterm babies because of its widespread availability and non-invasive nature.' They acknowledged that 'arterial sampling of partial pressure of oxygen remained the 'gold standard' but is not always possible and can never be continuous.'[4].

Supporting evidence
The NeoProm Collaboration meta-analysis of 5 prospective trials of similar design compared targeting a higher SpO_2 of 91-95% as opposed to a target of 85-89%. They found no difference in the primary composite outcome of death or major disability, but there were modest reductions in the secondary outcomes of death and necrotising enterocolitis when targeting a higher SpO_2 of 91-95% as opposed to a target of 85-89%. There was an increase in the incidence of ROP in the higher target group[5].

NICE has effectively endorsed the NeoProm findings and recommended a single standard for preterm infants, that 'preterm babies have a target oxygen saturation of 91% to 95%

after stabilisation."[4] They intend this guidance to apply to infants below 32 weeks gestation.

NICE commented in their rationale for this guidance that "there was evidence that higher target oxygen saturation levels reduce mortality. Although a higher target is associated with an increase in retinopathy of prematurity and an increased risk of BPD, the evidence suggested no increase in severe visual impairment at 18 months, and the reduction in mortality was considered to offset the increased risk of BPD. The committee was aware that target oxygen levels (up to 97%) may be more beneficial but there was no evidence to support this, so they made a recommendation for research."

NICE do not offer guidance on oxygen saturation targets for more mature preterm or term infants and they do not indicate when the above guidance ceases to apply, for example at corrected gestational ages approaching term, or beyond hospital discharge.

There are no randomised controlled trials (RCTs) to guide the optimal saturation targets for term infants or for ex-preterm infants at, or beyond a corrected gestational age of term. The European Respiratory Society guideline on long-term management of children with bronchopulmonary dysplasia[6] notes the lack of evidence and continues to recommend the same target saturation above 90%, consistent with the higher target range in the NeoProm review and the NICE guidelines. The American Thoracic Society Guidance for patients with BPD recommends oxygen for patients with an oxygen saturation less than or equal to 93% for 5% of the time[7]. Both documents note the low quality of evidence supporting this advice, although the ATS guidelines describes its recommendation as "strong recommendation, very low quality evidence."

It should be noted that if ex-preterm infants present after discharge with acute respiratory illness at RHC, clinical teams will prescribe oxygen if the SpO_2 is below 94%.

Clinical guidance

	Infants at risk of ROP < 1500g **or** <32 weeks	**Infants at term or a CGA of term and those discharged from ROP screening**
Target Range	91-95%	Local practice
Limits to be set on monitor	89-95%	Local practice

In practice, excessively frequent oximeter alarms make nursing care difficult so clinical teams may choose to set the alarms outside the recommended range and this is reflected in the advice in this guideline

Note that these recommended ranges are not applicable to infants with cyanotic congenital heart disease or persistent pulmonary hypertension of the newborn. Please refer to appropriate guidelines for the care of these infants.

Given the lack of robust evidence, it is difficult to offer guidance on saturation targets at more mature gestational ages and this is left to the preference of individual units. A target saturation to allow consistent clinical management within individual units is desirable.

Infants with significant pulmonary hypertension may require higher oxygen saturation targets to be set on an individual basis.

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Document Properties

Document Title
WoS_OxygenSaturation_Neonates

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Implementation / Review Dates
Implementation 14/01/10 Recent review: 24/4/24 Next Review: 24/4/27