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**Project:** Oxygen saturation targeting in premature infants and respiratory outcome

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**Introduction:**
The neonatal intensive care unit (NICU) admits unwell new-born infants at a range of different gestations.

Infants born at less than 30 weeks gestation have severely underdeveloped lungs. Many premature infants require respiratory support and oxygen therapy. Oxygen therapy is a delicate balancing act. Too little oxygen is associated with an increased risk of death or brain damage. Too much oxygen is associated with blindness and chronic lung disease.

The level of oxygen in the blood stream is estimated by oxygen saturation monitors. There has been considerable debate regarding optimal target saturation levels for premature infants.

The Christchurch neonatal intensive care unit has clear policy guidelines for nursing and medical staff around oxygen saturation targets. A new protocol has recently been introduced in line with national guidelines. However, even when these oxygen saturation targets are set, premature infants can spend up to 50% outside of this target.

**Aim:**
1. Assess oxygen saturations achieved for the first 72 hours of life in premature infants born <30 weeks gestation and analyse for associations between achieved oxygen saturations and respiratory outcomes
2. Audit alarm settings on oxygen saturation monitors
3. Survey bedside nursing opinion of oxygen saturation targeting and monitoring
4. Formulate recommendations on how the unit may improve oxygen saturation targeting.

**Method:**
Oxygen saturation data was downloaded for the first 72 hours of life for 51 infants, born March 2013-April 2015, at less than 30 weeks gestation from an established cohort.

This data was then analysed with respect to a number of respiratory outcomes of which the primary outcome was chronic lung disease (CLD) – defined as a need for oxygen or respiratory support at the equivalent age of 36 weeks of gestation. The audit of oxygen saturation alarm settings was conducted June-October 2015.

A total of 504 monitor alarm settings were collected. These were compared to unit protocol. Furthermore, a survey of bedside nursing staff was completed.

This survey looked into nursing opinion of oxygen saturation targeting and our ability to maintain infants in their target ranges.

**Results:**
Oxygen Saturation Targeting in First 72 hours. Infants who developed CLD were smaller at birth ($p$ 0.007), required a longer period of respiratory support ($p < 0.0001$) and required more hours of oxygen than those who did not develop CLD ($p < 0.0001$). Furthermore, infants who developed CLD spent significantly more time with low oxygen saturations in the first 72 hours of life ($p < 0.05$, for time spent below 90%, 88% and 85% oxygen saturation).

When in oxygen, infants who developed chronic lung disease spent more time in their target range and less time with higher than recommended oxygen saturations. Percentage time in spent target range in air, number of desaturation events was not significantly different.

Oxygen Saturation Alarm Limits. All infants had one or both oxygen saturation alarm settings incorrect 45% of the time. Infants on oxygen had one or both incorrect 54.4% of the time and had higher overall rates of incorrect alarm limits set than those in air in all gestational age groups, except >36 weeks.

The upper alarm setting was incorrect more frequently in those infants on oxygen. The lower alarm setting was incorrect more frequently in infants who were in air. Infants <28 weeks gestation on oxygen had the upper alarm limit set incorrectly at 100%, 43.6% of the time.

Nursing Opinion and Practice Survey. The survey had a response rate of 56% from nursing staff. When asked how feasible it was to maintain infants born <30 weeks gestation with the old guidelines, 32% said it was feasible for only some infants and 29% said it was feasible for few infants. The overwhelming majority (70%) said that this was due to infants of this gestation having inherently unstable physiology. The number that could recall both the alarm settings correctly was higher in the new protocol (30.1% old protocol v. 50.6% new protocol).

Most nurses reported oxygen saturation targets and alarm settings are not discussed routinely during nursing handover and the medical ward rounds.

**Conclusion:**
Our results showed CLD infants spend significantly more time with low oxygen saturations in the first 72 hours of life. However, the absolute percentage of time spent in these low saturations was less than 2%. Leading us to wonder if although this is statistically significant, does it actually have clinical implications?

Surprisingly infants who developed chronic lung disease spent a higher percentage of time in their target range and a lower percentage of time with higher than recommended oxygen saturations when in oxygen. These results need to be interpreted with caution due to the small sample size. The audit results have shown that our compliance with protocol is lower than expected but in line with other published studies.

A number of reasons for this were highlighted in the survey in particular the challenge for nursing staff to manage infants who have swinging saturation levels. However, such a high

percentage of infants on oxygen having their upper alarm at 100% indicates that changes in how oxygen saturations are approached are required.

The new protocol has been shown to be easier to recall, potentially leading to increased compliance. Further improvements could include further education on the importance of oxygen saturation targeting and a review of time in target and alarm settings during nursing handover and medical ward rounds.

In the future once changes have been implemented, an additional audit would be beneficial to illustrate if compliance has improved.