Increased Alarm Frequency after Implementation of Narrower Oxygen Saturation Targets in the NICU: a New Challenge for Alarm Safety

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Background: As part of our involvement in the VON’s iNICQ initiative on alarm safety, we created a multidisciplinary task force (comprised of neonatologist, nurse practitioners, nurses, nurse managers, respiratory therapists, information technologists and former NICU parents) to monitor oxygen therapy, ensure its safe use, and to improve the quality of our clinical care. Simultaneously, we also implemented new oxygen saturation (SpO₂) guidelines based on new evidence that suggests that narrow and accurate oxygen saturation ranges may maximize the amount of time babies spend in optimal saturation ranges and prevent serious neonatal morbidities, such as ROP and mortality.

Aim: To evaluate whether narrow (85%-95%) oxygen saturation guidelines alter the number of total alarm episodes (per day and/or per patient); and to assess how these changes may impact patient safety. This study was performed over two months’ time in our 54-bed, Level III community NICU that features modified private rooms.

Methods: Prior to implementing the new alarm limits, the bedside nurses were inserviced on the changes and educated on the clinical importance of adhering to the narrow oxygen saturation ranges. At the end of each 12-hour shift we recorded the total number of alarms, the NICU census and the number of intensive infants in our unit, defined as the number of infants requiring a lower Patient to nurse ratio (1:1 or 2:1). The monitors in the NICU (Philips IntelliVue MP70) are connected to an Emergin system which transmits patient alarms to the nurses’ Voceras. Alarms per day is recorded by the Emergin system.

Measures: We measured the number of total daily alarms before and after the implementation of new oxygen saturation guidelines which narrowed SpO₂ parameters from 82%-95% to 85%-95%. Total alarm data is presented as total alarms/day and also total alarms/day/patient, which takes into consideration our daily NICU census.

Results: We found that there was a significant increase in the total number of alarms/day after the implementation of the narrower saturation guideline policy, 372 ± 80 alarms/day vs. 671 ± 198 alarms/day, respectively (p < 0.001, Mann-Whitney test). This is a 55% increase in the average number of alarms/day. Before the change in SpO₂ guidelines, there were 14.1 ± 0.82 daily alarms per patient, calculated over 20 days (daily census: 26.8 ± 0.9). After implementation the number increased to 19.6 ± 0.80
daily alarms/patient, calculated over 30 days (daily census: 33.7 ± 0.9). See figures below.

**Discussion:** As predicted, the number of total alarms and the number of alarms/patient increased when the desired SpO₂ target range was narrowed. Our data suggest that the narrower oxygen saturation target range may be associated with an increase in the number of alarms in many NICUs who implement these guidelines. We hypothesize that this outcome may lead to an increased risk for developing “alarm fatigue” and may augment levels of frustration among health care professionals. Strategies to track the number of alarms and evaluate for “alarm fatigue” should be included in the oxygen saturation protocols currently being developed. Furthermore, upon implementation of the narrower SpO₂ guidelines, we observed that the total number of alarms/day/patient no longer correlated with the number of infants considered “intensive” receiving respiratory support in our unit. This data implies that the increase in alarm volume is not only related to more alarms from just these infants, but an increase in the number of alarms from all NICU patients. We plan to conduct follow-up studies to better understand this result, and to devise ways to implement bedside interventions to improve adherence to the oxygen saturation limits. We will also continue to use this data to identify patients who clinicians feel are doing “well” but may require an intervention to reduce the number of alarms. Currently, histograms are only available on our portable monitors, but we have plans to upgrade our current system to include that capability.

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