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## Major reduction in alarm frequency with a new pulse oximeter

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Sir: Intensive care monitor alarms are a major burden on both nurses and patients. Between 44 and 63 % of alarms are caused by pulse oximeters, with 94 % of these being non-significant [1, 2]. Pulse oximeters should, therefore, be the prime target when aiming to reduce alarm rates in the intensive care unit (ICU). Recently, a new technique for measuring pulse oximeter saturation (SpO<sub>2</sub>) has been developed (Masimo SET (signal extraction technology), Masimo, Irvine, Calif., USA). This technique uses mathematical manipulation of the pulse oximeter's red and infrared light absorbance to identify and subtract the noise components associated with these signals [3].

We compared the alarm frequency of the new Masimo SET with that of a conventional pulse oximeter in 17 unsedated pre-term infants [median birthweight 1000 g (range 360–2400), age at study 11 days (3–151)]. All infants had two SpO<sub>2</sub> sensors attached, one to each foot, and the signals from both sensors were measured using two SpO<sub>2</sub> modules fitted into the housing of a standard modular intensive care monitoring system (Kolormon, Kontron, Watford, UK). One module contained conventional (Kontron 7278), the other the new oximeter technology (Kontron/Masimo SET). Averaging times were 16 beats for the conventional and 8 s for the new pulse oximeter. SpO<sub>2</sub> alarms in both modules were set at 85 and 100 %. Heart rate alarms were set at 90 and 210 bpm, respectively. Pulse rate alarms were muted. The occurrence of an alarm was recorded by the monitoring system, printed and analysed for periods of approximately 24 h per infant. The frequency and cause(s) of alarms were analysed separately for each patient and expressed as per hour of monitoring.

During a total duration of documented monitoring of 329 h, 2241 alarms occurred. Of these, 1884 (84 %) were caused by the conventional pulse oximeter, 136 (6 %) by the new oximeter and 221 (10 %) by the electrocardiographic (ECG) monitor. Median frequency of occurrence of alarms per hour of monitoring was 4.0 (2.6–15.0) for the conventional pulse oximeter, 0.3

(0.0–1.9) for the new pulse oximeter and 0.6 (0.1–1.6) for the ECG monitor ( $p < 0.0001$ , new vs conventional oximeter).

Thus, the new technology oximeter assessed in this study generated 93 % fewer alarms than the conventional pulse oximeter with which it was compared, suggesting a major improvement in the differentiation between signal and noise during SpO<sub>2</sub> measurements in patients with frequent body movements. The low alarm rate of the new pulse oximeter investigated in this study may, theoretically, have been the result of a higher number of hypoxaemic episodes that were not detected by this device. Clinically, however, there was nothing to suggest this. Moreover, previous studies comparing the performance of the Masimo SET during hypoxaemia and simulated motion showed that it was even more reliable in the detection of hypoxaemia than a conventional pulse oximeter [3, 4]. We are, therefore, reasonably certain that the reduced overall alarm rate observed with the new oximeter investigated in the current study was not due to a higher proportion of undetected hypoxaemic episodes.

Environmental noise such as that produced by intensive care monitor alarms can be associated with adverse events, e.g. bradycardias, episodes of hypoxaemia and sleep deprivation [5, 6]. Frequent monitor alarms also pose considerable stress on the staff working in an intensive care unit (ICU). They may, moreover, result in potential delays in response; in a recent study, 67 % of monitor alarms in the neonatal ICU were ignored [1]. Desensitisation of nursing staff to alarms carries the risk of intervention in a severe event occurring too late. It can best be avoided by reducing the number of false alarms. The results of this study are encouraging, as they suggest that incorporation of advanced pulse oximeter technology into current ICU monitoring systems will result in a considerable reduction in the frequency of alarms and may thereby contribute to better patient care as well as to a less noisy atmosphere on these units.

## References

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