

## Pulse Oximeters' Reliability in Detecting Hypoxemia and Bradycardia: Comparison Between a Conventional and Two New Generation Oximeters

Bohnhorst B, Peter CS, Poets CF. *Critical Care Medicine* 2000;28(5):1565-1568

### Introduction

“Pulse oximeters are increasingly used for patient monitoring; however, they are traditionally very prone to movement artifact. Newly developed instruments have lower false alarm rates. We wanted to know whether this is achieved at the expense of an increased proportion of false negative alarms such as missed or delayed identification of hypoxemia and/or bradycardia.”

### Methods

Seventeen, unsedated, preterm (median GA 25 wk, range 24-30) and spontaneously breathing infants were monitored for ECG heart rate (HR), transcutaneous PO<sub>2</sub> (P<sub>Tc</sub>O<sub>2</sub>), and pulse oximeter saturation (SpO<sub>2</sub>) and pulse rate (PR) from three devices (the Nellcor N-200 and N-3000, and a Masimo SET Pulse Oximeter). The monitored data was captured and later analyzed for hypoxic (P<sub>Tc</sub>O<sub>2</sub> < 40 mm Hg) and bradycardic (heart rate < 80 bpm for > 5 seconds) events. Hypoxemia was considered identified by a pulse oximeter if the SpO<sub>2</sub> fell to < 85% within 2 minutes of the hypoxic criterion for P<sub>Tc</sub>O<sub>2</sub>. Bradycardia was considered correctly identified by a pulse oximeter if the PR fell to < 80 bpm within 2 minutes of the fall in HR.

### Results

There were 185 hypoxic and 54 bradycardic events found in 220 hours of monitoring. The N-200 alarmed for all hypoxic events but gave values of zero for 15 (8%); the N200 missed 14 bradycardias. “The Nellcor OXISMART missed 5% of hypoxic episodes and two thirds of bradycardias. In contrast, the Masimo SET oximeter detected both hypoxemia and bradycardia equally or even more reliably than a conventional pulse oximeter.”

	Masimo SET	Nellcor Oxismart	Nellcor N-200
<b>True Hypoxemias Missed</b>	2 (1%)	14 (7%)	15 (8%)
Missed due to Pulse Oximeter Zero Out	1	4	15
<b>True Bradycardias Missed</b>	4 (7%)	37 (69%)	17 (31%)

### Authors' Discussion and Conclusions

The Nellcor OXISMART SpO<sub>2</sub> high failure rate is “likely related to its method of ‘freezing in’ the last apparently reliable value for up to 1 min. during artifact conditions; if the memory is then updated by one falsely high value that may also remain displayed for another minute, a considerable delay in alarming to hypoxemia may result. Moreover, the pulse rate algorithm built into this instrument requires some improvement before this monitor can be recommended for home use.” The frequency with which the Nellcor N-200 falsely alarmed and displayed zeros for SpO<sub>2</sub> has “the risk of desensitizing caregivers, thereby delaying responses to true alarms. The improvement in false alarm rate achieved with some new developments (OXISMART) may be associated with a delayed detection of true alarms.”