Accuracy of Pulse Oximeters and the Influence of Sensor Type in Induced Hypoxia.
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Modern pulse oximeters use advanced signal processing technology to measure arterial oxygen saturation (SpO2) and may offer improved performance. We evaluated the accuracy of three newer pulse oximeters (Compumedics Vampire (V), Nellcor N595 (N) and Masimo Radical (M) when used with digital sensors in induced hypoxia. A further two N595s were used with ear and forehead reflectance sensors to enable the effect of sensor type to be assessed.

Methods
Simultaneous measurements of SaO2 by CO-Oximetry and SpO2 from the five pulse oximeters were obtained in eleven normal subjects over a range of inspired O2 fractions (FiO2 =0.10 to 0.21). Hyperoxia was also studied. Bias (mean difference) precision (SD of difference) and root mean square error (RMS) were calculated. The US FDA recommends RMS <3% over SaO2 range of 70-100%.

Results
212 samples were analyzed with SA02 ranging from 71.7 to 100%. Results were similar for all three oximeter types when used with finger proves with RMS <3%. Precision and RMS were markedly better for the reflectance sensor compared with ear or finger sensors. V-finger and N-ear bias was correlated with SaO2 (p<0.001) and arithmetic correction reduced RMS to 2.3 and 2.2%, suggesting potential for increased accuracy.

Conclusion
Average bias was negligible and RMS was within FDA specification for all pulse oximeter sensor combinations. The forehead reflectance sensor showed superior precision compared with finger and ear sensors.