

Development of a screening tool for sleep disordered breathing in children using the phone oximeter™.

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BACKGROUND: Sleep disordered breathing (SDB) can lead to daytime sleepiness, growth failure and developmental delay in children. Polysomnography (PSG), the gold standard to diagnose SDB, is a highly resource-intensive test, confined to the sleep laboratory.

AIM: To combine the blood oxygen saturation (SpO₂) characterization and cardiac modulation, quantified by pulse rate variability (PRV), to identify children with SDB using the Phone Oximeter, a device integrating a pulse oximeter with a smartphone.

METHODS: Following ethics approval and informed consent, 160 children referred to British Columbia Children's Hospital for overnight PSG were recruited. A second pulse oximeter sensor applied to the finger adjacent to the one used for standard PSG was attached to the Phone Oximeter to record overnight pulse oximetry (SpO₂ and photoplethysmogram (PPG)) alongside the PSG.

RESULTS: We studied 146 children through the analysis of the SpO₂ pattern, and PRV as an estimate of heart rate variability calculated from the PPG. SpO₂ variability and SpO₂ spectral power at low frequency, was significantly higher in children with SDB due to the modulation provoked by airway obstruction during sleep (p-value [Formula: see text]). PRV analysis reflected a significant augmentation of sympathetic activity provoked by intermittent hypoxia in SDB children. A linear classifier was trained with the most discriminating features to identify children with SDB. The classifier was validated with internal and external cross-validation, providing a high negative predictive value (92.6%) and a good balance between sensitivity (88.4%) and specificity (83.6%). Combining SpO₂ and PRV analysis improved the classification performance, providing an area under the receiver operating characteristic curve of 88%, beyond the 82% achieved using SpO₂ analysis alone.

CONCLUSIONS: These results demonstrate that the implementation of this algorithm in the Phone Oximeter will provide an improved portable, at-home screening tool, with the capability of monitoring patients over multiple nights.