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.