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Feasibility of multi-night, non-contact home breathing and acoustic assessments for improving sleep-disordered breathing diagnosis in children

ASA 2026 · Accepted

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Objectives To evaluate the feasibility of a novel unobtrusive under-mattress and bedside sensor system for continuous, multi-night home tracking of sleep, respiratory and snoring disturbances in children.

Methods In this ongoing trial, children aged 2–11 years with suspected OSA undergo ~2-weeks of in-home non-contact mattress-sensor and ≥3-nights of pulse oximetry recordings. Device recorded cardiorespiratory and motion signals undergo off-line processing, via an adult-trained multi-task deep learning model, to extract sleep and respiratory metrics. The device also performs real-time Fourier-transformation of acoustic data in 20 msec intervals to enable off-line automated evaluation of >600 ambient/clinical noise types (e.g., snoring, coughing, gasping). Standard deviation in derived metrics to date was used to evaluate night-to-night variability (N2NV). Data are reported as mean [95% CI].

Results In 11 children studied to date, 98 nights of device data (2–15 nights/participant, 973 hours total, 9.9 hours/night) and 35 nights of oximetry (282 hours; 8.1 hours/night) were successfully recorded. Device capture succeeded in 8/11 children with technical loss in 3 due to battery failure (2 children, 20% nights lost) or microSD capacity full (1 child, 80% nights lost). REM sleep showed lower N2NV than other stages (Wake: 9.1 [5.9, 12.2]%; NREM: 8.8% [5.8, 11.8]%; REM: 2.2 [1.7, 2.8]%). AHI N2NV was 1.1 [0.8, 1.4] events/hr, driven by hypopnea (0.9) and central apnoea (0.4) variation. Arousal index N2NV was 1.4 [1.2, 1.7] events/hr.

Conclusions This study demonstrates the technical feasibility of high-fidelity, multi-night, non-contact home sleep monitoring. Further paediatric-specific device algorithm fine-tuning should enhance diagnostic capabilities.