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COMPARING BEHAVIOURAL STATE ANNOTATIONS AND PSG ANNOTATIONS IN INFANTS

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Introduction: During the first year of life, infants spend more hours asleep than awake, making sleep one of the most important activities for their developing brains. Monitoring sleep, both in term and preterm infants, can offer valuable insights into their neuro-physiological development. The most common way to monitor infant sleep is by polysomnography (PSG), but this method requires obtrusive contact sensing on the body of the infant. This is undesirable in fragile NICU-infants, and impractical in a home situation. Therefore, we developed a framework for unobtrusively scoring infant behavioural states based on the work by Prechtl (1974), and we compared it to golden standard PSG annotations.
Materials and methods: Nine healthy infant participants (182 days ± 69 days) took their morning or daytime nap in the Tilburg University Babylab. PSG was recorded according to the guidelines set by the AASM (2007), and infants were continuously monitored by video and audio recordings. A non-obtrusive sensor was also used to collect respiratory data. Data were inspected in 30s epochs and scored by (1) an expert who rated the PSG data ("PSG-rater"), and (2) by 2 independent scorers ("behavioural raters") who rated the infant behavioural states based on an adaptation of the scoring system developed by Prechtl (1974; state 1 to state 5). Audio and video recordings were inspected retrospectively. Instead of solely scoring observable behaviour, the respiration signal was inspected for (ir)regularity, too. Also, a number of movement behaviours were added to Prechtl's system to come to the new framework used for this study.
Results: Preliminary results for this small sample showed that total agreement between the two behavioural raters was 86.2%, and the corresponding unweighted kappa (κ) was .81. Agreement between each of the behavioural raters on the one hand and the PSG rater on the other was 82.2% (unweighted κ = .73) and 85.8% (unweighted κ = .78), respectively. Agreement between both the behavioural raters between themselves, and between each of the behavioural raters and the PSG-rater was highest for the active awake state (80%, 93%, and 90%, respectively). Agreement between the behavioural raters was lowest for the quiet awake state (28%). Lowest agreement between behavioural rater 1 and the PSG-rater was found for the quiet sleep state (69%), and lowest agreement between behavioural rater 2 and the PSG-rater was found for the active asleep state (61%).
Conclusions: By adapting Prechtl's system into a new scoring framework we were not only able to achieve good inter-rater reliability between the behavioural raters, but also between each of the behavioural raters and the PSG-rater. Thus, our scoring system may provide an infant-friendly way of monitoring behavioural states in infants. Future work on a larger sample is needed to further substantiate our findings, and to study whether our framework would mainly be useful in non-clinical or also in clinical settings.
Acknowledgements: AASM: Grigg-Damberger, M., Gozal, D., Marcus, C. L., Quan, S. F., Rosen, C. L., Chervin, R. D., ... & Iber, C. (2007). The visual scoring of sleep and arousal in infants and children. Journal of Clinical Sleep Medicine, 3(2), 201-240.Prechtl, H. F. R. (1972). Strategy and validity of early detection of neurological dysfunction. In: C. P. Douglas & K. S. Holt (Eds.), Mental Retardation: Prenatal Diagnosis and Infant Assessment. Butterworths, London, 41-46.