6 Subjective Sleep Measures and Neurocognitive Outcomes in Pediatric Sickle Cell Disease

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Objective: Youth with sickle cell disease (SCD) are at increased risk of neurocognitive difficulties with and without neurological complications. Research has identified disease-related, socioeconomic, and sociodemographic risk factors as independently having significant associations with brain physiology for youth with SCD. Notably, sleep has a profound effect on youth's neurocognitive abilities including learning, executive function, memory, attention, and processing speed. Furthermore, youth with SCD are at an increased risk for poor sleep measured by self-report questionnaires and by polysomnography (PSG). Within the SCD literature, only a few studies have examined the relationship between sleep and cognition. Of these, the majority examined individuals with SCD and comorbid sleep disorder diagnoses. The aim of this study is to identify associations between subjective sleep measures and neurocognitive outcomes in youth with SCD.
Participants and Methods: This study investigated a cohort of 24 youth with SCD (ages 9-16, 11 males, 13 females; HbSS [63%], HbSB+ [8%], HbSC [21%], HbSB0 [8%]) who received sleep questionnaires and a neuropsychological evaluation. Exclusion criteria included a history of neurological disorder (e.g., overt stroke, seizures, or moyamoya disease) or prescribed psychotropic medication. Sleep questionnaires measuring sleep disturbance (e.g., sleep onset, sleep continuity, and sleep quality) and sleep-related impairments (e.g., daytime sleepiness, sleepiness interference with concentration, and difficulty with activities of daily living skills) were collected. Executive function, working memory, processing speed, and verbal comprehension measures were assessed. Demographics and disease-related risk factors were analyzed individually from medical records.
Results: All analyses were controlled for age, the time between neuropsychological testing and sleep questionnaires, SCD genotype, and sex. Partial correlations were conducted to explore associations with neurocognitive outcomes. Verbal comprehension was significantly correlated with sleep disturbance ($r = -.673$, $p = .001$). Multiple linear regressions revealed that sleep disturbance significantly predicts verbal comprehension ($\beta = -.572$, $p = .003$). Specifically, verbal comprehension decreased by 4.4 standard points for every one-point increase in sleep disturbance. Additionally, total sleep problems significantly predicted working memory ($\beta = -.414$, $p = .044$) and processing speed ($\beta = -.411$, $p = .046$). Specifically, working memory decreased by 3.5 standard points while processing speed decreased by 3.3 standard points for every one-point increase in total sleep problems reported. Sleep parameters did not significantly predict executive function.
Conclusions: Results support the association between poor sleep and neurocognitive difficulty in youth with SCD. Three of the participants in this study received a PSG, which further demonstrates the importance of the current findings. This study serves to identify potential risk factors for neurocognitive deficits and provides potential methods for identifying youth with SCD who may need to be referred for a PSG assessment. Research should replicate these findings with increased sample sizes including utilizing PSG and investigating neurobiological effects. Findings may inform future screening tools, treatment approaches, and advanced cognitive initiatives and resources for this population.

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