

**Title:** Sleep quality and neurocognitive function in children with and without Down syndrome

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**Introduction:** Previous research has shown that sleep dysfunction is linked to impairments in neurocognitive functioning in children and adolescents with Down Syndrome (DS), including deficits in language development, memory, and executive functions (EF) (Horne et al., 2018). While numerous studies have reported on the link between DS and sleep disorders generally, only a few have examined this relationship and its correlation with cognitive functioning. For instance, Breslin et al. (2014) found a link between poor sleep quality and neurocognitive performance. However, comprehensive cognitive batteries have not always been administered in past work. As more research is needed in this area, we aim to clarify the relationship between sleep quality and neurocognitive function in children with and without DS by comparing their performance on a novel battery of memory and cognitive tasks for intellectual disability. We hypothesize that children with DS will exhibit poor performance on an EF and memory tasks and that this performance will relate to poor overall sleep as measured through actigraphy and parent-report questionnaires.

**Method:** For this study, we used baseline data collected as part of a multisite measurement validation study with the purpose of determining the psychometrics and clinical trial readiness of the Arizona Memory Assessment for Preschoolers and Special Populations (A-MAP) for children with intellectual disabilities. The A-MAP is a novel, comprehensive touch-screen assessment which measures different domains of memory and learning, including novel measures of spatial and verbal memory and executive control. We examined a total of 68 children and adolescents (36 with DS and 32 mental age-matched TD children). The group with DS was 58.3% male with an age range of 6-17 years, while the TD group was 56.3% male with an age range of 3-6 years. Participants were similar in the verbal and nonverbal IQ raw score on the KBIT-II. Participants were asked to wear a Philips Respironics Actiwatch device on their non-dominant wrist for one week before or after their lab visit. We also administered the Child's Sleep Habits Questionnaire (CSHQ) to measure parent report of their child's sleep.

**Results:** Although the group with DS scored lower on the A-MAP EF measure, there was not a statistically significant difference between groups ( $p = 0.197$ ). The A-MAP measures of verbal and spatial memory were consistently impaired, however ( $p < 0.05$  for all comparisons). We found significant between group differences on the following sleep measures: average sleep time across 3 separate intervals (452.17 vs. 500.36 minutes in DS and TD, respectively;  $p < 0.001$ ) and sleep efficiency (85.14 vs. 87.46 in DS and TD,  $p = 0.05$ ) measured via actigraphy and sleep disordered breathing (SDB) (4.29 vs. 3.32 in DS and TD, respectively;  $p = 0.003$ ) on the CSHQ. We found no significant correlations between the sleep variables and the EF task in the DS and TD groups, but total sleep time and sleep efficiency did correlate with measures of visual-spatial memory specifically in both groups ( $p < 0.05$  for all comparisons).

**Discussion:** In summary, we found that the children with DS were getting significantly less overall and less efficient sleep than younger TD children. Additionally, elevated scores of SDB in the DS group indicate that this area of sleep behavior is of particular importance in our sample, and is also consistent with previous research regarding the prevalence of SDB in this population. These sleep deficits were primarily related to measurements of memory function. While performance on the EF task of the A-MAP did not differ statistically and was not related to sleep outcomes, measures of working and associative memory showed expected impairments and relationships with sleep quality. These findings emphasize the key domains of memory and learning that may be correlated with the sleep impairments often noted in DS.

**References:** Breslin, J., Spanò, G., Bootzin, R., Anand, P., Nadel, L., & Edgin, J. (2014). Obstructive sleep apnea syndrome and cognition in Down syndrome. *Developmental Medicine & Child Neurology*, 56(7), 657-664.

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