The impact of sleep variability on sleep duration and daytime behavior in children on the autism spectrum

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Background

- Autism spectrum disorder (ASD) refers to a group of neurodevelopmental disorders; children with ASD often have repetitive behaviors and social challenges (American Psychiatric Association, 2013)
- In addition to behavioral difficulties, children with ASD have sleep problems at a rate of 40-80 percent compared to 25-40 percent of typically developing (TD) children (Cohen, 2017)
- The developmental norm is for sleep duration to decline with age (Thorleifsdottir et. al, 2002)
- Baddam et. al (2018) showed subjective measures of sleep are as accurate as objective measures
- This research aimed to examine relationships of sleep duration and variability of sleep cycle with daytime behavior across developmental trajectories in children with ASD and TD
- It was hypothesized that children with ASD and TD would have declining sleep duration with age and that children with lower variability would have more desirable daytime behaviors

Method

- 50 participants, ASD (*n*=34*)* and TD (*n*=16), aged 7-18 years
- Parents completed the Yale Developmental Sleep Questionnaire
  - Parents were asked to report the earliest, latest, and usual time of their child's bedtime routine (BR), lights out (LO), and wake time (WT) from the most recent week, separately for weekend and weekday
  - In addition, parents were asked questions regarding the impact of their child's sleep on both parent and child daytime functioning
- Clinician-administered and parent-reported measures provided information on intellectual function and symptomatology: Differential Abilities Scales, Autism Diagnostic Observations Schedule, and Child Behavior Checklist
- A sleep variability score was calculated for each participant:
  - Variability score = sum of the difference in earliest and latest times for BR, LO and WT, and difference between weekend and weekday usual BR, LO, and WT
- Children were placed in either a low (*n*=18: 12 ASD, 6 TD) or high (*n*=32: 22 ASD, 10 TD) variability group
  - Low variability (lowVar) was defined as a variability score less than or equal to seven hours, as this means the child's sleep variability averages an hour or less per day; other children were high variability (highVar)

	N (male)	Mean Age (years)	IQ	Variability Score (hours/week)
ASD: highVar	22 (14)	12.7	98.5	10.2 hrs/wk
ASD: lowVar	12 (10)	11.97	92.4	5.0 hrs/wk
TD: highVar	10 (3)	13.23	111.6	10.5 hrs/wk
TD:lowVar	6 (4)	12.2	112.6	5.3 hrs/wk
Total	50 (31)	12.6	101.3	8.4 hrs/wk

Method

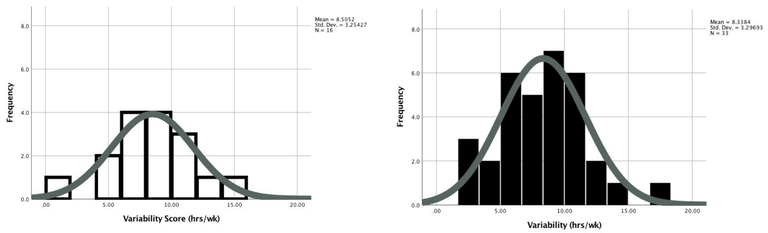


Figure 1: Distributions of the sleep variability scores for children with TD (left) and ASD (right). Bin width of 2 hours. Gaussian curves are superimposed over the distributions, demonstrating the normal distribution of the variability scores for both diagnostic groups.

Results

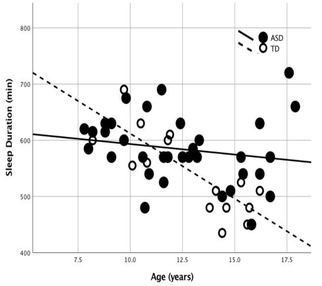


Figure 3: Age and sleep duration were plotted for TD participants. For both the lowVar (*r*=-0.825, *p*=0.043) and highVar (*r*=-0.716, *p*=0.020) groups, sleep duration was found to be negatively correlated with age.

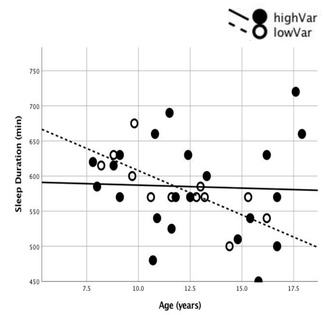


Figure 2: Age and sleep duration were plotted for ASD and TD participants. For TD participants, sleep duration was negatively correlated (*r*=-0.773, *p*=0.000) with age, but for ASD participants (*r*=-0.185, *p*=0.295) sleep duration did not show a linear correlation with age.

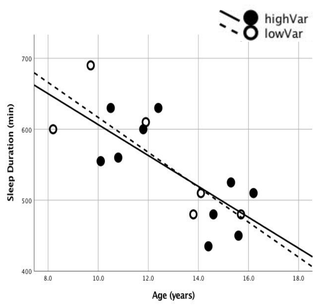
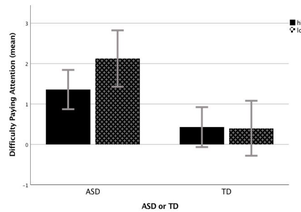


Figure 4: Age and sleep duration were plotted for the ASD group. For the low variability group, sleep duration was negatively correlated with age, similar to the trend seen in the typically developing group in Figure 2 (*r*=-0.740, *p*=0.006). However, the high variability group showed no significant correlation between age and sleep duration (*r*=-0.040, *p*=0.861).

Results

Figure 5: The mean of parents' responses to their child's difficulty paying attention on a scale of 0-3 was graphed for highVar and lowVar ASD and TD children. The difference for highVar and lowVar ASD children was nearing significant (*p*=0.052).



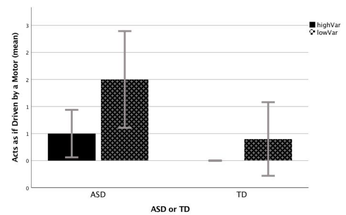


Figure 6: The mean of parents' responses to their child's tendency to act as if driven by a motor on a scale of 0-3 was graphed for highVar and lowVar ASD and TD children. The difference for highVar and lowVar ASD children was significant (*p*=0.040).

Results

- The ASD highVar group and TD highVar group have similar weekly variability, as do the ASD lowVar group and TD lowVar group
- As shown in Figures 4, 5, and 6, ASD children in the highVar and lowVar groups demonstrate different maturation of sleep time over age, and different daytime behaviors. These differences do not exist for TD children.
- TD children are less likely than children with ASD to be greatly impacted by their sleep variability, for both sleep duration and daytime behavior
- Children with ASD and highVar are less likely to experience negative motor and attentional difficulties as compared to their lowVar peers
- These findings show a subgroup of children with ASD who display high sleep variability and atypical developmental maturation of sleep duration
- In these children, the expected decrease in sleep duration does not take place. Counter to predictions, this group of children actually displays less motor and attentional difficulties than children with ASD and high sleep variability
- Future studies will build on these findings by using objective measures of sleep such as polysomnography or actigraphy (Hodge et. al., 2012) to explore the relationship between sleep variability and daytime behaviors

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