The Importance of Sleep in Development & Developmental Disorder

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Introduction

In typical development:

- ✓ Memory functions are supported and extended in sleep[1]
- ✓ Sleep integrates new vocabulary[2]
- ✓ There exist specific, longitudinal links between a mature sleep state and executive functions[3]

Sleep plays a crucial role in memory and learning in typically developing (TD) children

In atypical development:

- ✓ Individuals with Down syndrome (DS) show poor sleep and 70-80% exhibit obstructive sleep apnea syndrome (OSAS)[4]
- ✓ Sleep disturbances are evident in DS in infancy, suggesting possible, early impacts on cognition[5]

More work is needed to examine the relationship between sleep disturbance and cognition in individuals with DS across development

Aims

Study 1: To examine the role of poor sleep in neuropsychological outcomes in children and adolescents with DS

Study 2: To examine the relationship between sleep quality, behavior, and language in toddlers with DS

Study 1: Ages 7-12 years

(Breslin et al., 2014)

Methods

Materials

- o In home unattended ambulatory polysomnography (PSG) using the Compumedics Somté PSG system
- o PSGs were manually scored by a certified PSG technician

Polysomnography (PSG)

- o Participants also completed a customized battery of neuropsychological measures for DS, the Arizona Cognitive Test Battery[6]

Neuropsychological Measures

- **Verbal Measure**: *Kaufman Brief Intelligence Test, Second Edition (KBIT II)*
- **Cognitive Flexibility**: *CANTAB Intra-Extra Dimensional (IED)*

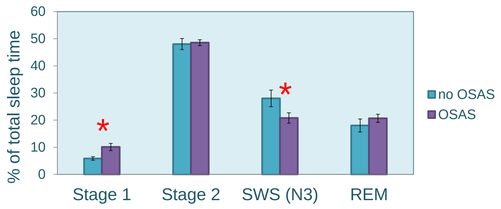
Participants

- o 38 children with DS ages 7-12 years, n = 31 sleep studies met quality criteria (61.3% had OSAS), similar on age, body mass index (BMI), and the presence of heart defects

Results

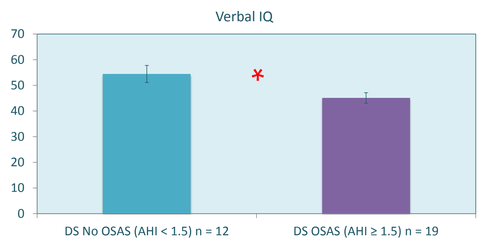
Sleep characteristics in relation to OSAS

Individuals with OSAS spend more time in S1 and less in SWS than those with no OSAS

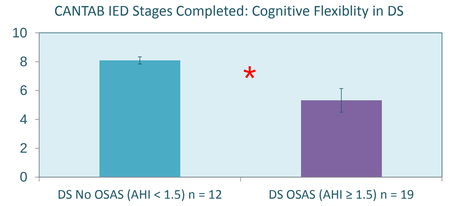


Cognition in DS in relation to OSAS

Lower verbal IQ in those with OSAS (9 points)



Lower performance in a test of cognitive flexibility in those with OSAS



Study 2: Ages 2-5 years

(Edgin et al., 2015)

Methods

Materials

LENA Digital Language Processor (16 hours)

Actiwatch (1 week)

Questionnaires:
Scales of Independent Behavior-Revised
MacArthur Bates CDI: Words & Gestures

Participants

- o 29 toddlers with DS & 20 TD toddlers ages 2-5 years old, similar on age, BMI, and medical background
- o DS group divided into "good sleepers" and "poor sleepers", depending on if sleep efficiency was > or < 80%

Results

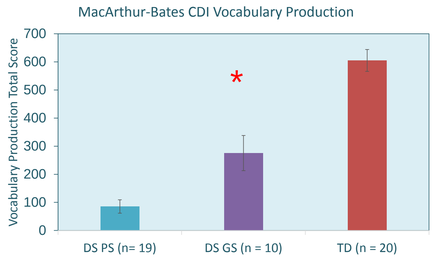
Overall Sleep Characteristics

Actigraphy Variables (M, SD)	DS PS	DS GS	TD
Sleep efficiency across 5 nights (%)	74.35* (3.35)	83.66* (2.57)	85.09* (4.31)
Average sleep time (min)	460.50* (47.94)	509.75* (47.67)	511.73* (48.51)
Onset Latency (min)	9.88 (5.90)	10.48 (10.45)	13.44 (10.59)
Wake after sleep onset (min)	122.60† (18.07)	78.32† (18.42)	68.39† (23.74)
Fragmentation Index	35.29† (5.01)	25.54† (5.41)	25.50† (6.02)

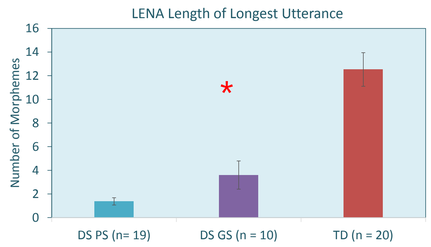
*=DS PS< DS GS, TD, p<0.001; †= DS PS> DS GS, TD, p<0.001

Sleep characteristics in relation to language outcomes

Lowest vocabulary production in poor sleepers with DS

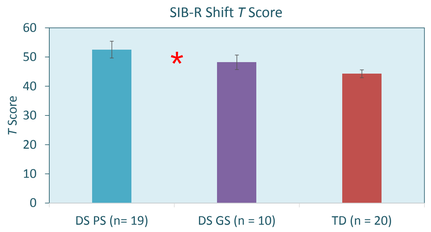


Shortest utterance length in poor sleepers with DS



Sleep characteristics in relation to behavioral outcomes

Poor sleepers with DS had more parent-reported difficulties with shifting from task to task



Conclusions & Future Directions

- o Deficits in sleep in DS seem to exacerbate poor executive functioning and delayed language skills across a range of ages
- o Slow wave sleep is most affected by OSAS, a stage important for memory consolidation
- o Currently, we are conducting a longitudinal sleep and cognitive study with infants 6 to 24 months of age
- o Future work should focus on causal links underlying relationship between poor sleep and cognitive outcomes in DS and other developmental disabilities
- o Early screening and treatment is highly recommended

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Acknowledgments

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