Sleep Problems in Down Syndrome



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Summary and Future Directions

Down Syndrome (DS) – General Features



- Most common diagnosed chromosomal condition in the US
- Most common genetic cause of IDDs.
- Several significant medical cooccurring conditions:
 - Congenital heart disease
 - Hypothyroidism
 - Feeding problems/GI issues
 - Enlarged tonsils and adenoids

Background: Sleep problems are highly prevalent in DS

- Results of parent questionnaires and EEG recordings in DS
 - Reduced time in NREM sleep
 - Increased sleep latency
 - Increased night wakings
 - Poor sleep efficiency
- OSA affects 54-90% of youth with DS compared to 1-4% of the population
- High prevalence of comorbidities (cognitive, behavioral, cardiovascular, growth)
- Sleep problems start from a young age
- Re-emergence of sleep problems in adolescence with obesity onset

- AAP recommends evaluation for OSA by age 4 with polysomnography (PSG)
- Concerns about tolerability of PSG in younger children
- Not all areas have PSG facilities
- Poor compliance and/or lack of knowledge of screening guidelines by many PCPs
- Repeat PSG is often necessary

PSG Referrals for Down Syndrome at VUMC



ADDS 2024 ActiGraph

Wearable Sensors in DS

- Smaller, cheaper, less intrusive vs PSG
- Capture sleep within the home/naturalistic environment
- Do not place a high burden on caregivers

- Have been used in DS at older age ranges
- Wanted to pilot in younger children given the AAP guidelines

Pilot study: Feasibility of use of wearable sensors in DS

Variable	Cohort (N=14)
Age M=7 years, 2 months	4 years, 4 months-10 years, 10 months
Sex	Female = 8 Male = 6
Race	White = 9 Black = 3 Asian = 2

- Used ActiGraph GT3X
- Participants wore the device for 7 nights, one of which included concurrent PSG
- In person clinic evaluations
- Parent completed sleep diaries & sleep questionnaires
- 100% compliance with wearing sensors
 - Some had to be placed once "in bed"
- Parents reported high satisfaction and ease of use



Resources to prep families

What Can I Do To Help My Child Prepare for a Sleep Study?

In preparation for the study

- Arrange a practice visit to the center to introduce your child to the rooms and equipment that will be used.
- Use visuals and behavioral supports to prepare your child for the experience.
- Use a First-Then board to help your child establish expectations for the study and related visits.



Instructions for Wearing the Watch and Recording

Wearing the E4 wristband is as easy as wearing a watch. This will show you how to put on your device to obtain the best quality signals.

- 1. Slide the loop towards the case and place the E4 wristband top-down on a surface.
- Wear the E4 wristband on your child's NON-dominant hand with the case on the top of the wrist. The EDA electrodes (under the snap-fastener) should line up on the bottom of the wrist. Line them up under the middle and ring fingers.



3. Wrap the band over snaps and tighten. To secure, connect one snap at a time. If too tight, loosen by one snap. Tighten the E4 wristband band enough to ensure the electrodes do not change position on the skin during normal movement but not so much as to constrict blood flow or cause discomfort.

Results – comparison between PSG, ActiGraph, Sleep diary

	PSG	ActiGraph	Sleep Diary
Total Sleep Time (TST) (min)	M= 402.92 (SD=65.74)	M= 404.50 (SD=38.61)	M=526.67 (SD=19.91)
Latency (min)	M=51.15 (SD=53.43)	M= 54.08 (SD=65.90)	M=20.17 (SD=11.11)
Wake After Sleep Onset (WASO) (min)	M= 35.69 (SD=35.67)	M= 68.50 (SD=58.11)	M=5.03 (SD=5.05)
Sleep Efficiency (%)	M= 82.38 (SD=14.18)	M= 82.80 (SD=10.45)	M= 95.15 (SD=5.16)

These highlighted values are not accurate using the standard Cole-Kripke algorithm because of fragmented periods of sleep and wake during the night. Will be addressed on follow-up data processing.

Summary and Next Steps

- Actigraphy works well for estimating TST, Latency compared to PSG
- Actigraphy overestimates WASO compared to PSG
- Need to address fragmented sleep periods
- Actigraphy is far more objective/comparable to PSG vs. sleep diaries

- Actigraphy alone does not distinguish between those with and without OSA
 - Sensor that detects apnea events?
- Analyzing data related to clinical parameters
- Would Actigraphy serve as an intermediary for determining who needs further PSG in DS?

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Questions?

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Thank You for Your Time.

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