



Sleep is for the “week”: The role of sleep on declarative memory in children

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Introduction

- **Background:**
 - Sleep is beneficial for memory.
 - Evidence suggests that sleep plays a large role in long-term memory consolidation (Stickgold, 2005; Marshall & Born, 2007).
 - Few prior sleep studies have examined relations between sleep and memory in children. One study showed that poor sleep was positively associated with increased behavioral problems, poor concentration and academic attainment in first grade children (Cho et al., 2015).
- **Aim:** The aim of our study was to examine the relationship between declarative memory recall and children’s average sleep duration over a one week delay.
- **Hypotheses:**
 - Participants who sleep more will demonstrate better declarative memory, such that higher quantities of sleep will be correlated with higher overall CMS scores.
 - Because we expect sleep to play a buffering role in long term memory, we do not expect to find a significant difference in memory decay between hour delay recall and week delay recall.

Methods

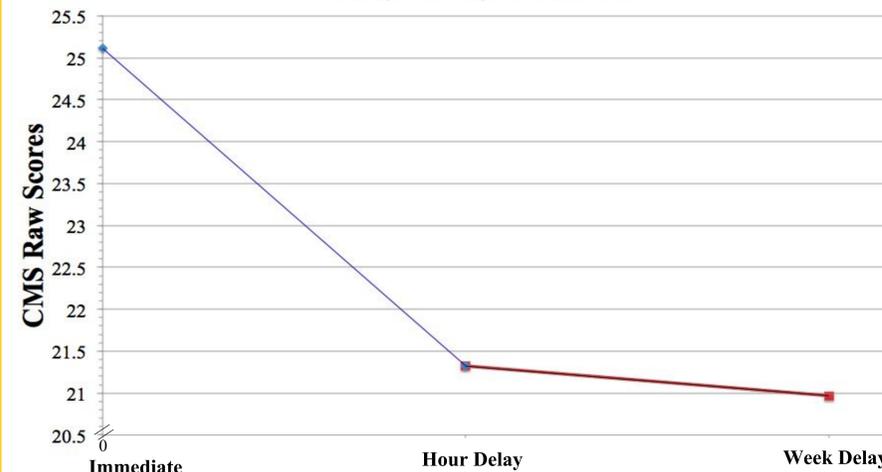
- **Participants:**
 - 200 participants (50% male) ranging from ages 4-8 years old were recruited from a larger research study (Riggins et al., 2018). The mean age was 6.16 years ($SD = 1.52$).
 - Participants who did not complete all parts of the two measures were excluded from all analyses such that final results included only 180 participants.
- **Procedure:**
 - Participants were read two short stories from the Children’s Memory Scale (Cohen, 1997). They were asked to recall them over the course of two visits.
 - Visit 1:
 - Read stories for the first and only time
 - Immediate Recall
 - Hour Delay Recall and Recognition
 - Visit 2:
 - Week Delay Recall
 - Participants’ parents completed the Children’s Sleep Habits Questionnaire (CSHQ; Owens, Spirito & McGuinn, 2000) over the course of the study.
 - The measure we used asked the parents to report their child’s average sleep duration in hours and minutes.

There was a mommy cat and some kittens.

Story A (Immediate)	Story Unit
A mother	1
cat	1
had five	0
brown	0
and white	0
kittens.	1

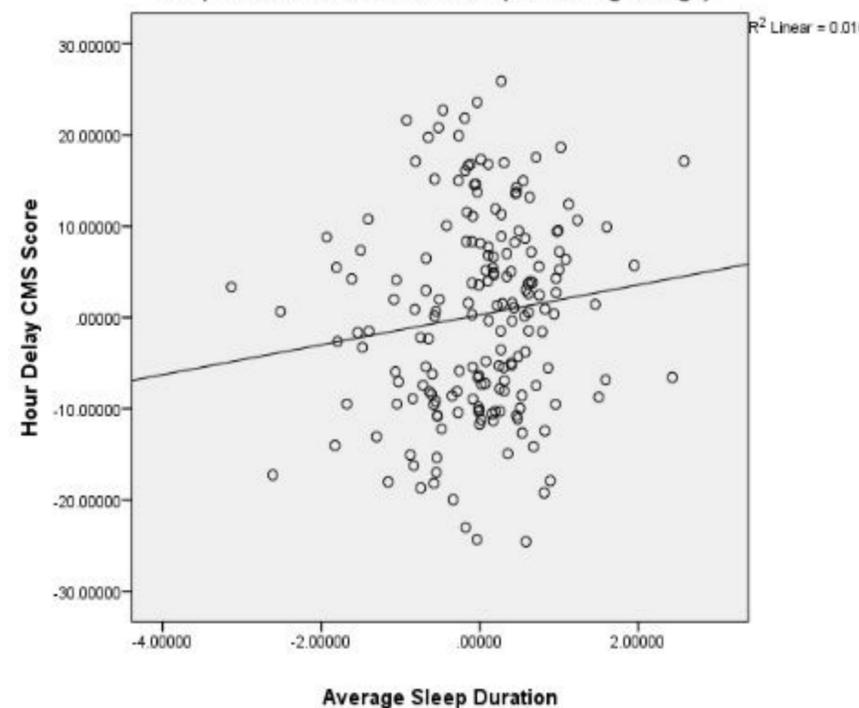
Results

Memory Decay Overtime



Partial Correlations (controlling for age)	Correlation (r)	Significance (one-tailed)
Raw Immediate Recall Scores and Average 24-hour sleep duration	0.102	0.086
Raw Hour Delay Recall Scores and Average 24-hour sleep duration	0.127	0.043
Raw Week Delay Recall Scores and Average 24-hour sleep duration	0.066	0.191
Memory Decay (immediate - week delay recall) and Average 24-hour sleep duration	0.038	0.307

Sleep Duration and CMS Scores (controlling for Age)



Discussion

- **Results**
 - Sleep duration was not significantly related to Immediate Recall or Week Delay Recall, but was significantly related to Hour Delay Recall ($r = 0.127, p = 0.043$).
 - There was no significant difference in memory decay for children in this study, who on average, slept in the range of 7 to 13 hours per night.
- **Implications**
 - Children maintain declarative memories over a large time span. Furthermore, they may not forget memories as fast as previously thought.
- **Limitations**
 - CSHQ is a self-report measure completed by the parent. Given this, they may have inaccurately reported their child’s sleeping habits.
 - The CSHQ asks parents to report a general estimation of their child’s average amount of sleep per day rather than the amount of sleep specific to the time of each visit.
 - A recognition task was administered after the Hour Delay Recall, which may have affected recall ability during Week Delay Recall.
- **Future Directions**
 - Use a different, more specific measure of sleep.
 - Sleep diaries
 - Actigraph watch (measures sleep and awake activity)
 - Test children’s memory of the CMS stories the day after being exposed to the stories to see if sleep and memory performance are correlated.
 - Test memory decay over larger time intervals (Wang et al., 2015).
 - Compare memory decay in adults and children.
 - Investigate if other subsets of the CMS battery show more memory decay overtime.
 - Previous research shows that sleep is involved in the decay process.
 - Sleep systemically chooses which memories to remove (Hardt, Nader, & Nadel, 2013).

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