

Impact of 5-night sleep restriction on actigraphy-estimated sleep in young adolescents: Preliminary associations with ADHD traits

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INTRODUCTION AND AIMS

Prior research suggests that children with attention-deficit/hyperactivity-disorder (ADHD) may experience disrupted sleep^{1,2}.

In typically developing children, short-term sleep restriction increases sleep pressure and efficiency^{3,4}; however, whether a similar homeostatic response occurs in children with ADHD is unknown.

Here we explore the effects of 5 nights of experimental sleep restriction on actigraphy-estimated sleep of children with (ADHD+) and without (ADHD-) high ADHD characteristics.

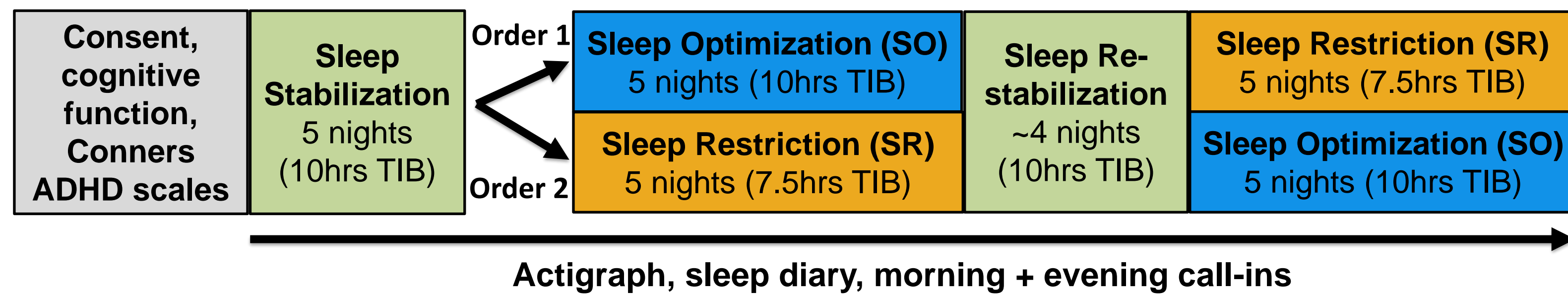
CURRENT STUDY AIMS: 1) Determine whether children with high and low ADHD traits show differences in keeping sleep-promoting and sleep-reducing schedules; 2) Explore whether ADHD traits predict differences in homeostatic responses to sleep restriction, specifically changes in sleep efficiency.

METHODS AND PROCEDURE

Participants: Young adolescents (N=30, 17F 13M); ages 10-13 years (M±SD: 12.15±0.91) with and without attention-deficit hyperactivity disorder (ADHD) diagnosis, free of mood disorders and psychosis.

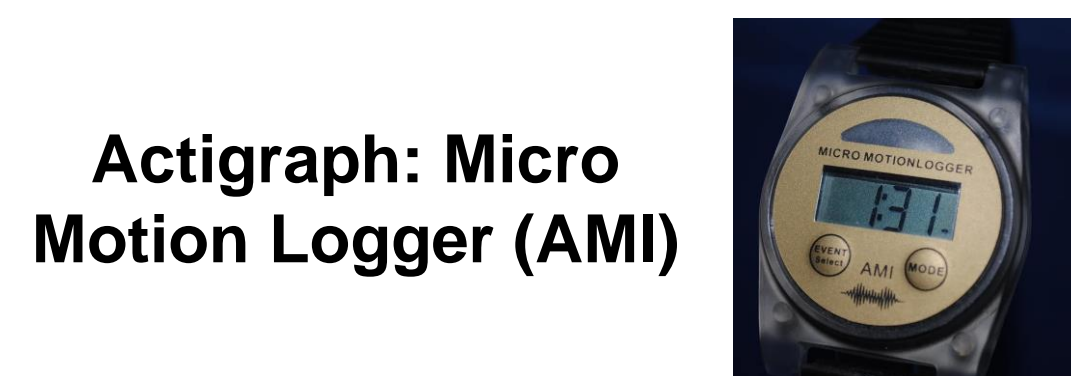
Procedure:

BEFORE STUDY: Conners-3 Parent ADHD and demographic assessment; at-home sleep stabilization. Children characterized as high (ADHD+; n=12, 5F 7M) vs. low (ADHD-; n=18, 12F 6M) in ADHD traits using parent probability rating (≥50% vs. <50% probability of ADHD)



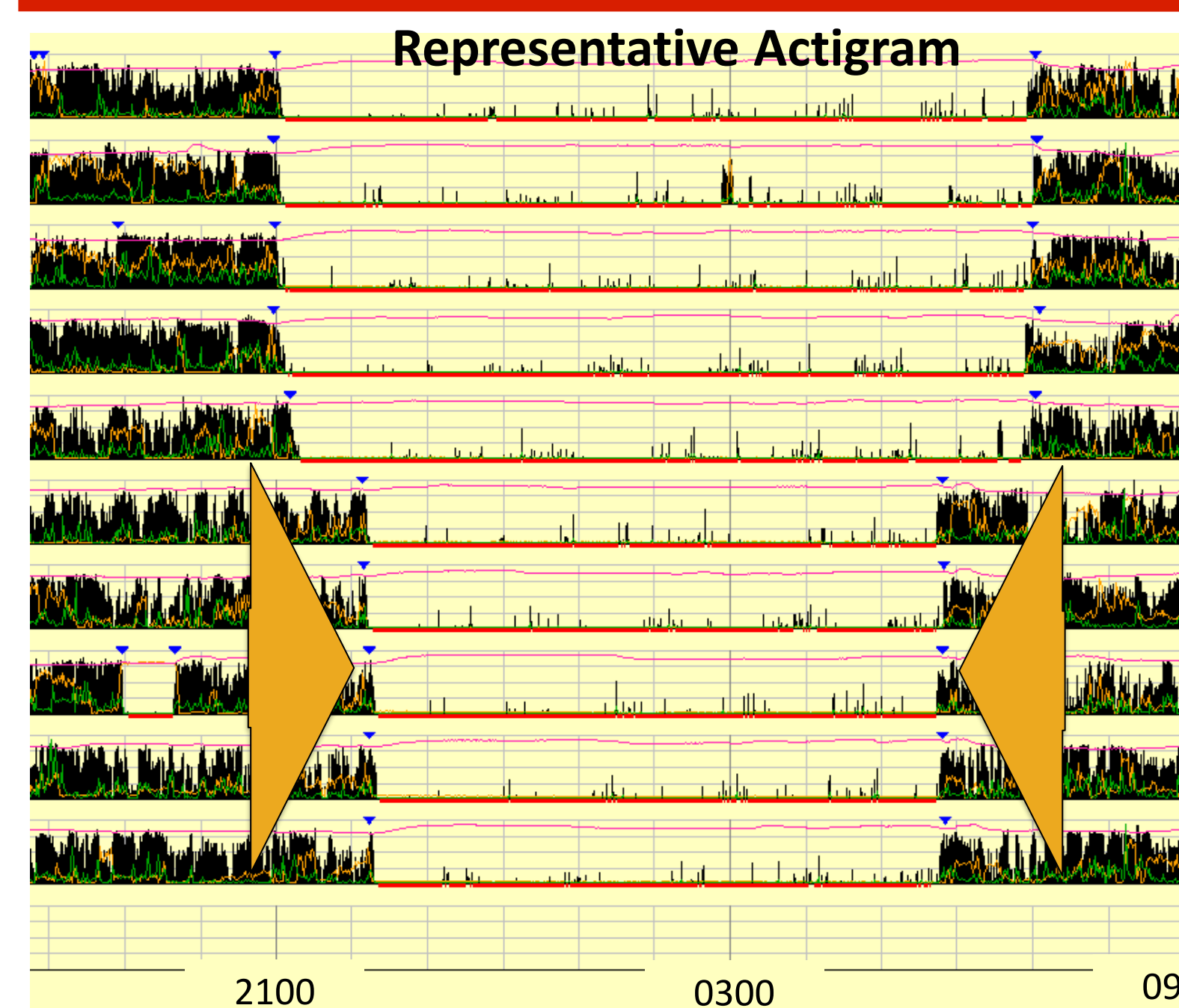
DURING STUDY: Two at-home, within-subject sleep schedules in a crossover (counterbalanced) protocol with ~4 nights restabilization between:

- **Sleep Optimization (SO):** Five nights of 10hr time-in-bed [TIB] set to habitual risetime
- **Sleep Restriction (SR):** Five nights of 7.5hr TIB, sleep opportunity reduced by delaying bedtime & advancing risetime equally



Sleep Diary

ACTIGRAPHY ANALYSIS VARIABLES



Stabilization (optimization = same schedule)

Restriction

Movement scored in 1 min epochs using Sadeh algorithm⁵

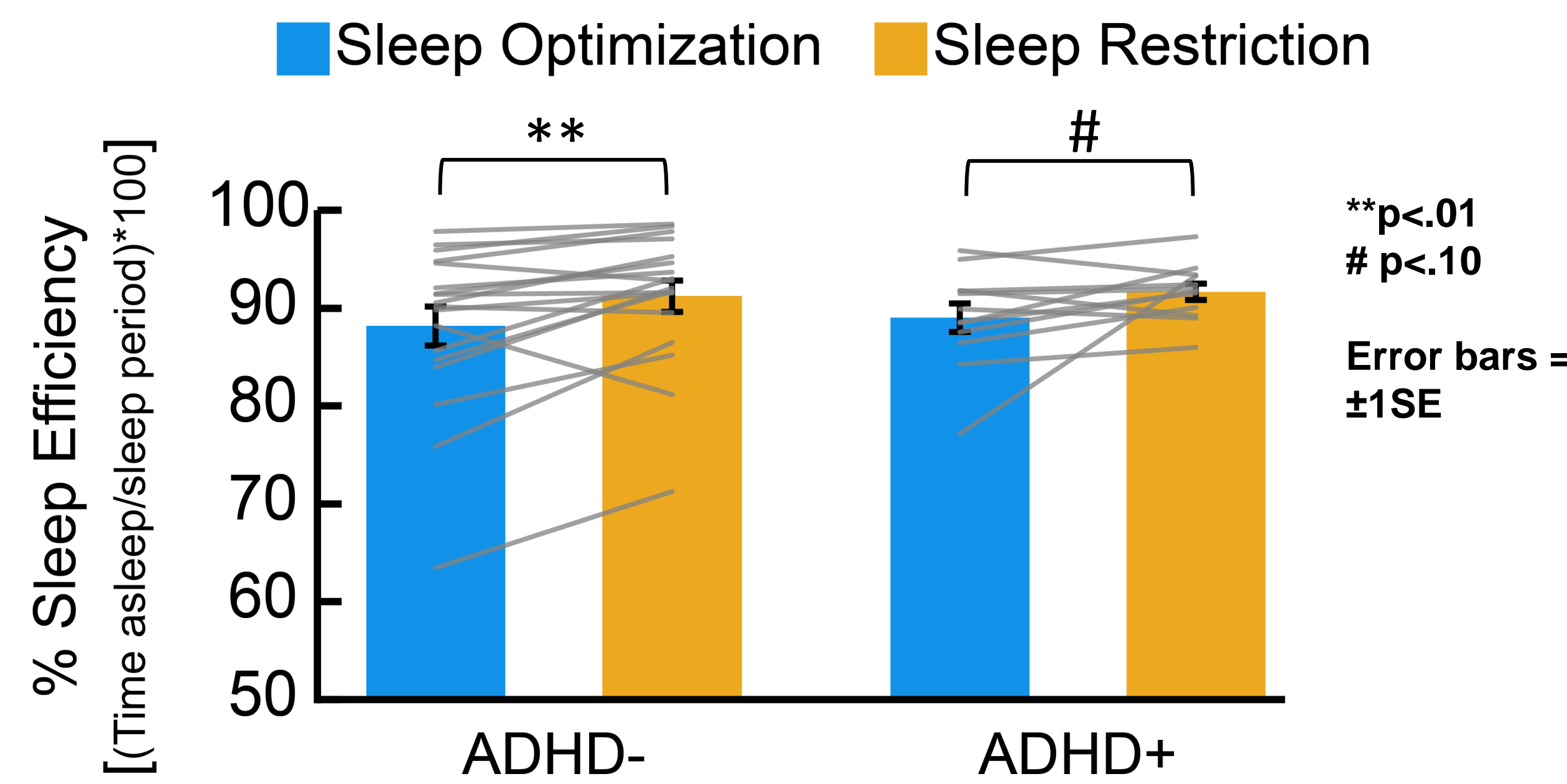
Sleep Period Time (SPT): Duration from sleep onset to final offset, including sleep & wake after sleep onset

Total Sleep Time (TST): Time actually spent asleep during sleep period time.

% Sleep Efficiency (%se): [total time asleep/sleep period time] *100

Peripubertal children (10-13yr) both with and without ADHD traits successfully follow sleep-promoting schedules. However, sleep efficiency (restfulness) may not be as malleable for those with ADHD

RESULTS (CONT.): SLEEP EFFICIENCY INCREASES ACROSS SR (COMPARED TO SO)

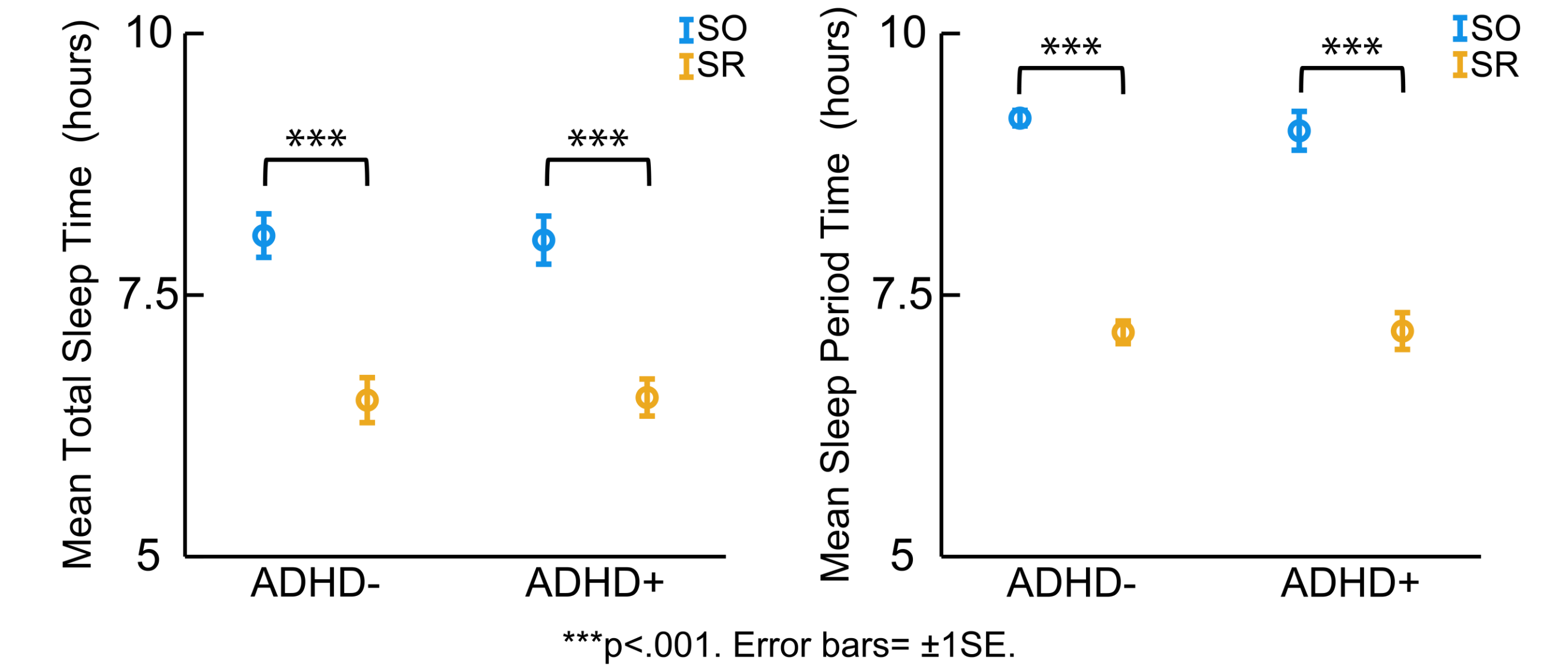


Analysis: 2x2 ANOVA [Group: ADHD- vs. ADHD+; Schedule: SO vs. SR] as predictors of %se. **Significant main effect of Schedule [F(1,28)=11.29, p=.002, ηp²=.29]; %se was higher in SR than SO.**

No main effect of Group; no Group x Schedule interaction (both ps>.77).

Planned t-tests: %se was significantly higher in SR only for ADHD- [t(17)=-3.04, p=.007, d=-.72]. Change for ADHD+ was trending [t(11)=-1.85, p=.092, d=-.53].

RESULTS: ADOLESCENTS SUCCESSFULLY ALTERED THEIR SLEEP PERIOD TIME & TOTAL SLEEP TIME IN RESPONSE TO SLEEP SCHEDULE



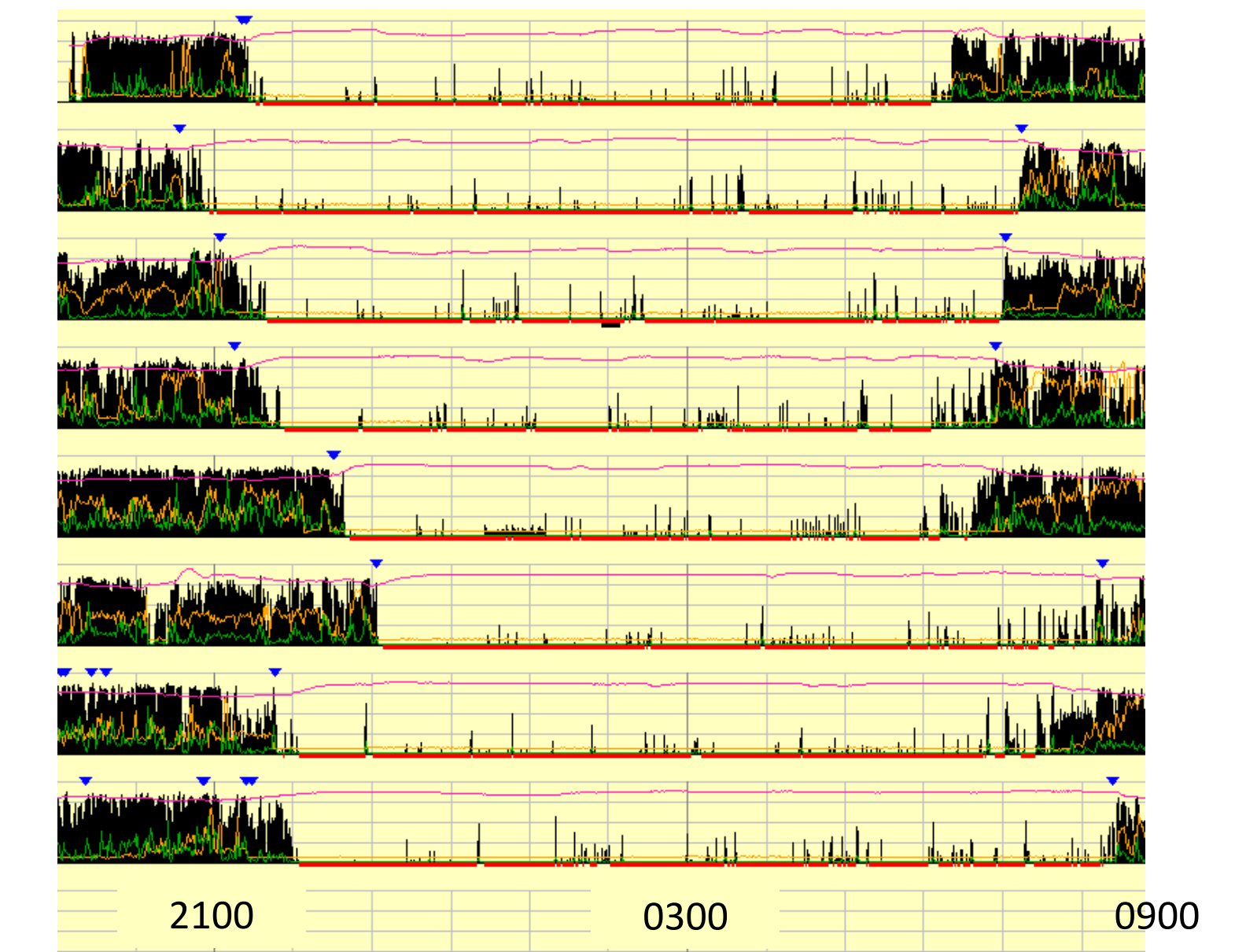
Two 2x2 ANOVAs [Group: ADHD- vs. ADHD+; Schedule: SO vs. SR] as predictors of 1) SPT and 2) TST showed a significant main effect of Schedule [For SPT: F(1,28)=674.88, p<.001, ηp²=.96; For TST: F(1,28)=287.26, p<.001, ηp²=.91].

No significant main effects of Group, and no Group x Schedule interactions (all ps>.38).

Planned t-tests showed significant changes in SPT and TST for both ADHD groups (all ps<.001).

EXPLORATORY: ADHD AND ADOLESCENT SLEEP AFTER THE SLEEP SCHEDULES?

Sample Continuation (No Schedule)



CONTINUATION: A subset of our sample (n=21; 13 ADHD-, 8 ADHD+) opted to wear the watch after original study completion for 7-10 more nights to assess sleep patterns following the experimental schedules.

So far, no significant differences between ADHD- and ADHD+ in SPT, TST, or %se (all ps>.11).

DISCUSSION

Our sleep restriction protocol successfully reduced sleep opportunity and sleep duration in peripubertal children, including those with high ADHD traits.

Notably, sleep restriction significantly increased sleep efficiency in children with low ADHD trait levels, while only marginally increasing efficiency in children with high ADHD trait levels. It is possible that children with high ADHD show an attenuated homeostatic response to sleep loss, though more data are needed to support this conclusion.

When left to recalibrate their own sleep patterns following successful adherence to both optimization and restriction sleep schedules, children with differing levels of ADHD traits did not significantly differ in their sleep period time, total sleep time, or sleep efficiency.

Future directions include: 1) Additional data collection; 2) More fine-grained analysis of the effects of the experimental sleep schedules on subsequent sleep recalibration (day-by-day); 3) More continuous analyses of individual differences in successful schedule completion as a function ADHD traits and other background variables.

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