

# Effect of Wake Extension and Short Recovery Sleep on Objective Vigilance and Subjective Sleepiness in Young Adolescents

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## INTRODUCTION

Adolescents often experience insufficient sleep, which influences next-day performance in attention-demanding tasks. Little is known regarding how wake extension and recovery sleep impact objective vigilance and subjective sleepiness in young adolescents.

We analyzed **PVT performance** and **sleepiness scores** on a baseline night and across an evening of wake extension followed by a short sleep opportunity.

## STUDY PROCEDURES

Twenty-two 10–13-year-old children (12.03±1.14 years, 12F) ranging in parent-rated hyperactivity (Conners-3-Parent  $t=41-89$ ) completed the study.

Exclusion criteria included: history of bipolar disorder or schizophrenia and ADHD medication for non-withdrawal.

## PRE-STUDY MEASURES AND PROTOCOL

- KSADS Diagnostic Interview and WASI IQ
- Conners-3 Assessment for ADHD severity (Parent)
- One week of actigraphy-monitored at-home sleep stabilization (9.5hr TIB)

## IN-LAB PROTOCOL OF SLEEP PERIODS AND TESTING BATTERIES (BATT)

Baseline BSL (9.5hr TIB)	Batt	Sleep 21:00 - 06:30				Batt
Wake Extension WE (4hr TIB)	Batt	Batt	Batt	Batt	Recovery Sleep	Batt
Time:	20:00	22:00	00:00	01:30	02:30-06:30	07:30
Hours awake:	13.5h	15.5h	17.5h	19h		

## TESTING BATTERY DETAILS

Participants completed batteries including a **5-minute tablet-based psychomotor vigilance task** (PVT; BrainBaseline; Figure 1) and **Stanford Sleepiness Scale** (SSS) at regular intervals during the in-lab protocol (see above).



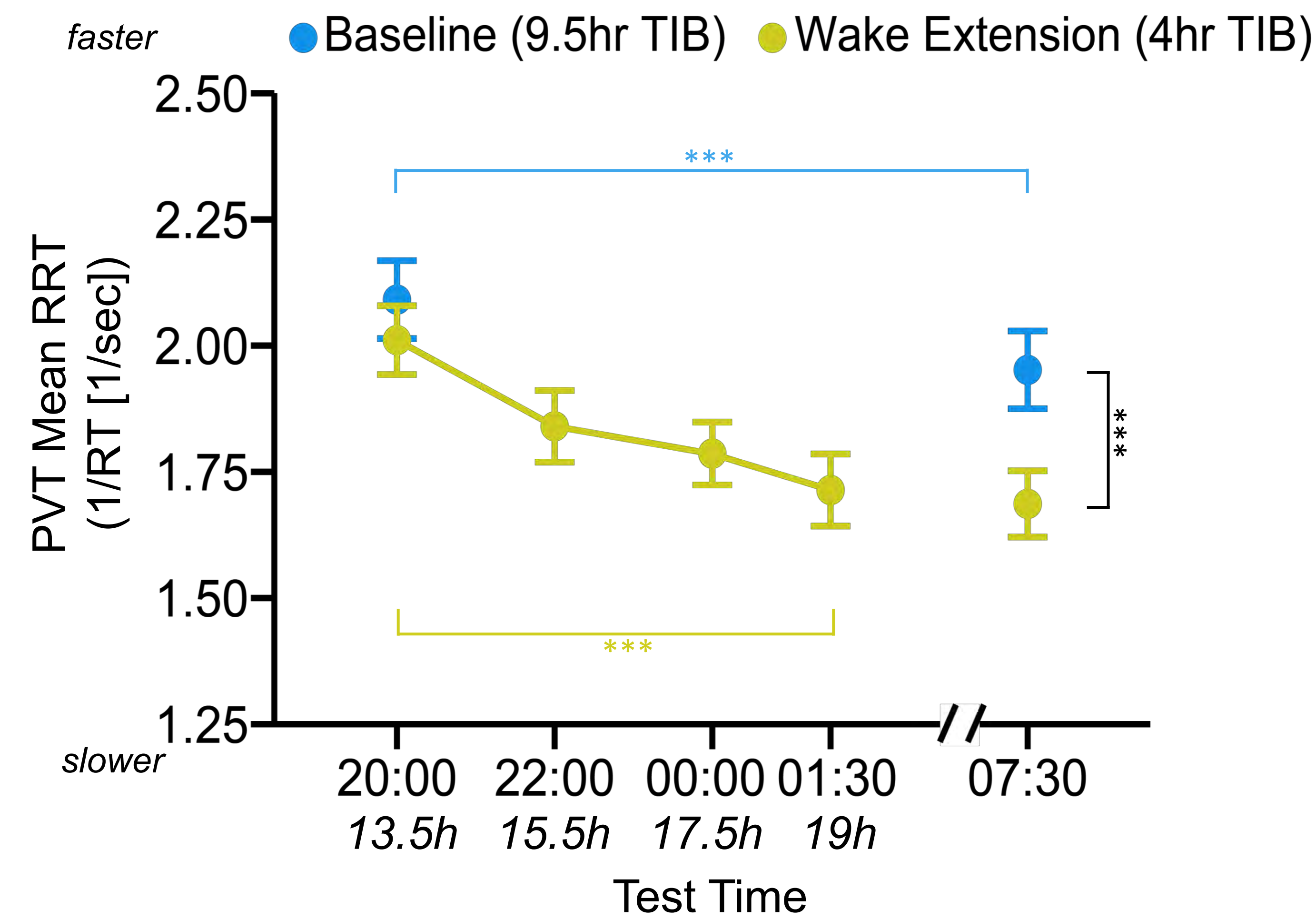
Figure 1. Tablet-based PVT

## REFERENCES

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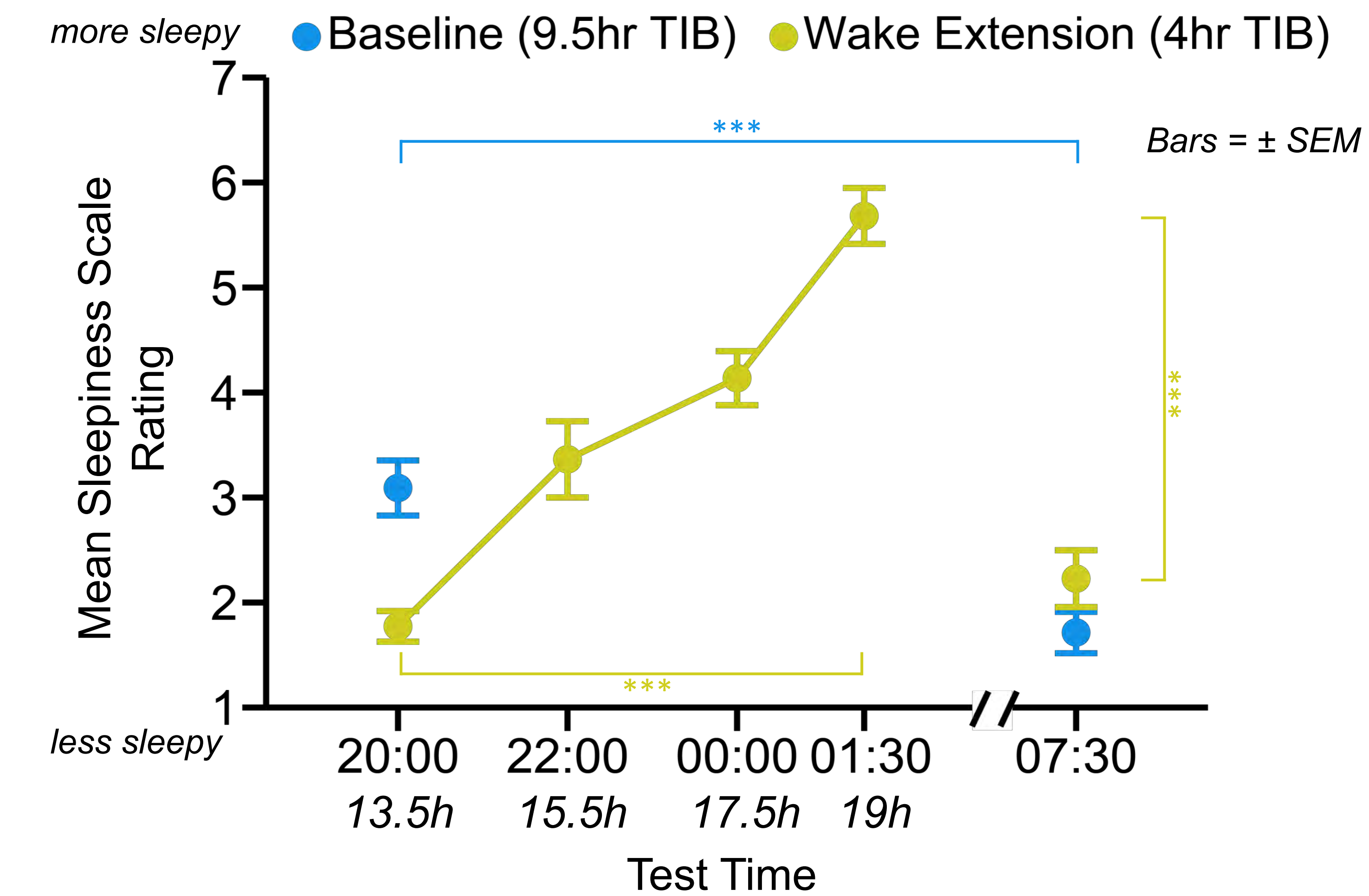
## RESULTS

### PVT PERFORMANCE ACROSS WAKE EXTENSION



Reaction time slowed as the participant stayed up for 19 hours ( $F(3, 63)=13.78, p<.05$ ). After wake extension, a recovery sleep opportunity did not improve reaction time ( $t(21)=0.64, p=.53$ ) or recover it to baseline level ( $t(21)=5.46, p<.001$ ).

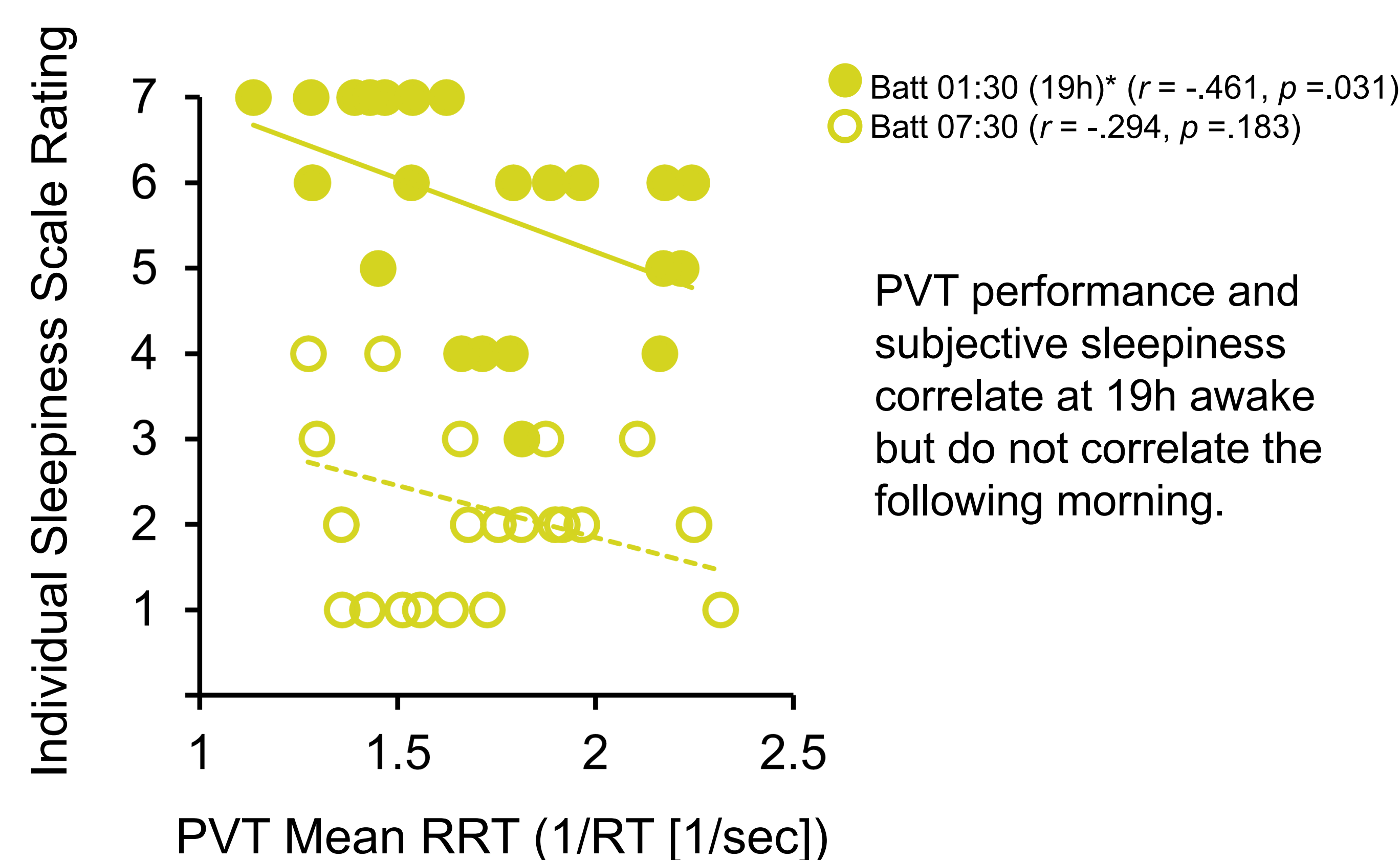
### SLEEPINESS ACROSS WAKE EXTENSION



Self-report of sleepiness increased as the participant stayed up for 19 hours ( $F(3,63)=56.80, p<.001$ ), then recovered to baseline level after a recovery sleep opportunity ( $t(21)=9.80, p<.001$ ).

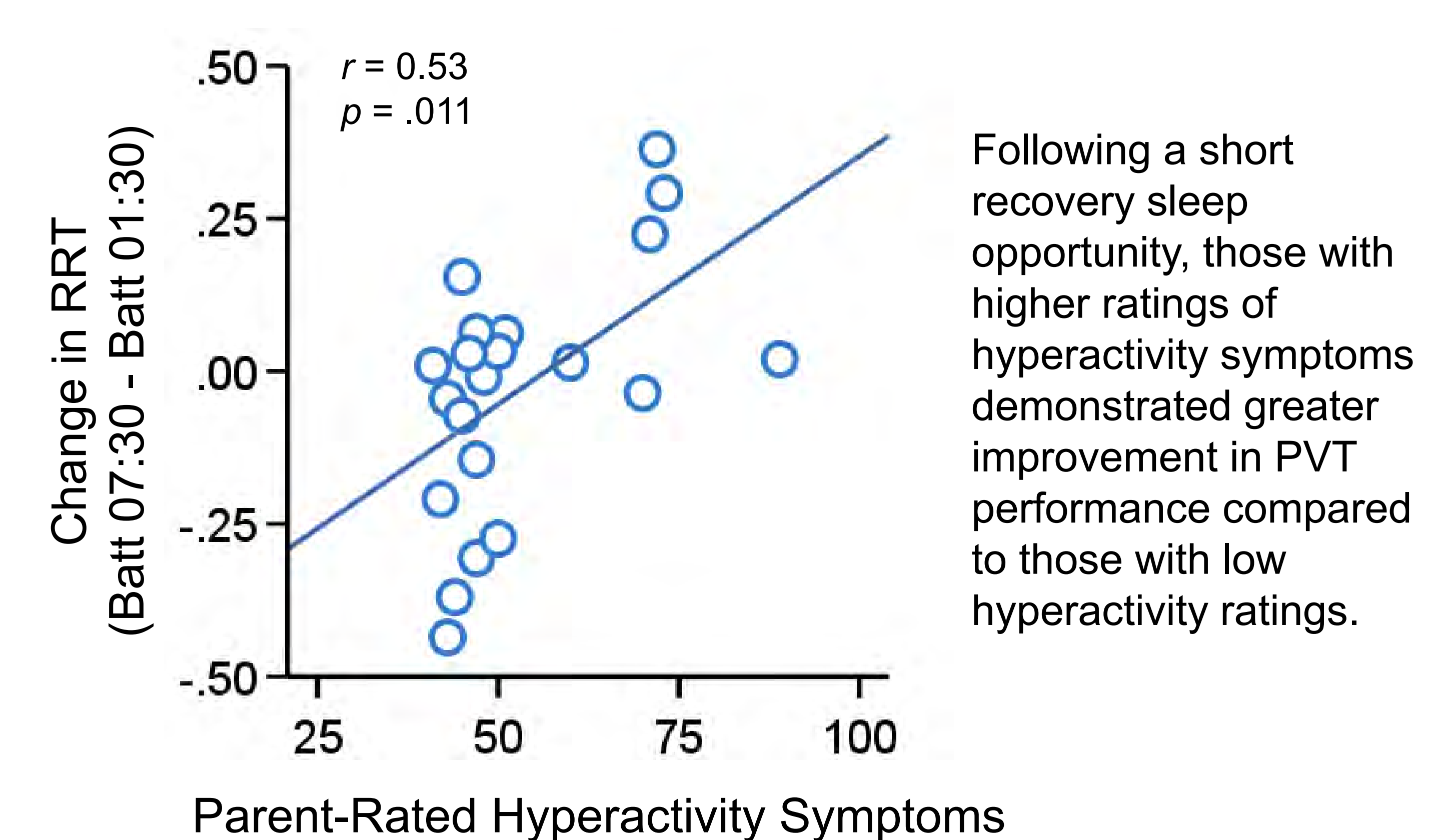
## RESULTS CONT.

### CORRELATION OF PVT PERFORMANCE WITH SLEEPINESS AFTER WAKE EXTENSION AND AFTER RECOVERY SLEEP



PVT performance and subjective sleepiness correlate at 19h awake but do not correlate the following morning.

### CORRELATION OF PVT IMPROVEMENT AND HYPERACTIVITY SYMPTOMS THE MORNING AFTER RECOVERY SLEEP



Following a short recovery sleep opportunity, those with higher ratings of hyperactivity symptoms demonstrated greater improvement in PVT performance compared to those with low hyperactivity ratings.

## DISCUSSION

PVT-measured vigilance deteriorated across wake extension in young adolescents, and 4hrs of recovery sleep was **insufficient to restore performance** to early evening levels.

SSS scores suggested that participants, like in adults, were **not aware of impairment** the morning after insufficient sleep.

Adolescents with greater hyperactivity symptoms demonstrated greater improvement of PVT performance after short recovery sleep.

Future analyses will examine the extent to which ADHD traits distinguish indexes of performance after wake extension and EEG profiles of recovery sleep.