



Acute Sleep Restriction and Circadian Misalignment Impairs Attention in High School Students



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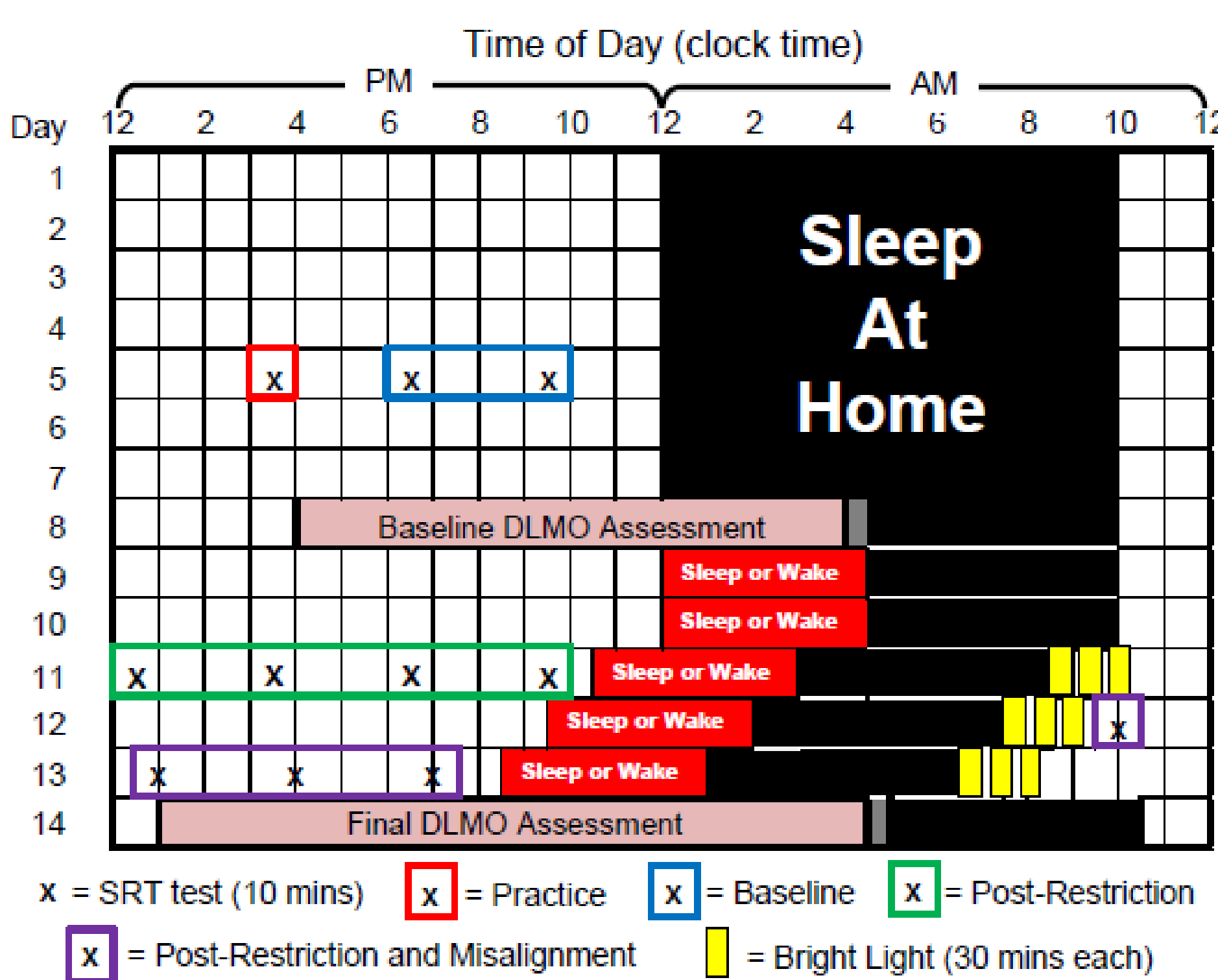
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STUDY AIMS

Examine reaction times in high school students (n=38, 21 girls) aged 14.1-18.0 years after:

1. sleep restriction;
2. sleep restriction + circadian misalignment

STUDY PROTOCOL



- Baseline sleep opportunity at home (days 1-7): 10 h
- Lab sleep opportunity (days 9-13): 10h, 8.5h, 7h, or 5.5h.
- Phase advancing protocol (days 11-13): sleep/dark gradually shifted earlier with 90 mins morning intermittent bright light.
- Simple reaction time (SRT) tests: 2.5h, 5.5h, 8.5h, and 11.5h after wake.
- Dim Light Melatonin Onset (DLMO) – a circadian phase marker – measured in lab on days 8 & 14.

After 2 nights of sleep restriction, lapses increased, median reaction time slowed, and mean response rate decreased from baseline in a dose-dependent manner.

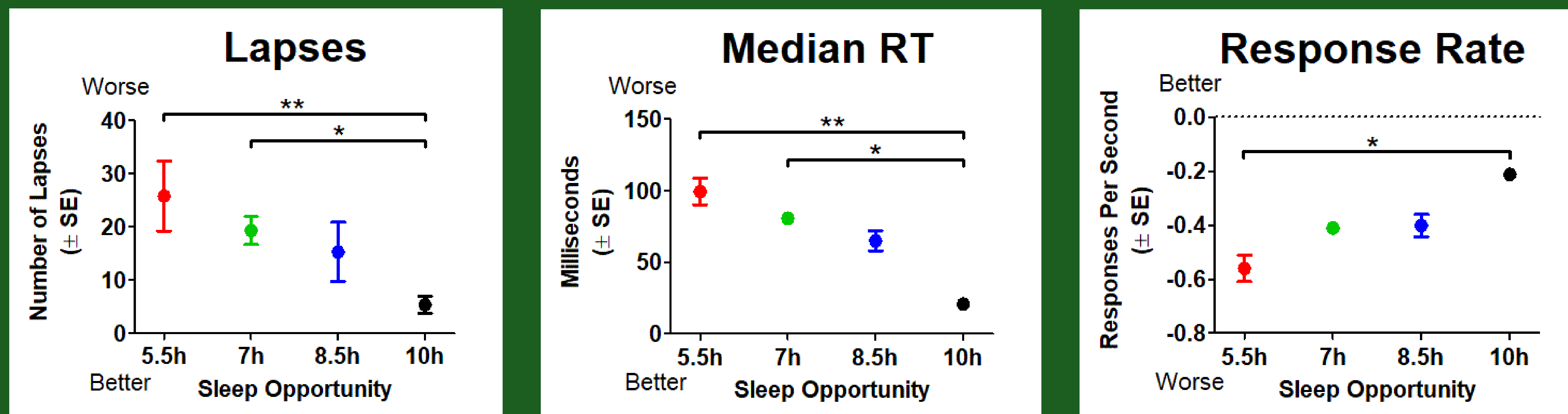


Figure 1: Daily mean on day 11 (after 2 nights of sleep restriction) subtracted from baseline mean (day 5). * $p < .05$; ** $p < .01$ when sleep opportunity groups were compared by post-hoc t-test.

A longer interval from DLMO → morning test time may be protective to attention decrements.

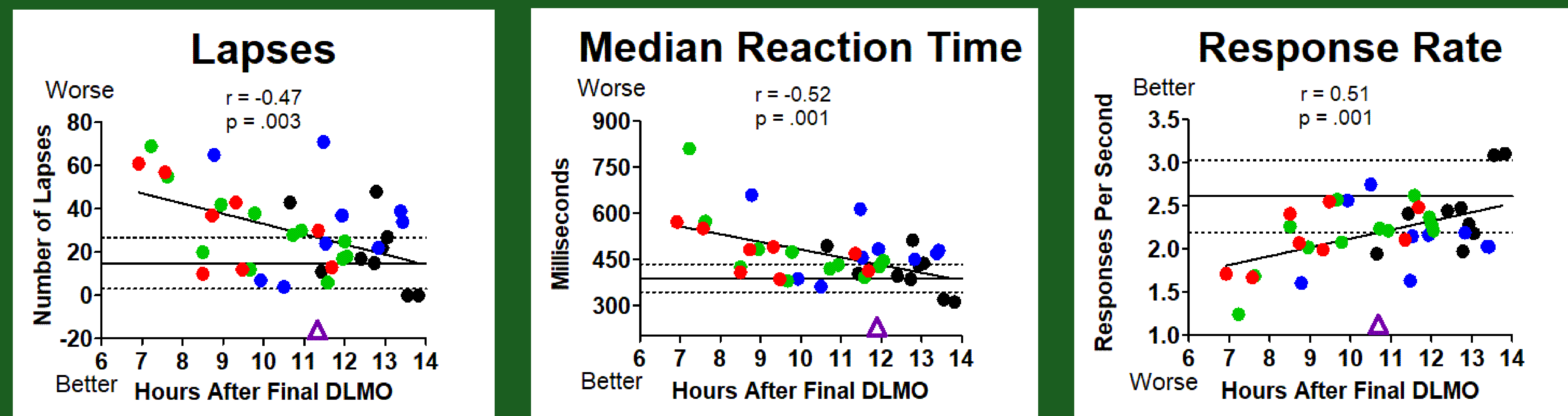


Figure 2: Attention outcomes in all 4 groups measured 2.5 h after wake on day 13 (after 2 days of the phase advancing protocol) vs circadian phase of test. Students were more likely to display attention similar to baseline when testing occurred more than ~10.5-12 hours after Final DLMO. Baseline mean (black horizontal line) ± 1 SD (dotted lines). Upward purple triangle = when regression line meets 1 SD worse than baseline mean).

RESULTS

- Attention outcomes worsened the more sleep was restricted (Fig 1).
- Final DLMO was shifted after the phase advancing protocol. See companion poster here:
- Morning performance (2.5 h after wake) was better when it occurred at a later circadian phase (Fig 2) even when sleep was restricted.

DISCUSSION

- Attention decrements occurred when sleep opportunity was 5.5h or 7h (average sleep duration for high school students).
- Advanced DLMO phase may be protective to morning attention when sleep is restricted.