



Sleep and sleepiness during cumulative sleep restriction and subsequent recovery sleep

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Introduction

This study investigates sleep and sleepiness during successive nights with restricted sleep and during recovery sleep in a study design that simulates a working week and subsequent recovery weekend.

Conclusion

Sustained short sleep with 4 hours time in bed per night reduces stage 1 sleep. The three process model of alertness regulation (TPMA) is capable of predicting sleepiness levels fairly accurately under such conditions.

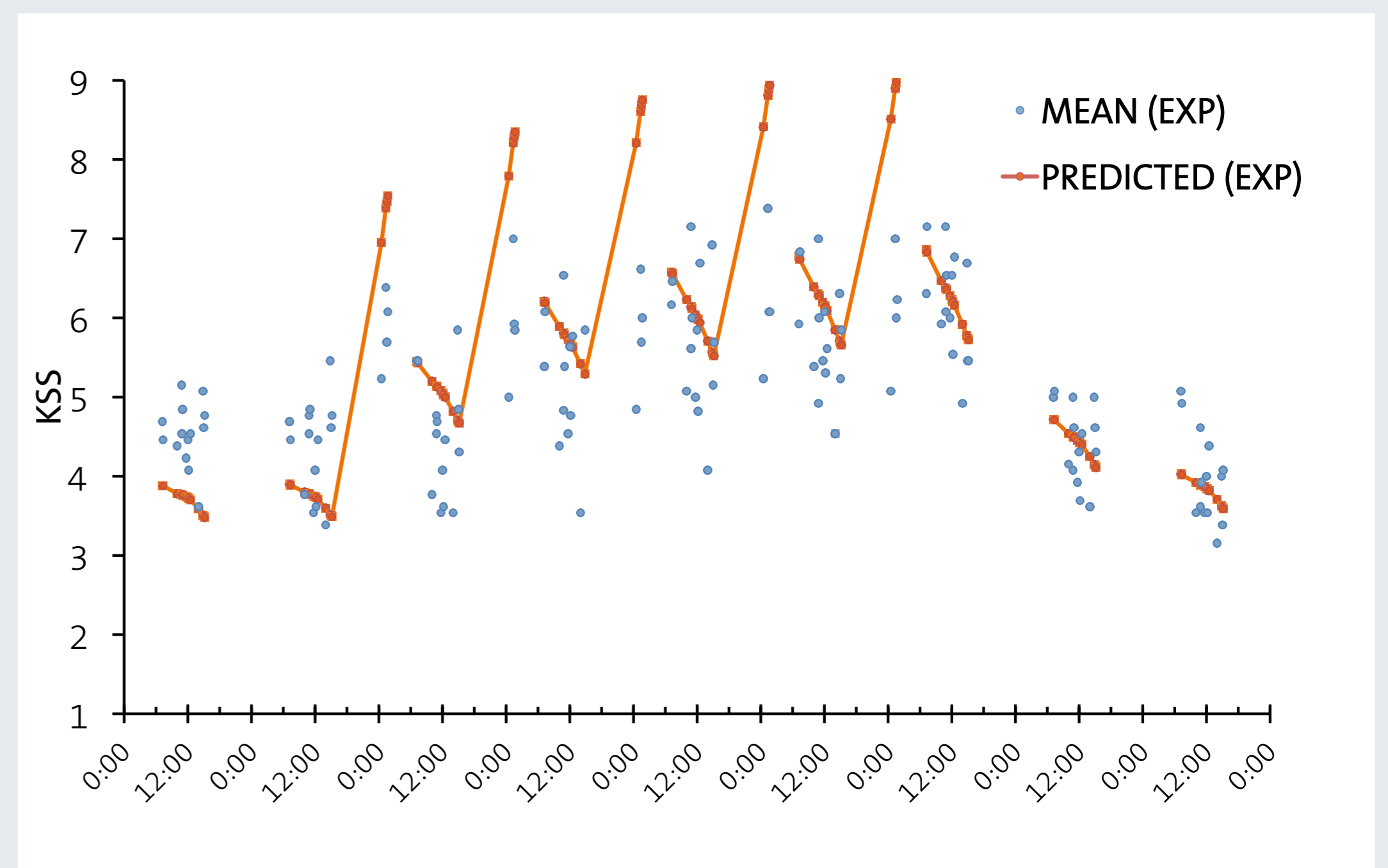
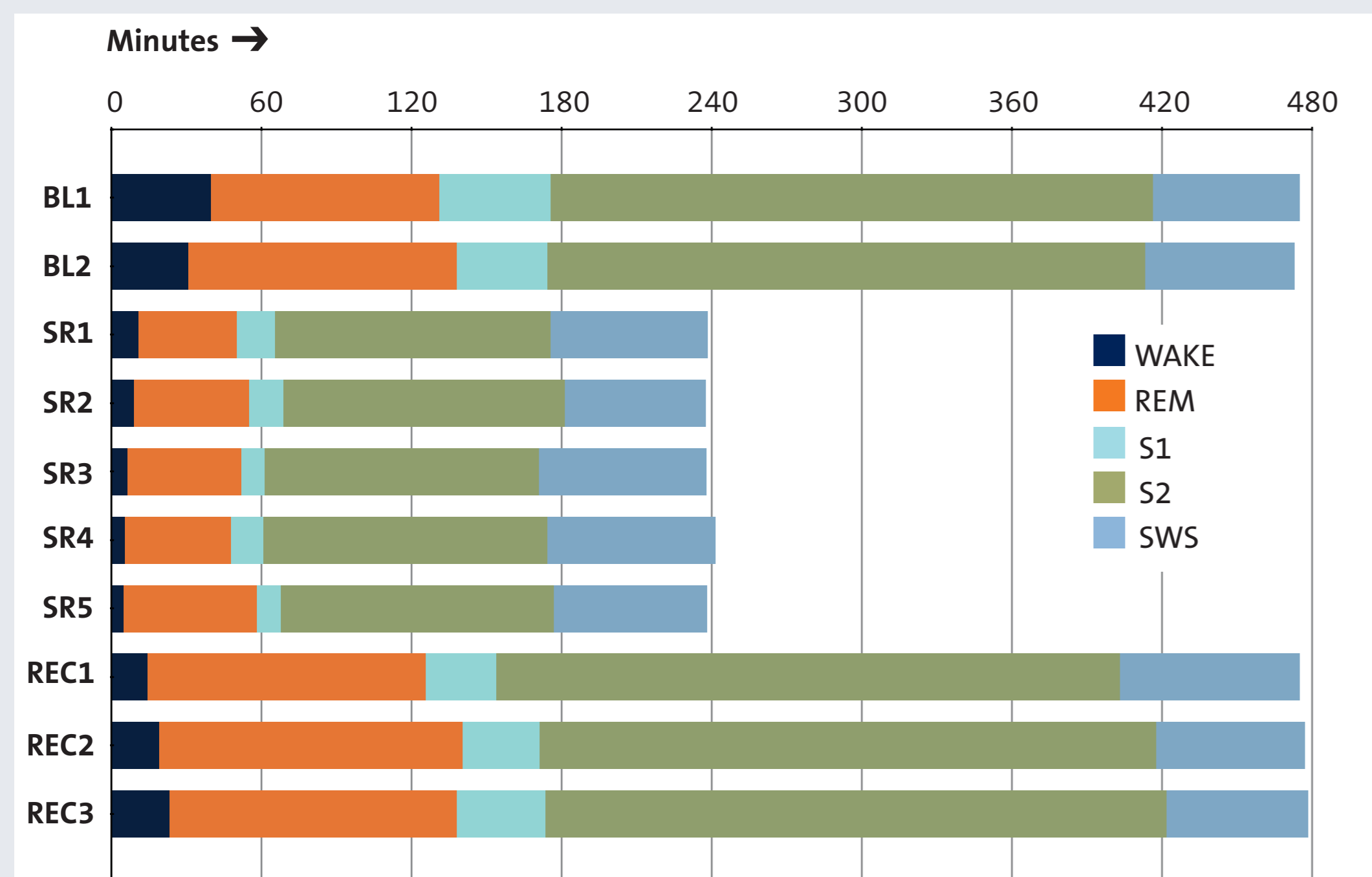
Results

During the 5 SR nights, sleep efficiency (.95 to .98; $p=.001$) and total sleep time (228 to 234 min.; $p<.001$) increased. Stage 1 (S1) sleep (15 to 10 min.; $p=.005$), time awake (11 to 5 min.; $p=.001$) and sleep latency (6 to 2 min.; $p=.02$) decreased.

Individuals sleepiness ratings in EXP correlated significantly to sleepiness as predicted by the TPMA in all but 1 individual, ranging from $r=.20$ ($p<.05$) to $r=.72$ ($p<.001$). Group means of sleepiness ratings (blue dots) as well as model predictions (red lines) are plotted below.

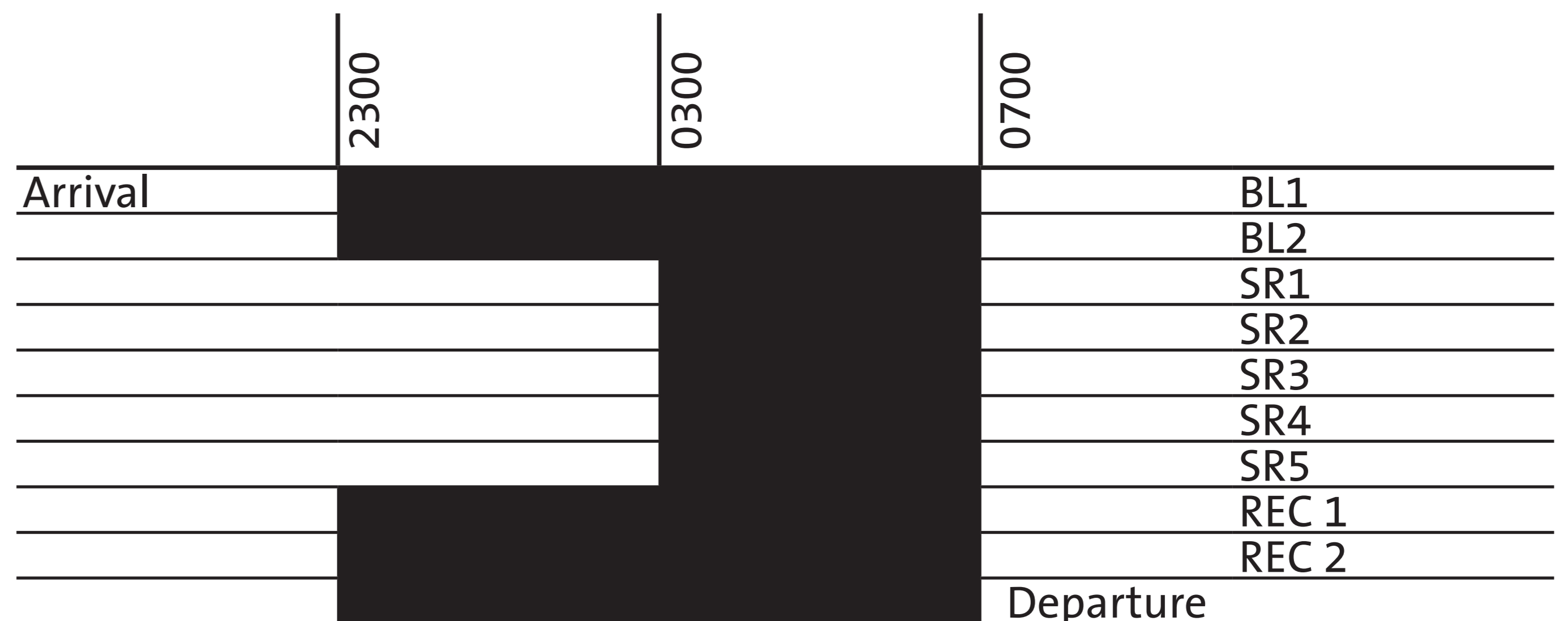
During the 3 REC nights, S1 sleep (28 to 35 min.; $p=.011$) and sleep latency (3 to 7 min.; $p=.039$) increased, whereas slow wave sleep (SWS; 72 to 57 min.; $p=.041$) decreased.

In CON, individuals sleepiness ratings correlated considerably worse to TPMA predicted sleepiness: only half the individuals showed a significant correlation.



Method

After 2 baseline (BL) nights of 8 hours time in bed (TIB), 14 healthy young men had 4 hours TIB per night for 5 nights (SR), followed by 3 recovery nights with 8 hours TIB (REC). 7 control subjects had 8 hours TIB per night throughout the experiment. Sleep stages were scored and repeated measures ANOVA used to detect changes across nights with restricted sleep and across nights with recovery sleep. In addition, subjects rated their sleepiness (Karolinska Sleepiness Scale, KSS) 140 times throughout the experiment. Ratings were longitudinally correlated to sleepiness as predicted by the three-process model of alertness regulation (TPMA).



Schematic study design of the experimental group. Time in bed (lights out) is indicated in black.

CONTACT