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.

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.

During the 3 REC nights, S1 sleep (28 to 35 min.; p=.011) increased, whereas REM sleep (11 to 8 min.; p=.017) 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 lines) as well as model predictions (red lines) are plotted below.

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.

Method
After 2 baseline (BL) nights of 8 hours time in bed (TIB), 14 healthy young men had 4 hours TIB per night for 3 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).

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

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