RECOVERY OF COGNITIVE FUNCTION FOLLOWING SIMULATED SPLIT SLEEP SCHEDULES

Stephanie A Centofanti[1], Michelle A Short[1,2], Cassie J Hilditch[1], Hans PA Van Dongen[3], Mark Kohler[1], Jill Dorrian[1], Siobhan Banks[1]

[1] Centre for Sleep Research, University of South Australia, Adelaide, South Australia, Australia; [2] Bushfire CRC, East Melbourne, Victoria, Australia;
[3] Sleep and Performance Research Center, Washington State University, Spokane, WA, USA

Introduction

- Shift work can lead to circadian misalignment and sleep deprivation, resulting in increased fatigue and reduced cognitive performance.
- In an 8h on / 8h off rotating shift schedule, circadian misalignment is likely to occur due to the rapidly rotating shifts. It is not clear whether the schedule also induces sleep loss and cumulative deficits in neurobehavioral performance – and if so, how long these deficits will take to recover.
- The aim of the present study was to explore neurobehavioral recuperation following four 24h periods on an 8h on / 8h off rotating shift schedule, compared to a 6h on / 6h split shift schedule.

Methods

- As part of an ongoing study, sixteen healthy subjects (N=8 per condition; ages 21-33; 8f) participated in a 9-day laboratory study.
- The study involved:
  - 2 baseline days (BL1, BL2; 10h time in bed (TIB) per day, 2200h-0800h)
  - 4 days on either a 8h on / 8h off rotating shift schedule (SS1-4) with 6h40min TIB during each 'off' period; or 6h on / 6h off split shift schedule with 5h TIB during each 'off' period
  - And 2 recovery days (R1, R2; 10h TIB per day, 2200h-0800h)
- Subjects all received 10h TIB per 24h in total, across both shift schedules
- Neurobehavioral tests were administered approximately every 2h during scheduled wakefulness. Tests included a 10min psychomotor vigilance test (PVT), the Samn-Perelli (SP) Fatigue Scale, and the Karolinska Sleepiness Scale (KSS).
- PVT Median Reaction Time (RT; milliseconds), SP fatigue scores and KSS scores were compared between shift schedules, and between BL, SS4, R1 and R2 days using linear mixed effects models and planned comparisons.

Results

- No significant main effect of shift schedule was found for all reported variables.
- There was a significant main effect of shift day for PVT median RT, $F(3,320)=4.17$, $p = 0.006$. A significant shift schedule*shift day interaction was found for PVT median RT, $F(3,320)=4.38$, $p = 0.005$ (Fig. 1A).
- There was a significant main effect of shift day for SP Fatigue, $F(3,332)= 6.85$, $p < 0.001$ (Fig. 1B). No interaction effect for shift schedule was found.
- There was also a significant main effect of shift day for KSS, $F(3,320)=13.06$, $p < 0.001$. A significant shift schedule*shift day interaction was found for KSS, $F(3,320)=3.50$, $p = 0.016$ (Fig. 1C).

Discussion

- There was an accumulation of subjective sleepiness and fatigue scores over the shift schedules, however all deficits returned to near baseline levels after one consolidated 10h sleep opportunity.
- Median RT remained low throughout the shift schedules and recovery days.
- Mean scores for all measures were not indicative of substantial fatigue, such that one consolidated 10h sleep opportunity sufficed after four days on the 8h on / 8h off rotating shift schedule and 6h on / 6h off split shift schedule.
- To what extent one consolidated 10h sleep opportunity would also suffice to recycle back onto the rotating shift schedule without carry-over effects on neurobehavioral functioning remains to be determined.
- Ongoing analyses of EEG, melatonin and cortisol data will further contribute to knowledge of recovery following these schedules.

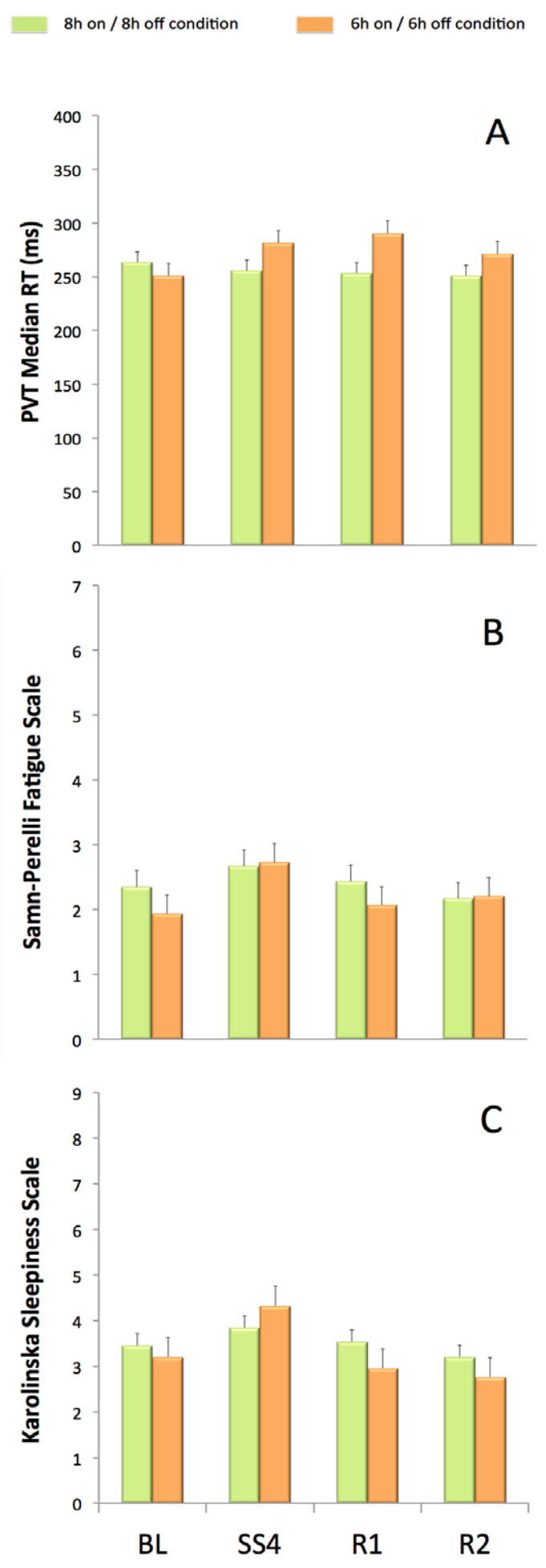

Figure 1- Data are presented as daily means (± SEM) across Baseline, Shift Schedule Day 4, Recovery Day 1 and Recovery Day 2.

University of South Australia | Centre for Sleep Research