



# Do split sleep/wake schedules reduce or increase sleepiness for continuous operations?

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## Highlights

- A split and a consolidated sleep/wake schedule were compared on sleepiness.
- The consolidated schedule had a long wake period and a long sleep period per day.
- The split schedule had two short wake periods and two short sleep periods per day.
- The split schedule led to a higher sleepiness level for half of the time awake.

## Abstract

This study compared the impact of split and consolidated sleep/wake schedules on subjective sleepiness during the biological day and biological night. This was achieved using a between-group design involving two forced desynchrony protocols: consolidated sleep/wake and split sleep/wake. Both protocols included 7 × 28-h days with 9.33 h in bed and 18.67 h of wake each day. While the consolidated sleep/wake protocol had 1 × 9.33-h sleep opportunity and 1 × 18.67-h wake

period each day, the split sleep/wake protocol had  $2 \times 4.67$ -h sleep opportunities and  $2 \times 9.33$ -h wake periods each day. For both protocols, subjective sleepiness was measured using the Karolinska Sleepiness Scale every 2.5 h during wake. A total of 29 healthy adult males participated, with 13 in the consolidated sleep/wake group (mean age = 22.5 yrs) and 16 in the split sleep/wake group (mean age = 22.6 yrs).

On average, subjective sleepiness during wake periods of the split condition was significantly higher than that during the first half of wake periods of the consolidated condition, but was similar to the level during the second half. These findings were observed for wake periods that occurred during both the biological day and biological night. Previous data have shown that cognitive impairment at night is lower for split schedules than consolidated schedules, but the current data indicate that feelings of sleepiness are greater for split schedules than consolidated schedules for at least half of the time awake. Thus, it should be explained to people operating split sleep/wake schedules that although they may perform well, they are likely to feel sleepy.

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## Keywords

Subjective sleepiness; Split sleep; Forced desynchrony; Shiftwork

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...The battery included the Karolinska Sleepiness Scale, Profile of Mood States, Psychomotor Vigilance Task, Postural Sway Test, and York Driving Simulator. Data from the test battery are not reported here, but they have been reported elsewhere for the consolidated sleep–wake condition (Darwent et al., 2010; Matthews et al., 2012a, 2012b; Sargent et al., 2010; Zhou et al., 2010, 2011, 2012) and the split sleep–wake condition (Kosmadopoulos et al., 2014; Zhou et al., 2017). The majority of the participants' free time between test