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Theoretical and empirical comparison of sleep and fatigue in two 2-section maritime watch systems: 6 hours on/6 hours off versus 8 hours on/8 hours off

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Introduction

Since 8 hours off compared to 6 hours off between watches provides seafarers with 2 hours extra for rest and sleep, it is hypothesized that the 8/8-system is associated with higher sleep quantity and quality as well higher on-watch alertness when compared to the 6/6-system.

Conclusion

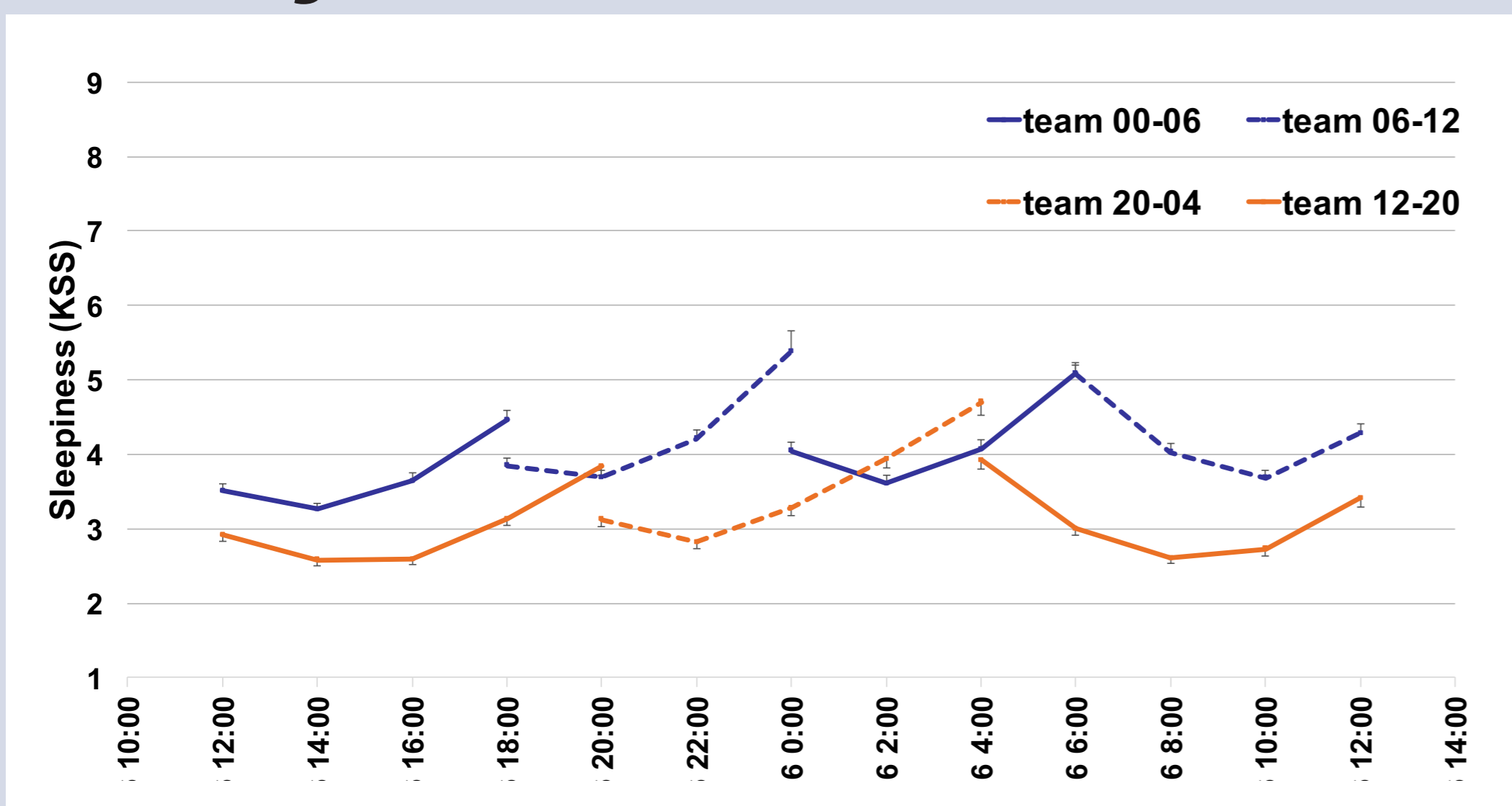
TPMA predictions were confirmed by the current empirical results; the 6/6 system is worse than the 8/8 system in terms of sleepiness, stress, fatigue, amount of sleep and usage of fatigue countermeasures.

Results

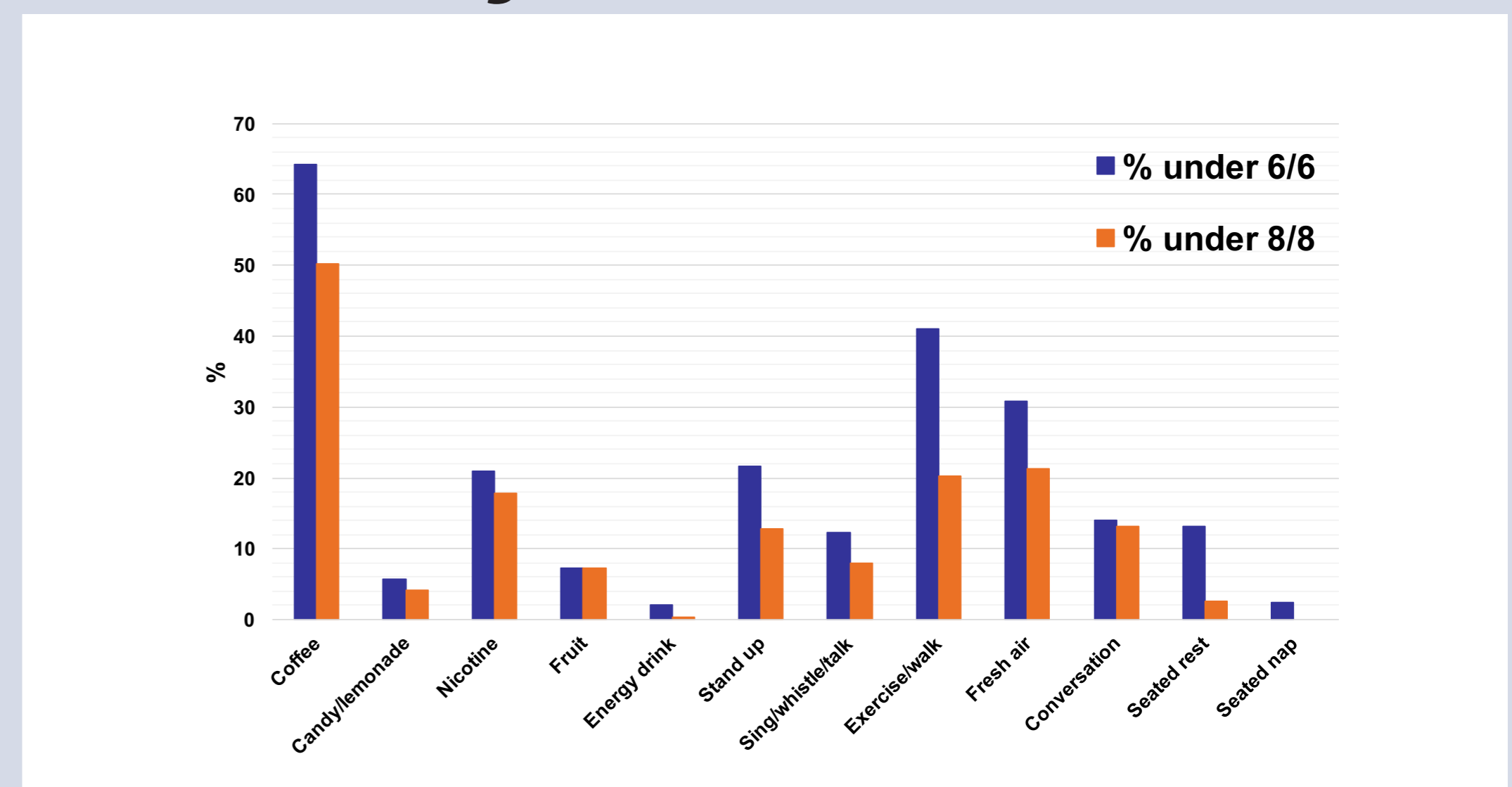
The proportion of KSS values ≥ 7 was considerably higher under the 6/6 regime (9.3%) than under the 8/8 regime (3.0%; $p < .0001$). Similarly, stress levels were lower under the 8/8 regime (2.5 ± 1.2) than under the 6/6 (2.9 ± 1.6) and so were fatigue levels (2.8 ± 1.1 versus 3.4 ± 1.3). The most severely affected watch under the 6/6 regime was the 06:00 to 12:00

watch with 11% of KSS values ≥ 7 . Under 8/8 it was the 20:00 to 04:00 watch which was most severely affected (5,3% of KSS values being ≥ 7). Average sleep duration per sleep episode under 6/6 was 256 ± 105 minutes, under 8/8 324 ± 106 minutes. The proportion of working days with usage of different fatigue countermeasures was higher under 6/6 for all countermeasures.

Higher sleepiness levels under the average day in the 6/6 regime:

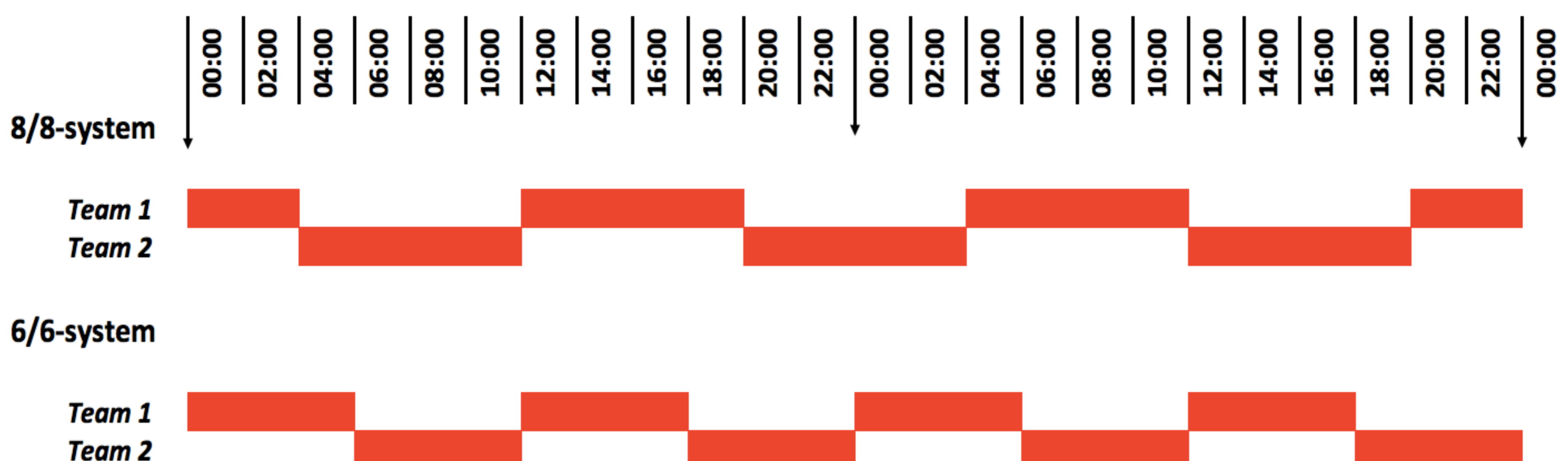


More frequent use of fatigue countermeasures under the 6/6 regime:



Method

Two alternating manning teams of 5 UK dredgers participated in a randomised crossed over design. Half of the crew was on ships running first a 6/6 system for 3 weeks that were, after a 3-week period of leave, turned into running an 8/8 system for 3 weeks. For the other half of the crew, the order was reversed. At work, the crew rated sleepiness (Karolinska Sleepiness Scale, KSS), stress (Stockholm University Stress Scale), and fatigue (Samn-Perelli fatigue scale) as well as sleep quantity and quality (Karolinska Sleep Diary) and wore actigraphs. Sleep and sleepiness were also theoretically modelled in both watch systems using the three process model of alertness (TPMA).



Schematic overview of 48 hours of the two watch systems. Watches are indicated in red, time in between is time off.

CONTACT