Sleep in Orthopaedic Surgeons: A Prospective, Longitudinal Study of the Effect of Home Call on Orthopedic Attending and Resident Sleep

Michelle Lawson[1], Karalynn J Lancaster, Colin David Lipps, Gerard Slobogean[2], Jacqueline Munch Brady[1], Nathan N O'Hara[3], Zachary Mark Working
[1]Oregon Health & Science University, [2]University of Maryland School of Medicine, [3]University of Maryland

INTRODUCTION:
The effect of home orthopaedic call on surgeon sleep has not been quantified despite known negative impacts of poor sleep on cognition, fine motor skills, and decision-making. The purpose of this study was to quantify the impact of resident and attending physician home call on sleep performance (total sleep, slow wave sleep (SWS), Rapid Eye Movement (REM) sleep) and heart rate variability (HRV). We hypothesized that home call would impair all sleep and HRV parameters.
METHODS:
Orthopedic residents and attendings at a Level I academic trauma hospital wore WHOOP 3.0 straps from June 2021 to July 2022. The WHOOP strap (previously validated against polysomnography) objectively measures sleep parameters. Call schedules were matched with physiologic data to compare baseline sleep to sleep performance on call. Total sleep, SWS, REM sleep, and HRV were recorded for all nights. Fixed effects regression models were used for statistical analysis.
RESULTS:
There were 16 residents (avg. age 32, IQR 30-32) and 14 attendings (avg. age 40, IQR 38-42) enrolled. Number of nights recorded for residents and attendings were 4,574 and 3,573, respectively. Overall, attendings (6.0 hr) slept significantly less than residents (6.7 hr) ($p<0.001$). When on home call, resident total sleep decreased by 20% from baseline ($p<0.001$), REM sleep decreased by 12% ($p<0.001$), and SWS decreased by 12% ($p<0.001$). For attendings, total sleep on call decreased by 10% from baseline ($p<0.001$), REM sleep decreased by 7% ($p<0.001$), and SWS decreased by 4% ($p<0.01$).
DISCUSSION AND CONCLUSION:
Orthopaedic surgery residents and attendings exhibit low baseline sleep, and taking home call reduces this further. On home call nights, residents and attendings experienced a significant decrease in total sleep, REM sleep, and SWS. This suggests there is a previously unmeasured toll of home call on orthopaedic surgeons, of which further research is required to ensure excellent patient care, maximize educational environments, and develop strategies for resilience.

	Residents Mean (IQR)	Attendings Mean (IQR)
Total sleep (hr)	6.7 (6.5-6.9)	6.0 (5.8-6.1)*
REM sleep (hr)	2.3 (2.2-3.4)	1.9 (1.8-2.0)
Slow wave sleep (hr)	1.8 (1.7-1.9)	1.5 (1.4-1.5)
Light sleep (hr)	2.6 (2.5-2.8)	2.6 (2.5-2.7)
Sleep disturbances (per hr of sleep)	1.2 (1.1-1.3)	1.4 (1.3-1.4)
Sleep latency (minutes)	4.2 (3.3-5.0)	2.3 (1.5-3.2)
Resting heart rate (beats per minute)	61.9 (61.1-62.6)	52.9 (52.3-53.6)
Heart rate variability (milliseconds)	54.4 (52.3-56.5)	76.4 (75.1-77.7)

Figure 1. Baseline sleep and physiologic characteristics.
Even on non call nights, resident and attending mean sleep is below the recommended 8 hours of sleep each night. Attendings sleep significantly less than residents (controlled for age). In addition, the sleep latency of 4.2 or 2.3 minutes suggests chronic hypersomnolence. * = p<0.05.

	Residents	Attendings
Total sleep	-20% (p<0.001)*	-10% (p<0.001)*
REM sleep	-12% (p<0.001)*	-7% (p<0.001)*
Slow wave sleep	-12% (p<0.001)*	-4% (<0.01)*
Resting heart rate	0% (p=0.47)	+ 1% (p=0.19)
HRV	0% (p=0.91)	-4% (p<0.01)*

Figure 2. Effect of call nights on orthopedic surgeon sleep.
Both residents and attendings have significantly decreased sleep on call nights. In addition, there was a significant decrease in both REM sleep and SWS on call nights. There was a significant depression of HRV amongst attendings but not residents on call nights. * = p<0.05.