Effect of Level I Trauma Call on Orthopaedic Attending Sleep Behavior and Physiologic Recovery: A Prospective Longitudinal Study

Michelle Lawson[1], Colin David Lipps, Karalynn J Lancaster, Qian Yang, Jacqueline Munch Brady[1], Zachary Mark Working
[1]Oregon Health & Science University

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. Almost all orthopaedic surgery attendings take home call, yet they often complete a full day of clinic or operative duties the next day. The purpose of this study is to prospectively quantify the impact of attending physician home call on sleep performance (total sleep, slow wave sleep (SWS), Rapid Eye Movement (REM) sleep)m and cardiac recovery metrics (heart rate variability (HRV)). HRV measures time variance in between heartbeats, reflecting sympathetic/parasympathetic system balance and recovery. Low HRV has been previously shown to reflect fatigue and impaired cognitive function. We hypothesized that home call would impair all sleep parameters, that HRV would decrease post call (reflecting poor recovery), and that sleep patterns would rebound the night after call to compensate for poor call sleep.

METHODS:

Twelve orthopaedic attendings taking call (subdivisions included trauma, spine, hand, and pediatrics) at a level I academic trauma hospital with full time in-house resident coverage wore WHOOP 3.0 straps. The WHOOP strap measures heart rate, HRV, ambient temperature, skin conductivity, and movement via a 3-axis accelerometer 100 times per second on a continual basis. It objectively measures and quantifies sleep parameters, including total sleep duration, SWS, and REM sleep, and has been previously validated against polysomnography (96% accuracy). A total of 124 individual call nights were prospectively recorded between June and December 2021. Call schedules were matched with physiologic data to compare baseline sleep (defined as the average of ~200 non-call nights per attending) to sleep performance on call. Total sleep, SWS, REM sleep, and HRV were recorded for all nights. “Poor” sleep was defined as <80% of baseline individual sleep.

RESULTS:

Total time slept, slow wave sleep, and REM sleep were all decreased on call nights compared to baseline. A notable shift from baseline occurred in all sleep parameters, suggesting sleep was impacted in a predominance of call experiences. In total, 30.0% of attendings had poor total sleep on call nights; 30.6% of call nights recorded poor SWS, and 41.9% of call nights recorded poor REM sleep (Figure 1). HRV was similarly decreased the morning after a call shift. Most call nights resulted in decreased HRV, with 25% of nights resulting in next-day HRV below 80% of baseline. Sleep and HRV improved on subsequent nights, with only 12% of surgeons below 80% of baseline HRV on post-call day two. Sleep performance in all categories rebounded on PCN1 and PCN2 (figure 2).

DISCUSSION AND CONCLUSION:

Orthopaedic surgeon sleep is significantly affected by taking level I call. Despite excellent resident coverage, attending surgeons showed reduced sleep performance and recovery metrics the following day. Most importantly, deep sleep and REM sleep are specifically impacted by call. As SWS and REM are recovery sleep cycles, this effect on sleep presumably affects next day alertness and cognitive function. This muted recovery is seen in the decreased HRV on days following a call shift. Sleep and recovery metrics appear to improve toward baseline on subsequent nights after call. These observed physiologic effects of home call on orthopaedic surgeon sleep may carry consequences for following day performance, and deserve consideration regarding surgeon health and patient safety.

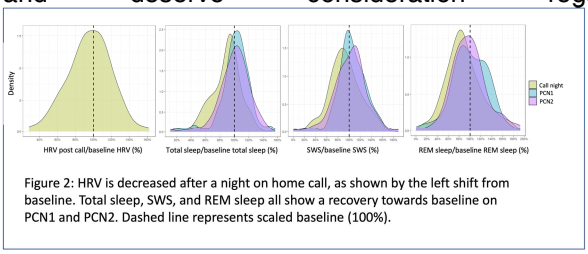

Figure 2: HRV is decreased after a night on home call, as shown by the left shift from baseline. Total sleep, SWS, and REM sleep all show a recovery towards baseline on PCN1 and PCN2. Dashed line represents scaled baseline (100%).

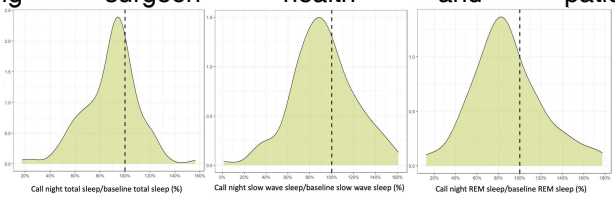

Figure 1: Attending call night total sleep, SWS, and REM sleep are all decreased compared to baseline, as seen by left-shift. Dashed line represents scaled baseline (100%).