

Editorial:

# Is Being On Call Driving You Crazy and Making You Sick?

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Given the economic and other non-altruistic factors associated with being on emergency room (ER) call (poor remuneration, general lack of appreciation by “entitled” patients, increased exposure to litigation, risk of EMTALA violations, chronic sleep deprivation, and a lifestyle that often shortchanges self and family), it seems reasonable to ask: Are physicians crazy for taking ER call? Or, is being on call driving some physicians crazy and making them sick?

Learning to function under conditions of chronic partial sleep deprivation is a rite of passage in residency and often continues as a way of life in medical practice. Physicians who take frequent ER call often function in a state of chronic partial sleep deprivation. The physical, cognitive, and psychological effects of years of chronic partial sleep deprivation are just beginning to be recognized.

## Physical Effects of Chronic Partial Sleep Deprivation

Recent studies link chronic partial sleep deprivation to obesity via effects on hormones that regulate appetite. Leptin is a hormone produced in adipocytes thus suppresses appetite, and ghrelin is a peptide hormone produced in the stomach that stimulates appetite. In a long-term study involving 1,024 volunteers from the Wisconsin Sleep Cohort Study, investigators found that less sleep was associated with lower leptin levels, higher ghrelin levels, and increased body mass index (BMI).<sup>1</sup> The increase in BMI was found to be proportional to the decrease in sleep time in persons who slept less than 8 hours per night.

Another study demonstrated an association between short sleep duration and obesity after controlling for potential confounding factors in young adults.<sup>2</sup> There have also been reports of increased preference for fatty foods, increased insulin resistance, decreased glucose tolerance, impaired immune system function, altered metabolism, and increased blood pressure associated with sleep deprivation. So, chronic partial sleep deprivation may lead to a variety of medical illnesses including obesity and other associated disorders such as diabetes and hypertension.

There is also evidence linking short sleep duration to increased coronary events and increased risk of mortality from any cause. One study reported an association between short sleep duration and increased risk of coronary events in women (age 45-65 enrolled in Nurses’ Health Study) after adjusting for potential confounding variables.<sup>3</sup> Another study found that individuals who sleep fewer than seven hours per night had an increased risk of dying from any cause over a 25-year period.<sup>4</sup> Yet another study showed that taking a siesta may reduce one’s risk of coronary mortality. Those who took an occasional midday nap had a 12% lower coronary mortality, and those who took a midday nap on a regular basis had an astounding 37% lower coronary mortality.<sup>5</sup>

## Cognitive and Psychological Effects of Chronic Partial Sleep Deprivation

There is also evidence that sleep deprivation impairs memory function and the ability to learn new information. In a study involving acute sleep deprivation (awake 35 hours), students performed on average 19% worse on memory tasks, and some

performed as much as 40% worse compared to students who were not sleep deprived.<sup>6</sup> The study also reported that functional MRI (fMRI) showed significantly decreased activity in the hippocampus of sleep-deprived students. The hippocampus is an essential brain structure in short-term memory. Also, sleep deprivation seems to impair consolidation of learning by interfering with the transfer of information from short-term memory (hippocampus) to long-term memory (neocortex) that occurs during sleep.

Another study has shown that students perform 20% better on a complex motor task following a good night’s sleep.<sup>7</sup> Improved performance also seems to be associated specifically with Stage 2 sleep (non-REM). Stage 2 sleep occurs in the last few hours of sleep, which may be curtailed in early risers. Other reports indicate that a “power” nap (30 min–1 hr) can improve performance.

One study compared performance in sleep-deprived residents on call every fourth or fifth night to residents who had a lighter call schedule and were given alcohol.<sup>8</sup> The study found that post-call performance of sleep-deprived residents was equivalent to the performance of non-sleep-deprived residents who had a blood alcohol level just below the legal driving limit (0.04–0.05 g/dL). Errors of commission in the sleep-deprived group were found to be 40% higher than the non-sleep-deprived group. And, much like people who have had several cocktails and think they are fine to drive, it was noted that sleep-deprived residents may not recognize their impairment.

Sleep loss can also lead to psychological disturbance and emotionally irrational behavior. Results from a recent fMRI study may explain why some physicians have increased irritability and overreact with inappropriate responses following a night of being on call. The study, involving 26 healthy individuals, showed a 60% increase in activity in the amygdala in response to viewing negative images following 35 hours of wakefulness.<sup>9</sup> The amygdala is a primitive brain structure that is intimately involved in regulating emotions related to the fight-or-flight response. It has also been linked to various psychiatric disorders including anxiety and depression. The medial prefrontal cortex provides an inhibitory influence on the amygdala so that emotions can be put into appropriate context so as to avoid overreaction.

The study showed that instead of prefrontal inhibition of the amygdala in sleep-deprived individuals, the amygdala activated the locus ceruleus, which secretes noradrenaline and fuels the fire of the fight-or-flight response. Essentially, sleep deprivation cuts the cortical brakes on the amygdala and steps on the accelerator, causing emotions to surge unchecked. The prefrontal amygdala disconnect appears to mimic pathological psychiatric patterns of response. There is also evidence that lack of sleep can aggravate pre-existing psychological conditions.<sup>10</sup>

## Chronic Sleep Deprivation and Medical Errors

Sleep deprivation in physicians is also associated with increased risk of medical errors. One randomized controlled study of 2,737 residents found that after five 24-hour shifts per month, residents were 7.5 times more likely to make a significant medical error, and the number of preventable fatigue-related errors resulting in patient death increased by 300%.<sup>11</sup> After only one to four extended shifts ( $\geq 24$  hr) per month, residents were 8.7 times more likely to report a preventable fatigue-related adverse medical event.

Although the Accreditation Council for Graduate Medical Education (ACGME) implemented limits on resident working hours in 2003 to 30 consecutive hours and 80 hours per week over a 4-week period, one large study found widespread noncompliance with these requirements.<sup>12</sup>

### Conclusions

Many questions remain unanswered. The cumulative cognitive and physical effects of chronic partial sleep deprivation over decades of a physician's career are unknown. Recent studies certainly point to significant adverse physical consequences of chronic partial sleep deprivation. The risks of driving while sleepy have also often been equated with the same type of increased risk that occurs while driving under the influence of alcohol. Evidence suggests that physicians who practice while under the influence of sleep deprivation expose patients to the same type of risk as physicians who practice under the influence of alcohol. Given the increased risk of developing alcoholic dementia in individuals who consume alcohol on a regular basis, one wonders whether there is a similar cumulative effect on cognition associated with long-term chronic partial sleep deprivation. Does the hippocampus sustain cumulative damage over time, owing to chronic sleep deprivation?

The cumulative psychological effects of chronic partial sleep deprivation over decades are also unknown. We do know that many psychiatric conditions are associated with sleep impairment. Although sleep disturbance was thought to be secondary to these psychiatric illnesses, recent studies raise the possibility that sleep disturbance may be causally related to the psychiatric condition or worsen a pre-existing psychiatric condition. Does chronic partial sleep deprivation over decades lead to personality changes, reduced empathy and compassion for patients, and physician burnout?

Physicians need to develop sleep risk-management strategies to minimize physical, cognitive, and psychological harm to themselves and harm to their patients via medical errors. Limiting on-call hours and taking a daily siesta may benefit both physicians and patients.

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