

# If You Thought That Night Float Solved Everything, Keep Dreaming

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In 2003, the Accreditation Council for Graduate Medical Education began limiting duty hours. The rationale for this change was that fewer hours would decrease fatigue and, in turn, increase patient safety. In response, many programs began using night float systems to meet these requirements while continuing to cover nighttime clinical needs. Perhaps in anticipation of this growth in the use of night float, in 2011 the Accreditation Council for Graduate Medical Education limited the number of consecutive nights of night float to 6. This limit on the number of consecutive night float shifts was later removed by the Accreditation Council for Graduate Medical Education in 2017.

It has been 8 years since the initial limitation of night float to 6 consecutive nights, and now, for the first time, a study by Dunn *et al.*<sup>1</sup> has more critically examined the effects of night float on both the quantity and quality of sleep for residents. The researchers used single-channel electroencephalogram recordings to investigate the sleep patterns of 29 anesthesia residents at their institution. They determined residents' sleep characteristics during the 3 nights before night float (baseline), during the 6 days of night float, and during the 3 nights after being on night float (recovery). The authors described at least three meaningful results. First, they found that during the baseline period, their residents got 5.9 h of sleep, on average, suggesting that residents may be sleep-deprived at baseline. Second, they found that residents slept only 4.5 h between shifts, on average, while on night float. Third, they found that although residents' total sleep time returned to normal during the recovery phase, time in both deep sleep and rapid eye movement sleep remained substantially reduced. This implies that 3 days of recovery were insufficient to return the residents to their baseline



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sleep patterns. In short, residents were not getting enough sleep at baseline, lost more sleep during the night float period, and did not return to baseline during the recovery period. The take home message is that night float can have negative effects on sleep and thus is less of a magic bullet than some may have thought.

When evaluating a night float system, it is important to study the overall effect on sleep for all residents, as was done in this study. They did this by comparing mean sleep times before, during, and after night float for each resident. Thus, the reported effects reflect average changes within each resident. They also provided two measures of effect size: absolute change and Cohen's *d* (which standardizes a change by dividing the difference in means by the pooled SD). This

should allow for more meaningful comparisons with future studies. Of note, there was significant variability in measured sleep variables within the cohort of residents. Thus, although sleep was disturbed on average for the entire cohort, it is quite possible that certain individuals adapted well to the night float system.

The present study did not compare night float to 24-h call, though the authors cited prior research that purports several advantages of night float over 24-h call. Advantages were described both for patients (reduced patient mortality and reduced surgical complications [surgery residents] and fewer missed diagnoses [radiology residents]) and for residents (increased sleep and personal time and reduced fatigue [surgery residents]). These findings seem to be at odds with the present study's results. One possible explanation to reconcile this difference could be that 24-h call is substantially worse for sleep and performance. Thus, a direct comparison of the effects of night float and 24-h call on

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This editorial accompanies the article on p. 401.

Accepted for publication April 3, 2019. From the Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General Hospital, and Harvard Medical School, Boston, Massachusetts.

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sleep quantity, quality, and recovery will be an important topic for future study. Another possible explanation is that the decrement in sleep quality found by Dunn *et al.*<sup>1</sup> might not meaningfully affect clinical performance.

In their concluding remarks, the authors suggest that their findings could have important implications for wellness and burnout. Data from anesthesiology residents in the United States indicate a high rate of burnout, and that burnout is partly related to hours worked.<sup>2</sup> Although duty hour regulations were introduced to improve both patient safety and resident wellness, the data from Dunn *et al.*<sup>1</sup> suggest that night float may not be fully delivering on the wellness front. Literature suggests that chronically insufficient sleep is associated with worse health outcomes and depression.<sup>3</sup> The impact of shorter stretches of insufficient sleep on wellness is unknown. However, the finding that night float was associated with decreased sleep quantity and quality provides a compelling avenue for future research.

The results from the study of Dunn *et al.*<sup>1</sup> will need to be replicated in other settings for a variety of reasons. The study cohort was comprised of only 29 residents from a single center. In addition, they had complete electroencephalogram data for only 12 of those 29 residents and no data on whether residents napped while on night float. Also, the sleep data indicated less sleep during night float in this study (5.9 h) as compared to a prior cohort from the same residency (6.6 h),<sup>4</sup> which suggests that the results may vary depending on other situational factors. The structure of night float itself is also likely to vary substantially between institutions (or even within the same institution), both in types of activities and in the number of contiguous days worked. Due to these variations, the impact of night float on sleep will likely vary to some degree in future studies. Replication will allow for improved generalization from one anesthesiology residency to another and across different medical specialties.

The study of Dunn *et al.*<sup>1</sup> is an important step toward improving our understanding of a significant challenge in graduate medical education. Changes made by the Accreditation Council for Graduate Medical Education

have been well intentioned. That said, these changes are often not informed by well designed studies. As the present study illustrates, more rigorous investigation before widespread changes in Accreditation Council for Graduate Medical Education requirements will help us better understand, and ultimately cope with, the unintended consequences that so often accompany good intentions.

## Competing Interests

The authors are not supported by, nor maintain any financial interest in, any commercial activity that may be associated with the topic of this article.

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