Resident Sleep During Traditional Home Call Compared to Night Float

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Abstract

Purpose This article aims to compare resident sleep while on night float with a traditional home call.

Methods We conducted a crossover observational study assessing sleep patterns of seven postgraduate year-2 ophthalmology residents at the University of Washington from 2019 to 2021 using the Fitbit Alta HR device. Overnight call was scheduled from 5 p.m. to 8 a.m. on weekdays, and 8 a.m. to 8 a.m. on weekends. The residency program implemented a partial night float rotation, during which two to three nights of consecutive call were assigned to a resident without other clinical duties. Sleep was recorded using the Fitbit Alta HR for residents while on a 5-week partial night float rotation, on 10-week home call rotations, with postcall relief, and for stretches of seven or more days without call responsibilities. Mixed model regression analysis was used to compare average sleep on home call, night float, and periods without call.

Results Sleep data were recorded for a total of 1,015 nights, including 503 nights on home call rotation and 230 nights on night float rotation. Residents slept more during periods away from call compared to either night float or home call rotations ($p < 0.001$). Residents experienced increased average overall sleep during 10-week rotations on night float compared to home call ($p = 0.008$). While there was no difference in overnight sleep on call between night float and home call ($p = 0.701$), residents experienced more sleep overall while on call on night float compared to home call due to more sleep being recorded during postcall naps ($p = 0.016$).

Conclusion Implementing a night float system can increase resident sleep by allowing for more sleep recovery during time away from clinical duties.

Keywords
- call
- night float
- home call
- ophthalmology residency
- postcall relief
- resident sleep

Background

Since the implementation of Accreditation Council for Graduate Medical Education (ACGME) duty hour restrictions on July 1, 2003, residency programs have been faced with the challenge of mitigating resident fatigue and work hours while optimizing surgical training and clinical experience.[1] This need was further emphasized in the ACGME 2020

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Common Program requirements, which required programs to apply strategies to encourage optimal resident well-being.[2] Multiple studies have shown that sleep deprivation experienced by residents is significantly associated with not only burnout, but also reduced cognition and adverse patient outcomes.[3–6] In recent years, multiple residency programs have implemented night float systems in an attempt to improve residents' experience on call and quality of life.[7–9] Per ACGME, residents assigned to night float are assigned onsite duty during night shifts and do not have daytime assignments.[10] Although schedules vary among programs, night float system typically consists of consecutive shifts of 10 to 12 hours over the course of 1 to 2 months.[11–13] A systemic review found that in several programs which had implemented night float call systems, resident satisfaction, morale, and quality of life increased,[5,8,14,15] and one study in ophthalmology residents showed a similar subjective improvement in burnout, fatigue, and workhours.[12] However, data for whether night float improves resident sleep quantity have been mixed,[13,16–20] and it is unclear whether night float improves amount or quality of sleep, especially when compared to home call.

Wearable activity trackers including the Fitbit Alta HR, employs photoplethysmogram sensors which measure volumetric variations of blood circulation to track cardiovascular system activity, in addition to three-axis acceleration sensors, to improve measurement precision.[21,22] Recent studies have demonstrated that Fitbit devices provide reliable measurements of total sleep time in healthy populations and have a high level of consistency between devices.[23,24] The objective of this study was to use the Fitbit Alta HR device to measure sleep patterns of ophthalmology residents on different call schedules, including home call, night float rotations, and time away from call.

Methods

This study was approved by the University of Washington Institutional Review Board and written consent was obtained from all participants. This was a crossover observational study assessing patterns of seven postgraduate year (PGY)-2 ophthalmology residents at the University of Washington from 2019 to 2021 using wrist actigraphy. Overnight call was scheduled from 5:00 p.m. to 8:00 a.m. on weekdays, and 8:00 a.m. to 8:00 a.m. on weekends. The residency program implemented a partial night float rotation, during which two to three nights of consecutive call (typically Sunday–Monday 8:00 a.m.–8:00 a.m., Monday 5:00 p.m.–8:00 a.m., and occasionally Tuesday 5:00 p.m.–8:00 a.m.) were assigned to a resident on a research rotation, without other clinical duties. The remaining nights of call were assigned to residents as home call with postcall relief, such that residents returned to regularly scheduled clinic after a call shift but were relieved of clinical duties at noon following overnight call. Typically, residents were scheduled for approximately 12 call shifts per month on night float rotations and 6 call shifts per month on traditional home call rotations, with no call taken on day consult rotations.

Sleep data of PGY-2 ophthalmology residents were collected using the Fitbit Alta HR commercial device (Fitbit, San Francisco, CA). Residents were asked to wear their Fitbits as much as tolerated throughout the entire PGY-2 year, with a minimum of at least 2 weeks on each call schedule over 365 days. Fitbit sleep and activity were matched to 8-week resident rotations on either night float, home call, or off call. If residents had a stretch of 7 days or more not on call, typically during a consult rotation when residents were not assigned regular call duties, this was also defined as off call time. Postcall recovery sleep was defined as any stretch of sleep recorded by the Fitbit, for which the majority of the sleep occurred between 8 a.m. and 8 p.m. on the day the call shift ends. Raw data collected from the participants on the Fitbit device were processed using the default proprietary algorithm developed by the Fitbit developers, and the results were uploaded from the Fitbit application synced with the device. The Fitbit provided data on "total minutes asleep" for every episode of sleep experienced, with a minimum of 15 minutes of sleep recorded per episode. These sleep minutes were tabulated for each call shift, as well as on off call dates during each call schedule rotation. The data were organized into categories including average amount of sleep over the entire rotation, as well as sleep minutes while on call and during postcall recovery for both night float and home call schedules. Mixed model regression was conducted in R software to compare sleep between the home call, night float, and off call groups.

Results

Seven residents participated in the study, with an average age of 29 and a male:female ratio of 5:2. Demographics and data collected from residents are listed in ►**Table 1**. Sleep data were recorded for a total of 1,015 nights, including 503 nights on home call rotation, 230 nights on night float rotation, and 282 on a rotation without call duties. All seven residents recorded sleep during home call rotations, while five residents recorded sleep during night float rotations, and five residents recorded sleep during periods away from call. Individual residents recorded (mean $\pm$ SD) 43 ± 20 nights of sleep on night float, 73 ± 48 nights of sleep on home call, and 56 ± 45 nights of sleep during periods away from call.

Residents slept more when they were not assigned call compared to when they were on call (both night float and home call; $p < 0.001$), with mean overall sleep 7.1 ± 1.2 hours on stretches without call and 6.3 ± 2.1 hours when residents were on rotations with either home call or night float schedule.

Comparing home call with night float, residents slept more overall during rotations on night float compared to home call ($p = 0.008$), with residents sleeping on average 6.6 ± 1.9 hours on night float rotations compared to 6.2 ± 2.2 hours while on home call.

For comparison of call nights, only data from the five residents who had recorded both home call and night float data were used. When considering sleep during call nights including overnight sleep and postcall recovery sleep (from 5 p.m. through 5 p.m.

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Table 1 Demographics and data collection of night float, home call, and off call cohorts

	Night float ($n = 5$)	Home call ($n = 7$)	No call ($n = 5$)	
Demographics				
Age, mean	29	29	29	
M:F ratio	4:1	5:2	4:1	
Data collection and adherence				
Nights recorded per call schedule, all residents, *n*	230	503	282	
On call nights recorded, all residents, *n*	73	161	N/A	
Number of nights recorded per resident, mean ± SD (range)	43 ± 20 (17–61)	73 ± 48 (11–145)	56 ± 45 (12–107)	
Percentage of nights recorded per resident, mean ± SD (range)	68 ± 35 (23–94)	39 ± 28 (3–83)	49 ± 40 (23–99)	
Average recorded sleep in hours, mean ± SD				***p*-Value**
Sleep per night over the entire rotation	6.6 ± 1.9	6.2 ± 2.2	7.1 ± 1.2	0.008[a]
Total sleep during call nights including overnight sleep and postcall recovery	5.1 ± 2.8	4.2 ± 2.6	N/A	0.016
Overnight sleep during call nights	2.5 ± 2.2	2.6 ± 2.1	N/A	0.701
Postcall recovery sleep	2.5 ± 2.5	1.3 ± 1.6	N/A	<0.001

Abbreviations: M: F, male:female; SD, standard deviation; N/A, Not applicable
[a]*p*-Value of home call versus night float.

the next day), residents on average slept more while on night float than on home call ($p = 0.016$). On average, residents slept 4.2 ± 2.6 hours on each shift of home call, and 5.1 ± 2.8 hours on each shift of night float, including both overnight and during postcall recovery sleep.

Postcall recovery sleep was significantly different between night float and home call schedules, as residents slept 2.5 ± 2.5 hours after night float call compared to 1.3 ± 1.6 hours after home call ($p < 0.001$). When examining overnight sleep while on call only, overnight sleep while on night float was 2.5 ± 2.2 hours whereas overnight sleep while on home call was 2.6 ± 2.1 hours, and this difference was not statistically significant ($p = 0.701$). Thus, postcall recovery sleep accounts for the increased resident sleep during night float rotations compared to home call rotations.

Discussion

This was a study designed to provide quantitative data comparing sleep of ophthalmology residents on different call schedules using the Fitbit Alta HR device. We found that residents on a night float schedule had significantly higher average sleep over a 10-week rotation than on a home call schedule ($p = 0.008$). Average sleep on call (including overnight and postcall recovery sleep) was also higher on night float shifts compared to home call shifts ($p = 0.016$).

Even though postcall relief was built into both night float and home call schedules to allow for sleep recovery after call, our results demonstrated that ophthalmology residents continued to sleep less while on either call schedule compared to periods away from call. This suggests that the sleep disruption and deprivation introduced by call is not fully remedied by providing time for postcall relief. However, our finding that residents slept more on night float blocks suggests that implementing a night float system could alleviate some of the sleep deprivation caused by call duties. This could be due to the overall lower number of hours on duty when residents were on night float compared to home call schedules, as residents are scheduled for approximately 58 hours of duty on night float rotations, while they are scheduled for an average of approximately 67 hours on home call rotations. While residents slept the same amount overnight on both night float and traditional home call shifts, residents slept more postcall during night float; the inconsistency of sleep schedules in the traditional home call structure may have prevented residents from using postcall recovery time to sleep. Additionally, postcall relief is provided only after 12 p.m. during home call schedules whereas residents are relieved immediately after night float shifts. This suggests that additional sleep during a home call shift may be possible if postcall relief was offered immediately after home call rather than at 12 p.m.

Residents experienced less than 7 hours of sleep per night on average while on either call schedule, consistent with sleep deprivation.[25] This is a finding that is consistent across residents of various specialties.[26] Sleeping less than 7 hours per night regularly is associated with adverse health outcomes, including diabetes, hypertension, and heart

disease.[25] We previously demonstrated that ophthalmology residents with decreased sleep experienced increased feelings of burnout, depression, and anxiety,[20,27] and other studies have also shown an association between self-reported sleep deprivation and an increased prevalence of burnout.[28,29] While the improvement of an average 24 minutes of sleep per night on night float rotations compared to home call seems modest, the cumulative 2.8 hours of additional sleep per week on night float may be impactful to reducing sleep deprivation. However, a transition from home call to night float requires shifting daytime clinical training hours to afterhours for a continuous period of time, so there are additional logistical and training implications to consider for each individual program.

Further analysis is required to determine whether the quality, in addition to quantity, of resident sleep between night float and home call schedules significantly varied. Night shift work has been associated with circadian rhythm misalignment, which can adversely affect sleep quality.[23,24] Past studies using subjective data have shown that residents reported experiencing more sleep disturbances while on night float rotations,[18] though a recent study using the Fitbit device found no significant difference in sleep efficiency between night float and on-call residents.[30] Similarly, wrist actigraphy has been shown to be capable of diagnosing circadian rhythm sleep disorders, when at least 7 days of actigraphy are performed with a sleep diary.[31,32] However, these diaries require a high level of participant burden to increase validity, which would be difficult for busy residents to maintain.[31] In addition, commercial fitness trackers such as the Fitbit have shown mixed results when used to evaluate specific sleep stages and pathologic sleep states.[33,34] Further studies analyzing sleep data from wrist actigraphy concurrently with sleep diary completion in residents on varying call schedules would be useful in determining differences in sleep quality and potential circadian rhythm misalignment.

Limitations of this study include low sample size and variable adherence with Fitbit usage among individuals, and the study's nonrandomized design with data obtained from a single ophthalmology program. Although all seven residents wore the Fitbit devices for at least 2 weeks while on home call rotations, two residents had not worn the device while on the night float rotation and two residents had not worn the device during any time away from call and were thus excluded from those analyses.

Additionally, the study did not formally collect subjective feedback regarding call schedules, or account for outside factors, including additional personal responsibilities or obligations, that could influence sleep opportunities. However, the objective measurement of total sleep time using the Fitbit Alta HR device for a large number of recorded nights on and off call provides unique insight into differences in resident sleep between two distinct call schedules. More studies are needed to investigate the effects of night float implementation on resident sleep patterns, as well as sleep quality.

Conclusion

Our data using objective measurements demonstrate that implementation of a partial night float system allowed PGY-2 ophthalmology residents to experience significantly higher sleep over the span of a rotation compared to traditional home call. Further studies with larger sample sizes incorporating subjective data among various residency programs are required to investigate how night float rotations affect sleep quality, in addition to sleep quantity.

Ethics Statement

This study was approved by the University of Washington Institutional Review Board (STUDY00000894), and written consent was obtained from all participants.

Conflict of Interest

None declared.

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