

# Implementation of a novel night float call system: resident satisfaction and quality of life

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**Background:** Compliance with Professional Association of Internes and Residents of Ontario duty hour guidelines has been problematic at our institution. To facilitate orthopedic residents' ability to go home postcall without significant disruption of ongoing clinical activities, a novel call system was adopted at our tertiary care centre. We sought to evaluate the satisfaction and quality of life of orthopaedic residents with that system.

**Methods:** We administered questionnaires to on-service residents. These included the Short Form-36 questionnaire and others addressing topics including education, stress, work-related problems and miscellaneous concerns.

**Results:** Seventeen residents were surveyed: 6 who had just completed a night float rotation, and 11 who were on a regular orthopedic service rotation while the night float system was in place. Quality of life was similar between residents on the night float block and those on the standard rotation; it was also similar to age-matched Canadian normative data. Eighty-nine percent of residents agreed that the presence of the night float rotation improved their quality of life on standard rotations, and 100% felt that their education was improved on standard rotations by having the night float system in place.

**Conclusion:** This call system results in improved resident quality of life and widespread overall satisfaction, and may be considered as a viable alternative to traditional call formats. Follow-up data as more residents experience the night float block will be valuable.

**Contexte :** La conformité aux lignes directrices de l'Association professionnelle des résidents et internes de l'Ontario en matière d'horaires de travail pose un problème dans notre établissement. Pour permettre aux résidents en orthopédie de retourner plus facilement à la maison après un appel, sans nuire significativement aux activités cliniques en cours, notre établissement de soins tertiaires s'est doté d'un nouveau système d'appel. Nous avons voulu mesurer la satisfaction des résidents en orthopédie à l'endroit de ce système et évaluer leur qualité de vie.

**Méthodes :** Nous avons administré des questionnaires aux résidents de garde, incluant le questionnaire SF-36 (Short Form-36) et d'autres questionnaires sur la formation, le stress, les problèmes liés au travail et diverses autres questions.

**Résultats :** Dix-sept résidents ont répondu aux questionnaires : 6 venaient de terminer leur garde dans une équipe de nuit et 11 travaillaient selon l'horaire régulier de l'orthopédie pendant que le système de garde de nuit était en place. La qualité de vie a été similaire entre les résidents de l'équipe de garde de nuit et ceux qui suivaient l'horaire régulier; elle s'est également révélée similaire en comparaison avec des données canadiennes assorties selon l'âge. Quatre-vingt-neuf pour cent des résidents se sont dits d'avis que la présence de l'équipe de nuit améliorait leur qualité de vie lors de leurs gardes régulières et 100 % ont estimé que leur formation se trouvait améliorée lors des gardes régulières du fait que le système de garde de nuit était en place.

**Conclusion :** Ce système d'appel entraîne une amélioration de la qualité de vie des résidents qui s'en disent globalement satisfaits et pourrait être considéré comme une solution de rechange viable aux types de gardes habituels. À mesure que d'autres résidents participeront à l'équipe de nuit, des données de suivi se révéleront utiles.

Resident duty hours are an important point of discussion in the current postgraduate medical education climate, as residency programs seek to balance duty hour restrictions with residents' educational needs and patient care requirements.

In 2003, the Accreditation Council for Graduate Medical Education mandated maximum resident duty at 80 hours per week averaged over a 4-week period. This was updated in 2011 to include any moonlighting activities.<sup>1</sup> The current Professional Association of Internes and Residents of Ontario (PAIRO) contract stipulates a maximum call period of 24 hours plus up to 2 additional hours for handover. Call frequency is a maximum of 1 night in 4 for in-house call, and 10 calls in 30 days for home call.<sup>2</sup>

In 2009, the president of the Association of Residents of McGill filed a grievance against the McGill University Health Centre, Montréal, Que., alleging that 24 hours of consecutive work jeopardized the health, safety and physical integrity of both patients and residents and consequently violated both the Quebec Charter of Human Rights and Freedoms and the Canadian Charter of Rights and Freedoms. This grievance eventually went to arbitration, and the arbiter ruled in July 2011 that 16 hours was the maximum allowable period of in-house call in the province of Quebec and allowed hospitals and residency programs 6 months to adjust call schedules accordingly. During the hearings, some residents raised concerns regarding potential negative effects on training and patient care, such as decreased clinical exposure and more frequent handover with concomitant potential for error and omission.<sup>3</sup>

Given ongoing debate about maximum duty hours, measured both per week and consecutively, residency training programs are seeking creative ways to optimize education and clinical experience without adversely affecting patient care. Valid concerns regarding resident quality of life also play a role in the search for compromise on what is admittedly a difficult and controversial topic.

Research on the effects of a night float system on residents' quality of life and duty hours has yielded conflicting results. Zahrai and colleagues<sup>4</sup> examined a night float system implemented at 2 level-1 trauma hospitals in Toronto, Ont., consisting of 5 overnight shifts (14 hours) worked in a single week from Monday to Friday. They found that night float residents had significantly decreased quality of life, as measured by the Short Form-36 (SF-36), compared with their colleagues doing standard 24-hour call.<sup>4</sup> Lefrak and colleagues<sup>5</sup> initially found that first- and third-year surgical residents engaging in a similar night float system had decreased exposure to educational opportunities, but were able to partially correct the disparity with alterations to their night float model. Cardiology fellows performing 2-week blocks of night float reported decreased fatigue and increased satisfaction, whereas internal medicine residents reported a greater emphasis on service and less emphasis on education while performing night float rotations than

while on 24-hour call.<sup>6,7</sup> A systematic review demonstrated improved quality of life among surgical residents after the introduction of a night float system, but showed conflicting data regarding operative exposure.<sup>8</sup>

Owing to the relatively small orthopedic program size (17 residents) and to clinically active attending surgeons, compliance with PAIRO duty hour guidelines has historically been problematic at our institution. In an effort to facilitate residents' ability to go home postcall without significant disruption of ongoing clinical activities, a novel call system was proposed. The purpose of the present study was to evaluate the satisfaction and quality of life of our orthopaedic residents after the implementation of this night float system. We hypothesized that the presence of a night float resident would improve quality of life for the other residents on service. We also sought to assess residents' educational opportunities and clinical exposure while on the night float rotation.

## METHODS

A night float resident at the postgraduate year (PGY)-3 or -4 level was designated and assigned only to on-call duties for a full 4-week (1 block) rotation. During this time, the night float resident was not attached to any of the regular orthopaedic services and had no additional clinical responsibilities. Duty hours were 5 pm to 6 am each day from Sunday to Friday, with cessation of clinical duties from Friday morning until Sunday evening.

In addition to the night float resident, junior and senior residents were on call each evening of the week until 11 pm, at which point they were excused. This allowed for additional manpower during typically busy evening hours, leaving the night float resident on call alone from 11 pm to 6 am and permitting the residents who were on call only until 11 pm to be present for the next clinical day.

Friday and Saturday call was performed by other residents in the regular 24-hour fashion; as the subsequent days, being weekends, involved no clinical duties, residents could easily be excused postcall in accordance with PAIRO guidelines. These changes were made at the beginning of the 2011-12 academic year, and this study was conceived to evaluate the effectiveness of the system.

We obtained ethics approval from our institution's Research Ethics Board.

In a prospective fashion, residents who completed a night float rotation were asked to complete survey questionnaires (see the Appendix, available at [cma.ca/cjs](http://cma.ca/cjs)) evaluating their quality of life and educational experience while on the rotation. Concurrently, residents on the regular orthopedic service were asked to complete the same questionnaires, evaluating the impact of having the night float system in place. Surveys took approximately 15 minutes to complete and were labelled only with the residents' PGY levels and whether they were evaluating a completed night

float rotation or a regular rotation with the night float system in place. The documents were consequently anonymous, were not available to faculty or other residents, and were analyzed by our statistician.

The SF-36 was used to assess general health-related quality of life, subdivided into physical and mental components.<sup>9,10</sup> Educational experience was evaluated using a survey loosely based on that of Lefrak and colleagues<sup>5</sup> and modified to fit the specifics of our night float system. Overall stress, major stressors, potential work-related problems, and potential personal problems were evaluated using the same questionnaires as those used by Zahrai and colleagues.<sup>4</sup> We defined call “conversion” as a resident, whether on night float or performing regular call, being physically present at the hospital for more than 1 hour after midnight.

### Statistical analysis

Descriptive statistics (i.e., counts, means, standard deviations, proportions) were used to describe the resident cohort. We performed independent samples *t* tests to compare the standard and night float groups on the SF-36 and their educational experiences. The Mann–Whitney *U*

nonparametric test was used to compare groups on stress levels, work-related and individual problems and the educational experiences measured on a 5-point Likert scale. We considered results to be significant if they had a probability value of less than 5%.

### RESULTS

Table 1 outlines the demographic characteristics of 17 residents in our orthopedic surgery program. At the time of study, 6 residents had completed the night float rotation. The remaining 11 residents were on regular orthopedic service with the night float system in place. All 17 participants were men.

With respect to educational opportunities, there were significant differences between the 2 rotations with respect to rounds attendance, but not teaching interactions with attending staff (Table 2). Monday morning trauma rounds and Wednesday morning academic half-days were mandatory except in exceptional circumstances, whereas other service rounds were mandatory only for the residents on 2 particular orthopedic services, with attendance by other residents varying based on interest and availability. Although the average number of cases performed was lower for the night float group than the standard rotation group, the difference did not reach statistical significance in this small data set. Hours spent studying per day were equal between the groups, whereas significantly more emergency department consults were performed by residents on the night float rotation than those on the regular orthopedic service. For calls that were converted (i.e., the resident was present in-hospital past midnight), the average number of hours of sleep per night was 3.7, and the night float residents converted an average of 80% of their overnight calls. Converted calls by residents working on standard orthopedic rotations refer to work done past midnight on Fridays and Saturdays, when regular 24-hour call was in effect without the presence of a night float resident.

**Table 1. Demographic and training characteristics of participants**

Characteristic	Group; no.	
	Standard	Night float
No.	11	6
Age $\pm$ SD, yr	30.9 $\pm$ 3.1	31.3 $\pm$ 2.2
Training level		
PGY-1	1	0
PGY-2	3	0
PGY-3	2	2
PGY-4	4	4
PGY-5	1	0

PGY = postgraduate year; SD = standard deviation.

**Table 2. Educational opportunities reported by participants**

Opportunity	Group; no. $\pm$ SD			
	Overall	Standard	Night float	<i>p</i> value
Monday trauma rounds	3.1 $\pm$ 2.8	3.8 $\pm$ 0.4	2.1 $\pm$ 2.0	0.001
Wednesday academic half-day	3.1 $\pm$ 1.5	3.8 $\pm$ 0.4	2.0 $\pm$ 1.9	0.01
Other service rounds	1.6 $\pm$ 2.3	2.3 $\pm$ 2.9	0.8 $\pm$ 0.9	0.04
No. of OR cases performed/assisted	2.4 $\pm$ 0.6	2.6 $\pm$ 0.6	2.1 $\pm$ 0.3	0.07
Attending teaching interaction > 5 min	4.0 $\pm$ 1.1	4.4 $\pm$ 0.8	3.4 $\pm$ 1.2	0.14
No. of consults seen in ED or ward	3.4 $\pm$ 1.0	3.1 $\pm$ 1.1	3.9 $\pm$ 0.3	0.01
Time spent studying per working day	2.2 $\pm$ 0.6	2.2 $\pm$ 0.6	2.1 $\pm$ 0.6	0.96
No. of > 80-h wk in hospital	1.7 $\pm$ 1.0	2.2 $\pm$ 1.0	1.0 $\pm$ 0.01	0.001
No. of calls	11.8 $\pm$ 9.8	5.6 $\pm$ 0.9	20.6 $\pm$ 10	0.08
Call converted from home call to in-house	7.7 $\pm$ 9.9	1.7 $\pm$ 1.4	16.3 $\pm$ 10.5	0.006
Hours of sleep on converted calls	3.7 $\pm$ 1.3	4.1 $\pm$ 1.2	3.1 $\pm$ 1.2	0.98

ED = emergency department; OR = operating room; SD = standard deviation.

Questions regarding residents' perception of educational experience demonstrated improved subjective educational and quality of life scores among residents on a regular rotation with the night float system in place (Table 3). Only residents who had completed the night float rotation answered the first 3 questions listed in Table 3, whereas residents on standard orthopedic rotations answered questions 4 and 5.

There were no significant differences between the groups with respect to the SF-36 data. Mean scores for the entire cohort were 56.8 on the physical component score (PCS) and 49.9 on the mental component score (MCS). These scores do not differ from the published Canadian normative data for this age group, (53.5 for the PCS,  $p = 0.25$ ; 51.7 for the MCS,  $p = 0.89$ ).<sup>11</sup> Stress levels measured in the domains of overall stress, stress of being a resident and stress of combining personal and professional life were equal between the night float and standard groups.

Residents were asked to rate a variety of potential work-related problems according to how much difficulty these issues presented. Feeling rushed and fear of error were greater among those on a standard rotation than those on night float (both  $p = 0.030$ ). No other significant differences were detected between the groups.

Finally, individual problems were explored, including time for leisure and academic activities, confidence and reservations about career choice. The only difference between groups was that residents on standard rotations felt that not having enough time for their social lives (sufficient time to see family and friends) was more of a problem than residents on night float ( $p = 0.009$ ).

**DISCUSSION**

Compliance with duty hour restrictions without compromising clinical activity has been an issue at our institution. Owing to clinically active staff and a low staff:resident ratio, residents have found it difficult to consistently take

postcall days. One of the aims of this night float system was to facilitate compliance with duty hour restrictions without compromising clinical workflow. The unpredictability of postcall days was one of scheduling difficulty; if a resident was not in-house after midnight, he would be available for clinical activity the next day, whereas a busy call shift resulted in a postcall day. This could obviously not be predicted in advance, so there was often last-minute shuffling of residents to cover clinics and operating rooms (ORs).

By having the night float resident unattached to a clinical service, this difficulty was avoided. All residents on regular rotations were available every day, as they were never on call past 11 pm. This facilitated scheduling and precluded residents who were postcall from feeling obligated to stay and engage in clinical duties, either out of unwillingness to leave a clinic without sufficient help or out of the desire to see an interesting case in the OR.

The system is structured so that each resident in our program will ultimately perform 3 blocks of night float over the course of his or her residency: 2 blocks in PGY-3 and 1 in PGY-4. This results in the loss of 60 days of regular clinical activity, assuming 20 weekdays per academic block. Previously, during PGY-3 and -4, residents would engage in call 1 night in 4, which over the 2 years of residency (26 academic blocks) would result in 130 potential postcall days, assuming that 5 calls each month would be followed by a weekday. Even if only 50% of these calls were busy enough to warrant taking a postcall day, 65 regular clinical days would be lost over 2 years. Our results demonstrate that the night float residents converted approximately 80% of their calls, meaning that the night float system does not result in any greater loss of clinical exposure than does taking regular PAIRO-mandated postcall days and may actually result in greater net clinical exposure.

The academic schedule at our institution consists of weekly trauma rounds at 7 am and a weekly academic half-day from 7 am to noon, which all residents generally

**Table 3. Residents' perception of educational experience**

Statement	Response, %				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Night float rotation offers a better overall experience	43	29	28	0	0
Night float rotation provides better opportunity to improve my clinical and diagnostic skills	14	43	29	14	0
Night float rotation provides adequate opportunities to be evaluated by attending staff	0	58	28	14	0
On regular rotations, my educational experience is improved by having the night float system in place	0	0	0	44	56
On regular rotations, my quality of life is improved by having the night float system in place	0	0	11	22	67

attend. In addition, the various orthopedic services have their own weekly academic rounds, which are usually attended only by the residents on that service. We found that the night float resident was significantly less likely to attend any of these formal academic rounds, but this should be regarded as an individual choice rather than a problem with the night float schedule. Handover typically occurred between 6 am and 7 am each morning, meaning that the night float residents were free from clinical responsibility during these rounds and chose not to attend. Lack of sleep on the preceding night presumably played a role, but this would apply equally to busy call shifts before the implementation of the night float system.

The fact that night float residents found that their rotation provided an inferior educational experience is not overly surprising. Much clinical teaching occurs in clinics, which are not attended during the night float rotation. In addition, the night float residents attended fewer ORs than residents on regular call, and although this result was not significant ( $p = 0.07$ ), assisting with or performing fewer operations means that there were fewer opportunities for educational interactions in that setting. The reported number of teaching interactions lasting longer than 5 minutes was lower for night float residents as well. Interestingly, residents were unanimous in agreeing that the night float system improved their educational experience while on regular rotations. We hypothesize that this is due to improved sleep with the night float resident performing overnight call.

In contrast to the results of Zahrai and colleagues,<sup>4</sup> we did not find that the night float residents had worse quality of life than their colleagues based on SF-36 results. This may be because our night float rotation was structured differently and extended over a 4-week block rather than isolated 1-week segments. Zahrai and colleagues hypothesized that disruptions in sleep cycle were at least partially responsible for decreased quality of life; a 4-week night float rotation offers more opportunity to adjust to different hours of wakefulness.

The fact that more than half of the night float residents felt that they did not have adequate opportunity to be evaluated by attending staff is a point of concern. Our program will address this issue; a potential solution involves a formal sit-down evaluation between the attending surgeon and the night float resident at the end of the surgeon's week of call.

### Limitations

This study has several weaknesses. Because our residents are doing night float in 4-week blocks, relatively few of them had completed the rotation at the time of study, which limits the available data from residents on night float. This will be less of a problem over the next several years, as more residents have an opportunity to experience and evaluate the night float rotation.

Second, we were unable to gather baseline quality of life and educational data before the implementation of the night float system. The decision to transition to this alternate call schedule was made relatively expeditiously, and consequently we did not have the opportunity to collect surveys from our residents before the change was made. Having baseline data from residents performing standard 24-hour call would have made direct comparison easier. Comparing SF-36 data between groups and to Canadian norms, although interesting, is less valuable than comparing pre- and postimplementation night float data to evaluate the effectiveness of the new system. We considered having orthopedic residents complete the survey while on off-service rotations not using a night float system (e.g., general surgery, neurosurgery) to provide surrogate baseline data. The objections to this approach were that educational opportunities tend to be very different off service and that our residents generally take their PAIRO-mandated postcall days while on off-service rotations, which was not usually the case while on an orthopedic rotation. Consequently, we were unable to compare objective quality of life data from before and after the implementation of the night float system, although more subjective measures indicate improved quality of life and satisfaction.

Residents may have been overly enthusiastic when completing the surveys, as the common perception of this system among residents is that it is an improvement over the previous call system and most are eager to see it continue. Finally, although residents were encouraged at the beginning of the night float rotation to keep track of consults, OR cases and hours of sleep, there is the possibility of recall bias.

### CONCLUSION

Quality of life measures were similar between our 2 groups, and were statistically equivalent to age-adjusted Canadian normative data. Eighty-nine percent of residents agreed or strongly agreed that the presence of the night float rotation improved their quality of life on standard rotations, while the remainder were neutral. Based on these results, we conclude that residents' quality of life while on the night float rotation is not significantly worse than that of their colleagues on standard rotation and that the quality of life of our residents is improved by having the night float system in place.

While clinical and educational opportunities are fewer during the night float rotation, residents feel that the benefits sustained during regular rotations by having the night float system in place outweigh these downfalls. We will continue to evaluate this system and look for opportunities to improve it, but it currently satisfies duty hour restrictions while allowing unimpeded workflow and clinical activity and enhances resident quality of life. It is thus a viable model for surgical programs considering changes to a traditional model of call.



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