

Perceived sleepiness in Canadian anesthesia residents: a national survey

La somnolence perçue chez les résidents en anesthésie canadiens : sondage national

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Abstract

Purpose To compare the self-perceived sleepiness of Canadian anesthesia residents providing modified on-call duties (12–16 h) vs. traditional on-call duties (24 h).

Methods A 25-item online survey was distributed to all Canadian anesthesia residents who, at that time, were on anesthesia rotations. The survey assessed resident demographics, perceived work patterns, and sleepiness, as well as their opinions on resident work hour reform. Self-perceived sleepiness was quantified using the validated Epworth sleepiness scale (ESS).

Results Three hundred eight of 400 (77%) eligible Canadian anesthesia residents completed the survey. Forty-three percent of residents who worked traditional on-call (duration 24.1 ± 0.5 h) shifts and 48% of residents who worked modified on-call (duration 15.5 ± 1.8 h) shifts met ESS criteria for excessive daytime sleepiness. Overall mean ESS scores did not differ significantly between the traditional (9.1 ± 4.9) and the modified call groups (9.5 ± 4.8). Residents with an on-call frequency of $\geq 1:4$ days or those who slept ≤ 2 h while on call perceived themselves as significantly more sleepy ($P = 0.045$ and $P = 0.008$, respectively). Six percent of residents admitted to taking “something other than caffeine” to stay awake on call.

Conclusion Many anesthesia residents do exhibit excessive daytime sleepiness, with a similar incidence for those working within either modified or traditional call systems. Our study suggests that sleepiness may be reduced by scheduling on-call duties no more frequently than one in every five nights and by ensuring that residents sleep more than 2 h while on call.

Résumé

Objectif Comparer la somnolence auto-perçue des résidents en anesthésie canadiens pendant des gardes modifiées (12–16 h) vs. des gardes conventionnelles (24 h).

Méthode Un questionnaire en ligne composé de 25 questions a été distribué à tous les résidents en anesthésie canadiens qui faisaient alors des stages en anesthésie. Le sondage a évalué les caractéristiques démographiques des résidents, les schémas de travail perçus et la somnolence, ainsi que leurs opinions concernant la réforme des heures de travail des résidents. La somnolence auto-perçue a été quantifiée avec l'échelle validée de somnolence diurne d'Epworth (ESS).

Résultats Au total, 308 résidents en anesthésie canadiens des 400 admissibles ont complété le questionnaire. Quarante-trois pour cent des résidents travaillant des quarts de garde conventionnels (durée $24,1 \pm 0,5$ h) et 48% des résidents travaillant des quarts de garde modifiés (durée $15,5 \pm 1,8$ h) ont rempli les critères ESS décrivant une somnolence diurne excessive. Il n'y a pas eu de différence significative dans les scores moyens globaux ESS entre les groupes de garde conventionnelle ($9,1 \pm 4,9$) et modifiée ($9,5 \pm 4,8$). Les résidents effectuant des quarts de garde à une fréquence $\geq 1:4$ jours et ceux qui dormaient \leq deux heures pendant leur garde se percevaient comme

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significativement plus somnolents ($P = 0,045$ et $P = 0,008$, respectivement). Six pour cent des résidents ont admis prendre «quelque chose de plus fort que la caféine» pour rester éveillé durant leurs gardes.

Conclusion *De nombreux résidents en anesthésie font preuve d'une somnolence diurne excessive, et l'incidence est semblable chez les résidents travaillant des quarts de garde modifiés ou conventionnels. Notre étude suggère que la somnolence pourrait être réduite en programmant les quarts de garde à une fréquence maximale d'une nuit sur cinq et en s'assurant que les résidents dorment plus de deux heures pendant leurs gardes.*

Introduction

Residency work hours and work hour reforms have become the focus of numerous comprehensive reviews.^{1–7} This heightened attention has been driven by a growing body of literature on the deleterious effects of sleep deprivation on residents' wellbeing and performance.^{2,3,7–10} Studies have identified many domains affected by fatigue, including professionalism, learning, errors, and completion of complex cognitive tasks.^{11–13} The increased incidence of post-call automobile accidents among interns and residents is well documented. Also, busy nights on call have been shown to cause neurobehavioral changes in residents equivalent to alcohol levels above the Canadian legal limit.^{14,15} Work hour reforms and increased scrutiny of resident physicians have also been influenced by increased public awareness of the issue and by high profile legal cases, such as the Libby Zion case.^{16–18} Consequently, national bodies in many countries have recently instituted legislation and guidelines to reduce sleepiness and fatigue among physicians by limiting working hours and on-call coverage.^{19–21}

Anesthesiology has a long track record of leadership regarding issues related to patient safety and care. Over the past 30 years, extensive research has been conducted, both in simulation and clinical care, investigating the effects of fatigue and sleep deprivation on anesthesiologists and anesthesia residents.^{16,22–26} Accordingly, Canadian anesthesia residency training program directors and committees have been proactive in instituting policies that are believed to reduce fatigue and improve the wellbeing of their residents. At least half of the Canadian training programs have attempted changes in on-call scheduling to limit the consecutive hours worked by residents to 12- or 16-h shifts, instead of the traditional 24- to 30-h shifts worked by other specialties (personal communication with Program Directors of the Association of Canadian University Departments of Anesthesia).

To date, the impact of sleep deprivation for Canadian anesthesia residents with shortened call schedules as

compared to those with traditional 24-h call schedules is unknown. This survey was designed to gather information regarding self-perceived sleepiness, resident work hours, opinions on work hour restrictions, and the impact of resident work hours on their personal and professional lives.

Methods

Following institutional Research Ethics Board approval, we obtained permission from all 16 Canadian anesthesia residency program directors to survey their residents. A web-link to the questionnaire was then sent to the inbox of all anesthesia residents from January to March of 2008 (Appendix, available as Additional Material online at www.cja-jca.org). Anesthesia residents who were not on anesthesia rotations during that time were excluded. Residents on anesthesia rotations during that time were asked not to complete the survey in the 24-h period immediately following an on-call shift. An anonymous online survey was chosen, because it was felt that it could best guarantee resident anonymity while efficiently collecting representative data from across the country.

The primary outcome of the study was the self-perceived sleepiness as determined by Epworth sleepiness scale (ESS) score for those residents who provide traditional 24-h on-call coverage vs. those who provide modified on-call coverage. Our hypothesis was that residents providing modified on-call coverage would perceive themselves as less sleepy than those residents providing 24-h on-call coverage. Secondary outcomes included the impact of self-perceived sleepiness on the number of hours worked per day and per week, the number of hours slept per night at home and while on call, call frequency, gender, dependents, and age.

The survey was designed by the authors and, to confirm clarity and absence of ambiguity, it was piloted on six occasions to small groups of University of Toronto anesthesia residents and fellows. Self-perceived sleepiness was determined using a validated self-administered questionnaire called the Epworth sleepiness scale. The questionnaire asks respondents to rate their likelihood of falling asleep in eight common scenarios. Higher ESS scores reflect a greater degree of sleepiness, and scores greater than nine are consistent with excessive daytime sleepiness.^{27–29} The impact of sleep deprivation on performance was determined using an expanded version of a previously published scale called the sleep deprivation index.³⁰

The questionnaire was administered using a commercially available survey software tool (Survey Monkey Inc., Portland, OR, USA). Anonymity was maintained by deleting respondents' Internet protocol and email addresses.

As an incentive for resident participation, there were prize draws for participating residents at each university

program. The prizes were either conference registration to the Canadian Anesthesia Society’s national meeting or a digital music player of equal monetary value. Multiple email reminders were sent to engage non-responders.

Data were analyzed using Sigma Stat 3.1 (Systat Software Inc, San Jose, CA, USA). Traditional descriptive statistics were used to examine the data, and the responses to various questions were cross-tabulated. Differences in responses to questions between groups were assessed using non-parametric statistical testing, as appropriate. A $P < 0.05$ was considered significant.

Results

Demographics and work patterns

Overall, 308 of 400 (77%) eligible anesthesia residents completed the survey. All 16 Canadian anesthesia residency program directors gave permission for their residents to be included in the survey. Resident participation rates were >60% at 13 of the programs, while two programs had very low response rates and one program had no resident responses. A total of 115 residents from eight different programs reported that they were currently working within a modified call system with on-call duration of 15.5 ± 1.8 h. The other 193 residents worked within a traditional call system with on-call duration of 24.1 ± 0.5 h. Resident demographics and their self perceived work hours were similar between the two groups, with the exception that there were more females in the traditional call group

Table 1 Resident demographics

	Modified call (n = 115)	24-h call (n = 193)
Median age	30 (28–32)	29 (27–32)
Females	47 (41)	103 (53)
Marital status: single	25 (28)	57 (31)
Married/common law	50 (56)	8 (46)
Long term relationship	13 (16)	35 (19)
Have children	32 (28)	47 (24)
Level of training		
PGY1	14 (16)	32 (18)
PGY2	17 (19)	40 (21)
PGY3	26 (30)	43 (24)
PGY4	13 (15)	34 (18)
PGY5	18 (21)	35 (19)

Percentages may not sum to 100% due to missing data. Data expressed as median (interquartile range) or number (percentage)

PGY post graduate year

Table 2 Resident sleep and work patterns

	Modified call (n = 115)	24-h call (n = 193)
Mean hours worked per day	9.87 ± 0.87	9.73 ± 1.25
Hours of sleep on an average weeknight	6.3 ± 0.9	6.5 ± 0.8
Call frequency		
$\geq 1:4$	38 (33)	49 (25)
1:5	41 (36)	101 (52)
$\leq 1:6$	36 (31)	39 (21)
Mean call duration at current hospital	15.5 ± 1.8	24.1 ± 0.5
Mean hours slept on call on a typical night	1.8 ± 1.1	2.9 ± 1.2
Mean hours worked per week (including call)	60.0 ± 10.0	63.5 ± 10.1

Percentages may not sum to 100% due to missing data. Data expressed as mean \pm SD and number (percentage)

(Tables 1 and 2). On average, residents recorded working just less than 10 h per day and just over 60 h per week, regardless of their call system. Anesthesia residents reported an average of 6.4 h of sleep per night while not on call. Residents in the modified and traditional call systems slept an average of 1.8 and 2.9 h per night, respectively, while on call.

Primary outcome

Epworth sleepiness scale scores (mean \pm SD) were similar between residents providing modified call (9.5 ± 4.8) and

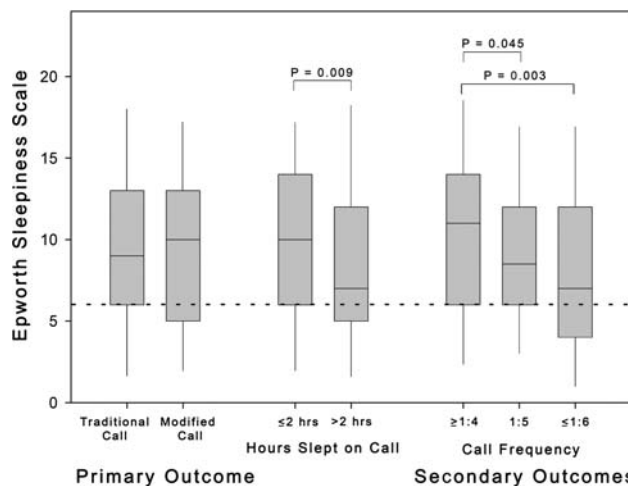


Fig. 1 Box plot of perceived sleepiness in Canadian anesthesia residents. The central bar represents the median, boxes extend from the 25–75th percentiles and the whiskers extend to the 5th and 95th percentile. The horizontal dashed line represents the mean Epworth sleepiness scale score of normal general population controls taken from the original description of the scale²⁷

traditional call (9.1 ± 4.9) ($P = \text{NS}$; Fig. 1). Likewise, 50% of residents in the modified call group and 45% of residents in the traditional call group ($P = \text{NS}$) reported an ESS score of greater than 10; therefore, they met the criteria for excessive daytime sleepiness.

Secondary outcomes

As also shown in the Fig. 1, residents who perceived that they averaged 2 h or less of sleep while on call had higher ESS scores ($P = 0.008$) than those who averaged more than 2 h of sleep while on call, regardless of their on-call duration. Residents who had a call frequency of no fewer than one in four days were sleepier than those who were on call one in five days ($P = 0.045$) and those who were on call one in six or fewer days ($P = 0.003$). Women also reported higher ESS scores than men (10.1 vs. 8.5, respectively; $P = 0.002$).

Anesthesia residents who provided traditional call perceived that they needed significantly more sleep while on call to function “adequately” compared to those providing modified call (2.8 vs. 1.8 h, respectively; $P < 0.001$; Table 3). Accordingly, residents providing traditional call perceived that they needed significantly more sleep while on call to function “well” (4.6 vs. 3.6 h, respectively; $P < 0.001$; Table 3).

Residents were also asked to rate their agreement or disagreement with a series of 18 statements suggesting a deleterious effect of sleep deprivation in a number of domains: personal and patient safety, professionalism, learning, and technical skills. No significant difference was found between the two groups’ perceptions about the impact of sleep deprivation (Table 4).

When asked their opinions on the ideal work week or trainee work hour reform, no significant differences were found between residents who provided modified vs. those who provided traditional call (Tables 5 and 6).

Five percent (16 of 308) of anesthesia residents admitted to using “something other than caffeine” to stay awake while on call.

Table 3 Perceived on-call sleep requirements

	Traditional call ($n = 193$)	Modified call ($n = 115$)
Number of hours of sleep on call to function ADEQUATELY toward the end of call	2.8 ± 1.7	$1.8 \pm 1.7^*$
Number of hours of sleep on call to function WELL toward the end of call	4.6 ± 1.7	$3.6 \pm 1.9^*$

Data are presented as mean \pm SD

* $P < 0.001$

Discussion

Our results found that almost half of the Canadian anesthesiology residents had ESS scores that met or exceeded the criteria for excessive daytime sleepiness, and their scores were in the range of sleepiness for which clinical intervention is usually required.²⁷

The similar self-perceived levels of sleepiness in residents working within modified call and 24-h call systems is likely to be multifactorial. Residents with greater sleep needs or busier personal lives may be choosing programs that have modified call. Alternatively, residents on modified call schedules may choose to be busy before their shift and may tire themselves out before their shifts begin. Moreover, the institution of modified call systems is not random; we suspect that busier hospitals across the country may have been more likely to institute a system of modified call. Additionally, residents in a modified call system may be expected to work the entire night, while residents in a 24-h call system may be encouraged to nap by supervising staff. Finally, we might not see a difference, because residents in both groups may be chronically sleep deprived.

The ESS questionnaire has been validated against objective measures of sleepiness, and psychometric analysis has shown that the instrument performs well when studying workers in their natural setting.^{28,29} It has been used by a number of researchers to study sleepiness among medical trainees and residents. A study by Woodrow et al.³⁰ found that University of Toronto internal medicine and psychiatry residents had ESS scores that were similar to those found in our study; while Toronto surgery residents had significantly higher mean \pm SD ESS scores (12.8 ± 4.7). A national study of trainees in New Zealand reported mean ESS scores of 8.2 ± 4.2 , while a multi-institution, multi-specialty study of American residents in 2002 reported a mean ESS score of 14.6 ± 4.4 .^{13,31} Despite perceived sleepiness among Canadian anesthesia residents being significantly lower than some groups of residents, the levels of sleepiness among some anesthesia residents remain a cause for concern. On average, Canadian anesthesia residents have ESS scores that are twice that of the normal controls (5.9 ± 2.2) who were included in the original development and validation of the ESS tool. Over one-third of the anesthesia residents had scores that are higher than the mean ESS scores of patients with obstructive sleep apnea.²⁸

Anesthesia residents may be chronically sleep-deprived, since they report sleeping less than the 7–9 h recommended by most national sleep organizations and the US Centers for Disease Control and Prevention.³² In a frequently cited study, Van Dongen et al.³³ showed that chronic restriction of sleep to 6 h per night is the equivalent to two nights of total sleep deprivation, which can seriously

Table 4 Perceived impact of sleep deprivation

	Modified call (n = 115)	24-h call (n = 193)
I feel unsafe driving home	4 (4–5)	4 (4–4)
I am less effective formulating diagnoses/making clinical judgments	4 (4–5)	4 (4–5)
I am less effective performing technical skills	4 (3–4)	4 (4–5)
My ability to write appropriate discharge orders and prescriptions is diminished	4 (3–4)	4 (4–4)
My ability to perform a short (1 h) operating room case is diminished	4 (2–4)	4 (3–4)
My ability to perform a long (6 h) operating room case is diminished	5 (4–5)	5 (4–5)
My ability to run a code is diminished	4 (2–4)	4 (3–5)
It takes me longer to do things	4 (4–5)	5 (4–5)
My ability to interact with colleagues is diminished	4 (3–5)	4 (4–5)
I am less effective communicating with patients and families	4 (4–5)	4 (4–5)
I am less empathetic towards my patients	4 (2–4)	4 (3–5)
I am more irritable	4 (4–5)	5 (4–5)
My ability to concentrate during morning rounds is diminished	5 (5–5)	5 (5–5)
My ability to retain information on a new patient is diminished	4 (4–5)	5 (4–5)
My ability to learn new procedural skills is diminished	4 (4–5)	5 (4–5)
My motivation to learn is diminished	5 (4–5)	5 (4–5)
My desire to teach medical students is diminished	5 (4–5)	5 (4–5)
I try to do my jobs as quickly as possible so that I can leave	4 (4–5)	4 (3–5)

Residents' responses to a series of 18 statements suggesting a detrimental effect of sleep deprivation on different aspects of performance. Median Likert (interquartile range) scores are reported. Likert scale: 1 = strongly disagree; 2 = somewhat disagree; 3 = no opinion; 4 = somewhat agree; 5 = strongly agree. Differences between groups were not significant

Table 5 Resident perceptions regarding work hour limitations

	Agree (%)	Mean suggested limit \pm SD
There should be a limit on the number of hours a resident can work per week	78	58.5 \pm 10.2
There should be a limit on the number of consecutive hours a resident can work	94	17.3 \pm 4.8
There should be a limit on the number of hours a staff anesthesiologist can work per week	81	57.8 \pm 11.3
There should be a limit on the number of consecutive hours a staff anesthesiologist can work	81	16.7 \pm 4.5
Work hour limitations should differ by specialty	55	

Proportions show overall responses, as there was no difference between residents working within a modified vs. traditional call system

Table 6 Resident perceptions of ideal call frequency and work hours

The ideal call frequency would be:	
1 in 3	1 (1.0)
1 in 4	30 (10)
1 in 5	121 (39)
1 in 6	129 (42)
1 in 7	23 (8)
The ideal on-call duration would be:	15.5 \pm 4.1
The ideal work week would be:	55.0 \pm 8.1

Overall responses are shown, as there was no difference between residents working within a modified vs. traditional hour call system. Data are shown as number of respondents (%) or as mean \pm SD

impair waking neurobehavioral function in healthy adults. As such, the finding of chronic sleep restriction and potential cumulative sleep deprivation among residents is

concerning. It is unclear why residents are not sleeping enough while not on call; furthermore, this study suggests a need to encourage improved sleep hygiene among residents.

Our finding, that residents on call, who average two or fewer hours of sleep or work one in four or more days, are sleepier than other residents is in keeping with the findings of Gander et al.³¹ who performed a national study of resident physicians in New Zealand. After controlling for demographic factors, they found that the frequency of night shift duty, night work, and schedule instability were independently associated with more fatigue measures than the total hours of work. Similar to our study, they also found that females were more likely to report higher ESS scores than male counterparts. The reasons for this gender difference in these national studies remain unclear.

Fatigue counter measures

Night call is central to anesthesia training and practice and, as such, comprehensive fatigue management plans are required.

Our survey findings suggest that frequency of call scheduling affects self-perceived sleepiness. It is difficult to postulate how the call frequency can be reduced in Canadian residency programs without either increasing the total number of residents or lengthening the training program. Moreover, since the current modified call schedule used in Canada does not seem to reduce perceived sleepiness, it may be appropriate to consider other options. For alternative call scheduling arrangements, consideration should be given to circadian principles, work schedules used by other industries, and comparative international data.³⁴ These options may include interventions such as shift work or night float systems that have become necessary among many American and European residency programs in order to ensure residents do not exceed their work week maximums. In a night float system, residents provide night-time coverage for a number of consecutive days or weeks. However, some educators fear that residents may adopt a “shift work mentality” that may detract from medical professionalism and continuity of care.^{35,36} Accordingly, others have raised concerns about the deleterious effects of night float systems on both resident education and patient safety.^{37,38}

Our study showed that residents who napped or slept for longer periods while on call perceived themselves as less sleepy. This was also confirmed in a study of emergency room doctors and nurses that demonstrated the effectiveness of planned naps to improve subsequent performance and alertness and decrease fatigue.³⁹ Despite these findings, introducing naps into an anesthesia resident’s night work would be logistically difficult to accomplish and would increase the number of patient handoffs. However, our results suggest that supervising staff should encourage residents to sleep, when appropriate, including those residents on modified call schedules. More research into this topic is also warranted.

Legal and ethical considerations prevented us from asking what substances (other than caffeine) residents are consuming as fatigue countermeasures. Drugs such as amphetamines, methylphenidate (ritalin), and modafinil (provigil) are all possibilities. Modafinil is used by military personnel, obstructive sleep apnea patients, and individuals with shift work related sleep disorders, and it has been shown to improve performance in some tasks among emergency medicine physicians.^{34,40} Although the types of substances residents are using remain unclear, this finding is may also warrant further study or intervention.

Work hour reforms

Despite the increased awareness of the negative effects of acute and chronic sleep deprivation, there remains enormous variation in on-call practices for anesthesia residents. In the United States, national guidelines limit consecutive on call hours to 30 (24 plus 6 h for handover) and limit residents’ work weeks to 80 h. In Europe, the European Working Time Directive (EWTd) currently limits medical trainees to 13 consecutive hours of work and a total of 58 h per week, decreasing to 48 h per week in 2009.⁴¹ In Canada, medical trainee work hour regulations are negotiated on a provincial level by resident unions. These agreements are variable, and many do not have hard caps on the maximum number of hours worked per week. In Ontario, for example, the maximum on-call duration for an anesthesia resident is 25 h (24 plus 1 h for handover).⁴² The average weekly work hours of Canadian anesthesia residents are fewer than the upper limits stated in the United States guidelines but more than the European Union directive. Currently, 96% of residents in our study reported work weeks that exceed the current EWTd limit, and 10% of residents reported work weeks that exceed the United States guidelines.

Unfortunately, the optimal resident work week and work patterns that maximize experience, without adversely affecting patient safety or resident wellbeing, remain unknown. Programs that reduce the number of hours that their anesthesia residents work must anticipate the inevitable decrease in clinical experience and establish practices to overcome the restrictions. However, there should be solace in knowing that such interventions may decrease attentional failures and serious medical errors made by trainees, as demonstrated in two well-publicized intensive care unit studies.^{43,44}

Study limitations

The primary limitation of this survey was a potential for participation and response bias. We had anticipated a personal bias among residents in favour of modified call, in order to further the agenda of trainee work hour reform. However, we did not uncover such results.

The primary endpoint of our study was resident self-perception of sleepiness, and we did not attempt to correlate this with actual sleepiness or clinical performance. Furthermore, there is strong evidence that residents and physicians tend to deny the effects of fatigue relative to other workers. This was illustrated in a large multi-country cross-sectional survey on error, stress, and teamwork where those in medicine were much more likely to deny the effects of fatigue on performance than those in comparable industries, such as aviation.⁴⁵ Of note, this study also found

that anesthesia residents were more likely to deny the effects of fatigue than anesthesia staff.

Conclusion

In conclusion, while modified call systems do not reduce the perceived sleepiness of Canadian anesthesia residents, ensuring more than 2 hours of sleep and reducing call frequency do lessen perceived sleepiness. Canada remains one of the few industrialized Western nations without national guidelines or legislation on medical trainee work hours. We suspect that increased pressure from patient safety groups and the fear of legislation or litigation will encourage some form of national policy in Canada in the near future. Based on the study's findings, the usual regulatory approach of placing simple limits on total hours worked may not result in a reduction of sleepiness among anesthesia residents. Instead, if these issues are to be better understood, future interventions should include monitoring hours of work and sleep in addition to measuring fatigue and error. Only then can actual evidence-based guidelines be established that may reduce the prevalence of sleep-deprived residents.

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Conflicts of interest None declared.

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