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Work hours, sleep deprivation, and fatigue: A British Columbia snapshot

Survey results suggest that more explicit work-hour limits may be needed to protect first-year residents and their patients.

ABSTRACT

Background: **The traditional medical school culture that accepts working long hours during training is often associated with sleep deprivation and fatigue. Recent studies have demonstrated that these factors can affect physician health and safety, and the quality of patient care. Since little Canadian information on this topic exists, we examined the pattern of hours worked and slept by first-year residents in British Columbia. Our objectives were to gain an understanding of how Canadian data compare with published data, and to see whether changes need to be made to the current regulatory system in BC, which has no formal, explicit guidelines limiting work hours for residents.**

Methods: **A questionnaire was distributed to postgraduate year 1 residents attending rounds in BC Lower Mainland teaching hospitals on academic half-days in July and August 2005.**

Results: **A total of 104 of 133 questionnaires (78%) were returned. During the study period residents worked an average of 65.4 hours per week. Statistically significant differences were found between the surgical and nonsurgical rotations for hours worked per week (80.4 hours vs 57.0 hours) and hours slept per week (38.3 hours vs 41.8 hours). Residents who were married or had children worked fewer hours than those unmarried residents with no children. The fewer hours of work, however, did not correspond to more hours of sleep.**

Conclusions: **A wide range of work hours exists depending on the clinical rotation. When compared to the 80-hour weekly duty-hour limit set by the Accreditation Council of Graduate Medical Education in the United States, residents on nonsurgical rotations worked hours that were below proposed guidelines; however, surgical rotations slightly exceeded the 80-hour weekly duty limit. Since no limits exist in the current collective agreement for BC residents, it may be prudent to have work-hour limits outlined more clearly to adequately protect residents and patients from the effects of sleep deprivation and fatigue.**

Background

Sleep deprivation and fatigue and their aftereffects during medical training are topical issues in medical education. Long work hours combined with acute and chronic sleep deprivation have raised concerns about the effects of fatigue on the physician's ability to learn, physician safety and well-being, and the quality of patient care.[1-3] Several studies have demonstrated that sleep deprivation and fatigue can adversely affect memory and cognitive performance.[4-6] More recently, it was found that residents working extended shifts in hospital are at increased risk of traffic accidents from falling asleep while driving home.[7] Furthermore, medical trainees consistently report increased levels of stress and depressed

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FATIGUE IN MEDICAL TRAINING QUESTIONNAIRE
Conducted in affiliation with GF Strong Rehabilitation Centre

Please complete all four pages and return this package within 48 hours of distribution. Date (dd/mm/yr): _____

1. What is your current age (in years)?
   _____
2. In the past two weeks, have you had seven or more days of vacation?
   a. Yes b. No
3. Do you have any diagnosed sleep disorder (e.g. narcolepsy, sleep apnea) or medical condition interfering with sleep?
   a. Yes b. No
4. Gender:
   a. Male b. Female
5. Marital Status:
   a. Single b. Married
6. Do you have any children?
   a. Yes If yes, how many? _____
   b. No
7. Please circle the letter below that best corresponds to your residency training program:
   a. Anesthesia
   b. Community Medicine
   c. Emergency Medicine
   d. Family Practice
   e. Internal Medicine
   f. Neurology
   g. Obstetrics & Gynecology
   h. Ophthalmology
   i. Otolaryngology
   j. Pathology
   k. Pediatrics
   l. Physical Medicine & Rehabilitation
   m. Psychiatry
   n. Radiation Oncology
   o Radiology
   p. Surgery: please specify:_____
   q. Urology
   r. Other: _____
8. Please circle the letter below that best corresponds to the rotation you are currently in:
   a. Internal Medicine
   b. ICU/CCU
   c. Obstetrics & Gynecology
   d. Psychiatry
   e. Surgery: please specify: _____
   f. Pediatrics
   g. Emergency Medicine
   h. Family Practice
   i. Other (please specify): _____
9. Have you changed your rotation in the past two weeks?
   a. Yes – Please specify the change:
      _____
      Date: _____
   b. No
10. Please circle the letter below that best describes the on-call cycle for your current rotation:
    a. Home-call
    b. In-house (hospital-based) call
    c. Other: please specify: _____
11. Please circle the letter below that best describes the on-call cycle frequency for your current rotation:
    a. On call every third night
    b. On call every fourth night
    c. No overnight call
    d. Other: _____
12. Please circle the letter below that corresponds to your call cycle/shift status today:
    a. On call
    b. Post call
    c. 1 day pre-call
    d. 2 days pre-call
    e. 3 days pre-call
    f. No overnight call
    g. Other: _____
13. How many hours have you worked in total (including only in-house call hours) in the past 7 days?
    _____
14. How many hours of sleep have you had in the past 24 hours?
    _____
15. How many hours of sleep in total have you had in the past 7 days?
    _____
16. Have you experienced any event in the past 2 weeks that has influenced your sleep patterns?
    a. Yes Please specify: _____
    b. No
17. Do you use any sleep aids/depressants (medications, herbal remedies) to help you sleep?
    a. Yes Please specify: _____
    b. No
18. Do you use any stimulants (medications, herbal remedies, caffeine) to help you stay awake?
    a. Yes Please specify: _____
    b. No

Figure. Fatigue in Medical Training Questionnaire.

mood when sleep deprived.[8,9] These factors lower the quality of life of medical trainees and may result in medical errors that compromise patient care.[10,11]

In an attempt to determine the extent of sleep deprivation and fatigue in medical residents, studies in the United States have documented the work and sleep hours of medical trainees to characterize these variables in different clinical settings.[12-14] Such findings have provided a context in which to understand the scope and magnitude of these issues, as well as information for the regulation of duty hours in the United States by the Accreditation Council of Graduate Medical Education (ACGME), which limits duty hours to a maximum of 80 hours per week. In Canada, however, little is known about the work and sleep hours of medical residents. A review of the literature reveals a paucity of Canadian data exploring these issues. Furthermore, explicit guidelines for resident work-hour limits in British Columbia do not exist as they do in the United States. We therefore examined the pattern of hours worked and hours slept by first-year BC residents to determine how the experience of Canadians compares with the experience described in the published data.

Methods

University of British Columbia Faculty of Medicine postgraduate year 1 (PGY-1) residents in Lower Mainland teaching hospitals were recruited since it is a year characterized by high stress, long hours worked per week, and fewer hours of sleep per week.[13,14] Residents were excluded if they (1) had been on vacation in the 2 weeks prior to the study, (2) suffered from a diagnosed sleep disorder, and/or (3) worked fewer than 35 hours per week (including call), which was considered part-time. A questionnaire (**Figure**) was distributed on academic half-days in July and August 2005. Ethics approval was obtained from the UBC Behavioural Research Ethics Board.

Table 1. Work and sleep hours per week for 96 PGY-1 residents in BC, according to demographic characteristics.

Demographic characteristics	Number	Hours worked in the past 7 days (including call)	Hours slept in the past 24 hours	Hours slept in the past 7 days
Males	43	68.0	6.4	43.2
Females	53	63.2	6.5	40.9
P value*		*P*=.272	*P*=.887	*P*=.199
Married	34	64.1	6.8	42.3
Not married	62	66.1	6.3	41.7
P value*		*P*=.603	*P*=.075	*P*=.681
Residents with children (all married)	11	63.4	6.9	41.7
Residents with no children	85	65.6	6.4	42.0
P value*		*P*=.713	*P*=.491	*P*=.973

*$P > .05$ (not significant) for comparison between groups; 2-tailed test, equal variances assumed

Results

Out of 133 questionnaires distributed to first-year residents in BC Lower Mainland hospitals, a total of 104 questionnaires were returned for a response rate of 78%. Eight residents were excluded for not meeting inclusion criteria. The average age of respondents was 27.7 years (SD=2.9). Subjects represented all residency programs except for community medicine and neurology. Work hours and sleep hours were analyzed according to demographics (**Table 1**) and rotation type (**Table 2**).

Residents were found to have worked an average of 65.4 hours per week, slept an average of 6.5 hours in the 24 hours preceding completion of the questionnaire, and slept an average of 41.9 hours in the previous week. Analysis revealed a wide range of work hours depending on the clinical rotation. Our results were reported based on rotation type (as opposed to residency specialty) because PGY-1 resident rotations may not accurately reflect the residency specialty of each resident's choice. (For instance, a general surgery resident might be spending a substantial amount of first year in nonsurgery rotations such as emergency medicine and internal medicine.) Self-reported hours of work included in-house on-call activities, as residents are expected to respond to matters on the ward during any portion of this time.

Our sample reflects the national trend in medical school enrollment, with female medical trainees (55.2%) outnumbering male trainees (44.8%).[15] Females worked an average 5 fewer hours per week than male residents, yet also reported getting 2 fewer hours sleep per week than their male counterparts. These values approached statistical significance (*P*=.272 and

Table 2. Work and sleep hours per week for 96 PGY-1 residents in BC, according to rotation type.

Rotation type	Number	Hours worked in the past 7 days (including call)	Hours slept in the past 24 hours	Hours slept in the past 7 days
Surgical rotations	28	80.4	5.5	38.3
Nonsurgical rotations	68	57.0	6.8	41.8
P value *		*P*=.001	*P*=.01	*P*=.005
General surgery	9	88.9	4.1	32.6
Orthopaedics	3	102.0	.5	36.5
ENT, plastics, surgical oncology, trauma, urology, vascular	6	72.2	6.3	41.0
Obstetrics & Gynecology	10	58.5	7.0	43.1
ICU/CCU	5	74.8	8.2	42.2
Internal medicine	32	63.2	7.0	44.0
Psychiatry	3	40.5	7.2	47.3
Pediatrics	15	61.9	6.3	42.7
Emergency	4	45.3	5.8	39.7
Family practice	8	57.1	.8	44.6
Radiology	1	56.0	6.0	32.0

*P <.05 (statistically significant); 2-tailed test, equal variances assumed

P=.199, respectively). Residents who were married or had children worked fewer hours than those not married or with no children. The fewer hours of work, however, did not correspond to more hours of sleep, suggesting that sleep deprivation for this group of residents was for reasons other than work. For instance, residents may have chosen to spend this extra time meeting family and personal commitments. Our findings appear consistent with other studies that have shown male residents report longer work hours than female residents, as do single residents and residents without children when compared to married residents and residents with children.[14]

A statistical difference was observed between the surgical and nonsurgical rotations for hours worked per week, hours slept per week, and hours slept per 24 hours. These findings confirm the results of others in the literature. Baldwin and colleagues, who studied PGY-1 and PGY-2 residents in the United States, reported that the high-intensity residencies were all surgical (general surgery, obstetrics/gynecology, neurosurgery, urology, orthopaedics, and ear, nose, and throat), with an average 106.5 hours of work per week and 36.8 hours of sleep per week. These residents slept the least per week and reported the highest levels of stress and lowest levels of satisfaction among the groups.[14] In the only Canadian study of work hours reported in the literature, Lewittes and Marshall found Ontario medical residents in surgery worked the most hours per week (median 90), compared with 78 hours for internal medicine, 75 hours for family medicine, and 50 hours for psychiatry.[16] Thus, it appears that residents on surgical rotations tend to work more hours than those on nonsurgical rotations.

Duty-hour limits

In response to concerns about the effect of long work hours on medical trainees, several countries have implemented limits on duty hours. In 2004, Great Britain and other European Union countries began adhering to the European Working Time Directive, which limits work to 58 hours a week for physicians in training (a limit that will be lowered to 48 hours per week by 2009).[17] New Zealand has mandated a 72-hour range.[18] In the United States, after much national debate, the ACGME initiated an 80-hour weekly duty limit in 2003 to prevent resident fatigue, promote well-being, and curb medical errors.[19,20] Duty hours were defined as all clinical and administrative duties, including time spent in-house during call activities and time spent on scheduled academic activities such as conferences. The situation in Canada, however, is less clear. Work hours are regulated at the provincial level through collective agreements negotiated by resident associations, and while many agreements outline conditions such as on-call frequency limits and the number of weekends on duty, few specifically put a limit on the total number of duty hours per week including on-call activities.[21] For instance, the current Professional

Association of Residents of British Columbia (PAR-BC) collective agreement regarding work hours states "A Resident shall be scheduled by the Hospital to work a reasonable number of hours. The Hospital will undertake to limit the average number of hours, having due regard for sound patient care and treatment and the educational requirements of the Resident Program."[22] Residents of Saskatchewan and Ontario also do not have an overall duty-hour limit specified in their collective agreements, but the Professional Association of Internes and Residents of Ontario collective agreement does limit residents who do in-hospital shift work (ICU, emergency) to 60 hours per week.[23] The collective agreements for Alberta, Quebec, and the Maritimes limit residents to 12 hours of clinical duties a day; however, this limit does not include on-call hours, resulting in no clearly defined maximum.[24-26] Manitoba is the only province that clearly states a limit of 89 hours per 7-day week, including first call.[27]

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Two questions remain: What is a "reasonable" number of hours for a resident to work? And should the current BC collective agreement be amended to explicitly limit the number of weekly work hours? With no clear definition of what is "reasonable" or "unreasonable" in terms of hours, it may be prudent to have more explicit wording of work-hour limits in the BC collective agreement to prevent fatigue and sleep deprivation. The ACGME has mandated the 80-hour weekly limit at all training hospitals in the United States as a starting point for addressing the issues. Since our medical training system most closely resembles the United States model, it seems reasonable to consider the ACGME's 80-hour weekly limit as a benchmark. British Columbian PGY-1 residents on nonsurgical rotations presently do not exceed benchmarks set in the United States. BC PGY-1 residents on surgical rotations approach this limit, with two surgical rotations (general surgery at 88.9 hours per week and orthopaedics at 102.0 hours per week) exceeding the 80-hour limit. The literature suggests it is residents exceeding this limit who are at risk for traffic accidents and medical errors.[4,6,7,10]

Study limitations

Our study had several limitations. Only BC PGY-1 residents were surveyed. The PGY-1 year was chosen as the literature suggests that this is the year when residents are most "at risk" because of a combination of increased work hours and inexperience. Thus, our results are less generalizable to residents in later years of training in BC or to residents in all years of training at other schools in Canada. In addition, the numbers of completed questionnaires for several specialty rotations were small (for instance, three for orthopaedics). This makes statistical validity an issue. However, our response rate of 78% for PGY-1 residents suggests our values reflect the reality of rotations at a specific time; future studies might sample groups at various times throughout the year to gain a more accurate picture overall. Another limitation is the accuracy of self-reported hours for work and sleep per week. Research suggests people may overestimate or underestimate self-reported values. While recall bias was minimized by having residents complete the questionnaire within 48 hours of receiving it, future studies might improve on the data collected by having students use a log or diary to capture the information. Furthermore, since work hours included in-house call, some residents may have been able to get some sleep while on call, thus affecting the values for hours slept without affecting total work hours. This was a limitation we had to accept since the workload variability inherent in a call night is an element beyond our control. Lastly, there were residents working at the time of our study who did not obtain and complete the questionnaire because they were not present at rounds when the questionnaire was distributed. These residents may not have attended rounds because they were too tired. Capturing information from all members of a particular PGY-1 class in the future will provide a clearer picture of hours worked and slept in a week.

Conclusions

The traditional medical school culture that sees residents working long hours and surviving on minimal sleep has slowly shifted under the mounting evidence that sleep deprivation and fatigue have detrimental effects on the physician's ability to learn, physician safety, and the quality of patient care. Our study shows that first-year residents in BC work an average of 65.4 hours per week, which is within the recommended 80-hour weekly duty-hour limit proposed by the ACGME. However, residents on surgical rotations approach, and in some cases exceed, the 80-hour limit. With no weekly duty-hour limits in the collective agreement for residents in BC, trainees (especially those in surgical specialties) may be at risk for harm to them-

selves and patients because of fatigue and sleep deprivation. Further studies need to be conducted to confirm our findings in a larger sample and to correlate work hours with clinical measures of fatigue. Our study provides further insight on the topic of resident work and sleep hours from a Canadian perspective, and raises the issue that more explicit work-hour limits in BC may need to be instituted to adequately protect residents and patients from the negative effects of extended work hours.

Competing interests

None declared.

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References

1. Buysse DJ, Barzansky B, Dinges D, et al. Sleep, fatigue, and medical training: Setting an agenda for optimal learning and patient care. Sleep 2003;26:218-225.
2. Schwartz AJ, Black ER, Goldstein MG, et al. Levels and causes of stress among residents. J Med Educ 1987;62:744-753.
3. Veasey S, Rosen R, Barzansky B, et al. Sleep loss and fatigue in residency training: A reappraisal. JAMA 2002;288:1116-1124.
4. Pilcher JJ, Huffcutt AI. Effects of sleep deprivation on performance: A meta-analysis. Sleep 1996;19:318-326.
5. Howard SK, Gaba DM, Smith BE, et al. Simulation study of rested versus sleep-deprived anesthesiologists. Anesthesiology 2003;98:1345-1355.
6. Weinger MB, Ancoli-Israel S. Sleep deprivation and clinical performance. JAMA 2002;287:955-957.
7. Barger LK, Cade BE, Ayas NT, et al. Harvard Work Hours, Health, and Safety Group. Extended work shifts and the risk of motor vehicle crashes among interns. N Engl J Med 2005;352:125-134.
8. Zohar D, Tzischinsky O, Epstein R, et al. The effects of sleep loss on medical residents' emotional reactions to work events: A cognitive-energy model. [published erratum appears in Sleep 2005; 28:385] Sleep 2005;28:47-54.
9. Papp KK, Stoller EP, Sage P, et al. The effects of sleep loss and fatigue on resident-physicians: A multi-institutional, mixed-method study. Acad Med 2004; 79:394-406.
10. Volpp KG, Grande D. Residents' suggestions for reducing errors in teaching hospitals. N Engl J Med 2003;348:851-855.
11. Landrigan CP, Rothschild JM, Cronin JW, et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. N Engl J Med 2004; 351:1838-1848.
12. Daugherty SR, Baldwin DC Jr. Sleep deprivation in senior medical students and first-year residents. Acad Med 1996; 71(1 suppl):S93-95.
13. Baldwin DC Jr, Daugherty SR. Sleep deprivation and fatigue in residency training: Results of a national survey of first- and second-year residents. Sleep 2004; 27:217-223.
14. Baldwin DC Jr, Daugherty SR, Tsai R, et al. A national survey of residents' self-reported work hours: Thinking beyond specialty. Acad Med 2003;78:1154-1163.
15. College of Family Physicians of Canada, Canadian Medical Association, Royal College of Physicians and Surgeons of Canada. National Physician Survey—Resident Questionnaires. 2004. www.nationalphysiciansurvey.ca/nps/results/PDF-e/PGY2/Tables/Tables/Q38.pdf (accessed 15 June 2007).
16. Lewittes LR, Marshall VW. Fatigue and concerns about quality of care among Ontario interns and residents. CMAJ 1989;140:21-24.
17. Pickersgill T. The European working time directive for doctors in training. BMJ 2001;323:1266.
18. Bhananker SM, Cullen BF. Resident work hours. Curr Opin Anaesthesiol 2003; 16:603-609.
19. Steinbrook R. The debate over residents' work hours. N Engl J Med 2002;347: 1296-1302.
20. Philibert I, Friedmann P, Williams WT. ACGME Work Group on Resident Duty Hours. Accreditation Council for Graduate Medical Education. New requirements for resident duty hours. JAMA 2002;288:1112-1114.
21. Woodrow SI, Segouin CS, Armbruster J, et al. Duty hours reforms in the United States, France, and Canada: Is it time to refocus our attention on education? Acad Med 2006;81:1045-1051.
22. Professional Association of Residents of British Columbia. Collective agreement. Section 20.01. www.par-bc.org/collectiveagreement.php/20#2001 (accessed 28 February 2006).
23. Professional Association of Internes and Residents of Ontario. Maximum duty hours. www.pairo.org/Content/Default.aspx?pg=1088 (accessed 30 January 2007).
24. Professional Association of Residents of Alberta. Home page. www.para-ab.ca/content/3_residents/collectiveagreement.asp (accessed 10 February 2007).
25. Fédération des médecins résidents du Québec. Home page. www.fmrq.qc.ca/formation-medicale/info_ang.cfm?cfgsection=affairessyndicales (accessed 10 February 2007).
26. Professional Association of Residents in the Maritime Provinces. Home page. www.parimp.ca/site_page.php?page=18 (accessed 10 February 2007).
27. Professional Association of Residents and Interns of Manitoba. Collective agreement. www.parim.org/Collective%20Agreement.htm (accessed 10 February 2007).