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Sleep-deprived doctors and patient safety: an unresolved link

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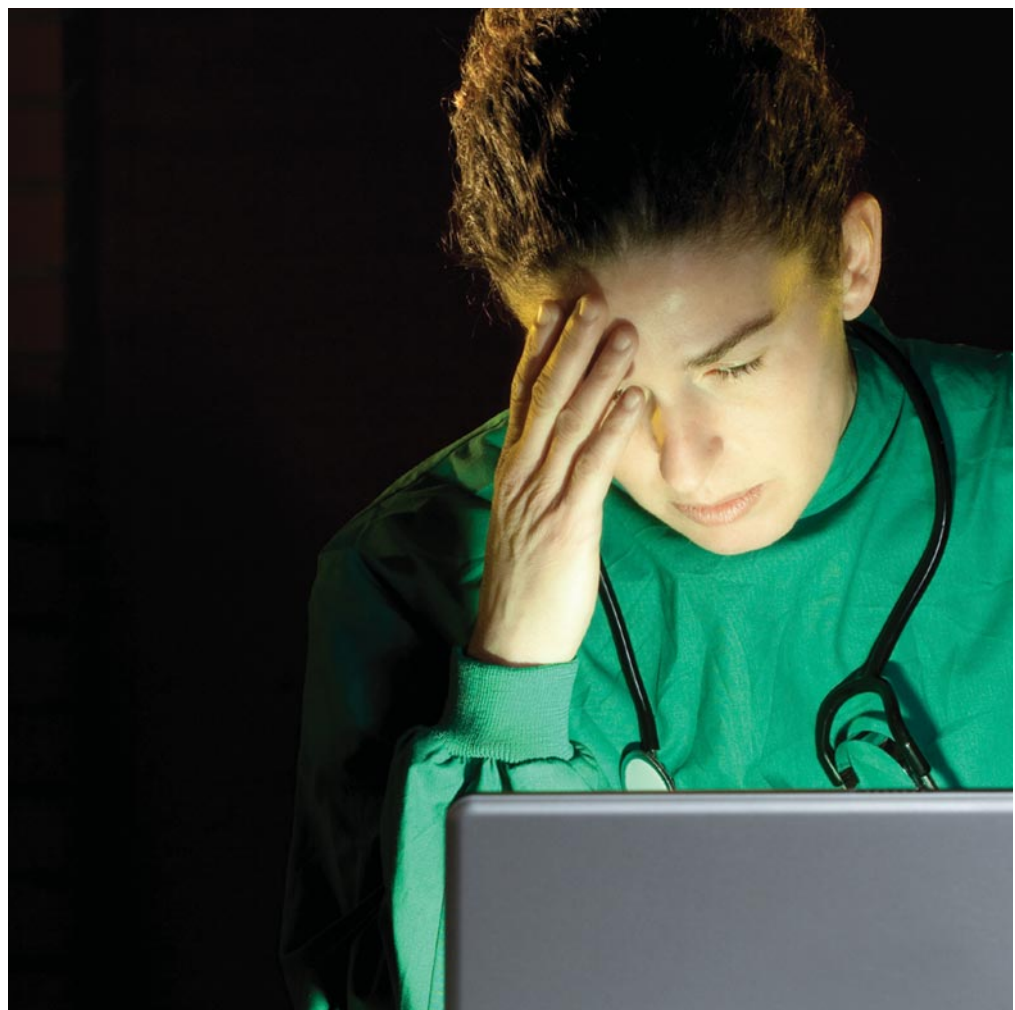
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Sleep-deprived doctors and patient safety: an unresolved link

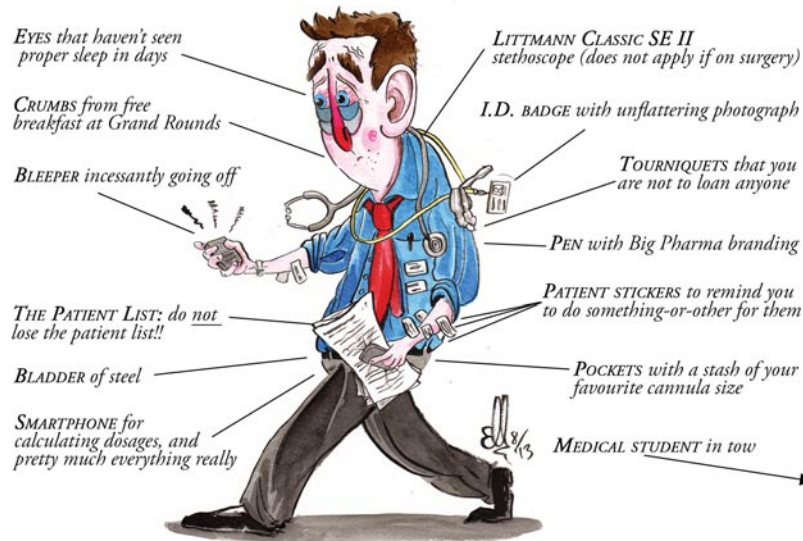


Abstract

In autumn 2013, Ireland's non-consultant hospital doctors went on a 24-hour strike to protest at the Health Service Executive's lack of compliance with the European Working Time Directive. This paper reviews the literature regarding the relationship between sleep deprivation, doctor performance and patient safety. Detrimental effects on doctor performance, including cognitive ability and in real and simulated surgery, have not been clearly demonstrated. However, the long-term effects of sleep deprivation on doctor health and burnout remain unclear. Relatively few strategies, ranging from changes to scheduling programmes to pharmacological interventions, have been investigated to manage sleep deprivation more effectively. Ultimately, more long-term research is required to elucidate the link between sleep deprivation and patient safety.

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RCSI medical student



Anatomy of a JUNIOR DOCTOR

Introduction

A serious prescription error and subsequent fatal drug interaction led to the death of 18-year-old Libby Zion in New York Hospital in 1984. This incident brought sleep deprivation and the long hours worked by medical interns to the forefront of public attention. It was Libby's father, Sidney Zion, a lawyer and journalist, who took the hospital to court.¹ As a result, a panel of experts known as the Bell Commission convened to review medical training and education in New York. One of the most important proposals to come out of this panel was the working hours limitation in 1989, which restricted residents to 80 hours per week and no more than 24 consecutive hours. However, the Accreditation Council on Graduate Medical Education (ACGME) only made this mandatory for resident training programmes in the USA in 2003. More recently, in July 2011, the ACGME limited postgraduate year one trainees to 16 hours of call, based on recommendations from the Institute of Medicine.² Sleep deprivation is not an issue restricted to American medical residents; in autumn 2013 in Ireland, non-consultant hospital doctors (NCHDs) went on a 24-hour strike to protest at the lack of compliance with the European Working Time Directive (EWTD) by the Health Service Executive. In a letter to the *Annals of Surgery*, executive director of The American Board of Surgery Frank R. Lewis suggests that Libby Zion's death did not result from sleep-deprived doctors, but rather from residents with too much responsibility and not enough senior supervision.³ Despite this evidence, he states that on the one hand, 80-110 hours per week is an extremely heavy workload and that if doctors are sleep deprived and have impaired judgement, patient safety may be endangered. On the other hand, he said that decreasing hours can reduce the clinical experience of residents and disrupt the continuity of patient care.³ In the balance is patient health and safety, both of which are paramount to the medical profession. Perhaps, then, the relationship between sleep deprivation, performance, and patient safety in medical professionals and students is not as unambiguous as we would immediately believe. This paper examines the literature to date.

Sleep deprivation and performance

Many tasks, including driving a car and flying a plane, are significantly affected by disruption of sleep schedules.⁴ However, studies examining the effects of sleep disruption on medical management and surgical task performance have turned up mixed results. In a prospective study by Halbach *et al.*, there was significant decline in the cognitive function of medical students and residents pre and post call.⁵ In Ireland, working consecutive, long hour shifts negatively affected cognitive functioning, attention, information processing, and motor skills among junior doctors.⁶ Conversely, in a similar study looking at the effects of different styles of call (call every fourth night or a week of 12-hour 'night float' shifts) on third-year American medical students, there was no change in cognitive function pre and post call.⁷ The authors of this study point out, however, that cognitive function does not necessarily assess judgment and decision-making – both very important to any physician. In addition, the study participants were all medical students who may not experience the same amount of fatigue as on-call doctors making decisions throughout the night.

Simulated surgery

Using verified outcome measures such as the Epworth Sleepiness Scale (ESS) and the National Aeronautic and Space Administration – Task Load Index (NASA-TLX), which determines subjective workload, Tomasko *et al.* determined that a 24-hour call period preceding a simulated laparoscopic surgical task had no effect on learning a new technique or applying a previously learned technique in medical students.⁴ However, call was associated with a higher subjective workload, which could detrimentally affect the ability of doctors to deal with unexpected events, i.e., bleeding vessel during surgery, and emotional stress. In a randomised controlled trial by Uchal *et al.*, voluntary surgeons and nurses were assessed on a laparoscopic physical simulator (suturing a perforated ulcer) after a 24-hour duty

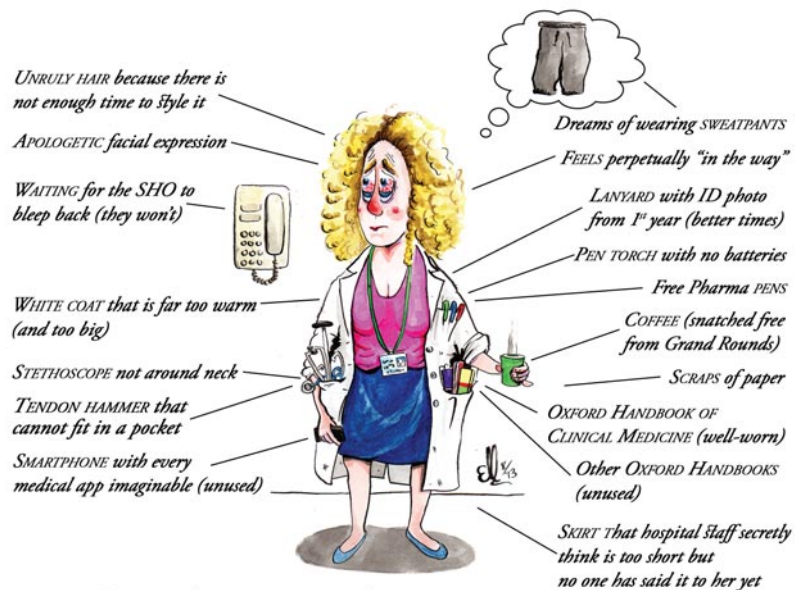


Figure of a MEDICAL STUDENT

(call) versus an eight-hour work day, and again no difference in performance was evident.⁸ As the author readily suggests, however, the results may not be representative of what chronic fatigue might eventually lead to with regard to effects on surgical performance. In another study using an Eyesi surgical simulator, nine residents were assessed at three different times – pre call, post work and post call – in a simulated ophthalmic anterior segment surgery, and evaluated on number of performance errors. There were no differences in the number of performance errors.⁹

Sleep deprivation and patient safety

Although the association between sleep deprivation and performance remains controversial, an important aspect of sleep deprivation is its effect on patient safety and outcomes. In a study by Landrigan *et al.*, medical interns made 36% more medical errors (including serious medication and diagnostic errors) if they worked consistent 24-hour shifts when compared to shorter shifts.¹⁰ Emergency doctors on night shifts tended to make more mistakes as the night continued, were slower at intubating a mannequin, and were more likely to place patients incorrectly in a triage test at the end of the shift when compared to doctors working day shifts.¹¹ Conversely, Mitchell and colleagues looked at the root cause analysis of sentinel events (major medical errors) in a health system in Dallas and found no association with resident fatigue.¹²

Surgical outcomes

A retrospective study at the University of Virginia, which looked at over 6,000 cardiac procedures performed by attending cardiac surgeons over nine years, found no association between surgeon fatigue and patient morbidity and mortality.¹³ In an analysis of appendectomies and cholecystectomies performed at night (after a 16-hour shift) versus during the day by residents at Harbor-UCLA Medical Center, there were no differences in complication rates, length of operation or conversion in these common surgical procedures.¹⁴

Sleep deprivation and doctor safety, health and education

Sleep deprivation can also have a significant effect on doctor safety. Residents are more likely to fall asleep at the wheel of a car when driving home after a call shift.¹⁵ Post-call residents are at significantly increased risk of needlestick injury.¹⁶ Mental health may also be negatively affected by sleep deprivation; according to Babson and colleagues, sleep deprivation increased the reporting of symptoms of anxiety, depression, and general distress in adults recruited from the general population.¹⁷ Sleep is important for maintenance of general health; doctors who do not get the appropriate amount of sleep can go on to develop chronic conditions, putting significant strain on the healthcare system in the future.¹⁸ Interestingly, although burnout, which is defined as the feeling of long-term, emotional exhaustion and reduced interest in work, is a common problem among medical trainees at the beginning of training, one study showed that excessive sleepiness based on the ESS was not correlated to burnout, but rather to personality type.¹⁹

Strategies to reduce sleep deprivation

The difficulty in addressing sleep deprivation lies in balancing three parameters: patient care; resident education; and, resident satisfaction/stress. No resident training programme or call schedule has successfully done so, thus far.²⁰ One of the main strategies proposed to reduce sleep deprivation is simply to reduce working hours. However, to date the evidence behind the reduction of work hours and improving patient outcomes has been inconclusive. A study looking at the 2011 work hour restrictions by the ACGME (16 hours for first-year residents) found that although residents were more well rested, they found they suffered increased work compression (doing the same amount of work in a shorter amount of time).²¹ The authors concluded that programmes should adapt their schedules to decrease work compression. Night float is a type of call schedule where doctors

are assigned to work a shift, but not necessarily to a specific ward, and instead 'float' to whichever team requires them. In a study by Matthews *et al.*, students subjectively felt more alert for clinical duties while on night float.⁷ In another study, Ray *et al.* looked at the use of modafinil, a wakefulness-promoting drug used in narcolepsy or shift work disorder, as an effective pharmacological countermeasure to one night of sleep deprivation and reduction in cognitive decline.²² The authors, however, do not state that this should be considered as a strategy for chronically sleep-deprived residents, as long-term effects of using these countermeasures are unknown.

Conclusion

The recent action by NCHDs in Ireland demonstrates the widespread importance of limiting the work hours of trainee doctors. The evidence for an association between sleep deprivation and doctor performance is not as plain as logic suggests, although many authors point out that there are

limitations to their studies. For instance, measurement of performance is often based on completion of a single task done after a call shift. These studies fail to take into account the effects of chronic fatigue on overall patient safety. Future studies that follow patient outcomes over extended periods of time and include a range of procedures may be beneficial.

Even if there is no clear case for a detrimental effect on patient health, sleep deprivation certainly affects the physical and mental well being of doctors. Most studies lack insight into a lifetime of sleep deprivation and stress. Current strategies to mitigate this issue have focused on reducing work hours. However, this may only serve to decrease the amount of time allotted to do the same amount of work. Future research should focus on developing more strategies, such as night float, which reduce work compression, and on ways to better utilise and train doctors in a shorter period of time. Based on the evidence to date, a great deal more work is required in this field to better serve patients and doctors alike.

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