

**Shift-work, Rest and Sleep: Minimising the Risks**  
**Discussion paper by the BMA Scottish Junior Doctors Committee**  
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**Introduction**

The Working Time Regulations (WTR – the UK legislation encompassing the EWTD) and the implementation of the New Deal contract have resulted in a general trend to a full-shift pattern of working for junior doctors. Changing work patterns in hospital practice also reflect our increasingly 24-hour society. It is estimated that approximately one in five of adult workers in Western countries work shifts of some sort.

The effect of shift-working on health and performance is therefore an issue that affects the lives of most, if not all, junior doctors today. It is of acute importance to all working in healthcare, may influence patient safety and is an issue that has recently received significant media attention. [1]

Many different shift work patterns have been developed in recent years. Due to a range of pressures, most recently the adoption of the EWTD into UK law, there has been a change from a “traditional” 24-hour-resident on-call pattern for junior doctors to a more regimented shift pattern, with the express aim of protecting employees from excessive work without adequate rest. It can be seen that the “traditional” on-call may expose the doctor and the patients under his or her care to potential risk if there is an intensive workload during that on-call period. However, it has also become evident that poor rota design of “WTR-compliant” shift patterns may also result in a shift structure predisposed to high-intensity work that may lead to fatigue and may carry unacceptable burdens of risk to doctors and patients.

The WTR is designed to protect the health and safety of workers, as the limits it places on working hours and patterns are thought to reduce fatigue. However, the benefit of the WTR in decreasing overall hours worked in a defined time period must be weighed against any increased risks in having contributed to a move to increased frequency of working shorter shifts. The risks of shift-related fatigue are discussed subsequently in the paper.

The problem of fatigue in medical workforces has been formally recognised by bodies representing anaesthesia [13] and obstetrics and gynaecology [14] and is being addressed in print by general medicine. [15] The NHS must therefore find ways to mitigate the short and long-term effects of shift work on doctors and on patients.

There is much debate currently regarding the adequacy of the training that is likely to be achieved within the constraints of shorter working hours, shift systems of working, and the WTR in particular. These issues are outwith the remit of this discussion paper.

**Effects on the shift-worker**

There is a considerable body of evidence that shift-working has multiple short and long-term effects on the worker.

Sleep is protective, allowing us to rest and recuperate, and to maintain high levels of cognitive function during waking hours. The human body has evolved to sleep at night, and the sleep/awake cycle is facilitated by a circadian rhythm of complex neuro-hormonal pathways. [2] Night-working can therefore cause sleep deprivation and fatigue, because night workers must sleep ‘against the flow’ of their circadian rhythm. A Japanese study of resident doctors in one university hospital correlated shorter hours of sleep and higher numbers of patients under the doctor’s care with the likelihood of the resident falling asleep at work. [12]

Deprivation of sleep is detrimental to performance. A positive correlation has been shown with fatigue and risk of needlestick injury, for example. [9] It also affects learning, reasoning, and physical and mental well-being. It can also result in alteration of lifestyle, influencing factors such as diet, smoking, alcohol and other substance use, and exercise. [2,3] There is evidence that sleep deprivation can be of detriment to personal relationships. [2,3]

The influence of sleep deprivation on the performance of motor tasks is not only important in the work place, but outside of work. In particular, there is clear evidence that doctors driving after long shifts, and particularly after night shifts, have an increased risk of accidents [8]. Studies have demonstrated poor performance in driving simulators by UK anaesthetists after a night on-call with evident implications for anaesthetist vigilance, and potentially for patient safety, during anaesthesia. [11] Thus sleep-deprived doctors may pose a danger to themselves and others. It is of note that a private individual was successfully prosecuted for dangerous driving resulting in the Selby rail crash in 2001, after driving while seriously fatigued [17], although fatigue (or calculated fatigue) has not consistently been held to contribute to culpability in road traffic deaths.

The longer-term effects of sleep deprivation are less certain, but a recent compensation payment by the Danish government to night-workers who developed breast cancer [4] demonstrates that sufficient evidence is accumulating to persuade the authorities of a link between negative health outcomes and long-term night-shift work. It has been suggested that shift work itself may be carcinogenic to humans. [5] There is also evidence of increased cardiovascular morbidity including MI and stroke. [6]

This should equally apply to the healthcare profession, and suggests we should limit the number of successive night shifts worked. In all likelihood, night-shift work has multiple effects on the health of the individual and it is likely that exposure to it should be minimised over a working lifespan.

### **Effects on Patient Safety**

Disruption of circadian rhythms and resultant fatigue could result in night-workers operating in a state of reduced vigilance and cognitive reasoning. This has been likened to operating at levels of functional impairment equivalent to alcohol intoxication. [2,3,7] Moreover, fatigue impairs awareness of the limitations of one's abilities, so the affected worker may not realise that they are potentially making mistakes. [2] This may apply to doctors performing high-acuity tasks such as examining patients, prescribing and administering drugs and performing anaesthesia or surgical operations, often without direct supervision. [2,3]

Indeed, there is evidence from many acute medical and surgical specialties suggesting a link between fatigue and medical error. A detailed survey of anaesthesia-related mortality in France in 2006 implicated night work as a potentially causative factor in 2% of analysed deaths possibly or certainly attributable to anaesthesia (n=235). [10] The UK CEPOD survey of peri-operative deaths identified a similarly small, but potentially preventable, proportion of deaths attributable to fatigue.

A Japanese study of resident doctors in one university hospital correlated shorter hours of sleep and higher numbers of patients under the doctor's care with the likelihood of the resident falling asleep at work, [12] thus in this study the busiest doctors were most likely to be prone to fatigue-related performance impairment.

Further risk has been identified in relation to the number of shifts worked. A review of observational studies in industry estimated risk of *reported* adverse incidents (unintended process events or personal injury) as, on average, increasing to 6% on the second night shift, 17% on a third and to 36% higher risk on a fourth night shift worked (over the baseline risk estimated for the first night shift). [16] For comparison, risk was assessed in a similar manner for successive day shifts, producing the figures: 2%, 7% and 17% for the second, third and fourth days respectively. [16] The effect of night shifts compounds the risks of working multiple shifts, and makes the case for limiting the number of successive shifts worked. This form of analysis seems

not to have been performed in a healthcare setting, although there is no reason not to believe the potential applicability of the recommendations.

Patient safety is of paramount importance to our society. Nearly one quarter of NHS complaints are in regard to patient safety, including medical negligence claims. [21] The NHS Litigation Authority in England paid £769m in connection with clinical negligence claims in 2008/09 compared with £633m in 2007/08. In Scotland £26m was paid in connection with clinical negligence claims in 2008/2009 compared with £12.1m in 2007/08. Good rota design that mitigates against fatigue can help to prevent medical error. A key finding of a recent survey by PMETB was: "Medical errors linked to overwork are more likely in posts that are not EWTD compliant." [22] Trainees who blamed mistakes on overwork had 64 per cent WTR compliance compared to 77 per cent WTR compliance amongst those who did not blame mistakes on overwork. Obviously this survey is limited by the problem of reporting bias, but the message seems clear: shorter hours of work can potentially help to reduce error.

### **Lessons from other Industries**

Healthcare is not alone in being an industry in which workers are subject to fatigue-inducing work patterns. Other high-risk industries take the problem seriously. For example, road-haulage drivers, train crews and pilots all have regulated maximum hours of work and mandatory rest periods.

Aviation has formalised its measures to reduce fatigue-related error in the recommendations of the Aerospace Medical Association. These include frequent rests during shifts, including naps. [18] However, the authors acknowledge that there is widespread variation in individual response to fatigue. Thus there is a need for the design of rotas that minimise fatigue development for all workers.

### **Suggestions for risk minimisation for doctors working night shifts**

The key to minimisation of risk to doctors and patients is good rota design to avoid excessive out-of-hours working for individuals on the rota. The BMA's JDC has produced a useful guide. [19] Many rotas which are compliant with New Deal and WTR on paper may in fact lead to considerable predictable fatigue in the doctors who work those rotas. For example, there are juniors who are working rotas which include seven consecutive 12.5 hour nightshifts. The European Commission has made it clear that making junior doctors work 80-hour weeks is not in the spirit of the legislation and places doctors and patients at risk. [25] Attention should be given to identifying these rotas and to altering them appropriately to minimise this risk of fatigue and its associated sequelae.

Doctors should be encouraged to participate fully in this process, and to engage accurately and honestly in the contractual duty of hours' monitoring. Employers and supervising consultants need to be aware of the risks associated with fatigue in doctors and to act constructively to help to minimise this.

Individuals must take personal responsibility for their ability to work safely and effectively. This must include taking adequate rest between shifts, and taking appropriate rest during shifts. They must consider the safety of themselves, their patients and the general public before, during and after a long shift. However, this requires the support of management, rota masters and senior doctors.

Employers can facilitate this through the provision of appropriate facilities in the work place for rest both during the day and at night. On-call rooms should be available for night-working staff and be of sufficient standard to facilitate adequate rest breaks and for post-call resting. Furthermore, safe "handover" periods should be incorporated into any rota; a recommendation of the 2007 NCEPOD report on emergency care [26]. Of particular note in this context is the sensible advice contained within the BMA's "Be safe: be rested" campaign which incorporates these suggestions. [20]

The issue has recently been examined in some detail in Australia, where the Queensland Health Department has issued a “Fatigue Risk Management System Resource Pack”. [23] This admits that fatigue is an identifiable workplace hazard which must be managed in the same way as other hazards, where legislation demands appropriate minimisation of risk. Furthermore, Queensland Health has issued a policy which stipulates that all facilities must develop a comprehensive Fatigue Risk Management System as part of its duty of care to its staff and to the public. Whilst some may disagree with the recommendation of high-dose caffeine as a fatigue counter-measure, this is a key document, and an example of a governance system taking the issue of fatigue seriously, and attempting to manage the problem.

### **Summary Points**

- Fatigue is defined as an impaired capacity to perform physical or mental work.
- Fatigue is a potential consequence of the delivery of 24-hour patient care and may be inevitable if measures are not put in place to reduce the risk of it occurring.
- Fatigue is associated with measurable cognitive and psychomotor impairment.
- As such, fatigue poses a risk to healthcare staff and to patients.
- Specific risks to the shift-worker include: acute fatigue-related consequences such as increased risk of needlestick injury, and of post-shift accidents such as life-threatening road traffic accidents. Further negative impact on quality of life and relationships can be demonstrated.
- Longer term risks to the health of the shift-worker include an increased incidence of cardiovascular disease, including MI and stroke, and of cancer.
- Risks to the patient include an increased risk of medical errors being made, with the greatest risk occurring following a series of night shifts.
- Other industries such as aviation have formalised guidelines to reduce fatigue-related error, including regulated maximum hours of work and mandatory rest periods and working in pairs at a minimum.
- Good rota design can mitigate the likelihood of fatigue developing – this can best be achieved by engagement of doctors in rota-making, by a constructive approach to rotas from employers and through encouragement of accurate, honest and coercion-free monitoring of rotas.
- Doctors must understand the potential for fatigue-related impairment of abilities and must take personal responsibility for minimising risks. This includes taking adequate rest between and during shifts, and optimising hydration and food intake.
- Opportunities to rest during night shifts in particular needs attention with encouragement for doctors to nap when opportunities allow, away from clinical areas.

### **Recommendations**

1. It is important to recognise that the detrimental effects of fatigue on the doctor and on his or her patients can be managed to reduce associated risks. Good working practice should encompass risk management strategies.
2. Good rota design provides the key, with active involvement of junior doctors in the design process and a willingness on the part of management and trainees to pilot rota changes to find a mutually acceptable solution. Solutions can be found that adequately provide appropriate 24/7 service cover, optimise training opportunities and minimise detrimental effects.
3. Within rotas, runs of shifts each in excess of 12 hours should be avoided i.e. the “week of nights” should be avoided. Instead, a split of 4/3 day shifts/night shifts is preferable, although better still would be a reduction in the number of shifts worked in any seven day period, to five for example. Although the WTR allow for up to 13 consecutive shifts, this should be recognised as high risk for fatigue developing and such a working pattern should be avoided. Furthermore, the practice of working seven consecutive 13-hour shifts (i.e. 91 hours in seven days), followed by a week of low (or even zero hours) is likewise high risk, and also should be avoided.

4. The possibility of utilising a “traditional” 24-hour on-call rota model should be considered for some specialties, if appropriate work intensity monitoring suggests it is safe to do so. This cover could potentially be non-resident in some specialties. Many junior doctors view this model of working as less disruptive to daily life, including access to training opportunities and to social life.
5. During shifts at work, adequate rest facilities should be provided by the employer. Evidence supports “napping” during night-working and this should specifically be encouraged and supported by employers. It is observed that better rest is achieved in private surroundings, even for “naps” and the system of “on-call” rooms provides this facility. The JDC and Academy of Royal Colleges’ Trainees’ Committee have called for the retention of on-call rooms in a statement in 2007 [24] and this view is supported by SJDC.

### Conclusions

There is now sufficient evidence to conclude that shift work, particularly out-of-hours shift work, may be harmful to the worker, even in the short term [5] and may have a detrimental impact on patient safety.

As a consequence, several recommendations can be made: shift lengths should be as short as practicable, rest breaks should be facilitated and doctors encouraged to rest during night shifts as much as is possible; and shift workers and employers need to be educated as to how circadian rhythms can be influenced to maximise sleep quality and sleep duration, and thus maximise alertness at work, to minimise risks to staff, to patients and to society as a whole.

### References

1. <http://news.bbc.co.uk/1/hi/health/7187093.stm> (accessed 12/08/09)
2. Horrocks N, Pounder R, on behalf of a multidisciplinary working group. *Working the night shift: preparation, survival and recovery – a guide for junior doctors*. London: Royal College of Physicians, 2006
3. Kelsall D. *Must we keep depriving residents of sleep?* **Canadian Medical Association Journal** 2009;180(11):1087
4. Wise J. *Danish night shift workers awarded compensation* **BMJ** 2009;338:1152
5. Fritschi L. *Shift work and cancer: Short and long term effects provide compelling reasons to act now.* **BMJ** 2009;339: 2653
6. Bøggild H, Knutsson A. *Shift work, risk factors and cardiovascular disease.* **Scand J Work Environ Health** 1999;25:85-99
7. Arnedt JT, Owens J, Crouch M, et al. *Neurobehavioural performance of residents after heavy night call vs alcohol ingestion.* **JAMA** 2005;294:1025-33
8. Barger LK, Cade BE, Ayas JS, et al. *Extended work shifts and the risk of motor vehicle crashes amongst interns.* **N Eng J Med** 2005;352:125-134
9. Ayas NT, Barger LK, Cade BE, et al. *Extended work duration and the risk of self-reported percutaneous injuries in interns.* **JAMA** 2006;296:1055-62
10. Lienhart A, Auroy Y, Pequignot F, Benhamou D. *Mortality related to anesthesia and sleep deprivation in medical doctors.* **Anesthesiology** 2007;107:512
11. Murray D & Dodds C. *The effect of sleep disruption on performance of anaesthetists – a pilot study.* **Anaesthesia** 2003;58:520-525

12. Taoda K, Nakamura K, Kitihara T, Nishiyama K. *Sleeping and working hours of residents at a national university hospital in Japan*. **Industrial Health** 2008;46:594-600
13. Fatigue and Anaesthetists, Guideline published by Association of Anaesthetists of Great Britain and Ireland. July 2004  
<http://www.aagbi.org/publications/guidelines/docs/fatigue04.pdf>
14. American College of Obstetrics and Gynaecology committee opinion number 398, February 2008: *Fatigue and patient safety*. **Obstet Gynaecol** 2008;111(2 pt 1):471-4
15. Brown LK. *Physicians and sleep deprivation*. **Curr Opin Pulm Med** 2008;14:509-511
16. Folkard S, Lombardi DA, Tucker PT. *Shiftwork: Safety, Sleepiness and Sleep*. **Industrial Health** 2005;43:20-23
17. <http://news.bbc.co.uk/1/hi/england/1754336.stm> (accessed 08/09/09)
18. Caldwell JA, Mallis MM, Caldwell JL, Paul MA, et al. for the: Aerospace Medical Association Fatigue Countermeasures Subcommittee of the Aerospace Human Factors Committee. *Fatigue countermeasures in aviation*. **Aviat Space Environ Med** 2009;80:29-59
19. Rota Design Made Easy, Sept 2006  
[http://www.bma.org.uk/sc/employmentandcontracts/working\\_arrangements/work\\_patterns/Rotadesignmadeeasy.jsp](http://www.bma.org.uk/sc/employmentandcontracts/working_arrangements/work_patterns/Rotadesignmadeeasy.jsp)
20. Be safe, be rested. BMA  
<http://www.bma.org.uk/sc/employmentandcontracts/pay/accommodation/besafeberested.jsp> (accessed 30/10/09)
21. *Spotlight on Complaints: a report on second-stage complaints about the NHS in England* Healthcare Commission. 2008
22. National Training Surveys 2008-2009. October 2009, Postgraduate Medical Education and Training Board
23. Fatigue Risk Management System Resource Pack, Queensland Government 2009.
24. Joint position statement on on-call rooms. BMA JDC and Academy of Royal Colleges' Trainees' Committee, December 2007
25. <http://www.timesonline.co.uk/tol/news/uk/scotland/article6797724.ece> (accessed 16/08/09)
26. Emergency Admissions: a journey in the right direction? National Confidential Enquiry into Patient Outcome and Death (NCEPOD) 2007

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