

Association of Anaesthetists of Great Britain and Ireland

Fatigue and Anaesthetists – Expanded Web Version

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(If this is on web draft full initials need to be added)

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1. Recommendations:

- Every anaesthetist carries a personal obligation to provide a safe and effective service and should be aware of the problem of fatigue
- Departments must have a plan to manage staff at all grades who have undertaken an onerous duty period and consider themselves unfit to continue work
- Job plans should be constructed that are not likely to lead to predictable fatigue
- Job plans of career grade staff should include flexibly worked fixed theatre sessions without named lists in order to provide regular relief for colleagues
- Routine rest breaks should be implemented
- A 'Handover Protocol' should be used before all rest breaks, even short ones
- Equipment checking protocols should be instituted with regular, repeated use for long cases and before each out of hours case
- All hospitals should ensure the availability of 'on-call' rooms for those doctors working night shifts, to allow them to take rest breaks
- Management should provide accommodation adjacent to the theatre suite for napping and 'post-call' sleeping facilities
- Good quality accommodation should be available for resident on-call staff
- All staff should have access to good quality refreshments at all times
- There should be a review of on-call responsibilities for anaesthetists over 55 years of age (in conjunction with advice from an accredited specialist in occupational medicine)
- Private practitioners must ensure that a combination of NHS and Private work does not lead them to practice when compromised by fatigue

2. Introduction

- 2.1. Physiological factors cause fatigue. Neither pride nor professionalism can overcome them.
- 2.2. All anaesthetists are aware of instances where their tiredness may have had an adverse effect either upon themselves or their patient.
- 2.3. The Working Time regulations are directed toward limiting the number of hours that doctors can work for safety reasons.
- 2.4. Workload pressures, insufficient numbers of personnel and increasing complexity of procedures all magnify the problem of fatigue. This has been recognised in publications by anaesthetic bodies in America¹ and Australia and New Zealand².
- 2.5. This document explores the problem of fatigue in anaesthesia and makes proposals that will reduce the risks for both patient and practitioner. A shorter version of this document was published by the Association of Anaesthetists of Great Britain and Ireland in July 2004 and distributed to all current members. This web version contains background and further information supporting the published document and is available on the Association of Anaesthetists of Great Britain and Ireland's web-site (www.aagbi.org).

2.6. The Consultant Contract

Although presently (June 2004) the European Working Time Directive allows workers to opt out and thereby agree voluntarily with their employer to work more than 48 hours per week, the new consultant contract significantly appears to apply a mandatory 48-hour working week. (Terms and Conditions of Service – schedule 3 paragraph 2)

This will inevitably bring with it pressure to work more intensely for shorter periods of time and to maintain throughput by an “open all hours” approach.

The management of fatigue will be all the more important.

2.7. The Association's Fatigue Working Party 1978

- 2.7.1. A letter in *Anaesthesia* in 1978 asked the profession what they thought about the nature, magnitude and importance of fatigue in the practice of anaesthesia³. As a result of this enquiry the Association's Research and Education Committee set up a Fatigue Working Party under the chairmanship of Dr WDA Smith, which commissioned four studies into the problems of fatigue⁴.

2.7.2. These studies included:

- a study of attitudes to fatigue
- ways of measuring fatigue
- the relationship between sleep and fatigue
- how reaction times varied with fatigue.

Unfortunately none of the results of the studies commissioned by the working party produced convincing or publishable results

2.7.3. Nevertheless, in his report to the Research and Education Committee in October 1981, Dr Smith wrote “the inquiries initiated may be important to the specialty (especially in view of the current concern about manpower, distribution of workload and the effect of age).”⁴

2.8. The British Medical Association’s 2001 Annual Representative Meeting passed a resolution commissioning their Board of Science to report into the dangers of tired doctors driving home after prolonged periods of work, and to investigate the effects of sleep deprivation on doctors, their wellbeing and their patients.

3. Fatigue and Driving

3.1. A study by the Royal Society for the Prevention of Accident states in its introduction “Driver fatigue (falling asleep at the wheel) is a major cause of road accidents, accounting for up to 20% of serious accidents on motorways and monotonous roads in Great Britain⁵” The Government’s Road Safety Strategy, “Tomorrow’s Roads – Safer for Everybody”⁶ identified driver fatigue as a main area of driver behaviour that required addressing. Several American studies had observed similar findings. One study⁷ had calculated that 17% of road accidents in the USA (about 1 million) are fatigue related, whilst another⁸ that 30 – 40% of accidents involving heavy trucks were caused by driver sleepiness. Studies in mainland Europe have similar findings, with one in Bavaria⁹ estimating that 35% of fatal motorway crashes were due to reduced driver vigilance (driver inattention and fatigue).

3.2. One of the most recent, and highly published, incidents concerned the ‘Selby Road/rail Crash’ in 2001 when a 38-year-old man was jailed for five years after being convicted of causing 10 deaths by dangerous driving. The driver had fallen asleep at the wheel after spending the night talking on the phone.

3.2.1. The attitude of the courts to drivers who continue to drive when tired has hardened. The Magistrates’ Sentencing Advisory Committee now states that “If a driver continues to drive when sleepy it is to be regarded as an aggravating factor when it comes to sentencing”¹⁰. Would a doctor

who continues to practice when sleepy be similarly viewed by the court, and what responsibilities would the employer have?

3.2.2. The effects of jet lag as a result of travel through multiple time zones may further compound this effect. In spite of the widespread awareness of the risks of jetlag after long distance airline travel, a recent study¹¹ by the BBC revealed that 50% of passengers disembarking from transcontinental flight at Manchester airport were intending to drive themselves home, many of the journeys involved travel on motorways

4. Fatigue and the Railways

- 4.1. Parallels have been drawn between anaesthetic practice and aviation. Possibly a more realistic and pragmatic comparison might be provided by the railway industry.
- 4.2. A train driver is required to maintain a high degree of vigilance often over a prolonged period of time, responding to stimuli throughout the entire journey and interpreting signals in a constant requirement to recognise malfunction, conflicts or the need for clarification. The potential for error is large. Unlike aviation, an automatic pilot is not available. An error may have serious consequences for safety of passengers and train crews.
- 4.3. The Defence Evaluation and Research Agency carried out a survey¹² in 2000 of rosters and current working practices in the railway industry. There was concern that rosters do not always provide an accurate representation of the hours worked. When trains are delayed due to incidents on the line, work periods will be extended beyond 12 hours. Although swapping shifts is generally permissible, drivers must clearly cover each other's shifts in full. As a result the rest period between consecutive shifts may be curtailed.
- 4.4. A control procedure is essential to ensure that covering shifts complies with good practice. A pre-requisite is that anyone responsible for resourcing shift operations needs to be aware of the principles of good practice and advances in the field of chronobiology, shift work and fatigue studies which need to be monitored.

5. Fatigue and Aviation

- 5.1. Parallels are also often drawn between anaesthesia and aviation e.g. induction/ take-off, emergence/ landing. Between these intense events are long periods of vigilant systems monitoring interrupted by unpredictable, task-related critical incidents. Other common factors include: work schedules that result in acute sleep loss and sleep debt, continuous hours of wakefulness and disruption of circadian rhythm.

5.2. The aviation industry and pilot organisations have recognised that fatigue and sleep deprivation are important factors in lowering mental fitness leading to irrational behaviour and deterioration in performance and decision-making. This is greatest in tasks requiring self-generated arousal such as systems monitoring and may be unrecognised.¹³

5.3. The catastrophic consequences of fatigue-related incidents in aviation have led to the establishment of fatigue monitoring programs providing pro-active tour scheduling, feedback to crews and intervention measures that have resulted in a culture of openness.

5.4. Monitoring for pilot fatigue regularly includes

- EEG monitoring
- Palm-top/ wrist actigraph monitoring of reaction times
- Psychological testing (e.g. Karolinska Sleepiness Scale)¹⁴

5.5. Within a culture where the part fatigue plays in staff malfunction is openly acknowledged, it is difficult to find recent incidents where fatigue has been a major factor. Nevertheless:

- NASA attributed fatigue resulting from work-rest patterns in managers as having contributed to flawed decision-making in the space shuttle ‘Challenger’ incident.¹⁵
- The National Safety Transportation Board found that fatigue in a 60-year-old captain who had completed more than 14 hours of duty that included two additional, unscheduled flights in the night with a probationer First Officer contributed to a Air New England plane crashing in 1979¹⁶
- Similar factors in association with poor weather conditions were in evidence again in Hyannis, Massachusetts in the Kennedy crash
- In a study by Helmreich et al in 2000, when Pilots and doctors were asked whether they agreed or disagreed with the question “Even when fatigued, I perform effectively at all times?” 26% of pilots agreed in comparison with 60% of doctors (70% of surgeons and 47% Of anaesthetists)¹⁷

5.6. In a supportive culture, aircrew are more likely than doctors to recognise the effect of fatigue on performance and to develop management interventions.

6. Fatigue and Medical Practice

6.1. Many studies have shown that fatigue reduces medical task performance. ECG interpretation accuracy is reduced amongst sleep-deprived house staff¹⁸, and intubation skill diminished in emergency room physicians working the night shift compared with similar staff during the day¹⁹

- 6.2. The Australian Incident Monitoring Scheme (AIMS) reported 152 incidents (2.7% of all reports) up to 1997 which listed fatigue as a factor contributing to the incident.²⁰ These incidents included: pharmacological incidents (eg: syringe swaps, wrong drug), haste, distraction, inattention and failure to check equipment. A significant factor identified as avoiding serious outcome was providing relief for fatigued anaesthetists.
- 6.3. Many of these fatigue-related performance shifts are increased in older physicians who are less tolerant of night and shift working. This may have significance for the increasing demand now being placed on Senior Career Grade staff for night, weekend and resident on-call cover.
- 6.4. There are two studies which report that more than 50% of “anaesthesia providers” admit that they had made errors in medical judgement which were attributed to fatigue^{21 22}.
- 6.5. A fatal case report of an anesthesiologist who fell asleep whilst anaesthetising an eight-year-old made front page in the *Denver Post*²³. During testimony it was claimed that the defendant had been repeatedly warned about falling asleep during operations. He was convicted of criminal medical negligence but acquitted of criminally negligent homicide. Conviction was later overturned on a technicality.
- 6.6. The overall welfare of patients is the responsibility of the Chief Executive of the Trust or Hospital (or the licence holder in the independent sector) who, through the process of clinical governance, ensures that appropriate systems are in place to ensure delivery of a service that is both safe and effective. This places an onus on trust managers to ensure that working practices and duties are formulated to avoid fatigue in their staff

7. Definitions and Physiology

- 7.1. Fatigue: a subjective feeling of the need to sleep, an increased physiological drive to fall asleep and a state of decreased alertness²⁴. Fatigue is the inability to continue effective performance of a mental or physical task. Fatigue is personal, hard to identify unequivocally and, consequently, difficult to measure and / or regulate. It should not be confused with habituation, lack of motivation or boredom, although these may be both cause or effect of fatigue
 - 7.1.1. Fatigue can evolve from two mechanisms²⁵
 - a. Active fatigue is generated by continuous, prolonged and task-related effort
 - b. Passive fatigue as a result of system monitoring with rare or non-overt perceptual-motor responses
- 7.2. Sleep is a state of reversible unconsciousness in which the brain is less responsive to external stimuli²⁶. Sleep is distinguished from unconsciousness

and anaesthesia by a characteristic cycle of sleep phases with specific Electroencephalograph patterns and physiological changes.

- Natural sleep is divided into two distinctive states: non-rapid eye movement (NREM) and rapid eye movement (REM) sleep.
- It has been suggested that sleep might conserve energy by reducing core temperature slightly and lowering metabolic rate by 10% compared with quiet wakefulness. Sleep would prevent perpetual activity as a response to environmental stimuli leading to excessive energy consumption. However, sleep is a state of starvation and there is no evidence that sleep is important for tissue repair. Sleep has been implicated as an important factor in storage of long-term memory. Facts learnt during the day are usually better remembered the next morning whereas facts learnt shortly before going to sleep are often poorly recalled

7.3. Sleep Homeostasis: There is a natural balance relating the quality and quantity of sleep taken against the number of hours during which the individual has been awake. The normal adult sleep requirement is approximately 8 hours per night. Most adults achieve 1 to 1.5 hours less than their requirement, and if the sleep taken is more than two hours less than that required performance is impaired. Multiple awakenings in the sleep period will also reduce performance.

7.3.1. It takes two consecutive nights of **optimal** sleep at the correct time to recover from significant sleep loss²⁷

7.3.2. Sleep requirements do **NOT** lessen with age; this is a commonly held misconception. Over the age of 45 years:

- The number of awakenings increases with a deterioration in sleep quality
- Repaying sleep debt by extending sleep time is more difficult
- There is a decrease in stage 3-4 non-REM sleep with increasing age.

7.3.3. Fatigue can cause spontaneous “microsleeps”, which may last seconds, or even minutes, and the individual may be unaware of these. During microsleep the individual can be unresponsive to external stimuli. Extreme pressure for sleep can result in “shut down” in an individual **regardless** of the situation

7.4. Circadian Rhythm: The natural body rhythm associated with sleep and wakefulness. The normal rhythm drives the 24-hour sleep-wake pattern, daily digestive activity, hormonal secretions, and mood as well as alertness and performance levels¹. Humans are programmed for increased sleepiness twice daily at approximately 3 – 7 am and 1 – 4 pm.

7.4.1. If the rhythm is disrupted a reduction in performance and alertness results (eg jet lag and shift working) with forgetfulness, increases in reaction time, lethargy, and apathy, and reductions of vigilance, psychomotor coordination, information processing and decision-making ability.

The greatest risk occurs where significant sleep loss is combined with circadian rhythm disturbance.

7.4.2. Chronobiology: Recently an increasing interest has been devoted to the effect of circadian (and other body) rhythms on the responses of organisms to outside influences such as drugs²⁸. Both the pharmacokinetics and pharmacodynamics of drugs can be influenced by their time of administration and these effects will influence the pharmacological sensitivity of patients to many drugs such as local anaesthetics, induction agents, and muscle relaxants²⁹. Furthermore it has now been clearly demonstrated that the response to noxious stimuli is not constant over the 24 hour period. Although the temporal relationship is complex diurnal variation in pain perception has been reported after abdominal surgery using PCA with peak morphine use occurring at 0900 h, and least at 1500 h³⁰. Chronic pain has also been demonstrated to exhibit a circadian pattern, and this may directly affect an anaesthetist suffering from a chronic condition during shift working.

7.5. Stress: Mental emotional or physical strain or tension. Stress occurs when there is a perceived imbalance between demands being made and an individual's ability to meet those demands

7.6. The Multiple Sleep Latency Tests²⁷ can quantify daytime sleepiness. Over 50% of Californian anesthesiologists reported clinical management errors due to fatigue. Residents were found to have 'near pathological' sleepiness both post call and during normal working shifts. Four days of prolonged sleep extension brought them back into the normal range. These studies suggest a chronic sleep debt in a normal population of anaesthetists.

7.7. Subjective feelings of fatigue are inaccurate and underestimated. A challenging situation can make an individual feel more awake, but does not overcome the pressure for sleep. The maintenance period of anaesthesia is not surprisingly the time most at risk of succumbing to microsleeps and loss of vigilance.

7.8. An avoidance mechanism often used unconsciously to compensate for fatigue is a general slowing of performance in an attempt to compensate. This may have a temporary effect on reducing the incidence of errors but will result in a decreased throughput and increased backlog, with increased stress to 'catch up'.

7.9. The Working Time Regulations

UK Health and Safety legislation, which enact the European Commission's Working Time Directive (EWTD)

Key Points:

- 11 hours rest in every 24 hours

- minimum 24 hours rest in every 7 days or minimum 48 hours rest in every 14 days
- maximum of 58 hours per week

8. Factors affecting Fatigue

8.1. Effect of Age

The evidence from road safety studies suggests that young (<30 years), male drivers as the group with the highest risk, particularly those driving company cars, and suggest that those doing high mileage on monotonous roads with stressfully tight schedules are at greatest risk possibly due to 'risk taking'³¹. This is balanced by the evidence as stated above in paragraph 3.3.2 that, over the age of 45, recovery from fatigue is delayed. Studies in the USA³² added that shift workers and those with sleeping difficulties had the greater risk of significant fatigue.

8.2. General health

Studies of motor vehicle accidents identified untreated sleep apnoea as the only significant health factor responsible for an increased likelihood of accident. Sleep apnoea is estimated to affect 1% of the adult population and sufferers who continue to drive may be up to six times more likely to be involved in a road traffic accident³³

8.3. Effect of Time of Day

8.3.1. Sleep-related driving accidents peak in the early hours, between 0200 and 0600, and in the mid afternoon between 1500 and 1600, due mainly to circadian rhythms. Horne³⁴ calculated that drivers are 50 times more likely to fall asleep at the wheel at 0200 than at 1000.

8.3.2. Driver age makes a difference,³⁵ with younger drivers more at risk in the early hours, and older drivers more likely to fall asleep during the early afternoon.

8.4. Long motorway journeys are more likely to provoke sleep with a rate of 20% of accidents having a sleep basis compared with 14% on rural non-motorway roads and 5% on built-up roads.³¹

8.5. Hypoglycaemia and hypovolaemia

Many resident staff find it increasingly difficult to access food and drink during long periods of duty during anti-social hours. As a result they may become hypovolaemic or hypoglycaemic, both conditions which may decrease reaction times or psychomotor performance.

8.6. Alcohol and drugs

8.6.1. Increased alcohol levels and the use of so-called recreational drugs impair performance when driving. Legislation limits the levels of alcohol

and drugs in the blood that are deemed safe for driving purposes. Clearly, use of alcohol and drugs will impair the performance of any task; be it manual or intellectual.

8.6.2. Alcohol is widely used to promote sleep¹; however, it has the potential to disrupt it significantly. It is a potent suppressor of REM sleep³⁶ and, as the blood alcohol level declines, there is likely to be a rebound increase in REM sleep with the risk of increased awakening and hence a reduction in total sleep time. In addition, there may be changes in the tendency to fall asleep that are dependent upon the time the alcohol was taken.

8.6.3. Psychomotor performance impairment due to fatigue correlates well with that produced by ingestion of alcohol³⁷. Seventeen hours of wakefulness results in a decrease in performance equal to that produced by a blood alcohol level of 50 mg% and, **after 24 hour without sleep, this decrement was equal to that produced by 100 mg% of blood alcohol.** The blood alcohol level in the UK above which disqualification from driving is mandatory is 80 mg%!

8.7. Other Factors

Illness and prescription medicines can all have relevance in precipitating fatigue in addition to their other effects. The BMA's Board of Science and Education's paper³⁸ 'Driving under the influence of drugs; an internet resource' refers to the danger of drowsiness caused by simple over-the-counter medications.

8.8. It may be possible to draw analogies between data from road safety studies and incidents occurring whilst 'driving' an anaesthetic machine. Road accident studies show that accidents are often more severe than expected because of the lack of avoidance activity: anaesthetic incidents may be due to inattention to gradual changes in the patient's physiological parameters or equipment malfunction. On the road, a single vehicle is often involved: long surgical procedures may increase the chances of reduced concentration in the anaesthetist. Fatigue-related road accidents may be due to wide turns or exaggerated braking: anaesthetic incidents may result from incorrect dosage of drugs or inappropriate technique.

9. Work Patterns

9.1. Workload and patterns of work have a major effect on fatigue. Volume and complexity of work are important in different ways. While a high volume of work contributes, an equally important factor is complexity. Paradoxically, monotony with lack of challenge or variation can be equally tiring. In each instance, there is a requirement to maintain concentration and vigilance.

9.1.1. In the first situation the stimulus is excessive and adequate concentration can only be maintained for a limited period of time before

errors begin to be made. Equally, after such a stimulus a recovery time will be necessary.

- 9.1.2. In the second instance the stimulus is inadequate to maintain an adequate level of arousal, especially if an individual is already tired.
- 9.2. The risk of error due to fatigue during long, boring or repetitive activities is considerable wherever it occurs. In each case practitioners must at all times maintain a level of concentration which enables them to assimilate information continuously and to respond rapidly and appropriately to this information.
- 9.3. Disruption of normal circadian rhythms increases the likelihood of fatigue. The advent of shift work may pose risks to performance (*see below*). Even if we are not working shifts, our efficiency will deteriorate during the hours in which we would normally be asleep.
- 9.4. Medical culture has traditionally fostered unsatisfactory ways of behaving. Long hours of either high intensity or boring work have been seen as the norm. Protest against them has been viewed as lazy or unprofessional. We now know from National Confidential Enquiry into Perioperative Deaths (NCEPOD) studies that it is inappropriate for the most interesting and complex cases to take place at night, where the risks will be still further increased.
- 9.5. The wide range of activities in which anaesthetists are involved will contribute to fatigue and impair function. We need to recognise this and devise protocols and strategies for fatigue prevention that will be equally effective in these varied situations. These should include clearly defined controls on the duration both of high intensity and of tedious activities. There must also be realistic provision for support and/or relief in these situations. This will need to take a variety of forms to suit individual situations. It is particularly important that standardised handover procedures are established and adhered to with every change of anaesthetic personnel (See Appendix 1).
- 9.6. The subspecialties of Intensive Therapy (ITU) and Obstetrics pose special problems because of their truly '24-hour' activity. Within the theatre environment, with the exception of the rare life- or limb-threatening emergency operations, activity is controllable or should be. Within the Delivery Suite and ITU workload is not controllable. The anaesthetist must remain present and available to respond to life-threatening emergencies.
- 9.7. One further obstacle to the reduction of unhealthy and unsafe working hours is the culture of doctors who regard their ability to function at all hours as a desirable trait, the 'machismo' or "In my day" mentalities.
- 9.8. Changes in professional and social values have led to pressure that the same regulations as already apply in other walks of life be applied to the medical profession and for the application of statutory instruments to control working hours. The BMA has responded in a mixed manner to these moves, aware of the difficulties of reducing working hours but at the same time maintaining

quality training and high standards of patient care. Team working has been one such alternative mechanism proposed to provide this continuity of care³⁹

9.9. Trainees

- 9.9.1. With the implementation of the "New Deal" working pattern and the proposed implementation of the EWTD in August 2004, the number of continuous hours worked by junior doctors has been, and is being, reduced, although at present it is still much longer than the average person's working week. Many trainees are moving toward a shift pattern. Although there is no doubt that there has been a reduction in hours worked it is not yet clear if this equates to a decrease in fatigue levels.
- 9.9.2. Night work creates its own challenge by its disruption of circadian pattern. Individuals working at night have circadian programming driving sleep and when they attempt to sleep during the day, their clock is programmed for wakefulness.
- 9.9.3. Studies have shown that adaptation does not occur despite prolonged exposure to night work¹. Many individuals cannot reset their body clock to allow for effective daytime sleep after night duties. Daytime sleep is typically shorter and of inferior quality compared with sleep at night⁴⁰
- 9.9.4. The needs of a young family, study time for higher exams, and duties that can only be done in the day, may play a major role in the capacity to alter the endogenous rhythm to night work.

9.10. Staff and Associate Specialist (SAS) career grades

- 9.10.1. SAS grade posts were originally intended to improve service provision during 'normal' working hours and the Staff Grade post, particularly, was not intended to address the problem of deficiencies in out of hours cover. That principle has been slowly eroded over the course of time due initially to manpower shortages but subsequently because of the regularisation of trainees' hours of work. This change in work pattern will be exacerbated by the increasing compliance with the EWTD regulations required for trainee doctors.
- 9.10.2. Surveys of work load since 2000 show that SAS doctors are being expected to accommodate more of their fixed sessions outside normal working hours. This group already has existing problems of isolation, poor support structures, absent lines of communication and low morale. All these factors contribute to fatigue and are likely to deteriorate further for SAS doctors as a consequence of potential work pattern changes affecting both consultant and trainee colleagues.

10. Working Time Regulations

10.1. The Working Time Regulations already apply to most UK employees,⁴⁵ although there are a few exceptions. One of those exceptions is doctors in training, but that will change from August 2004 when this group will come within the remit of the EWTD. Career Grade Staff are already covered by the regulations, although there is currently confusion as to the effects of derogation and opting in. The British Medical Journal's Career Supplement in July 2003 carried an article which outlines the current situation.⁴¹

10.2. The Department of Health Circular⁴² on the implementation of the EWTD recognises the difficulty of the proposals and states "Implementing the EWTD for doctors in training will present a considerable challenge affecting the working patterns and training of these doctors and also the provision of out-of-hours' emergency cover. Meeting this challenge will require significant changes in ways of working and the way in which services are delivered but such changes must be seen as part of the broader modernisation agenda that will deliver a more responsive service that better meets patients' needs."

10.3. It goes on to say "Crucially, the need to make changes to service delivery to support compliance with the EWTD *must not be seen as a reason for failing to deliver against service targets or reducing access to high quality healthcare services. An approach of closing local services in order to meet the EWTD will not be acceptable.*" (our emphasis)

10.4. This effectively suggests that there must be no reduction in work done by the medical workforce even though the hours available by trainees to do it must be reduced. To compensate, either more anaesthesia must be performed by each individual anaesthetist or alternative strategies for the delivery of anaesthetic services found.

10.5. The Department of Health in their 'Code of Conduct for NHS Managers'⁴³ states, "As an NHS manager, I will make the care and safety of patients my main concern and act to protect them from risk." This will be an argument in support of any moves to reduce risk to patients.

10.6. The guide to the EWTD document also states "NHS Trusts have the responsibility as employers to deliver a safe working environment and to comply with the EWTD, as health and safety legislation covering all their staff. Commissioners will need to support NHS Trusts to meet this legal requirement by including the action needed to comply with the EWTD in their discussions on overall capacity planning." This clearly places a responsibility on the employers to protect both their staff and patients from avoidable fatigue through making proper provision of funding and personnel.

10.7. At the time of writing it would seem that full acceptance of the EWTD cannot be achieved without an increase in activity, a reduction in throughput or a significant change in working practices.

11. Shift Working

- 11.1. Shift working in the practice of clinical medicine is a recent innovation arising partly from the impact of the EWTD but also from a gathering recognition that around the clock working harms both health and productivity. This novel fact actually dates from 1917 and the studies of munitions workers by the Industrial Fatigue Research Board.
- 11.2. Shift work includes any arrangement of daily working hours that differs from the standard, aimed at extending the organisation's operational time from 8 to 24 hours, usually by a succession of different teams of workers. This is distinguished from extended working hours, defined as working more than 48 hours per week.
- 11.3. Shift work alters the circadian rhythmicity, resulting in health concerns which have been the subject of study since the beginning of the last century.
- 11.4. In developed countries there is an estimated 20-30% of the workforce who perform shift work⁴⁴
- 11.5. A proportion of the workforce is known to be temperamentally intolerant of any type of shift work. The condition is often labelled as shift maladaptation syndrome. Tolerance of shift work often depends on various factors that affect work-home life balance. It is often associated with motivation⁴⁵, employee involvement in shift design⁴⁶ and individual control over the shift pattern worked⁴⁷
- 11.6. Social Interference of Shift Work
 - 11.6.1. Human social activity is arranged with an orientation to daylight hours. Social rhythms, sports events, religious ceremonies, travel and even entertainment are all disrupted by work on Saturday and Sunday. As a result it becomes difficult to balance one's time budget including working hours, community and leisure time with the complex organisation of social activities especially. The inevitable result is that shift work often results in social marginalisation⁴⁸.
 - 11.6.2. Shift work can often be beneficial to those who enjoy solitary pursuits or who give priority to family and domestic matters rather than personal leisure. Shift workers have greater opportunities to use daytime hours for particular needs or to allow more rest days between shift cycles.
 - 11.6.3. Shift systems which are a backward fast rotation (night-afternoon-morning) and which include a quick return, working two shifts in a day and compressed working weeks eg. three to four days of 12 hours per

day, are frequently preferred irrespective of their negative effects as they provide longer spans of rest days.

11.7. Performance Efficiency during Shift work

11.7.1. The de-synchronisation of circadian rhythms, particularly when associated with sleep deficit and fatigue, results in significantly impaired work efficiency. This is at a peak in the early morning when workers are particularly error-prone and is observed in many groups of shift workers from train and truck drivers to switchboard operators.

11.7.2. Sleepiness due to the truncation of sleep by an early start to the morning shift increases the error and accident rate in train and bus drivers. Night shift workers have also reported increased sleepiness and EEG changes, specifically bursts of alpha and beta power density. This is believed to indicate a tendency for workers to fall asleep while on duty⁴⁹.

11.8. Sleep Disorders induced by Shift Work

11.8.1. Shift work disrupts sleep. A deficit often occurs before a morning shift because of an earlier start time and between night shifts, largely because workers are attempting to sleep when they should be awake. Shift workers may also experience difficulty in both falling asleep and remaining asleep during the day since they are at the wrong point in their circadian cycles and, usually, environmental conditions are far from ideal.

11.8.2. Daytime sleep is often of poor quality with a reduction in Stage 2 and REM sleep. Truncated night sleep before a morning shift will often have a reduced REM component because of early morning wakening^{50, 23}.

11.8.3. Sleep difficulties will often start within months of commencing shift work. If these are prolonged, severe sleep disturbances will result in chronic fatigue, nervousness, persistent anxiety and depression, which may often result in a requirement for psychotropic medication⁵¹.

11.9. Accidents

11.9.1. Shift workers may be more prone to error and work accidents due to work-reduced vigilance and performance capabilities than their day worker counterparts. The evidence is inconsistent. Some studies report a high overall incidence of injuries and accidents on night shift while others show either no overall increase but an increase in their seriousness ie. those requiring hospital treatment at night, or an overall increased incidence on day shift

11.9.2. Shift scheduling and fatigue due to sustained operations have been cited as important contributor factors⁵² in major industrial disasters

including Three Mile Island, Chernobyl, Bhopal and Challenger, all of which occurred during the night hours.

11.10. A broad range of factors have been identified (see Fig. 1) that might promote adaptation to night work, shift work and indeed, extended work shifts. However, these have not been studied in the civilian work shift population and the relative merits are still to be established.

Fig 1. In selecting any suitable shift system there are many different features worthy of consideration

- The extension of workers' duty hours from 6 to 12 hours;
- The number of teams who alternate during the working day, that is to say, two, three or four shifts;
- The presence and extension of night work;
- The speed, i.e. slow and fast rotation;
- The direction, i.e. clockwise or counter-clockwise, of the shift rotation;
- The regulation and length of shift cycles;
- The start and finishing times of shift cycles;
- The interruption or not of weekends or Sundays, i.e. discontinuous or continuous shift rotas

11.11. The first area is work schedule design. The aim is to produce more biocompatible schedules for those who are required to work shifts. The long-term effectiveness of these schedules has not been reported. In the short term the results appear promising⁵⁴.

11.12. The second area is napping which has been considered in military applications but not in the type of schedules required of the civilian shift worker. Third, bright light exposure has been successful in shifting rhythms in controlled laboratory situations but workplace studies have yet to be conducted. Pharmacological studies of night workers are gaining support from drug manufacturers. All of these studies have been in acute laboratory situations. Long-term studies have not been reported and are clearly needed because of the side effects and abuse potential of drugs.

12. Shift Work and Health

- 12.1. Over the past 30 years, several reviews^{53, 54} have identified gastrointestinal dysfunction and chronic sleep deprivation as the principal concerns of shift workers.
 - 12.1.1. The former presents as vague, non-specific abdominal symptoms, elevated by many into a clinical entity “shift work maladaptation syndrome”. Peptic ulceration is more common in shift workers, often attributed to such factors as poor catering facilities, increased consumption of cigarettes and caffeine, reliance on alcohol to promote sleep etc.
 - 12.1.2. There is no conclusive evidence, however, that sleep deprivation in shift work results in chronic ill-health. The incidence of cardiovascular disorders is increased in shift workers and this appears to be related to the number of years of exposure.
- 12.2. Four patterns of shift work are usually considered.
 - 12.2.1. The commonest is the weekly rotation. It is the most socially acceptable and the easiest to integrate into lifestyle but has the major disadvantage that physiological adjustment is neither complete nor totally lacking. The result is often a difficult compromise.
 - 12.2.2. Rapid rotation systems require one or two days at each level before rotation to the next in sequence. Physiological adjustment becomes impossible and management is aimed at reducing the sleep debt, fatigue and poor performance as well as the chances of disorientation.
 - 12.2.3. The third pattern is permanent night work, which shares certain functional characteristics with a slowly rotating shift pattern.
 - 12.2.4. With slow rotation, there is a minimum of ten consecutive shifts before a move to the next one in the sequence. Physiological adjustment is possible here despite significant personal costs. Problems will develop when the adjustment is lost during days off. Readjustment needs to take place when there is a return to work. Physiological adjustment is difficult to achieve with irregular shifts and requires maintenance of some form of 24-hour activity and significant self-discipline.
- 12.3. Shift systems develop according to local need and are often characterised by the number of hours worked per shift, the speed of rotation and its direction. Normal shift length is eight hours but increasingly 12 hours is becoming common, permitting longer time off. In the military context, six hours on and 12 hours off are more normal. Long shifts result in fatigue, loss of sleep and performance decrement.

12.3.1. Shorter shifts are popular when highly sophisticated equipment is used. Vague feelings of discomfort and disorientation similar to jet lag occur with rapid rotation and irregular shift patterns as well as those based on non-24-hour cycles. This is due to disruption of the 24-hour cycle and the emergence of a more natural 25-hour one.

12.3.2. The long-term health effects of this “shift maladaptation syndrome” are unknown. The direction of the rotation should be in the phase delay direction, morning-afternoon-night-rest days. For practical reasons, the reverse, afternoon-morning-night-rest days, is often preferred. However, physiological adjustment is less easy to achieve.

13. Shift Patterns

13.1. One proposal put forward to facilitate reduction in hours, hopefully with a reduction in fatigue levels, is the introduction of shift working. However, unless, this can be combined with the total reorganisation of the Theatre and Ward working pattern this cannot result in any effective increase in work done⁵⁵.

13.2. To achieve this desired effect, not only must the Anaesthetic Service work a shift pattern, but so must all the necessary support services, e.g. anaesthetic technicians and nurses, laboratory, porters and ward staff

13.3. Similar qualifications (and other concerns) also apply to the introduction of ‘long days’ or ‘long lists’. This implies the utilisation for elective work of lists lasting up to 12 hours. Without the commensurate infrastructure throughout the hospital to support such lists they will be putting patients at risk.

13.4. It is also the view of this Working Party that a 12-hour list is not an acceptable working practice for an individual anaesthetist of any grade without proper relief periods for refreshment and rest during the 12 hours. The EWTD requires that a rest period of 20 minutes is taken after a six-hour work session. A possible structure could be as follows:

<p>During the 12-hour period Meal Breaks – minimum one hour Rest period – 3 x 20 minutes</p>
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13.5. Surgery which is expected to be very prolonged requires special provision and is probably best dealt with by the allocation of two anaesthetists who jointly undertake the case in its entirety. Departments should have systems to address this problem when it arises unexpectedly

- 13.6. For shift work, forward rotating patterns [day-evening-night] are associated with the least disturbance to normal sleep patterns. It is recommended that night shifts should be for a maximum of five nights^{56 57}
- 13.7. Laboratory investigations have demonstrated that planned naps can improve subsequent alertness and performance. They provide one of the most direct and basic interventions for sleep deprivation and require no training or technology for effective use¹.
- 13.8. It is recommended that hospitals continue the provision of “on call” rooms for those doctors working night shifts, so they are able to rest.

14. Independent Practice Considerations

- 14.1. Fatigue occurs in whatever setting the anaesthetist chooses to work. Practitioners undertaking a full day’s work in the NHS followed by a twilight shift in independent practice are at particular risk of exceeding the 13-hour maximum shift length defined in the Working Time Regulations.
- 14.2. The attitude taken by the courts or insurers to medical accidents occurring when either the maximum daily shift length or the 48-hour week length has been exceeded is uncertain (and as yet unknown).
- 14.3. There is little doubt that if anaesthetists form group practices, the ability to minimise the length of the working day is facilitated.
- 14.4. The obligation to control workload in the independent practice environment currently rests upon the doctor acting as an independent contactor.

15. Fatigue Reduction

- 15.1. The AIMS Study²⁰ suggests a number of factors that can minimise fatigue-related incidents: These include relief strategies, regular and rehearsed equipment checking routines, improved workplace design (including drug ampoule and syringe labelling protocols) and regulation of working hours
- 15.2. Education may be fundamental to improving understanding of the need for fatigue avoidance. Sleep medicine is hardly taught in British, Irish or North American medical schools and therefore the physiology of sleep and fatigue is poorly understood. It is believed that, in other high-risk areas, educational programmes have been developed which could easily be adapted to the medical environment with probable benefits¹. Once fatigue is understood strategies for its avoidance on an individual basis can be developed.

- 15.3. Recognised techniques to minimise sleep disturbance include:
- i) Regular bedtime and wake-up time
 - ii) Sustained adequate sleep
 - iii) Two nights of good sleep before work period
 - iv) Bedroom associated with sleep (No work done there)
 - v) Bedroom quiet, dark and cool
 - vi) Avoid heavy eating and drinking before bedtime
 - vii) No alcohol, caffeine, nicotine close to bedtime
 - viii) No exercise < 3 hours before sleep time
 - ix) If not asleep within 30 minutes, get up and do some relaxing activity
- 15.4. Napping has been shown to be of positive benefit to improve subsequent alertness and performance. In a study of pilots⁵⁸ a 40-minute nap increased performance by 34% and physiologic alertness by 54% compared with the no-nap condition. Shorter naps have been found to increase the risk of waking during deep non-REM sleep and this would increase the likelihood of inertia on waking. To further reduce the risk of inertia a further 15 minutes is recommended after the nap to allow a full wake-up period. If longer nap is possible, two hours is beneficial as it permits one cycle of deep Non-REM sleep
- 15.5. Caffeine is probably the most widely used stimulant used to maintain wakefulness. Its onset of action occurs 10-15 minutes after ingestion and lasts about 3-4 hours, although this is reduced by tolerance. Its adverse effects include tremors and palpitations, and these may reduce its usefulness in susceptible individuals. Caffeine ingestion should be stopped at least one hour before sleep period.
- 15.6. Regular rest breaks may be helpful to allow a reactivation of interest by permitting a period of dissociation from involvement in the case in hand. A protocol must be developed and enforced to allow proper handover to the relieving anaesthetist and again on return to ensure that omissions of care do not occur. (see **Appendix 1**) Rest breaks and rotation of task duties are mandatory in air traffic control and naval ship procedures, but not in Medicine. In order to allow periods of relief from the operating theatre, there must be an additional member of staff available and qualified to provide the relief. Flexibly worked theatre sessions (i.e. a fixed theatre session but without a named theatre list) is a suitable way to provide this.
- 15.7. Refreshments must be provided for staff who cannot leave the theatre environment, to ensure the avoidance of hypoglycaemia or dehydration. Snacks or meals must be nourishing and appetising to allow a period of relief from case-side care to be complete and sustaining.
- 15.8. Bright lighting can increase alertness and move the circadian clock.
- 15.9. Physical activity can be used to reduce fatigue and counter sleepiness. Walking around the theatre can counter sleep episodes.

- 15.10. Social interactions, e.g. conversing at a social level with theatre staff, may be beneficial to prevent sleepiness but the benefit must be balanced against the danger of distraction
- 15.11. Following a period of out-of-hours work with significant disturbance to normal sleep an anaesthetist should be able to divest him/herself of clinical commitments on the subsequent day or until there has been an opportunity to take an adequate rest period.
- 15.12. Other
- 15.12.1. Drugs. Whilst the use of alertness-enhancing drugs is not to be recommended at present, work on amphetamine analogues such as modafinil⁵⁹ has suggested that they have significant alertness-promoting properties with fewer side effects and little effect on recovery sleep when compared with the amphetamine class of drugs⁶⁰. Melatonin has been shown to promote natural sleep and may cause a 'circadian shift' to a new schedule. It can have adverse effects on mood and the cardiovascular system.
- 15.12.2. All staff have a professional duty to behave responsibly before work. No conscientious anaesthetist would indulge in excessive alcohol consumption prior to a period of duty, but a sense of responsibility must also deter excessive partying or similar demanding social practices. (See **Appendix 2**) After a demanding period of duty is complete, full recovery should be possible before the anaesthetist is expected to drive a motor vehicle to return home. The employer must make such recovery facilities available.
- 15.12.3. Sensible use of holiday and break periods is important. The anaesthetist who enters into a contract to provide services as a locum to his own or another Trust during annual leave periods from his base is not likely to be adequately refreshed on his return.

16. Effects of Proposals

- 16.1. As far as patients are concerned, a decrease in fatigue and its associated consequences must result in an increase in safety and quality of care. The consequences seem to the Working Party to be so well proven that NOT to adopt the measures proposed would be against the best interests of the service.
- 16.2. The effects of these proposals on the quality of life for the anaesthetist also seem to be self evident. There are a few minor restrictions on leisure activities which the working party do not believe will be too arduous or too great, and which may, be of positive value to the anaesthetist as well as the patient.

- 16.3. One consequence of these proposals would be to transfer as much work as possible to the daytime. That would also be in accordance with the advice of NCEPOD.
- 16.4. The Association of Anaesthetists of Great Britain and Ireland has published the results of a Working Party into Theatre Efficiency⁵⁵. We also believe that our recommendations fit well with their conclusions particularly with the proposal to move more work from the night to the day.

Appendix 1

Handover information

- Names of Anaesthetists and time of handover should be entered on the chart
- Name, age, ASA grade
- Procedure, surgeon
- LA/GA
- Regional technique details
- Pre-existing conditions
- Method of airway maintenance (+ difficulty)
- Dentition
- Type of ventilation
- Gas/ volatile agent flow rates
- Use/ time of opioids
- Use/time of neuromuscular blocking agent
- Antibiotics/ anti-emetic use
- Fluid balance/blood loss
- Patient positioning
- General condition
- Adverse events
- Postoperative analgesia/fluid plan

Appendix 2

Management of Alertness

- Minimise sleep debt by maximising sleep prior to on-call
- Nap whenever possible for 45 mins or >2 hours
- Overcome sleep inertia by increasing light levels, stretching, walking briskly, being relieved from duty and taking refreshment
- Alert colleagues if microsleeps/nodding off occurs and ask for relief
- Whenever relief available take a break
- Caffeinated drinks
- If working next day, nap rather than working through
- Nap before driving home
- Post call, sleep rather than party to pay off sleep debt. Go to bed earlier than normal

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