

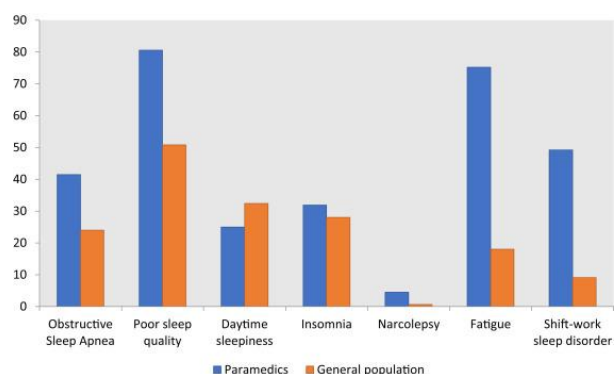
## **Sleep deprivation in clinical health settings. Does it matter?**

Sleep deprivation is a term that is used to describe a state caused by an inadequate quantity or quality of sleep<sup>1</sup>. While sleep needs vary amongst individuals, guidelines suggest that a typical adult requires seven to nine hours of sleep per night and anything less than seven hours is deemed as an insufficient duration of sleep and can stimulate sleep deprivation<sup>2</sup>. In our modern, fast-paced society, there are numerous factors contributing to sleep deprivation, including stress levels, social habits and occupational demands. Those who work extended hours or undergo shift work are at particular risk of being sleep deprived. As healthcare is a 24-hour service, doctors and nurses must work variable, often lengthy shifts in order to provide continuous care for in-patients. Therefore, it is unsurprising to find that sleep deprivation is highly prevalent amongst healthcare workers.

Many research studies have shown that healthcare workers are less likely to get the daily recommended hours of sleep. A literary review conducted by Stanojevic, Simic, and Milutinovic highlighted that up to 70% of nurses sleep less than 6 hours a night<sup>3</sup>. In addition to this, other studies have shown that issues with sleep are found to be more widespread in the healthcare industry compared to other professions. For example, a 2018 study found that health care support workers and practitioners had one of the highest levels of short sleep duration, with almost a half of workers reporting insufficient sleep<sup>4</sup>.

### ***What factors put healthcare workers at risk of sleep deprivation?***

There are many reported reasons as to why healthcare workers experience higher rates of sleep deprivation. This includes the requirement to regularly work long hours against changing schedules. Shifts are customary in the health service and are usually of eight to twelve hours' duration<sup>5</sup>. Working a shift pattern tends to have adverse effects on the natural sleep-wake cycle, and night shifts, in particular, are associated with reduced sleep<sup>5</sup>. Having minimal recovery time (less than 11 hours) between shifts is also suggested to put people at increased risk of sleep deprivation.



*Figure 1: A bar chart illustrating the prevalence of different sleep disorders in paramedics and in the general population<sup>6</sup>.*

In addition to irregular shift patterns, healthcare workers are often required to work beyond their normal hours to maintain the health service. A nationwide survey carried out by the British Medical Association in 2017 found that the majority of GPs, consultants and medical trainees in the National Health Service (NHS) frequently worked outside of regular hours<sup>5</sup>. As previously outlined, there is a correlation between the length of hours worked and the risk of sleep deprivation, with longer hours leading to an increased risk. Therefore, healthcare workers, especially those who are made to regularly exceed the advised limit for weekly working hours, are more vulnerable to suffering from sleep deficits.

Another contributor to sleep deprivation amongst healthcare workers is the intensity and complexity of the work. Excessive and complex workload, such as successive patient consultations, performing surgery, and carrying out administrative tasks, can lead to acute or cumulative fatigue due to the need for sustained attention over a long period of time<sup>5</sup>. Given that a high-intensity workload is a dominant and unavoidable obligation of the role of a health-care professional, it is similarly inevitable that sleep deprivation is a conventional burden of the position.

Certain specialties are faced with additional pressures, for example, doctors working “on-call” patterns where they are required to respond out of working hours. In 2017, almost 90% of consultants in the NHS worked non-resident on-call on weeknights or weekends, during which they were commonly contacted with medical queries<sup>5</sup>. Repeated, unplanned interventions during a period of being on call overnight, for example, being called to consult on a patient’s condition and treatment plan, can have a negative impact on the natural sleep-wake cycle. This can cause fragmented and poor-quality sleep which can consequently promote sleep deprivation.

**What are the impacts of sleep-deprivation amongst healthcare workers on patients?**

Optimal mental performance necessitates a sufficient amount of sleep. A lack of sleep results in a decline in cognitive execution, with memory, decision-making, and concentration being impaired by an absence of sleep<sup>7</sup>. A healthcare worker relies on these abilities to carry out their role which can often determine their clinical outcome. The capability to make quick and calculated decisions is crucial, especially in emergency, trauma and ITU settings. Healthcare professionals who cannot function to the best of their abilities can make significant attention-related errors which can compromise patient care<sup>8</sup>. Thus, a deterioration in such cognitive qualities is strongly linked to undesirable effects on patient treatment and welfare.

A multitude of studies have shown that patient safety can be compromised when under the care of a sleep-deprived physician. The most comprehensive of these was a study which found that interns in the US made 36% more serious medical errors during a standard work schedule than during an intervention in which extended work shifts were eliminated<sup>9</sup>. The results of the study also showed that the rate of diagnostic errors were 5.6 times higher when working extended shifts<sup>9</sup>.

**Table 3. Incidence of Serious Medical Errors.**

Variable	Traditional Schedule	Intervention Schedule	P Value
	<i>no. of errors (rate/1000 patient-days)</i>		
<b>Serious medical errors made by interns</b>			
Serious medical errors	176 (136.0)	91 (100.1)	<0.001
Preventable adverse events	27 (20.9)	15 (16.5)	0.21
Intercepted serious errors	91 (70.3)	50 (55.0)	0.02
Nonintercepted serious errors	58 (44.8)	26 (28.6)	<0.001
<b>Types of serious medical errors made by interns</b>			
Medication	129 (99.7)	75 (82.5)	0.03
Procedural	11 (8.5)	6 (6.6)	0.34
Diagnostic	24 (18.6)	3 (3.3)	<0.001
Other	12 (9.3)	7 (7.7)	0.47
<b>All serious medical errors, unit-wide</b>			
Serious medical errors	250 (193.2)	144 (158.4)	<0.001
Preventable adverse events	50 (38.6)	35 (38.5)	0.91
Intercepted serious errors	123 (95.1)	63 (69.3)	<0.001
Nonintercepted serious errors	77 (59.5)	46 (50.6)	0.14
<b>Types of serious medical errors, unit-wide</b>			
Medication	175 (135.2)	105 (115.5)	0.03
Procedural	18 (13.9)	11 (12.1)	0.48
Diagnostic	28 (21.6)	10 (11.0)	<0.001
Other	29 (22.4)	18 (19.8)	0.45

Figure 2: A table comparing the incidence of serious medical errors made by physicians following a traditional schedule and those abiding to an intervention schedule<sup>8</sup>.

In some cases, the errors made by a sleep-deprived healthcare worker can potentially be fatal. A study carried out in the US reported a three times more likely occurrence in patient mortality from preventable events when sleep-deprived first-year residency doctors were on call<sup>10</sup>. In this study, 2,737 residents completed 17,003 monthly reports. A case-crossover analysis method was used to examine the correlation between the number of extended-duration shifts worked in the month and the occurrence of significant adverse errors and events that could have been averted. Interns that worked five or more extended-duration shifts per month reported more failures associated with attention and an additional 300% of fatigue-related preventable adverse events resulting in a fatality were also stated<sup>10</sup>.

Sleep deprivation causes mood disturbances and increased stress levels<sup>11</sup>. In terms of healthcare professionals, this may have a detrimental effect on their professionalism and a negative impact on their communication skills, both with patients and colleagues. This wanes patient satisfaction – the patient is not treated in a way in which they expect or deserve. In the context of sleep deprivation and increased irritability, rapport between members of the multidisciplinary team can worsen which further jeopardises patient care as joint decision-making and shared responsibility is essential to delivering quality care.

### ***What are the impacts of sleep-deprivation on healthcare workers themselves?***

Sleep deprivation does not only impact patients – it is also of great harm to the personal health and wellbeing of healthcare workers. Many studies have discovered that chronic sleep loss increases one's risk of developing a number of conditions including obesity, diabetes, and cardiovascular disease<sup>12</sup>. Nurses working alternating night shifts for over a span of 15 years have been found to be 1.79 times and 1.35 times more likely to develop breast and colorectal cancer respectively<sup>13,14</sup>. Exposure to light at night acutely suppresses the production of the hormone melatonin. Melatonin demonstrates cancer-protective capability as it has antiproliferative effects. The suppression of melatonin inhibits its oncostatic activity thus, evidence from various studies highlights an association between night work and cancer risk via the melatonin pathway<sup>13,14</sup>.

In addition to profound, complex health disturbances, sleep deprivation is also reported to cause circadian disruption of hormones, altered immune function, and mental health problems via mechanisms associated with cellular stress and alternated cognitive patterns<sup>5,15</sup>. In a study investigating the relationship between sleep and mental health issues in Australian paramedics, it was observed that the paramedics reported significantly higher levels of depression and anxiety symptoms than members of the general population<sup>6</sup>. However, it could be argued that paramedics are exposed to distressing situations which are more likely to cause higher rates of mental health problems. Sleep deprivation may instead be a confounding factor. It is difficult to tease apart the mental strains of working in intense, upsetting clinical environments from the negative cognitive impact of sleep deprivation. In fact, it is likely that both are contributing factors and potential reasons why clinicians are 2.45 times more likely to commit suicide than those in other fields of employment<sup>16</sup>.

As mentioned previously, sleep deprivation reduces concentration and when combined with delayed reaction times, another side-effect of inadequate sleep, it can lead to increased risk of road traffic incidents<sup>11</sup>. A study that examined the frequency of documented motor vehicle crashes and “near misses” involving healthcare workers following shifts of longer than 24 hours found that there was a two-fold increase in these incidents in comparison to if they had come off shorter shifts<sup>17</sup>. Another study of nurses working night or rotating shifts reported that they were seven times more likely to demonstrate drowsy driving behaviours<sup>18</sup>. Thus, sleep determines an individual’s ability to drive safely; a deprivation of sleep threatens one’s safety on the road which could potentially be catastrophic.

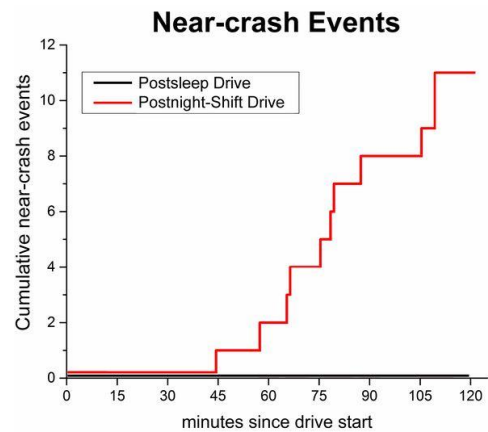


Figure 3: A comparison of the risk of near-crash events following a post-sleep and post-night shift drive.

### ***Does sleep deprivation in clinical health settings really matter?***

Some may argue that sleep deprivation is simply a constitutional and accepted standard in clinical health settings and is deemed to be “a part of the job”. Research based on the patterns between sleep and health issues dates back to the mid-19<sup>th</sup> century which potentially indicates the apparency of the side effects of sleep deprivation<sup>19</sup>. Unfortunately, similar to how an organism adapts to its environment, healthcare workers have learnt to live and cope with sleep deprivation. With long waiting times and pay disparity taking precedent in the media spotlight, the wellbeing of healthcare workers is to an extent overlooked and possibly neglected. However, as described previously, sleep deprivation is associated with serious hazards and should be exercised with caution by balancing the risk against staff shortages.

Alternatively, while there is an abundance of studies available, research on the impacts of the quantity and quality of sleep on workplace performance commonly comprises of inadequate data<sup>8</sup>. The tests being carried out lack uniformity, and responses regarding the quality of sleep are subjective. Moreover, other lifestyle factors are often not regulated, such as looking after children, caffeine intake and amount of physical activity, all of which can contribute to the amount of sleep an individual receives.

Furthermore, it is important to note that healthcare is not the only profession in which workers are susceptible to sleep deprivation. Aviation workers and military personnel are amongst those who are extremely prone to the condition. Such roles also demand the highest levels of cognition, often for extended periods of time<sup>8</sup>. Similar to a healthcare environment, multiple lives are at stake. In these careers, personnel are highly trained and counted on to minimise errors and negligence is not as common as in healthcare. It can therefore be argued that better training could potentially drive correct, sub-conscious decision-making and help mitigate errors arising from sleep deprivation.

Despite being a prevalent issue, sleep deprivation in the healthcare industry is gradually improving. Measures have been implemented to ensure that workers receive adequate amounts of sleep before commencing their duties. For instance, a directive has been designed to protect the health and safety of junior doctors in the NHS by limiting working hours from an average of 56 to 48 hours per week and imposing minimum rest requirements that involve workers completing a period of 11 hours of continuous rest per day<sup>20</sup>.

### **A conclusive note**

The ability to maximise patient care and satisfaction is interrelated to a variety of aspects of a healthcare professional's lifestyle. This includes the amount of sleep they receive on a daily basis. One cannot deny the importance of a good night's sleep to allow the body to rest and recuperate. Ultimately, a lack of sleep constitutes to sleep deprivation which can have detrimental outcomes for both the patient and the healthcare professional in charge of their care. Based on several research studies and case reports, sleep deprivation in clinical health settings does matter – in some cases, it is a matter of life and death.

### **References:**

1. Better Health Channel. *Sleep Deprivation*. Available from: <https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/sleep-deprivation> [Accessed 15<sup>th</sup> February 2022].
2. Olson EJ. *Mayo Clinic Expert Answers: How many hours of sleep are enough for good health?* Available from: <https://www.mayoclinic.org/healthy-lifestyle/adult-health/expert-answers/how-many-hours-of-sleep-are-enough/faq-20057898> [Accessed 15<sup>th</sup> February 2022].
3. Stanojevic C, Simic S, Milutinovic D. Health effects of sleep deprivation on nurses working shifts. *Medicinski Pregled*. 2016;69(5-6): 183-188.
4. Khubchandani J, Price JH. Short sleep duration in working American adults, 2010-2018. *Journal of Community Health*. 2020;45(2): 219-227.
5. British Medical Association. *Fatigue and sleep deprivation – the impact of different working patterns on doctors*. British Medical Association. Report number: BMA 20170986, 2018.
6. Khan WA, Conduit R, Kennedy GA, Jackson ML. The relationship between shift-work, sleep, and mental health among paramedics in Australia. *Sleep Health*. 2020;6(3): 330-337.
7. Sanches I, Teixeira F, Moutinho dos Santos J, Ferreira AJ. Effects of acute sleep deprivation resulting from night shift work on young doctors. *Acta Medica Portuguesa*. 2015;28(4): 457-462.
8. Parry DA, Oeppen RS, Amin MS, Brennan PA. Sleep: its importance and the effects of deprivation on surgeons and other healthcare professionals. *British Journal of Oral and Maxillofacial Surgery*. 2018;56(8): 663-666.

9. Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. *New England Journal of Medicine*. 2004;351(17): 1838-1848.
10. Barger LK, Ayas NT, Cade BE, Cronin JW, Rosner B, Speizer FE, Czeisler CA. Impact of extended-duration shifts on medical errors, adverse events, and attentional failures. *PLoS Med*. 2006; 3(12): e487
11. Owens JA. Sleep loss and fatigue in healthcare professionals. *Journal of Perinatal and Neonatal Nursing*. 2007;21(2): 92-100.
12. Linda, E. The potential effects of sleep loss on a nurse's health. *American Journal of Nursing*. 2015;115(4): 34-40.
13. Schernhammer ES, Kroenke CH, Laden F, Hankinson SE. Night work and risk of breast cancer. *Epidemiology*. 2006;17(1): 108-111.
14. Schernhammer ES, Laden F, Speizer FE, Willett WC, Hunter DJ, Kawachi I et al. Night-shift work and risk of colorectal cancer in the nurses' health study. *Journal of the National Cancer Institute*. 2003;95(11): 825-828.
15. Gerada G. Clinical depression: surgeons and mental illness. *Royal College of Surgeons of England: Bulletin*. 2017;99(8): 260-263.
16. Wall M, Schenck-Gustafsson K, Minucci D, Senden MG, Lovseth LT, Fridner A. Suicidal ideation among surgeons in Italy and Sweden- a cross-sectional study. *BMC Psychology*. 2014;2(1): 53.
17. Barger LK, Cade BE, Ayas NT, Cronin JW, Rosner B, Speizer FE et al. Extended work shifts and the risk of motor vehicle crashes among interns. *New England Journal of Medicine*. 2005;352(2): 125-134.
18. Scott LD, Hwang WT, Rogers AE, Nysse T, Dean GE, Dinges DF. The relationship between nurse work schedules, sleep duration, and drowsy driving. *Sleep*. 2007;30(12): 1801-1807
19. Rosenberg C. *A look back at the history of sleep research*. Available from: <https://www.sleephealthsolutionsohio.com/blog/history-of-sleep-research/#:~:text=In%201845%2C%20a%20British%20doctor,studied%20as%20a%20health%20issue> [Accessed 25<sup>th</sup> February 2022].
20. British Medical Association. *Doctors and the European working time directive*. Available from: <https://www.bma.org.uk/pay-and-contracts/working-hours/european-working-time-directive-ewtd/doctors-and-the-european-working-time-directive#:~:text=For%20junior%20doctors%2C%20it%20means,if%20this%20is%20not%20achieved> [Accessed 25<sup>th</sup> February 2022].