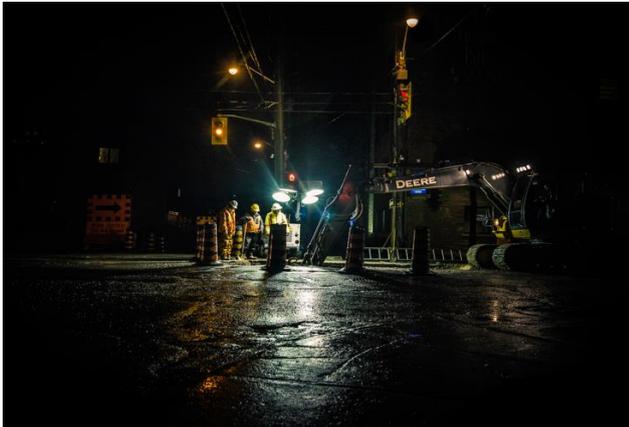




Shift Work, Sleep and Health



This POSTnote describes how working outside of daytime hours – shift work – affects physical and mental health and performance through its impact on sleep and circadian timing. It also describes policy implications and interventions.

Sleep and circadian timing

Sleep is essential, interacting with many bodily systems.¹ Two biological processes regulate the duration, quality and timing of sleep and determine chronotype (one's measurable degree of "morningness" or "eveningness"):^{2,3}

- **circadian timing** – a process that generates 24-hour bodily rhythms that define periods of sleepiness and wakefulness and schedule other physiological processes in line with Earth's light-dark cycle.^{3,4} The body's master clock in the brain synchronises with the outside world primarily through light, and with clocks in other cells in the body via hormonal and neuronal signals.⁴ Circadian rhythms are also affected by the timing of meals, physical activity and social cues.⁴
- **sleep-wake homeostasis** – a process that increases (or decreases) the pressure to sleep with the time spent awake (or asleep).³ Its workings are not well understood.⁵

Shift work – including night work and long working hours – is common to many sectors, with night workers comprising 12% of the UK workforce.^{6–8} Shift work can disrupt sleep and circadian timing, which can affect health and performance and increase the risk of accidents.^{6,9} Reducing its impact is a potential way to improve public health, health and safety in the workplace, and increase productivity.^{10–12}

The health effects of shift work

Shift work, particularly night work, requires sleep to occur at an abnormal time (during the day).⁹ Changes in the timing of sleep and light exposure can cause circadian disruption by

Overview

- Shift work (working outside regular daytime hours) is common in many safety-critical and other sectors, including transportation and healthcare.
- Shift work can disrupt sleep and circadian timing, essential biological processes that affect many aspects of physical and mental health and performance.
- Shift work is linked with an increased risk of sleep problems, occupational and driving accidents, and long-term health conditions.
- Interventions include optimising shift schedules, facilitating rest breaks, screening for sleep disorders and raising awareness in employers and employees.

misaligning the internal rhythm with the external light-dark environment.⁴ Complete circadian adaptation to shift work is unfeasible, requiring a permanent reversal of day and night.⁹ Shift workers thus tend to have increased sleepiness during night shifts, and shorter and poorer quality sleep during the day.⁹ Chronic sleep and circadian disruptions (SCDs) can result in a diagnosis of shift work sleep disorder, which affects 10–30% of shift workers.¹³ SCDs are associated with short- and long-term health effects in shift workers (see also [POSTnote 585](#) and [POSTbrief 29](#)):^{9,14,15}

- **Short-term effects** – SCDs cause sleepiness and fatigue and impair attention, memory, emotional regulation, decision-making and other functions, which affect performance.⁹ Shift workers show an increased risk of occupational and driving accidents.⁹ A survey in 2017 of NHS junior doctors found that 57% reported an accident or near-miss on the drive home after a night shift.¹⁶
- **Long-term effects** – shift work is associated with increased risk of obesity, type 2 diabetes and cardiovascular disease.⁹ Shift workers may be at greater risk of mental health conditions such as depression and anxiety, although more research is needed.^{17–19} There is also mixed evidence on the increased risk of long-term cognitive impairments and the risk for cancers (Box 1).⁹

The interactions between sleep and circadian disruption may increase the impact of each and make their individual effects difficult to separate.⁴ More research is needed to determine the role of other shift work-related lifestyle factors (such as diet and physical activity) in contributing to health

outcomes.⁹ Other important but under-studied factors include years spent doing shift work, shift schedules, light exposure, and differences in adaptation to and tolerance for shift work, which may be genetically determined.^{9,13,20} Younger workers and those with evening chronotypes may be more resilient to these effects.^{13,20}

Box 1. Research on possible links between shift work and cancer

The International Agency for Research on Cancer listed shift work-related circadian disruption as an area of concern in 2007.²¹ Particular focus has been on the link between shift work and breast cancer.²² A 2018 review by the Institution of Occupational Safety and Health (IOSH) concluded that the risk of breast cancer is smaller than originally thought or may not be significant at all.²² Some studies have examined the links between shift work and ovarian, lung, prostate and colorectal cancer.^{22,23} IOSH have concluded that more research is needed to verify any associations.²² Possible mechanisms may include exposure to light at night, which suppresses the circadian release of the hormone melatonin, a known anticarcinogen.^{23,24} Shift work-related circadian disruption may also affect regulation of genes linked to tumour development or exert its effects through increased obesity, which is a risk factor for cancer.²⁵

Policy implications

Shift work is common in healthcare, manufacturing, transport, communications, emergency services, security, entertainment and service industries, among others.⁶ The Trades Union Congress (TUC) notes that, except for healthcare, night workers comprise more men (60%) than women (40%).⁷ Proportionally more black and minority ethnic workers work at night (15%) than white workers (11%).⁷

The NHS

Staff in the NHS (one of the largest employers of shift workers) are at high risk of SCDs from night work, long hours and on-call work.^{26,27} This was recognised in recent reports by the Royal College of Anaesthetists, the Royal College of Nursing and the British Medical Association (BMA).^{26,28,29} SCDs and fatigue may also affect patient safety, with some studies showing increased risk of medical errors associated with long working hours.^{30–32}

Safety-critical industries

Shift work-related fatigue was an important factor in accidents such as the Clapham Junction rail crash in 1988 and the Exxon Valdez oil spill.⁶ To prevent such incidents, safety-critical industries such as aviation and rail are subject to additional regulations defining appropriate working conditions and hours.⁶ Most industries use Fatigue Risk Management Systems (FRMS) which include scheduling, fatigue monitoring, reporting, and education for employers and employees.³³ Some also include the use of biomathematical models to predict individual fatigue risk, although their validity remains to be confirmed.³³ There is concern that adoption of adequate FRMS varies across sectors.^{33,34} Fatigue has been implicated in 21% of UK rail incidents, most recently in the 2016 Croydon tram crash.^{35,36} The British Airline Pilots Association (BALPA) views pilot fatigue, caused by poor scheduling practices, as one of the top factors affecting aviation safety.³⁴ In 2016, over 50% of surveyed European pilots felt that fatigue is not taken seriously in the workplace, especially among low-cost and

cargo airlines.³⁷ BALPA and the European Transport Safety Council argue that regulations introduced in 2016, while intended to improve conditions, do not enforce adequate management of pilot fatigue.^{34,38}

Minimising the health effects of shift work

Employers have a duty to protect the health and safety of workers, including preventing and managing the effects of shift work.⁶ Trades unions and the NHS Staff Council have published guidance on shift work, and along with academics and health care professionals, have argued that more could be done (Box 2).^{10,39–45} The BMA has asked employers to commit to a “Fatigue and facilities charter”; this has been adopted by NHS Wales.^{46,47} Researchers have proposed various interventions but more evidence is needed to determine effectiveness and adverse effects.⁴⁸ One strategy is to decrease or increase blue-light exposure during night shifts to respectively minimise circadian disruption or facilitate adaptation.⁴⁹ The latter approach may reduce sleepiness at work.⁴⁹ Minimising light exposure after night shifts may also improve daytime sleep.⁴⁹ Scheduling shifts based on chronotype may reduce circadian disruption, with a study of factory workers showing that this can improve sleep and well-being ratings.^{50,51} In terms of drugs, low-quality evidence suggests that melatonin may improve sleep length after night shifts.⁵² Modafinil may increase alertness during night shifts, although it carries the risk of headache, nausea and increased blood pressure.⁵² A management strategy is to enable shift workers to eat healthily, increase physical activity and attend regular health screenings.^{22,48}

Box 2. Strategies to prevent and manage the effects of shift work

- **Shift design** – optimising shift length, timing, the number of consecutive shifts, providing rest breaks between shifts, using forward-rotating shifts (day-evening-night) and other strategies.^{6,20,42,46} A trial of shorter night shifts, fewer consecutive shifts and avoiding abrupt day-night shift transitions in NHS junior doctors reduced medical errors by 33%.³²
- **Rest breaks and/or naps** – providing opportunities and facilities to rest.^{42,46} Short naps increase alertness, counteracting the cognitive impairments of sleep deprivation.^{53,54} 10–20 minute naps are more immediately effective, with longer naps inducing grogginess and impaired performance.⁵⁵ Naps’ effectiveness may also be mediated by their timing in the day and by prior sleep deprivation.⁵⁵
- **Sleepy driving prevention** – resources for safe commuting after night shifts (such as cab fares) or overnight rest facilities.^{42,46}
- **Sleep disorder screening** – regular screening for sleep disorders such as shift work sleep disorder and obstructive sleep apnoea.⁴⁶

The TUC and Royal Society of Public Health suggest that employers and employees need better education about the effects of shift work and interventions, including raising awareness that night work is not comparable to the daytime equivalent.^{10,27} They have also called for the Health and Safety Executive to increase enforcement of best practices.^{10,27} Changing the culture around shift work is also emphasised, such as the false belief that healthcare workers are more resilient to the effects of SCD.⁴⁰ Some workers prefer shift work for financial and lifestyle reasons.²⁷ Employee control over shifts needs to be balanced against health and safety requirements.

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