

Night-shift work: can we prevent the adverse health effects?

Trabajo nocturno: ¿podemos prevenir sus efectos adversos en la salud?

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Night-shift work has become a structural component of modern economies, supporting essential services from healthcare and transportation to logistics and manufacturing. But with this systemic need comes a significant burden on health. Mounting evidence links night-shift work to a wide range of adverse outcomes, from acute fatigue to chronic diseases including cancer. While scientific understanding of its mechanisms has grown rapidly, preventive policies — both at institutional and individual levels — have lagged behind. In this article, I argue that the health consequences of night-shift work are no longer an occupational hazard to be suffered, but a modifiable public health issue requiring targeted prevention strategies.

Circadian disruption and the rise of night-shift work

In 2018, Eurostat data across 28 European countries showed that 13% of workers reported working night shifts regularly — 17% of men and 9% of women.⁽¹⁾ In Spain, estimates suggest a comparable pattern, with particularly high prevalence in healthcare, hospitality, security, transportation, and industrial sectors. Nurses, security personnel, truck drivers, and factory workers are among those most frequently affected.

Why does night work matter for health? At its core lies *circadian disruption* — a misalignment between the body's internal biological rhythms and the external environment. Human physiology is governed by a master clock located in the suprachiasmatic nucleus (SCN) of the hypothalamus, which synchronizes peripheral

clocks in virtually every tissue and organ. The SCN receives input primarily through light exposure to the retina, making light the most potent *zeitgeber* (time-giver). However, other factors such as meal timing, physical activity, and social and behavioural factors, such as work schedules, school hours, social interactions, and use of digital media, also entrain circadian rhythms.

These rhythms regulate multiple biological functions and systems including hormonal secretion, gene expression, immune function, metabolism, and DNA repair. Disrupting them — as occurs during night-shift work — induces a cascade of physiological stressors, potentially altering disease risk over time.

Health effects of night-shift work

The health consequences of night-shift work span both short-term and long-term effects. Acute effects include sleepiness and fatigue, insomnia, gastrointestinal disturbances, mood and concentration problems, increased risk of accidents and errors, all with implications not only for the worker but for workplace safety overall.

Chronic effects of night shift work raise deeper concerns and span several important health domains. One of the most alarming is cancer. In 2019, the International Agency for Research on Cancer (IARC) classified night-shift work involving circadian disruption as “probably carcinogenic to humans” (Group 2A). This classification was based on strong evidence from animal studies, mechanistic data, and more limited but suggestive human data for breast, prostate, and colorectal cancers.⁽²⁾

Cardiometabolic disorders also show a clear association with shift work, with studies indicating an increased risk of hypertension, metabolic syndrome, type 2 diabetes, and cardiovascular events among shift workers.⁽³⁾

Mental health and cognitive function may be adversely affected as well, with chronic shift work linked to higher rates of depression, anxiety, and even cognitive decline. These effects are likely mediated through pathways such as poor sleep quality and social isolation.⁽⁴⁾

Beyond physical and mental health, night shift work often interferes with work-life balance. Workers may experience greater challenges in managing family responsibilities and social life, as working time arrangements are closely associated with various social and family dynamics.⁽⁵⁾

How night work affects the body

Multiple biological pathways are involved in the health effects of night-shift work. One of the most immediate consequences is sleep disruption. Fragmented or shortened sleep interferes with the body's restorative processes and negatively affects glucose regulation, blood pressure control, and emotional resilience. Another key factor is exposure to artificial light at night (LAN), which suppresses the

production of melatonin — a hormone with antioxidant, anti-inflammatory, and potential anti-cancer properties.

Night work also disrupts hormonal balance by altering the circadian patterns of cortisol, sex steroid hormones, and insulin. These changes can destabilize homeostasis across multiple endocrine systems. In addition, circadian misalignment has been associated with immune and inflammatory alterations, including shifts in cytokine profiles and the development of chronic low-grade inflammation, a condition implicated in numerous chronic diseases.

Lifestyle factors further contribute to the overall health burden of night-shift work. Although the differences between night and day workers are not always large, night workers are more likely to engage in unhealthier behaviours. These may include irregular eating patterns, reduced physical activity, higher rates of smoking, and poorer dietary choices — all of which may amplify the adverse biological effects of circadian disruption.

Regulation, recognition, and gaps in policy

Despite growing recognition of these risks, policy responses remain fragmented. The EU regulates working hours, including provisions for night work and several countries have developed recommendations. However, these focus more on duration and rest periods than on circadian health. In Spain and elsewhere, pregnant workers have special protections, including options to avoid night shifts, but few other groups benefit from such accommodations.

One major question concerns occupational disease recognition. Would a nurse who develops breast cancer after two decades of night shifts have her condition recognized as work-related? In most countries, including Spain, this would not happen, though some Scandinavian countries, e.g. Denmark, have taken steps toward recognition in specific settings.⁽⁶⁾ The 2019 IARC classification has not yet translated into systematic legal or compensation frameworks across Europe.

Prevention: what can be done?

Given the known risks, the focus must now shift to prevention. Both organizational and individual strategies can substantially reduce harm.

Institutional and Organizational Measures

To effectively prevent the health effects associated with night shift work, a range of strategies can be implemented, many of which are considered among the most efficient and practical. First and foremost, minimizing exposure to night shifts where possible is key. This includes limiting their frequency and duration, avoiding permanent night schedules, and ensuring adequate recovery time when shifts rotate.

When rotation is necessary, forward-rotating shifts — moving from morning to afternoon to night (a clockwise pattern) — tend to be less disruptive to the circadian system than backward rotations. Additionally, it is beneficial to limit the number of consecutive night shifts, ideally avoiding more than two to three in a row to prevent cumulative fatigue.

Lighting can also be used strategically to support workers' circadian rhythms. Bright light exposure at the beginning of a shift can enhance alertness, while dimmer lighting toward the end can help prepare the body for sleep once the shift is over. Providing designated rest areas and opportunities for controlled naps during breaks can further help combat fatigue.

Ongoing health monitoring and counselling play a vital role, especially with regard to cardiometabolic health and mental well-being. Regular health checks can help detect early signs of stress or illness. Education is equally important: employers should inform workers about the health risks associated with night work and provide practical strategies to mitigate them.

Finally, special attention should be given to vulnerable populations. Older workers, individuals with chronic illnesses, and those with caregiving responsibilities may require tailored policies, such as the option to avoid night shifts or receive modified schedules that better suit their needs.

Individual-Level Strategies

While institutional changes are essential for mitigating the health effects of night shift work, individual behaviours can also play a valuable supporting role. Good sleep hygiene is fundamental; strategies such as using blackout curtains, eye masks, and white noise can significantly improve the quality of daytime sleep. Maintaining a consistent sleep schedule, even on days off, further supports circadian stability.

Managing light exposure is another effective strategy. Wearing blue-light blocking glasses during the commute home can help reduce melatonin suppression, making it easier to fall asleep afterward. Meal timing also matters—eating during the active part of the shift and avoiding heavy meals before sleep can aid digestion and improve sleep quality. Although still an emerging area of research, some evidence suggests that time-restricted eating may help counteract the metabolic disruptions associated with night work.

Regular physical activity, particularly when performed during daylight hours on non-working days, can help regulate circadian rhythms and improve overall health. It is also important to avoid stimulants late in the shift. While caffeine can be useful early on to boost alertness, consuming it too close to the end of the shift may interfere with the ability to fall asleep afterward.

Finally, maintaining strong social support is crucial. Staying connected with friends and family, and involving them in shift planning, can reduce feelings of isolation and help buffer the psychological stress often associated with night work.

Importantly, these strategies require institutional support — e.g., adjusting canteens to healthy meal options during night hours, offering flexible leave, and funding occupational health services.

Research to inform policy

In our research group, we are deeply involved in studies exploring the mechanisms^(7,8) behind the health effects of night-shift work,⁽⁹⁾ with a special emphasis on molecular and exposome approaches. From tracking melatonin profiles and inflammatory markers to analysing light exposure via wearable sensors and satellite data, we aim to provide a more complete understanding of risk.

What is still missing, however, are evaluations of health policies and interventions. Does implementing forward-rotating shifts reduce metabolic risk? Can structured sleep and nutrition counselling improve outcomes for night-shift nurses? These are questions we must now prioritize.

A final issue lies in equity: low-income workers and migrants are overrepresented in night-shift roles and often have fewer resources to protect their health. Prevention must not be a luxury; it must be embedded in labour standards.

Conclusion

Night-shift work is unlikely to disappear, but its harms can and must be reduced. From workplaces to workers, and from regulation to research, we have the tools to intervene. What's needed now is the will to prioritize health over convenience, and to ensure that the people who keep our societies running through the night are not sacrificing their long-term well-being in the process.

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