

Research Project Proposal

SWITCH: Shift Workers' Individualised Treatments for Circadian Health

THE CHALLENGE

Shift work is a significant health and economic burden. Shift work, particularly night work, often leads to acute and chronic sleep loss, and misalignment between the internal circadian pacemaker (i.e., body clock) and the timing of sleep. This leads to increased risk of alertness impairment, workplace errors, accidents and injuries, and adverse physical and mental health outcomes in employees.

We know that an individual's pattern of light exposure is a key factor in determining the response of the body clock to shift work. Strategic light exposure can help to shift the timing of the body clock to help adapt to shift work schedules, and can also be applied in the workplace as an effective method to improve alertness, performance and safety during the night shift. Understanding more about the role of light in determining an individual's response to night shift and the development of recommendations and/or interventions for light exposure can help shift workers to manage their sleep, alertness and health.

OUR STUDY

We have received funding from the National Health and Medical Research Council to examine the role of light in the response to shift work and to help develop more individual recommendations for light exposure to improve the management of shift work. The research is a collaborative project between experts from Monash University, the University of Sydney and Harvard Medical School.

This study aims to deliver lighting interventions and *individualised* recommendations for shift workers to facilitate adaptation to night shift, promote alertness and improve workplace performance and safety, and employee health.

What is involved?

We are seeking participation from organisations employing night shift workers. We will provide expertise on optimal lighting patterns for individual workers and deploy lighting interventions in the workplace. We will then monitor shift working employees to assess the impact of the lighting changes on outcomes including sleep, alertness, mood and body clock timing.

Workplace lighting installation

We have extensive expertise in optimising the specifications of light for improving sleep, alertness and health, and the deployment of alternate lighting in operational settings. We have previously demonstrated that lighting of increased intensity and short-wavelength content can improve alertness and performance in night shift workers. This project will apply this experience to design lighting to help manage sleep and health in night shift workers in your workplace. Lighting will be designed with consideration of workplace operational and OHS requirements (e.g., maintaining visual acuity for workers).

Individual lighting recommendations

In addition to optimising the lighting environment during shift, the project will provide individual workers with recommendations on when to seek/avoid light away from the workplace to help adapt to their night shift schedule. Research has demonstrated considerable variability in an individual's body clock timing and the impact this has on their adaptation to shift work. By measuring body clock timing for an individual, we will use a biomathematical model to generate personalised recommendations for behaviours to facilitate improved circadian adaptation for each worker.

Personalised recommendations for an individual worker may include: optimising light exposure with light-emitting glasses outside of work hours, adjusting the timing of their sleep based on their work roster, and recommendations for the timing of food and caffeine intake. Our previous research applying similar simple behavioural recommendations in day workers and night workers has proven effective in promoting circadian alignment and improving well-being, and has revealed a large appetite for personalised support for individual management of shift work.

Monitoring of employees

To assess the impact of the interventions, participating employees will be monitored for up to two weeks prior to the changes and two weeks afterwards.

1. Once before and once after the lighting changes, participants will complete a 20-minute online survey measuring general sleep-wake behaviour, health and wellbeing.
2. Each day, participants will record their sleep timing, and alertness and mood during shift on a mobile app (max. of 5 mins each day).

3. Sleep behaviour and light exposure will be monitored by a wrist-worn activity monitor and a light pin worn at the lapel, respectively. Both devices are lightweight and have been used extensively in field studies with shift workers.
4. On at least two 48-h occasions, participants will collect urine samples for measurement of individual circadian timing, based on the concentration of the urinary metabolite of melatonin. This will be crucial for the development of *individualised* behavioural recommendations and to assess the impact of the lighting changes. This procedure has been conducted many times in operational settings and is designed to minimise participant burden. It can be done in participants' own time without a need to attend a sleep laboratory.

Additional research considerations

All research procedures will be approved by the Monash University Human Research Ethics Committee. Staff will be informed about the details of the study and will be asked to volunteer if they'd like to participate. They will be informed that they will be free to withdraw at any time and all data collected will remain confidential.

BENEFITS FOR YOUR ORGANISATION

- The proposed lighting during shift will be designed to acutely promote alertness. This will reduce sleepiness and fatigue experienced by night shift workers. Daytime workers are also expected to benefit from the alerting effects of the lighting.
- Lighting during shift and the personalised lighting recommendations will also encourage a shift in the timing of a worker's body clock to better align with the timing of their work shift and sleep times. This will improve their ability to sleep between shifts, and to remain more alert during shift.
- Improved circadian timing is likely to also improve overall health and well-being, including mental health.
- Overall, workers are expected to obtain more sleep, feel more alert, experience increased productivity and safety (i.e. reduced risk of accidents), and feel healthier.

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