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1-31-2019

# Risks and Risk Reduction for Shift Work, Long Hours of Work, and Sleep Deprivation

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# Risks and Risk Reduction for Shift Work, Long Hours of Work, and Sleep Deprivation

## Abstract

[Excerpt] Today, only about 30% of employed Americans work during the daytime, 35 to 40 hours a week, five days a week, Mondays through Fridays. When people 8-hour rotating work shifts, with their associated tightly-packed schedule, shift workers work 400 more hours per year than those who work only 40 day-time hours.

Our circadian (“around the day”) rhythm is the result of our brain and body blending internal body cycles to be in sync with the external world. We are aware of the time of day; light/dark (day/night); mealtimes, traffic noise, and what everybody else is doing. There are separate high and low activity periods throughout the 24-hour day for our internal cycles of hormones, heart rate, body temperature, blood pressure, etc. Our body temperature drops to its lowest point around 3-4 AM, then rises slowly again at about 5-6 AM – this affects performance, activity, and alertness and is the most difficult time to stay awake and alert. About 10 – 20% of the population seem to naturally be “morning types” (“larks”) and “evening types” (“owls”). Morning types have a small swing between their body temperature maximum and minimum and seem to have more trouble adjusting to shift work than the evening types with a relatively large swing in body temperature.

While our systems can adjust without difficulty to small, gradual changes -- such as seasonal changes in day length – the abruptness of changing shifts causes our bodies to become temporarily and severely disorganized. Once disrupted, the body tries to adapt by re-synchronizing all the affected functions, but these take different amounts of time to reach the new rhythm. If the cycle is disrupted again before a new rhythm is in place, the body needs to adjust again. Moreover, work schedules may require sleeping during the day – this can be difficult with daylight and daytime noises – so people sleep fewer hours and are less refreshed. Sleep deprivation is a serious problem because we need sleep to accomplish important brain activities, some requiring a lot of energy and so can’t be done while we’re awake and using this energy to process sensory information. Most adults need about 8 hours of sleep, though the typical range is 6 to 10 hours. Unfortunately, you can’t make up a sleep debt, even if you try to sleep late on your days off.

## Keywords

shift work, long hours, sleep deprivation, workplace hazards

## Comments

### Required Publisher Statement

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### Recommended Citation

Brown, N.J. (2019). *Risks and risk reduction for shift work, long hours of work, and sleep deprivation* [Electronic version]. Ithaca, NY: Cornell University, Workplace Health and Safety Program.

## **Risks and Risk Reduction for Shift Work, Long Hours of Work, and Sleep Deprivation**

**Nellie J. Brown, MS, CIH**

**January 31, 2019**

### **What are the risks of shift work, long hours of work, and sleep deprivation?**

Today, only about 30% of employed Americans work during the daytime, 35 to 40 hours a week, five days a week, Mondays through Fridays. When people 8-hour rotating work shifts, with their associated tightly-packed schedule, shift workers work 400 more hours per year than those who work only 40 day-time hours.

Our circadian (“around the day”) rhythm is the result of our brain and body blending internal body cycles to be in sync with the external world. We are aware of the time of day; light/dark (day/night); mealtimes, traffic noise, and what everybody else is doing. There are separate high and low activity periods throughout the 24-hour day for our internal cycles of hormones, heart rate, body temperature, blood pressure, etc. Our body temperature drops to its lowest point around 3-4 AM, then rises slowly again at about 5-6 AM – this affects performance, activity, and alertness and is the most difficult time to stay awake and alert. About 10 – 20% of the population seem to naturally be “morning types” (“larks”) and “evening types” (“owls”). Morning types have a small swing between their body temperature maximum and minimum and seem to have more trouble adjusting to shift work than the evening types with a relatively large swing in body temperature.

While our systems can adjust without difficulty to small, gradual changes -- such as seasonal changes in day length – the abruptness of changing shifts causes our bodies to become temporarily and severely disorganized. Once disrupted, the body tries to adapt by re-synchronizing all the affected functions, but these take different amounts of time to reach the new rhythm. If the cycle is disrupted again before a new rhythm is in place, the body needs to adjust again. Moreover, work schedules may require sleeping during the day – this can be difficult with daylight and daytime noises – so people sleep fewer hours and are less refreshed. Sleep deprivation is a serious problem because we need sleep to accomplish important brain activities, some requiring a lot of energy and so can’t be done while we’re awake and using this energy to process sensory information. Most adults need about 8 hours of sleep, though the typical range is 6 to 10 hours. Unfortunately, you can’t make up a sleep debt, even if you try to sleep late on your days off.

### **Adverse effects of shift work/long hours on health:**

Repeated changes in light-dark cycles, such as shift work, have been associated with a wide range of health disorders...

- Cardiovascular problems, coronary heart disease; also an increase in the risk factor of obesity
- Infections

- Digestive problems
- Fertility problems
- Depression
- Diabetes, disturbed glucose regulation (further affected by meals at nonstandard times)
- Cancers, including breast cancer

The long-term consequences of weekly shift changes studied in animals indicated a 20% shorter life span.

Could we prevent these problems by predicting who is best suited for shift work? Not with questionnaires, which do not appear to be sensitive or specific enough to select applicants or employees for shift work.

### **Consequences of Shift work/Long Hours: Workplace Overexposures, Risks, Errors, and Accidents**

A sleep-deprived worker can fall asleep for seconds or minutes, even while standing, operating machinery, or driving a vehicle. The sleepier the person, the more rapidly and frequently this occurs. In terms of performance, a person who has been 24 hours without sleep is equivalent to a drunk with a blood alcohol level of 0.10%. So, making critical decisions, important observations, or driving/operating machinery or equipment are serious problems for sleep-deprived workers who are more likely to commit errors or have accidents.

For workplace inhalation of chemicals or exposure to noise, the basic assumption of the occupational exposure limit-setting process by OSHA is that workers work a traditional 8-hours/shift, 5 day/week schedule. So, when people work longer hours, the greater exposure must be taken into account when evaluating sampling and monitoring data of workplace exposures.

Heat stress and cold stress are other workplace conditions to consider in relation to shift work, compressed work weeks, and double shifts. Heat stress, by itself, has been known to produce sleep deprivation. Also, it is necessary to look at the interaction of heat stress with other workplace stressors.

Ergonomic studies of standardized, prolonged lifting in daytime workers indicate that the ability to lift declines over time, even with normal breaks, for an 8-hr day. For longer days, the lifting ability decreases further and, for night work, the energy expenditure is higher. These suggest that separate standards of lifting capacity and other physically-demanding tasks should probably be established for long hours and for nightshifts.

For employees coming and going at night, security becomes an important consideration. With fewer potential witnesses around at night, employees could be seen as easier victims. High-risks for violence include building entrances and parking areas, as well as work in the field or

making deliveries. Nighttime construction work for buildings or roads may have the added risk of worker visibility.

Electromagnetic fields (EMFs) adversely affect circadian rhythm. Power line fields affect circadian rhythms but only if the field is turned on and off. Very strong static magnetic fields can interfere with circadian rhythm, including hormone levels and body temperature regulation.

**Consequences of Shift work/Long Hours: lonely people**

Sleep deprivation and its mood swings and fatigue can affect relationships with family and friends who may not understand the shift worker’s physiological upsets, edginess, tiredness, moodiness, or depression. A spouse may begin to feel ignored and disliked. Shift work can lead to a higher rate of separation or divorce. Children may begin to feel as though they have an occasional second parent who doesn’t care about them enough to be around more often. Shift workers tend to form close bonds and friendships among themselves as a way to lessen the pain of isolation.

**WHAT CAN BE DONE TO MINIMIZE THE CONSEQUENCES?**

Humans are not nocturnal animals – so the following are suggestions for reduction of the risks associated with shiftwork and sleep deprivation.

	<b>What the employer can do...</b>
<b>Schedules and Work Organization</b>	<p><b>Regular, predictable work schedules and adequate staffing levels</b>, on a yearly basis, if possible. These help with work/family balance, such as child care, and may help with employee retention.</p> <p>For <b>electromagnetic field (EMF) exposure</b>, avoid schedules which cause loss of awareness of day-night cycles.</p> <p><b>Enforce maximum allowable work hours.</b></p> <p><b>Forward shift rotations only</b> – not backwards against the clock.</p> <p>Overall, the <b>slower the rotation the better</b> with weeks spent on a particular shift.</p> <p>Do certain jobs need to be done 24-hrs a day? <b>Tailor shift schedules to subgroups</b>, rather than for an entire organization.</p> <p><b>Avoid tasks requiring error-free activity toward the end of a 12-hr shift or in the 3 – 6 AM</b> period, whatever the length of the shift.</p> <p><b>Rest breaks</b> provide recovery from muscular fatigue. For jobs involving vigilance, a break of 5 – 10 minutes every ½ to 1 hour may be needed to maintain a high level of alertness and decision-making.</p>
<b>Training and education</b>	<p>Workers need to know what to expect and how the body may respond to shift work.</p> <p>Invite family members to attend.</p>
<b>Workplace lighting</b>	<p>During evening and night work shifts, <b>full daylight-spectrum bright light</b> promotes the resetting of the body’s sleep and wake cycles, but <b>filter out wavelengths &lt;480nm</b>, as these have the most serious effects on circadian rhythm, errors, and breast cancer risk. (see more information below on bright light therapy)</p>

<b>Workplace Depts and Policies</b>	Have Human Resources, Personnel, Benefits, and other services available for those working unusual hours, to avoid disrupting their sleeping routine. Schedule workplace trainings on work shifts; avoid holding people after their shift or bringing them in early to avoid disrupting people's sleep schedule (as well as work/family balance such as child care). Evaluate workplace risks for violence and implement a workplace violence prevention program.
<b>Food and Drink</b>	Make healthy food choices available, including in vending machines. Have adequate and appropriate liquids available to deal with heat stress and cold stress.
<b>Physical Exercise</b>	Improved physical condition can either increase tolerance of shift work or increase the rate of adjustment to shift work. <b>Promote physical exercise</b> by: <ul style="list-style-type: none"> <li>• having facilities available</li> <li>• offering discounts to gym, pool, or exercise programs, or for assisting employees to purchase equipment for home use</li> </ul> Make it as easy as possible for people to make regular exercise a habit.
<b>Napping</b> <sup>131-137</sup>	Naps can <b>compensate for fatigue and improve alertness or delay its decline</b> . Use of a short nap (<1hr.) during the early morning hours of the first night shift can improve the ability to respond to visual signals during the second half of the night shift.

	<b>What the employee can do...</b>
<b>Medical care</b>	<b>Physicals:</b> to address the adverse health impacts discussed above, evaluate for <ul style="list-style-type: none"> <li>• Elevated blood lipids</li> <li>• Glucose intolerance</li> <li>• Hypertension</li> <li>• Mammography and breast exams</li> <li>• Smoking</li> </ul> <b>Medical assessments:</b> keep a sleep diary or other tools to assess sleepiness and fatigue (physical or mental). <b>Bright light therapy:</b> evening bright light for several hours, <u>avoid morning bright light using sunglasses</u> , then daytime sleeping in total darkness. This can shift the circadian rhythm such that the lowest point of alertness occurs a few hours after shift work ends. May include morning melatonin therapy.
<b>Schedules</b>	Union/worker involvement in: <ul style="list-style-type: none"> <li>• designing shift schedules; shift work designs are likely to be controversial among the membership and need to be resolved before approaching the employer so as to present a united front</li> <li>• establishing a right to transfer to daytime work without loss of pay and benefits for those who cannot tolerate working nights</li> </ul> Schedule doctor and dentist appointments that don't disrupt your sleep routine.
<b>Relaxation techniques</b>	Meditation Yoga, besides the physical exercise, deep breathing exercises are calming.

	Progressive muscle relaxation
<b>Sleep hygiene</b>	<p>Maintain a regular sleep time for the duration of the week, <b>including days off (Tell your family why these are necessary and ask them to respect the necessity.</b></p> <ul style="list-style-type: none"> <li>• On your morning drive home after working all night, <b>wear dark glasses</b> so the daylight will not reset your biological clock and delay your sleep cycle.</li> <li>• <b>Attempt sleep immediately after the night shift.</b></li> <li>• <b>Keep your bedroom cool and pitch-dark.</b> Use eye shades if necessary.</li> <li>• Try to relax, unwind, and go through a <b>regular bedtime routine</b> before sleeping</li> <li>• <b>Keep your bedroom quiet;</b> insist that family and friends respect your sleep hours.</li> <li>• Tune a radio between two stations to use background “white” noise.</li> <li>• Use earplugs, unless you need to be on-call or wake up for duty</li> <li>• Warm bath or shower before bed; increasing body temperature a couple of degrees shortens the time to fall asleep and promotes deep recuperative sleep</li> <li>• Try to prepare for your sleep schedule on your days off before the shift changes</li> </ul>
<b>Food and Drink</b>	<p><b>Eating meals or snacks at the same time each day.</b></p> <p><b>To stay awake at work,</b> use light to moderate amounts of protein.</p> <p><b>To produce drowsiness at home:</b></p> <ul style="list-style-type: none"> <li>• use high carbohydrate foods; avoid greasy foods that cause indigestion and disturb sleep.</li> <li>• If hungry at bedtime, a light snack is preferable to a large meal.</li> <li>• Avoid caffeine during the last half hour of your shift or near sleep time. The same goes for nicotine, either tobacco smoking or patch.</li> <li>• Avoid alcohol if you must sleep during the day as it can produce easily-disrupted, lighter sleep with intense dreaming, sweating, and headaches.</li> </ul>
<b>Physical Exercise</b>	<p>Improved physical condition can either increase tolerance to shift work or increase the rate of adjustment to shift work. It enhances deep, physically restorative sleep. If strenuous exercise interferes with your sleep, avoid it within 6 hours of going to bed or exercise after you wake up, instead.</p>
<b>Napping</b>	<p>Naps, to prevent anticipated fatigue and alertness loss, appear to be effective, but you can’t “stock up” on sleep time. If napping before going to work, or if a nap is likely to be interrupted for a call to come to work, limit it to 45 minutes to prevent entering deep sleep.</p>

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