

CIRCADIAN RHYTHM & WORKPLACE SAFETY

Online
Training



What are circadian rhythms?

Circadian rhythms are physical, mental, and behavioral changes that follow a daily cycle. They respond primarily to light and darkness in an organism's environment. Sleeping at night and being awake during the day is an example of a light-related circadian rhythm. Circadian rhythms are found in most living things, including animals, plants, and many tiny microbes. The study of circadian rhythms is called chronobiology.

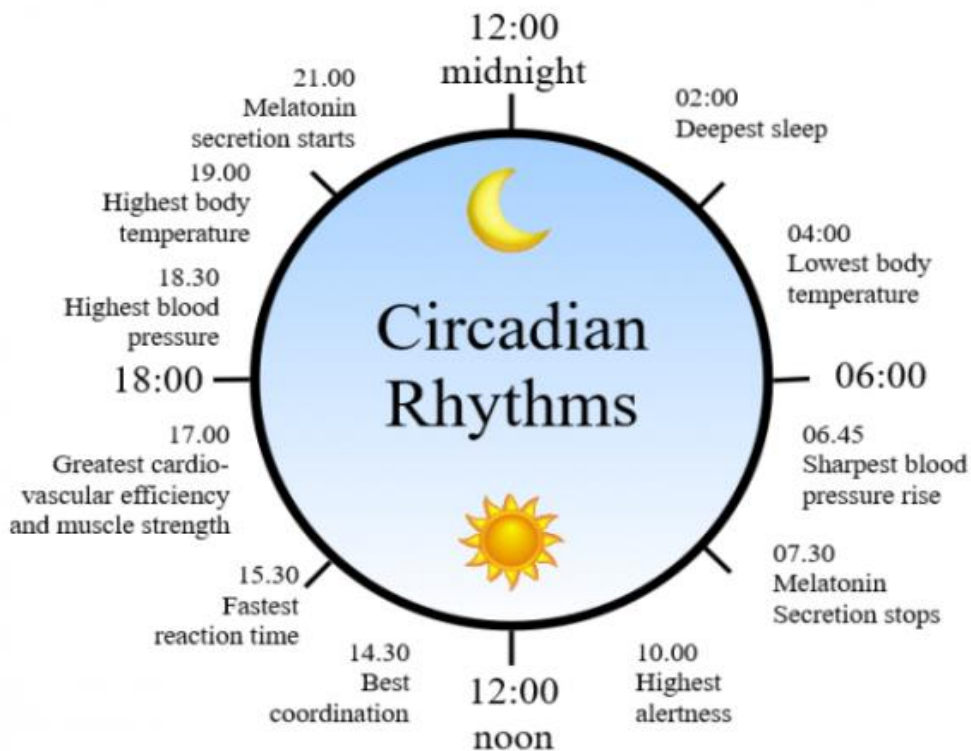
What are the effects on circadian rhythms?

Many human physical functions follow a daily rhythm or a 24-hour cycle. These cycles are called circadian rhythms. The word circadian comes from the Latin "circa dies" which means "about a day." Sleeping, waking, digestion, secretion of adrenalin, body temperature, blood pressure, pulse and many other important aspects of body functions and human behavior are regulated by this 24-hour cycle. These rhythmical processes are coordinated to allow for high activity during the day and low activity at night.

Normally, the body uses cues from its processes and from the environment such as clock time, social activities, the light/dark cycle, and meal times to keep the various rhythms on track. For example, body temperature is highest during the afternoon and early evening (6:00 p.m.) and lowest in the early morning (4:00 a.m. or just before sunrise). However, if the person is working at night, the body temperature does not have as much variation during a 24-hour period as it would normally. The temperature rhythm and other body rhythms get out of sync: these rhythms also get out of phase with the person's activity pattern. This disorientation can lead to feelings of fatigue and disorientation. "Jet lag" is a term often used to describe these feelings.



THE CIRCADIAN RHYTHM



The term circadian was coined by Franz Halberg, it comes from two Latin words namely *circa* which means ‘around’, and *dies/diem* which means ‘day’. Circadian means ‘approximately one day’.

Most people naturally experience changes in sleepiness and alertness throughout the day, with two dips in alertness in a 24-hour day. Usually, the larger dip occurs around 2 – 6 a.m. and the smaller one around 1 – 4 p.m. These patterns are controlled by our circadian biological clock, which regulates the timing of periods of alertness and sleepiness throughout the day by responding to light and dark, consequently affecting our physical and mental states.

Circadian rhythm can be easily disrupted by many factors, including sleep deprivation, working long or irregular hours, shift work or even being on-call. Any of these can affect a body’s regeneration cycle and lead to almost constant fatigue. This reduces the clarity of thinking and performance. Continually not getting enough sleep only makes things worse, affecting employees’ health and performance which increases the risk of injury.

WHY STUDY THE EFFECTS OF SHIFT WORK?

Shift work is a reality for about 25 percent of the North American working population. Interest in the effects of shift work on people has developed because many experts have blamed rotating shifts for the "human error" connected with nuclear power plant incidents, air crashes, and other catastrophic accidents.

Alternating day, night and afternoon shifts are common in

- industrial work
- customs & immigration
- mines
- hospitals
- protective services -- police, fire, ambulance
- hospitality -- hotels, food service
- health care
- transportation services -- trucking, airlines

Shift work is also common in workplaces where technical processes cannot be interrupted without affecting the product and/or where expensive equipment is used more profitably when in constant operation. The overall prevalence of shift work is similar for women and men. However, there are gender differences in shift work patterns by sector of employment. Many more women than men work in the health care sector, while many more men than women work in manufacturing.

Many workers find that shift work disrupts their family and personal life and leads to health problems including chronic fatigue and gastrointestinal disorders. On the other hand, some workers prefer shift work because it usually allows for more free time.

WHAT ARE SOME STRATEGIES FOR IMPROVEMENT?

The best solution to the problems of shift work would be to eliminate it but this is not often a practical possibility. Shift work is likely to continue to be a reality for a large percentage of Canadian workers.

There are two basic levels where improvements can be made:

The organizational level

primarily through the design of shift schedules, education and better facilities.

The individual level

helping workers to get better sleep, a healthier diet, and the reduction of stress.

WHAT ARE SOME ORGANIZATIONAL APPROACHES?

There are several approaches the organization can take to help reduce the effects of shift work. There are also several important considerations for organizations.

Shift Schedule Design: Optimizing the design of the shift schedule is the most effective way of reducing the health and safety problems. Satisfaction with a particular shift system is the result of a complicated balancing act that is the best compromise for personal, psychological, social and medical concerns.

Length of the rotation period

The number of days on any one shift before switching to the next shift. The optimum length of the rotation period has been disputed.

The most common system has a rotation period of one week, with five to seven consecutive night shifts. However, since it generally takes at least seven days for adjustment of the circadian rhythms, it is argued that just as adjustment starts to occur, it is time to rotate to the next shift. Some schedule designers feel that a longer shift rotation should be arranged so that the worker spends from two weeks to one month on the same shift that would allow circadian rhythms to adjust. A problem occurs when the worker reverts to a "normal" day/night schedule on days off, thus, possibly cancelling any adaptation. Also, longer periods of social isolation may result. Others suggest a rapid shift rotation where different shifts are worked every two to three days. This system may reduce disruption to body rhythms because the readjustment of circadian rhythms is minimized. It also provides time for some social interaction each week. In the end individual differences and preferences, play the most important role.

Direction of rotation of shifts. It is recommended that shifts rotate forward from day to afternoon to night because circadian rhythms adjust better when moving ahead than back.

Start and Finish Times. Early morning shifts are associated with shorter sleep and greater fatigue. It is advisable to avoid shift start times as early as 5 or 6 a.m. The social customs and desires of the specific work force should be considered as well as the availability of public transportation. The safety on the streets, in terms of crime and violence, is another consideration.

Length of rest between shifts. It is recommended that a rest period of at least 24 hours occurs after each set of night shifts. The more consecutive nights worked, the more rest time should be allowed before the next rotation occurs.

Alternative forms of organizing work schedules. For example, extended work days of ten or twelve hours have been used. It has the advantage of fewer consecutive night shifts and longer blocks of time off. However, the additional fatigue from long work hours may also have adverse effects. The physical and mental load of the task should be considered when selecting the length of a work shift. Exposure to chemical or physical agents should also be considered when selecting a shift system as well as ergonomic hazards.

ADDITIONAL CONSIDERATIONS

Provide time off at "socially advantageous" times like weekends whenever possible. Start a special shift system if production demands result in extended periods of overtime work. Inform shift workers of their work schedules well ahead of time so they and their families and friends can plan activities. Allow as much flexibility as possible for shift changes. Keep schedules as simple and predictable as possible.

Facilities

The provision of certain facilities can help the shift worker cope better.

- Give attention to the work environment. For example, good lighting and ventilation are important on all shifts. Do not widely separate workstations so that workers at night can remain in contact with one another.
- Provide rest facilities where possible. Whenever a person must remain at work after a night shift to attend a meeting or a training session, providing rest facilities is advisable. When a night worker is "on call" and must remain in the building, it is advantageous for this person to be well rested rather than tired and bored.
- Provide healthy cafeteria services so a balanced diet can be maintained. The nutritional needs differ between day shifts and other shifts because of circadian rhythms. Provide educational and awareness materials on the benefits of eating a balanced meal.
- Consider offering facilities for social activities with the needs of the shift worker in mind. Recreational opportunities are often minimal for workers on "non-day/night" shifts.
- Consider access to quality day-care for shift workers' children. Some strain on all family members would be alleviated.

Education:

Educate employees on the potential health and safety effects of rotational shift work and what can be done to stop these effects. In particular, education in stress recognition and reduction techniques is helpful.

