



Loss Control TIPS

Technical Information Paper Series

Innovative Safety and Health SolutionsSM

Alternative Work Schedules: Shiftwork, Rotating Shifts, and Overtime

Introduction

Shiftwork has been defined as any work performed outside the hours of 7:00 a.m. and 6:00 p.m. (Monk and Folkard, 1992). The evolution of shiftwork has occurred in response to several trends in industry and society. Many types of jobs in the service sector require round-the-clock staffing and/or coverage extending beyond the standard daytime hours. Examples are physicians, nurses, police officers, and transportation workers. Some operations, like power plants, must remain operational at all times. Some companies operate second and third shifts to maximize cost effectiveness of expensive machinery which would be too costly to duplicate. The operation of multiple shifts allows overtime which is sometimes perceived to be less expensive and less risky than recruiting additional employees.

Circadian Rhythms

Physiological functions of the body change throughout the 24-hour day. These daily fluctuations, called *circadian rhythms*, are observable in heart rate, temperature, blood pressure, and hormone excretion. These rhythms should be left intact for normal physical and psychological function. However, they can be disrupted by external events. Examples of external events are daily light and darkness, and temporal activities like work hours and meal times. Shiftwork (evening and night), rotating shifts, and extended hours (overtime) can influence physical and psychological function.

Possible Effects of Alternative Work Schedules

Researchers have studied various aspects of shift systems and work schedules. Specific topics considered include characteristics of shift systems, permanent night work versus slowly and quickly rotating shift systems, duration of shifts, timing of shifts, distribution of leisure time within the shift system, direction of shift rotation, timing of rotation of shifts, time autonomous working groups, and shift systems with part time workers.

The literature regarding potential health effects of long work or shift hours does not show conclusive results. While consistent, definitive, and reliable *cause and effect relationships* have not been established, some *associations* have been identified. (Further study has been recommended.)



Some associations include:

- Fatigue and insomnia occurs more frequently in night workers.
- Shift work has been reported to cause sleep loss and diminished sleep quality, which can result in a deficit in work performance.
- Work performance has been reported to decrease during night shift hours or from long work hours.
- Increased fatigue and lowered performance from long work hours have been linked to a greater frequency of accidents.
- The ability to perform work declines as time on task and the length of the work period increase. These effects are more pronounced at night.
- Long work hours have been found to be a major reason for fatigue and a primary cause of shift work intolerance.
- There is a link between sleep loss, fatigue and occupational stress.
- Some studies have shown an association between shift work and neurosis.
- Long work hours have been associated with cardiovascular disorders (ischemic heart disease) and gastrointestinal disorders.
- Shiftwork is associated with increased alcohol consumption.
- Longer periods of exposure to rotating shifts leads to less alteration in basic sleep pattern of the individual.
- Aging decreases circadian adjustment to night work, with the change becoming obvious before retirement age.
- Aging is associated with decrease in quiet or deep sleep and decreased ability to recover from sleep deprivation.
- Some adjustment of circadian rhythms occurs as a worker accommodates to a stable shiftwork schedule. For example, circadian rhythms have been reported to recover, although not fully to normal, after 3-4 weeks on the same night shift.
- Pre-existing health problems may be exacerbated by shiftwork.

Performance rhythms of shiftworkers are the result of complex, multifaceted processes. Individual physiological differences play a significant role. Underlying concerns regarding tolerance of shift work include the type of schedule; individual motivation for shiftwork; job requirements; and psychosocial, environmental, nutritional, political, and social factors. These factors are also related to previous shiftwork experience and emotional contentment with the job.

It has been suggested that, in many circumstances, difficulties arise because the shiftworkers themselves are not sufficiently informed and are not involved in the analysis, planning, and design stages of the shifts; this results in a low acceptance rate of the plan by the workers.

Variables That Affect Tolerance to Shift Work

Researchers have identified a number of variables which influence individuals' tolerance to shift work. These factors fall into three categories:

Individual
Work
Social-environmental

Individual factors which have been related to better long term tolerance in shiftwork include:

- age
- ability to sleep at unusual hours
- flexibility of sleeping habits
- ability to control hours of work (choice)
- ability to overcome drowsiness
- individual physical fitness
- individual personality

Work factors which influence the success of shiftwork include:

- shift rotation schedule
- length of shift
- job design
- physical working conditions
- direction and frequency of shift rotations
- workload

Social-environmental conditions include:

- family composition
- housing conditions
- social status

Researchers generally agree that further study regarding each of these factors, as well as the interactions between and among these factors, is necessary.

What About Flextime?

A recent trend toward “flextime” has relevance to alternative work schedule issues.

Flexible work arrangements allow the employee and employer to determine a mutually acceptable distribution of working hours per shift or over a determined block of time and according to a specific schedule (e.g., days per week).

Flextime can encompass a variety of work arrangements: variable starting and ending times for work, compressed work week, work week reduction, work at home/telecommuting, job share, and part time hours. Each method has its own set of inherent advantages and disadvantages. Employee involvement in the work arrangement design is a powerful factor that will influence its success.

When establishing flextime arrangements, careful consideration must be given to all of the shiftwork factors identified above.

Making Alternative Schedules Workable

Some general recommendations regarding alternative work schedules are:

- Maintain high levels of illumination for evening and nights shifts at the workplace.
- When possible, involve workers in the design and implementation of alternate work schedules.
- Permanent evening or night shift assignments may be preferred for some operations because a permanent arrangement allows the internal rhythms to become re-entrained according to a rest/work pattern.
- Alternately, it may be better to work only occasionally outside the morning/afternoon period and to work only one such evening or night shift, because such an occasional change will not significantly disrupt the usual 24-hour cycle.
- In determining which of many possible shift plans to select, establish criteria to allow justifiable and systematic judgments. Criteria might include daily work duration, number of consecutive night shifts, number of hours of free time following each night shift number of free days per cycle, etc.
- Encourage shiftworkers to use “coping strategies” for resetting their biological clocks, obtaining restful sleep, and maintaining satisfying social and domestic interactions. For example, sleep directly after a night shift. Sleep time should be regular and free from interruptions. Shiftworkers should seek to gain their family’s and friends’ understanding of their rest needs. Set aside specific times of the day for family, friends and leisure activities.
- Work during the daylight hours is preferred.
- Evening shifts are preferred to night shifts.
- If shifts are necessary, two opposing rules apply: (1) either work only one evening or night shift per cycle, then return to day work, and keep weekends free, or (2) stay permanently on the same shift (whichever it is).
- A shift duration of eight hours of daily work is usually adequate, but shorter times for highly (mentally or physically) demanding jobs may be advantageous; and longer times (such as 9, 10, or even 12 hours) may be acceptable for some types of routine work.
- Avoid quick shift changes
- Schedule heavy, demanding, or dangerous work at times when workers are at peak performance and most alert (i.e., not in the middle of the night or at the end of a long 12-hour shift).
- Compressed workweeks often are acceptable for routine jobs, for example, four days of 10 hours each.
- Follow general recommendations for establishing effective rest break practices when establishing alternate work schedules. (refer to “Rest Breaks and Cumulative Trauma Disorders,” *The Hartford Technical Information Paper*, S860.300).

Summary

Many factors affect shiftwork: health and well-being, performance and safety, psychological and social aspects. All interact with each other. Conclusions for selecting a suitable work regimen depend on the given conditions.

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