

## The Optimal Work Schedule

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### Shift Length

- Traditional (8 hours) compared to extended (10 or 12 hours) or overtime
- Preferred by 74% of workers
  - more days and weekends off
  - more total sleep
  - maximize leisure time
  - minimize travel to/from work
- Consequences of extended shift length include:
  - Increased fatigue
  - Decreased performance
  - Increased risk of accident
    - 13% increase for 10-hour shift
    - 27.5% increase for 12-hour shift
  - Increased toxic exposure
- Shift length guidelines include:
  - 8-hour shift length: recommend 5-day work weeks and limit to 10 consecutive days
  - 12-hour shift length: recommend 3-4 day work weeks and limit to 7 consecutive days
  - Allow 36-48 hours between work sets

### Fixed Shift Work

- Fixed shift work is defined as permanent unusual times of the day (i.e., afternoon/evening or night shift)
- Preferred by 90% of workers
  - Easier to schedule family events, appointments, daycare, etc.
  - Participate in educational training
  - Keep a second job
- Health consequences of fixed shift work (night shift) include:
  - Higher incidence of gastrointestinal disease
  - Risk of cardiovascular heart disease is 40% higher for unusual shifts compared to day shift
  - Risk of reproduction complications
- Performance consequences of fixed shift work include:
  - Decreased performance efficiency (i.e., speed and accuracy) between 10pm and 6am
  - Lowest performance efficiency at 3am
- Accident risk consequences of fixed shift work include:
  - Highest on night shift
  - Night shift accidents had great severity
  - Risk highest rates at start of night shift
  - Risk increases for each consecutive day
    - Night shift - 36% on 4th consecutive shift
    - Day or afternoon/evening shift - 17% on 4th consecutive shift

## Rotational Shift Work

- Rotational shift work is defined as shifts that rotate or change according to a schedule
- Preferred by 10% of workers, as it disrupts family/personal life
- Health consequences of rotational shift work include:
  - Sleep deprivation (i.e., quality and quantity) due to disturbed circadian rhythms (which is associated with decreases in worker performance – productivity, safety, and health).
  - Widespread complaints of chronic fatigue
  - Higher incidence of gastrointestinal disease
  - Unhealthy nutritional habits
  - Increased relative risk of cardiovascular heart disease
  - Increased levels of depression symptoms, especially in female employees.
- Rotational shift work guidelines include:
  - 8-hour shifts are preferred to 12-hours shifts
  - Design for forward rotating schedules (e.g. mornings to evenings to nights) rather than backward rotating schedules (e.g. evenings to mornings to nights)
  - Design for short cycle rotations (e.g. every 2 to 3 days)
  - Avoid shift start times that are too early in the morning (e.g. 6am) as it reduces sleep duration
  - Maximize the time off between blocks of consecutive shifts
  - Limit the number consecutive work days to 5 to 7
  - Provide 2 to 4 full days off between work sets
  - Provide a minimum of 11 consecutive hours for rest between shifts
  - Restrict consecutive night shifts to 4 or less
  - Consider travel time, especially for 12-hour shifts, as recovery time is decreased.
  - Provide rest days that fall on all or part of the weekend
  - Provide excellent lighting for all shifts
  - Provide rest or nap facilities
  - Provide 24-hour healthy food services
  - Provide recreational activities at all times of day
  - Consider child/elderly care support

## Job Rotation

- Job rotation is a technique that moves workers between two or more jobs in a planned manner
- Proper use for job rotation includes:
  - Temporary administrative control until engineering controls can be implemented
  - Supplemental approach to compliment engineering controls that reduce exposure to ergonomic risks
- Challenges to implementing job rotation include:
  - Union contracts limit rotation between jobs
  - Job pay scales to not allow rotation to dissimilar jobs
  - Employee resistance to rotate to "hard" jobs
  - Typically, rotation is based on proximity and similarity therefore, there is not a lot of diversity in terms of exposure
  - Need to cross train all employees
  - Productivity and quality challenges
  - Initial start-up and training time - estimated \$6,000/person per process

- Inappropriate use of job rotation include:
  - Permanent fix to address quantifiable ergonomic risk factors
- Proper job rotation process includes:
  - Identify problematic jobs or areas
  - Quantify risk for all jobs
  - Identify jobs in the rotation schedule
  - Determine best sequence
  - Determine ideal length of rotation
  - Verify effectiveness and make adjustments
  - Implement engineering solutions
- Job rotation principles include:
  - No more than two yellow processes
  - Red processes only once per shift
  - If one red process then only one yellow process
  - Move from lower body burden to upper body (never neck and shoulder red to red)
  - Better to switch hand dominance
  - No mirror process rotation
  - Consider different muscle groups
  - Change schedule based on changes to process

### Recommended Reading

- Knauth, P. (2006), "Workday Length and Shiftwork Issues,": in *The Occupational Ergonomics Handbook – Interventions, Controls, and Application in Occupational Ergonomics*, W.S. Marras and W. Karwowski, Eds., Taylor & Francis, New York, pp. 29.1 – 29.17.
  - Popkin, S.M., Howarth, H.D., and Tepas, D.I. (2006), "Ergonomics of Work Systems,": in *Handbook of Human Factors and Ergonomic*, G. Salvendy, Ed, John Wiley & Sons, New Jersey, pp. 761 – 800.
  - Spencer, M.B., Robertson, K.A., and Folkard, S. (2006). The Development of a Fatigue / Risk Index for Shiftworkers. Health & Safety Executive Research Report 446.
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