Shift Work

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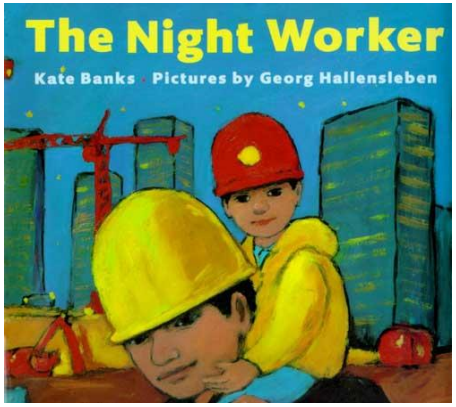
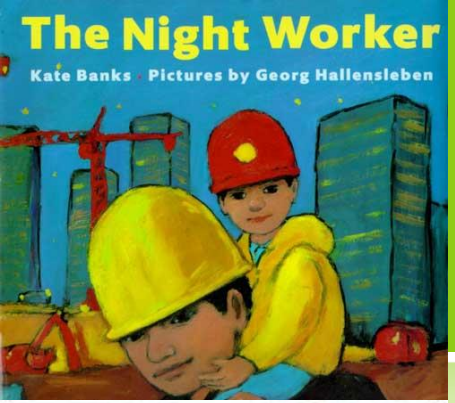
What is Shift Work?

- Regularly scheduled work outside of the normal daytime working hours of 7AM-6PM

Why do we need shift work?

- Critical services on 24 hour basis
  - Police, fire, military, healthcare, utilities, transportation,
  - A production process > 8 hours or continuous
  - Expensive machinery that must be used continuously to be profitable
  - Support services for other shift workers



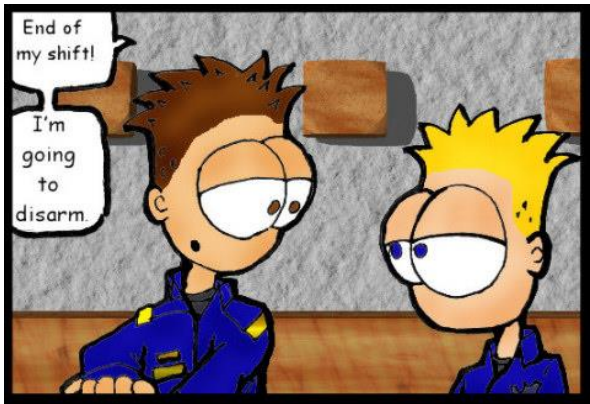


Who does shift work?

- Men do more night and rotating shifts
- Women do more evening and part time work
- Younger > Older workers
- African-American > Caucasian
- Single > Married
- Single Mothers > Married Mothers
- In 2 job married couples ¼ - 1/3 have at least one shift worker

SHIFT WORK

- The prevalence of shift work is difficult to determine.
- Estimates vary depending on the definition employed and the region studied.
- But U.S based estimates suggest that nearly 20% of employed adults are shift workers.



- 20 Million Americans do shift work ; 26% of men, 18% of women
- Drop out rate: 20% at year 1; 33% at 2 years
- Tolerance declines with age
  - Cumulative effects
  - Decreased physiological reserve > 40

Types of Shift-Work

- Permanent night shifts
- Afternoon or evening shifts
- Shifts beginning before 6AM

- Condensed work weeks with extra long weekends
- Variable or rotating shifts
  - Day to evening or day to night
  - May change weekly or monthly

Night-Shift Workers

Night-Shift Workers

- Night-shift workers with regular start times between 6 pm and 4 am make up an estimated 4.25% of the total U.S. workforce.
- Most permanent night workers never really get used to the schedule
- Many nights they feel tired and sleepy
- Fatigue because of return to day hours on days off
- Family and friends active during the day
- Errands and chores during the day
- Sleep less during the day

Early Morning-Shift Workers

- ICSD classifies early morning shifts as those starting between 4 am and 7 am.
- This is the most common alternate work
- Shift with at least 18.1 million U.S. workers (12.4% of the workforce) falling into this category.
- These workers are likely to be on the road at their nadir of circadian alertness and may also be particularly sleep deprived, owing to their early time of rising.
- Early morning-shift workers may have the highest risk of all workers for automotive accidents.

Evening/Afternoon-Shift Workers

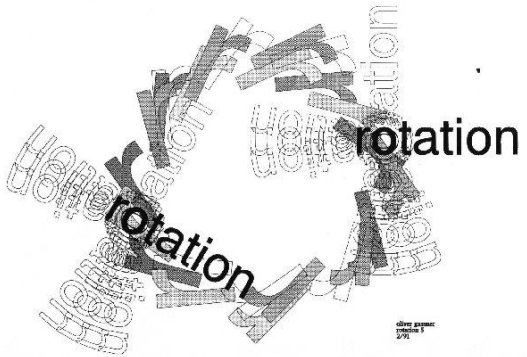
- Evening-shift workers with regular start times between 2 pm and 6 pm make up 4.3% of all U.S. workers and can be impaired in terms of social isolation and quality of life.
- The resulting tendency to delay internal rhythms combined with schedules that allow later morning wakeup times may account for the increased total sleep time of evening-shift workers.
- some evening-shift workers have shortened sleep times due to family obligations that require earlier wakeup times on days off that could result in significant impairment over time.

Rotating-Shift Workers

- The U.S. population is estimated to include 4 million rotating-shift workers (approximately 2.7% of the total workforce), but nearly all shift workers could be considered to have rotating schedules because most revert to a normal pattern of nocturnal sleep during days off.
- Rotating-shift workers remain sleepier than daytime workers.
- In a meta-analysis of sleep patterns, workers on rotating shifts had nearly as much sleep reduction as permanent night workers relative to day workers.

Speed and Direction of shift rotations

- Rapid shift rotations (multiple rotation within a week): are associated with reduced total sleep duration compared with slower rotations (e.g., at least 3 weeks per shift schedule).
- Both rapid clockwise and counterclockwise rotations negatively impact total sleep duration and increase circadian misalignment.



Medical significance of Biologic Rhythms

- Onset of symptoms varies with the time of day
  - Asthma
  - Angina
  - Cerebral infarction
  - Myocardial infarction
  - Epileptic seizures
  - Skin tests
  - Allergic response
  - Physiologic response to
    - Toxin
    - Drug
      - Theophilin,insulin,penicillin,prednisone,lidocaine,digitalis…

Exacerbation by shift work

- Sleep disorders
- Asthma
- Diabetes mellitus
- Coronary artery disease
- Psychiatric disorders (depression & Bipolar disorders)
- Epilepsy
- GI disorders
- Long-term Drug Therapy, polypharmacy

Health Hazards

- Gastrointestinal Problems
- Cardiovascular problems
- Sleep and stress related disorders
- Drug and Alcohol use
- Risks from prolonged exposure to chemical and biological substances and other hazards
- Effects on pregnancy

Digestive

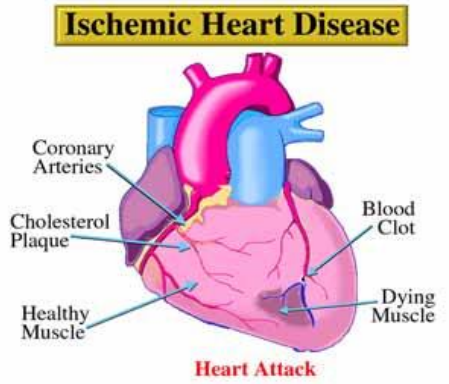
- Increased incidence of ulcers.
- Often eat at night when digestion and other body functions are slowed down
- May eat less nutritious foods at night (snack foods)
- Drink more caffeine products at night

GI Upsets

- 75% of night workers vs. 20% of day workers
- Complaints
  - Loss of appetite
  - Constipation
  - Dyspepsia
  - Heart burn
  - Abdominal pain
- Many problems may not show up until years later
- Reasons
  - Poor food quality
  - More caffeine
  - More alcohol
  - More tobacco

Cardiovascular problems

- Increased incidence of ischemic disease
- Elevated triglyceride levels in phase advance workers
- May be related to disturbance of circadian blood pressure and pulse rhythms
- Substance abuse more likely in shift workers



Hypertension

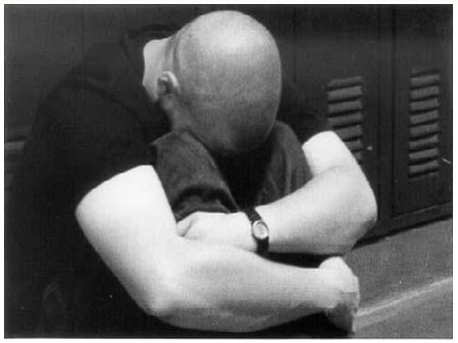
- Shift workers were found to have approximately 25% greater chance of developing significant hypertension than non shift workers

Cognitive Ability

- Recent studies have found deterioration in cognitive ability in shift workers vs. non shift workers.
- This increases with duration of exposure
- The effect seems to diminish 4 years after discontinuation

Psychological

- Shift workers demonstrate:
  - More depression and despondency
  - More likely to use psychotropic drugs or require hospitalization
  - Will have magnification of underlying depression or bipolar disorders
  - Circadian rhythm disturbance may be a cause for depression



Social Risks

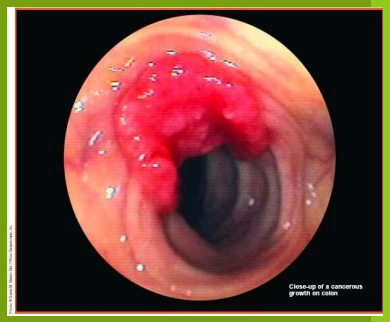
- Number 1 problem: missing family and friends
- Would rather loose sleep than miss social opportunities
- Some activities are flexible (ie: gardening, woodworking, fixing cars)
- Some are not (clubs, team sports, childcare, school activities)

Social Impact

- Increases
  - Divorce
  - Family violence
  - Social Isolation
  - Sexual dysfunction
  - May affect women more than men

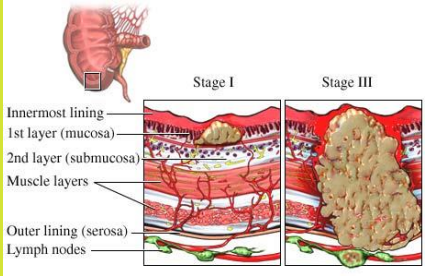
Circadian rhythm related issues

- Peak bronchial reactivity between 4-7 AM
  - Asthma may be worse in workers exposed to irritants
- Shift work increases glucose levels in insulin dependent diabetics.
  - One study shows a 35% increased risk for developing diabetes
- Sleep deprivation lowers seizure threshold
- Increases frequency of migraines
- The absorption, excretion, metabol effect of medications is affected by rhythms



Colorectal Cancer

- data suggest that working a rotating night shift at least three nights per month for 15 or more years may increase the risk of colorectal cancer in women 35%
- Shorter durations also have increased risk
- This may be due to the suppression of melatonin production with nocturnal light exposure. Melatonin has anti-cancer properties



Breast Cancer

- Attributed to inhibition of melatonin production by light exposure during the night

Shift Work Sleep Disorder

- Circadian Rhythm disruption
- Insomnia
- Disrupted sleep schedules
- Reduced performance
- Difficulties with personal relationships
- Irritability/depressed mood
- Sleep apnea 11.6% vs 5% in general population

Increased accidents

- To and from work
- Microsleeps
  - Alert to suddenly severe fatigue
  - Worse with monotonous tasks
- Decreased vigilance/concentration
- Lower performance
- Higher error rates

Making an Impact

Strategies to WAKE UP

Administrative Controls

1. Limit shift work to essential jobs
2. Schedule toughest most dangerous tasks for early in the shift. Less demanding tasks for later in the shift
3. Avoid scheduling demanding or dangerous tasks at the beginning of an early morning shift

1. Tailor supervision:
    1. Extra supervision between 3:30 AM and 5:30 AM
    2. Younger workers have more accidents at the start of a shift following weekends
    3. Older workers have more accidents at the end of a shift.
2. Supervise inexperienced workers more closely until they learn their job

- Encourage good eating habits at night. Encourage light meals that are nutritious and easy to digest
- Allow adequate meal and rest breaks
- Have good emergency plans in place for odd shifts (nighttime emergency responders may be fewer than day)

Permanent afternoon, evening or Night shift

- Pro: More time to adjust
- Con:
  - Disruptive to social life
  - Permanent night workers may accumulate a greater sleep deficiency over time

Odd Shift Out

- Compressed workweek:
  - 3-4 days of 10-12 hour shifts
- Pros:
  - More time off and between work schedules
  - More opportunities for family and social activities

- Cons:
  - Increased fatigue
  - Decreased performance by the end of the shift
  - Daily exposure to chemical, biological and physical hazards my be increased
  - Some families may have trouble arranging childcare or eldercare

Rotating or Variable shifts

- Length of rotation:
  - Workers rotated to a new shift schedule too rapidly or without sufficient break may have trouble functioning

- Speed of rotation
  - Longer rotations of 10-14 days may allow more time to adjust.
    - Circadian rhythm may require 3 weeks to fully adjust to a new shift
    - Faster rotations of 2-3 days do not allow for circadian rhythm adjustment
    - Mental functions adjust more rapidly
    - More trouble with the first 4 shifts
    - Faster rotation allows workers to get through the more difficult night shift rotation quicker

- Direction of the rotation
  - Clockwise rotation from morning to afternoon to night causes fewer problems than the reverse order

Engineering controls

- Reduce night traffic, noise and distractions
- Be aware of hazards. Calculate toxic exposures based upon shift duration (i.e.: 8H TWA vs. 12 hour shift)
- Promote alertness:
  - Keep area brightly lit
  - Reduce glare and reflective surfaces
  - If feasible, allow workers to play music that will keep them awake

- Maximizes safety and health controls
  - Good ventilation
  - Temperature control
  - Machine guarding
- Avoid isolating workers
- Provide food preparation areas, rest areas, consider and exercise facility

Provide worker education and instruction

- Talk about health and safety difficulties
- Emphasize performance and accident risks
- Teach employees to recognize social and family problems

The crew and support team members in classroom training.

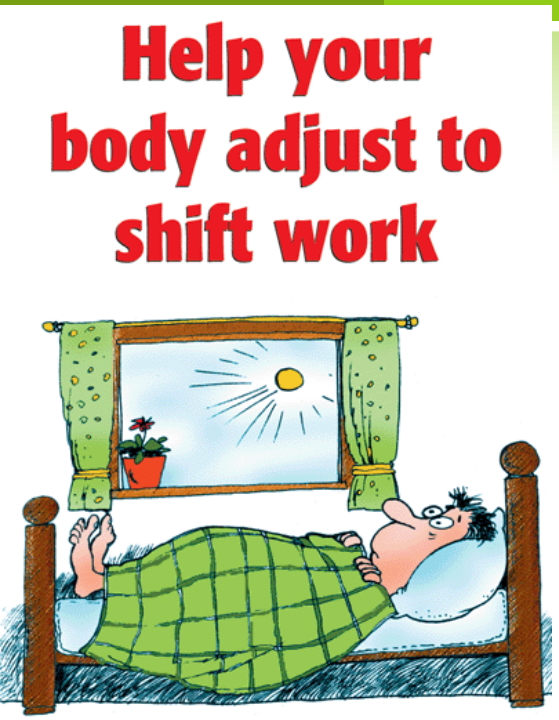
They should know….

- Protecting their sleep periods
  - Maintaining regular rest and wake routines
  - Avoid exercising for 2 hours before going to bed
  - Keep light out the bedroom
  - Disconnect the phone
  - Maintain a quiet sleep area

- Eat nutritious meals
- Keep a regular eating routine
- Select foods high in carbohydrate rather than heavy fatty high protein meals before sleep

- Family and friends should be made aware of the potential harmful consequences of shift work
- Adjust family and social life to maximize interaction
- Maintain physical fitness
- Learn strategies to remain awake

Sleep (Not now!)



- Night workers get the least sleep (6.6 hours)
- Evening workers get the most sleep (7.1 hours)
- Day workers get medium amounts (6.7 hours)
- Rotating workers sleep the least of all.

- Sleep during the day is usually 2-3 hours shorter
- It is lighter sleep and more easily disturbed by noise
- There are more activities and noise during the day