Sleep Deprivation and Shiftwork

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AND HOW’S MY LITTLE SANDY? DID YOU MISS YOUR DADDY WHEN I WAS WORKING ALL THAT OVERTIME?

I’M SANDY
TOPICS

Consequences of longer work hours
• Sleep deprivation and health
• Workplace exposures and illness
• Mental awareness, response time, decision-making; accidents, work quality
• Social consequences; work/life balance

What can be done to minimize the consequences?
• By the employer?
• By the worker?
EXERCISE

- Are you a lark or an owl? Are you a morning person or a night person? Or in-between?
- What are the principal 2 stressors which you experience because of shift work or long hours of work?
- What work/family balance problems do you experience because of shift work or long hours of work?
- What self-care do you do which you find helps to minimize the stress of shift work or long hours of work?
Working long hours

Shift workers work about 400 hours more per year than Monday-Friday workers.
Consequences of Long Hours of Work

Sleep Deprivation and Health
Body rhythms are motivated by...

- internal cues
- external cues

...which are synchronized to achieve a balance within the body.

A well-balanced, synchronized human will...

...sleep at night and

...be active during the day
Circadian Rhythm

Internal rhythms will also be in balance so that …

…body temperature and …hormonal levels

rise and fall at appropriate times throughout the 24-hour cycle, in sync with the external cues.
Alertness
Temperature (°F)
Growth Hormone (nanograms/ml)
Cortisol (micrograms/100 ml)
Potassium (milli equivalent/hr)

Circadian Rhythm

When out of balance, there is a confusion of signals to the part of the brain that triggers circadian responses.

When work hours keep people in a constant state of imbalance, it is impossible for the rhythms to get resynchronized for the numerous body functions involved.
Example of Circadian Rhythm

Body temperature drops to its lowest point around 4 AM, then rises slowly again at about 6 AM...

...this affects performance, activity, and alertness as they reach a low point from 4 – 6 AM and

...is the most difficult time to stay awake and alert.
"Now that we're all upright and awake again I'll continue my report."

Copyright, USA Today.
Once disrupted, the body tries to adapt by re-synchronizing all the affected functions.

But, different systems take different amounts of time to reach the new rhythm – the longest is about 3 weeks for liver function and bone repair to catch up with the rest of the body.

If the cycle is disrupted again within the 3-week period, the body needs to adjust again.
What’s wrong with not feeling good?

Working long hours can be stressful and lonely.
How Your Body Responds to Stress

Today, we are living in the bodies of our ancestors but in a very different world from theirs.

Yet we inherited the adaptive responses that enabled them to survive........

How Your Body Responds to Stress

...long-term problems such as weather extremes, food deprivation, and environmental catastrophes
Long-term stress and cortisol

- Suppression of the sex hormones
- Increased gastric acid
- Depression of the immune system
- Irritability and hyper-alertness (depletes serotonin in the brain needed for regulation of mood and sleep cycles)

Long-term stress and cortisol

- Fat storage
- Salt retention
- Elevated blood pressure

- Loss of essential minerals
- Erratic heart rhythms
- Increased fats and cholesterol in the bloodstream

Repeated stress from desynchronization of circadian system produces significantly higher salivary cortisol levels.
Chronic stress has been shown to decrease the rate of new nerve cell production in the hippocampus, causing this part of the brain to shrink in size – one cause of depression.

This can produce difficulty learning and remembering, even in people going about their daily routine.

We may try to make our brain feel good…

• cigarettes
• caffeine (coffee, tea, soft drinks)
• alcohol or drugs (including sleeping pills, laxatives, pain killers, cough medicine, and tranquilizers)
• food, even abuse of food (chronic stress can cause cravings for the very foods which “feed” the stress)

... by overdoing things.
That which doesn't kill you makes you stronger.

A few chocolate chip cookies wouldn't kill me.

Suddenly I feel strong enough to finish the whole box.
Extremes are a problem

People who obtain too little sleep are at increased risk of…

- Cardiovascular problems, also risk factors such as obesity
- Reduced plasma antioxidant capacity
- Infections
- Digestive problems
- Fertility problems
- Diabetes, disturbed glucose regulation, altered metabolic response (meals at nonstandard times)
- Cancer

Extremes are a problem

People who find they need extra sleep (more than normal) may be experiencing…

- sleep apnea
- early symptoms of cardiovascular problems, or
- other health conditions

“NOT ENOUGH HOURS IN A DAY...”  “JUST WEREN'T ENOUGH HOURS IN A DAY...”  “NOT ENOUGH HOURS IN...”  SHEESH! I KNOW WHAT I'LL DO DIFFERENTLY NEXT TIME...
A Sleep Debt is Never Paid Up

If you need 8 hours and obtain 6 hours, sleep is deprived by 2 hours.
Over 4 nights, your sleep debt = 8 hours.

Usually, recuperation involves…
…deeper sleep over 1 to 2 nights
…sometimes one sleeps longer -- but, the longer sleep is much less than the actual amount of lost hours of sleep.
The architecture of a night’s sleep (eight hours).

REM SLEEP IS NEEDED FOR PEAK PERFORMANCE

Lack of sleep or poor-quality sleep interferes with the ability to learn and remember, reducing our coping skills for stress.
Exercise

How might sleeping during the day be different from sleeping at night?
EEG sleep changes in a single subject sleeping either in the day-time or at night and with or without noise in the sleeping room. Brief awakenings indicated by upward spikes.

Clinical depression -- retired shift workers greater than in retired day workers

Effective treatments can include:
- light therapy
- lithium or other antidepressants, which are known to influence the circadian period of specific rhythms.
Alertness and Cognitive Performance

These declined with increasing numbers of years working shifts, up to 20 years.
- Memory and memory retrieval
- Processing speed
- Selective attention

This was independent of age.

These abilities appeared to return to normal 4 years after moving from shiftwork to normal worktimes – suggesting reversibility.

Two studies suggest that the mechanism may be exposure to light at night which suppresses the normal nocturnal production of melatonin by the pineal gland.

...decreased melatonin may increase the release of estrogen and/or

...melatonin would have inhibited tumor growth by blocking uptake of linoleic acid

Breast cancer

Fluorescent and halogen lights (at blue end of spectrum) are most disruptive to melatonin production.

While a 36% increase in risk may be a small relative increase (compared to obesity at 50% or family history at 100%), it does suggest the need for women who work night shifts to be particularly prudent in following breast cancer screening recommendations.

One of the studies was based on the medical and work histories of more than 78,000 nurses from 1988 - 1998. (This study indicated increased risk of colorectal cancer in women, as well.)

Consequences of Long Hours of Work

Workplace overexposures Errors and Accidents
Sleepy shift workers are 40 times more likely than day workers to be involved in accidents.
Falling asleep while working; microsleeps

When deprived of sleep the human brain can shift spontaneously and in an uncontrolled fashion from wakefulness to sleep to meet its need. The sleepier the person, the more rapidly and frequently this occurs.

Spontaneous sleep episodes can be microsleeps that last only seconds or extended lasting for minutes.

These can occur while a person is standing or operating machinery.
Sleep deprivation can reduce...

- concentration
- memory
- handling of complex tasks
- logical thinking
- critical thinking
- perceptual skills

- decision-making skills
- vocabulary and communication skills
- creativity
- motor skills and coordination
- assimilation and analysis of new information
Number of errors, by time of day, on a laboratory measure of performance (grammatical reasoning task) for workers on 8-hour and 12-hour shift schedules. Significant performance decrements occurred on the 12-hour shift.

The distribution, by time of day, of 6,052 vehicular accidents that were judged by investigators to be fatigue-related.

Effects of longer work hours

- Longer than an 8-hour day with its typical rest and meal breaks could impair task performance.
- A 12-hour/4-day week may be more detrimental to performance and produce more self-reports of drowsiness and fatigue than does an 8-hr/6-day week.
- Increased errors in moving from an 8-hr to a 12-hr shift; consider avoiding tasks requiring error-free activity toward the end of a 12-hr shift.
Sleep-deprived or drunk – what’s the difference?

Psychomotor performance:

24 hours w/o sleep = blood alcohol level of 0.10%

Security Issues

For employees coming and going at night, the security of buildings, entrances, and parking areas should be considered.
Consequences of Long Hours of Work

Personal and Social Consequences
Work/Life Balance
Perceptions and feelings of shiftworkers’ partners

Disruption variables

- Adapt life to husband’s rota
- High conflict with partner
- Intimate relationship suffers
- General disruption to relations
- Joint social life suffers
- Personal social life suffers
- Poor contact with children
- Child contact level detrimental
- Special events must adapt


Figure 1. Personal disruption.
Aspects of Life Altered

- Alone during the night-time
- Alone during the evenings
- Alone during the daytime
- Greater child care
- Meals made/eaten at odd times
- Noise levels down after nights

Percentage of sample

- Incidence of alteration
- Concern caused by alteration


Figure 2. Aspects of partners' lives altered to accommodate husband's work schedule.
Family issues

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.

Spouse may begin to feel ignored and disliked. 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.
Family issues

Shift workers tend to form close bonds and friendships among themselves as a way to lessen the pain of isolation.

Higher rate of divorce: fathers married less than 5 years working nights were 6x more likely than their daytime counterparts to separate or divorce.

Mothers married more than 5 years and working nights were 3x more likely to separate or divorce.
What can be done to minimize the consequences...

...by the Employer?
Is There An “Ability” To Tolerate Shift Work?

- About 20% of shift workers will never adapt to shift work.
- Questionnaires on health during shift work do not appear to be sensitive or specific enough to select applicants or employees for shift work.
- Inability to tolerate shiftwork increases with age, even for permanent night staff; typically begins about 40 – 45 years of age.
Is There An “Ability” To Tolerate Shift Work?

- About 10 – 20% of the population are “morning types” (“larks”) and “evening types” (owls).
- Morning types have a small swing between their temperature maximum and minimum and seem to have more trouble adjusting to shift work than those with a relatively large swing, the evening types.
I quit drinking coffee. I don't like to be dependent on chemicals.

How's it feel?

I felt a little slow getting ready for work, but you have to expect that on a Monday.

It's Thursday.
Workplace Interventions

- Regular, predictable work schedules
- Held over after the shift? Or called in before the shift?
- Enforce maximum allowable work hours
- Forward shift rotations only

These help with work/family balance, as well.
Workplace Interventions

Make the workplace more “family-friendly” by increasing workplace flexibility, so that family members have more autonomy in meeting family needs such as child care.

Sometimes, family members may work nonstandard schedules deliberately in order to deal with family issues.

Creative approaches to rostering workers may help with retention of employees.
Due to the increased errors in moving from an 8-hr to a 12-hr shift...

...consider avoiding tasks requiring error-free activity toward the end of a 12-hr shift.
Workplace Interventions

It helps to know what to expect and how the body may respond.

Training and education on:
- circadian rhythms
- symptoms of fatigue
- workhours/shift work issues
- coping and countermeasures
Workplace Interventions

**Rest Breaks** – both for physical fatigue and mental alertness

For physiologically-demanding work, recovery from muscular fatigue is the major requirement.
For less physically-demanding work, the restorative effect of rest pauses declines throughout the work period.

For jobs involving vigilance, a break of 5 – 10 minutes every ½ to 1 hour may be needed.
Workplace Interventions

During evening and night work shifts, use full daylight-spectrum bright light to promote the resetting of the body’s sleep and wake cycles.

Avoid fluorescent and halogen lights at the blue end of the spectrum as these are most disruptive to melatonin production and have greater breast cancer risk.
Workplace Interventions

Have Human Resources, Personnel, Benefits, and other services available for those working unusual hours, to avoid disrupting their sleeping routine.
Workplace Interventions

Make healthy food choices available.

Have adequate liquids available to deal with heat stress and cold stress.
Workplace Interventions

Promote physical exercise by:
- having facilities available
- offering discounts to gym, pool, or exercise programs
What can be done to minimize the consequences...

...by the Employee?
Improving Sleep

Maintain a regular sleep schedule for the duration of the week, including days off. Keep a regular meal schedule, as well.

Tell your family why these are necessary and ask them to respect the necessity.
Invite family members to employer training on work hours and related issues.
Improving Sleep

- Take a nap 2 hours prior to your shift to help make up for sleep loss
- Try to prepare for your sleep schedule on your days off before the shift changes
Improving Sleep

- Eat a meal or snack at the same time each day for the duration of the work shift to establish some regularity for your body’s internal clock.
- Avoid caffeine during the last half hour of your shift because it can take so long to leave the body that your ability to fall asleep and remain asleep can be affected. Nicotine effects are similar to caffeine (either tobacco smoking or patch) and should be avoided within several hours before desired onset of sleep.
Improving Sleep

- On your morning drive home after working all night, try wearing dark glasses so the daylight will not reset your biological clock and delay your sleep cycle
- Avoid alcohol if you must sleep during the day
- Try to relax, unwind, and go through a regular bedtime routine before sleeping
Improving Sleep

- Ensure adequate screening from noise and interruptions by keeping your room quiet and insisting that family and friends respect your sleep hours. Tune a radio between two stations to use background “white” noise. Use earplugs unless you need to be on call or wake up for duty.
- Keep your bedroom cool and pitch-dark. Use eye shades if necessary.
Improving Sleep

- Warm bath or shower: increasing body temperature 1.5 – 2.5 C shortens time to fall asleep and promotes non-REM deep recuperative sleep
- Warm feet induces rapid onset of sleep

(Melatonin manipulates body temperature pharmacologically; may be one mechanism of sleep induction.)

Improving Sleep

- Schedule doctor and dentist appointments that work for your schedule
Relaxation techniques

- Meditation
- Yoga
- Progressive muscle relaxation
Diet

Eating and drinking habits which are conducive to sound sleep hygiene appear to have a solid research base:

- Avoid caffeine near sleep time; caffeine is also a diuretic which could interrupt sleep
- Light to moderate amounts of protein help sustain arousal; high carbohydrate foods may produce drowsiness
- If hungry or thirsty at bedtime, a light snack or small drink is preferable
Diet

- Avoid greasy foods that cause indigestion and disturb sleep
- Alcohol can promote relaxation and help a person fall asleep, but produces easily disrupted, lighter sleep. It suppresses REM sleep in first half of the night leading to REM rebound and withdrawal effects in the second half; awakenings from intense dreaming activity with sweating and headaches are not uncommon.
Physical Activity and Conditioning

Improved physical condition can either increase tolerance of shift work or increase the rate of adjustment to shift work.

Physically fit people also have a larger amplitude circadian rhythm.

Physical training appears to increase strength and produces more positive subjective reports; including nocturnal decrease in subjective fatigue.
Chronobiotics

Drugs to adjust the timing of internal biological rhythms

- Melatonin and agonists
- Vitamin B_{12}
- Benzodiazepines and related substances (sleeping pills) -- strong addictive risk; useful for insomnia not shiftwork or jet lag – impair cognitive performance.
- Hypnotics
- Slow-release caffeine

*Drugs cannot instantaneously reset the biological clock.*

"If it's all the same to you, chief, I'd like to work from home tomorrow."