SHIFT WORK SLEEP DISORDER

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WHO IS A SHIFT WORKER?

- Broad definition: worker who does not follow a standard daytime schedule (9-5)
- Bureau of Labor and Statistics (2004): approximately 15M Americans full time
- 50% of all young, dual-earner couples with young children include at least 1 spouse who works nonstandard hours
SHIFT WORK

• 1st shift workers: watchmen, military
• Modern day shiftwork: started in late 1800’s
• Accelerated by the industrial revolution: emphasis on nonstop production and 24 hr productivity
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<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
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<td>5,512</td>
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SHIFT WORK

- 1866: Unions pressured employers to limit workday hours to 8 hrs
- 1886: Riots in Haymarket Square, Chicago resulted in 8 deaths
- 1933: National Industrial Recovery Act gave provisions for minimum wages, maximum work hours and collective bargaining
- 1935: National Labor Relations Act (Wagner Act) dictates labor law for private employees up to this day
24/7 INDUSTRIES

- Aviation (flight crew and maintenance)
- Energy Sector (oil and gas, nuclear power plants, electric utilities)
- Manufacturing
- Mining
- Transportation (public transit, trains, ports, etc)
- Health Care
- Military, Law Enforcement
Shift workers by reason for working shift, usual full-time wage and salary workers, May 1997 (percent)

- Nature of the job: 51
- Mandated by employer: 13
- Other reasons: 13
- Better pay: 6
- Couldn't get any other job: 5
- Better child-care arrangements: 4
- Allows time for school: 3
- Better arrangements, care of family members: 3
- Not reported: 1
- Easier commute: 1

36.5
Percentage of currently employed adults who reported short sleep duration.

$411 billion
Estimated annual cost to the U.S. economy of short sleep duration among U.S. workers.

42.9
Percentage of communications equipment operators who reported short sleep duration, the highest percentage of all 93 occupation subgroups.

45.8
Percentage of firefighting and prevention workers who reported short sleep duration.

43.3
Percentage of nursing, psychiatric, and home health aides who reported short sleep duration, the highest percentage within the Healthcare Support major occupational group.

All statistics for short sleep duration apply to the 29 states that participated in the occupational portion of the BRFSS survey in either 2013 or 2014.
SHIFT WORK

• Fixed, partially fixed or rotating shifts
  • 1st shift: 8A-4P
  • 2nd shift: 4P-12MN
  • 3rd shift: 12 MN-8A

• Shift rotation may be rapid (3 days) or long (4 weeks), may proceed forward or backward

• Most common schedule: 5 days on a single shift, followed by 2 days off

• Compressed Work Week (CWW): work 40 hrs in less than 5 days
  • Reduces shift changes, allow for more days off
SLEEP WAKE CYCLE
SLEEP WAKE CYCLE

- Two process model of sleep/wake regulation
  - Intrinsic circadian rhythm
  - Homeostatic drive for sleep
    - For each hour of wakefulness, homeostatic drive for sleep increases
    - Sufficient homeostatic drive obtained typically after 14-16 hrs
BIOLOGICAL RHYTHMS

- Ultradian: recurrent cycle repeated throughout the day (<24 hrs): eating, drinking, excretion
- Circadian: 24 hr cycle
- Infradian: > 24 hrs: menstrual cycle
CIRCADIAN RHYTHM

• Aka the body clock
• Internal and external determinants
• Influences sleep/wake cycle, appetite, hormone levels, blood pressure, etc.
• Suprachiasmatic nucleus
MELATONIN

- N-acetyl-5-methoxy tryptamine
- Produced in the pineal gland
- Used as a marker of individual circadian rhythms (DLMO)
- Secretion affected by blue light
CIRCADIAN RHYTHM

• Intrinsic clock slightly longer than 24 hrs
• External cues (Zeitgebers): helps entrain us to a 24 hr schedule
  • LIGHT
  • Temperature
  • Social interaction/noise
  • Medication
  • Exercise
  • Food
NORMAL VARIANTS

• Night owl
• Morning lark
• Short sleeper: <6 hrs sleep/night
  • All have no sleep/wake complaints
• Long sleeper: >10 hrs sleep/night
SHIFT WORK SLEEP DISORDER (SWSD)
SHIFT WORK SLEEP DISORDER

- ICSD 3 criteria (all must be met):
  - Report of insomnia/excessive sleepiness, accompanied by a reduction of total sleep time, which is associated with a recurring work schedule that overlaps the usual time for sleep
  - Symptoms present and associated with work schedule for at least 3 months
  - Sleep log and actigraphy for at least 14 days (work and free days) demonstrate a disturbed sleep and wake pattern
  - Sleep/wake disturbance not better explained by another disorder, medication use, poor sleep hygiene or substance use disorder
Circadian Rhythm Discordance

SCN

Zeitgeber

Discordance

Unhappy Shift-worker
Night-shift worker

Fragmented daytime sleep (circadian disruption)

Wakefulness

Circadian drive for wakefulness

Shift workers required to be asleep

Shift workers required to be awake

Impaired wakefulness during work hours: circadian and homeostatic effects
DAYTIME WORKER
SHIFT WORK SLEEP DISORDER

- Affects approximately 10% of night and rotating shift workers
- State of perpetual jet lag, especially if you do rotating shifts
- Main issues:
  - Lack of nocturnal consolidated sleep, when sleep is most restorative
  - Impaired ability to sleep during the day due to circadian and social influences
  - Decreased total sleep time (1-4 hrs less than non-shift workers)
SHIFT WORK SLEEP DISORDER

• Risk factors:
  • Increasing age: peak in sleep disturbances at age 52, decreases after age 62
  • Female gender: women have decreased average total sleep time than men
  • Rotating shifts: more rapid shift rotations, backward shifts
  • Intrinsic tolerance
SHIFT WORK SLEEP DISORDER

• Symptoms
  • Excessive sleepiness at work
  • Insomnia
  • Fatigue
  • Impaired concentration/cognitive slowing
  • Headaches
  • Irritability/mood changes
SHIFT WORK SLEEP DISORDER

- May lead to:
  - Work-related issues
    - Absenteeism
    - Mistakes/injuries at work, poor job performance
    - Accidents due to drowsy driving
  - Health problems
    - Obesity (leptin/ghrelin)
    - Drug and alcohol dependency
    - Mental health issues (depression, anxiety)
    - Cardiovascular disease
    - Infections (colds, flu)
    - Dyslipidemia
PAYING THE PRICE FOR SLEEP

- Chernobyl: April 1986
  - Considered world’s worst nuclear disaster
  - Engineers involved were working >13 hrs straight
  - 31 deaths
PAYING THE PRICE FOR SLEEP

• Three Mile Island, PA: March 1979
  • Most serious nuclear incident in the US
  • Occurred bet 4-6 AM
  • Shift workers did not notice the plant lost coolant,
    leading to overheating of the reactor
PAYING THE PRICE FOR SLEEP

• The Challenger Explosion: January 1986
  • Managers involved had only slept 2 hrs before arriving to work at 1 AM that morning
PAYING THE PRICE FOR SLEEP

• Exxon Valdez Oil Spill: 1989
  • 258,000 barrels of crude oil spilled into Alaska
  • Third mate Gregory Cousins was sleeping at the helm, unable to turn boat
    back into the shipping lanes
  • He had only taken a ‘catnap’ in the 16 hrs prior
  • Entire crew had just put in a 22 hr shift loading barrels
    into the ship
TREATMENT OF SWSD
TREATMENT: MAKING DAY INTO NIGHT

- Non-pharmacologic: 1st line
- Pharmacologic: when conservative interventions fail
TREATMENT: NON-PHARMACOLOGIC

- Make sleep a priority: goal is to get adequate sleep (7-8 hrs)
- Engage your family: minimize daytime noise and disturbance, DO NOT DISTURB sign at front door for deliverymen
- Minimize your commute, takes time away from sleep
- Reduce light exposure after work (sunglasses, blue light filters)
- Blackout curtains, white noise machines, ear plugs
- Increase light exposure at work
TREATMENT: NON-PHARMACOLOGIC

- Plan a nap before or during night shift
- Avoid caffeine, alcohol and nicotine at least 6 hrs before bedtime
- Keep a regular sleep schedule, even on days off
- Try not to work more than 5 night shifts in a row. For 12 hr shifts, no more than 4 in a row
- Take at least 2 days off after a string of night shifts, if possible
- Avoid rotating shifts
TREATMENT: NON-PHARMACOLOGIC

• Rotating shift: ask for a clockwise rotation. It is easier to stay up late than go to bed early (easier to travel West than East)
• Plan ahead for a major change in shift schedule. Move your sleep time a few days in advance
• Minimize sedating medications during work shift and alerting medications during sleep time
• Moderate caffeine intake during work shift
## TREATMENT: NON-PHARMACOLOGIC

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Sleep Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evening Shift (5 p.m. — 1 a.m.)</td>
<td>3 a.m. — 11 a.m.</td>
</tr>
<tr>
<td>Night 1 of Transition</td>
<td>5 a.m. — 1 p.m.</td>
</tr>
<tr>
<td>Night 2 of Transition</td>
<td>7 a.m. — 3 p.m.</td>
</tr>
<tr>
<td>Night 3 of Transition</td>
<td>8 a.m. — 4 p.m.</td>
</tr>
<tr>
<td>Night Shift (11 p.m. — 7 a.m.)</td>
<td>9 a.m. — 5 p.m.</td>
</tr>
</tbody>
</table>
TREATMENT: PHARMACOLOGIC

• Stimulants
  • Modafinil/Provigil:
    • 100-200 mg QD, 1 hr before shift
    • SEs: headache, nausea, dry mouth, HTN, palpitations, dizziness, insomnia
  • Armodafinil/Nuvigil:
    • 150 mg QD, 1 hr before shift
    • SEs similar to modafinil
TREATMENT: PHARMACOLOGIC

- Melatonin
  - 1 to 10 mg; take 3-5 hrs before desired bedtime
  - SEs: headache, irritability, depression
TREATMENT: PHARMACOLOGIC

• Sedative-hypnotics
  • Only recommended for short term use
  • Risk of tolerance and dependence and adverse side effects
# Sedative-Hypnotic Drugs

## Benzodiazepines
- Alprazolam (Xanax®) ★
  - Oral
- Chlordiazepoxide (Librium®)
  - IM, IV, Oral
- Clonazepam (Klonopin®)
  - Oral
- Clorazepate (Tranxene®)
  - Oral
- Diazepam (Valium®) ★
  - IM, IV, Oral, Rectal
- Estazolam (Prosom®)
  - Oral
- Flurazepam (Dalmane®)
  - Oral
- Lorazepam (Ativan®) ★
  - Oral, IM, IV
- Midazolam (Versed®) ★
  - IM, IV, Oral
- Oxazepam (Serax®)
  - Oral
- Quazepam (Doral®)
  - Oral
- Temazepam (Restoril®)
  - Oral
- Triazolam (Halcion®) ★
  - Oral

## Barbiturates
- Amobarbital (Amytal®)
  - IV
- Butobarbital (Butisol®)
  - Oral
- Mephobarbital (Mebaral®)
  - Oral
- Pentobarbital (Nembutal®) ★
  - IM, IV, Oral
- Phenobarbital (Luminol®) ★
  - IM, IV, Oral
- Secobarbital (Seconal®)
  - Oral

## Selected Other Sedative-Hypnotics
- Buspirone (Buspar®) ★
  - Oral
- Chloral Hydrate (Somnote®)
  - Oral, Rectal
- Eszopiclone (Lunesta®) ★
  - Oral
- Ramelteon (Rozerem®) ★
  - Oral
- Zaleplon (Sonata®) ★
  - Oral
- Zolpidem (Ambien®) ★
  - Oral
TREATMENT: PHARMACOLOGIC

• Zolpidem: most prescribed sedative-hypnotic
  • GABA A agonist
  • Intermediate acting
  • SEs: sedation, sleepwalking, sleep eating, hallucinations

• Zaleplon: most short acting

• Eszopiclone: longest acting
  • SEs: headache, metallic taste
TREATMENT: PHARMACOLOGIC

• Benzodiazepines: GABA A agonist, low risk of abnormal nocturnal behaviors
  • Triazolam
  • Temazepam: lowest sedation in the elderly
  • Flurazepam
  • Diazepam
  • Lorazepam
  • Clonazepam: long acting
TREATMENT: PHARMACOLOGIC

• Off label:
  • Trazodone: antidepressant, risk of orthostatic hypotension esp in elderly, lower incidence of excess sedation
  • Gabapentin: leg swelling, dizziness, weight gain
  • TCADs (Amitriptyline and Nortriptyline): weight gain, xerostomia, depression, nightmares, QT prolongation
  • Mirtazapine: weight gain
  • Quetiapine: QT prolongation, dopamine blockade
QUESTIONS?

NOT SURE IF TOMORROW MEANS TODAY
OR TOMORROW