

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 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



Week	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Work Hrs.	Pay Hrs.
1	D	D	D	D	D	D	D	84	106
2	D	D	D	D	D	D	24	96	124
3	N	N	N	N	N	N	N	84	106
4	N	N	N	N	N	N	–	72	88
						Total		336	424
						Average		84	106
						Annual		4,168	5,512

SHIFT WORK

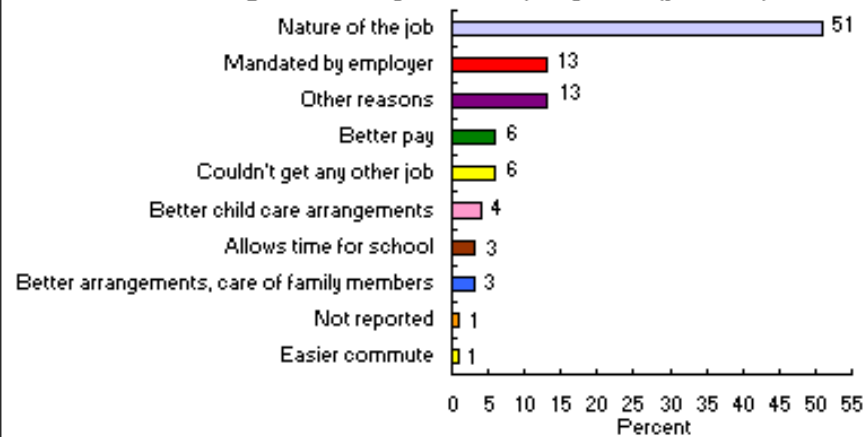
- 1866: Unions pressured employers to limit workday hours to 8 hrs
- 1886: Riots in Haymarket Square, Chicago resulted in 8 deaths
- 1933: National Industrial Recovery Act gave provisions for minimum wages, maximum work hours and collective bargaining
- 1935: National Labor Relations Act (Wagner Act) 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)



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.



Percentage of employed adults reporting short sleep duration who work in Production occupations (printing workers, plant and system operators, metal workers, woodworkers, apparel workers, and other similar occupations). This is the highest percentage of the 22 major occupation groups.



0 10 20 30 40 50 60

58.2

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

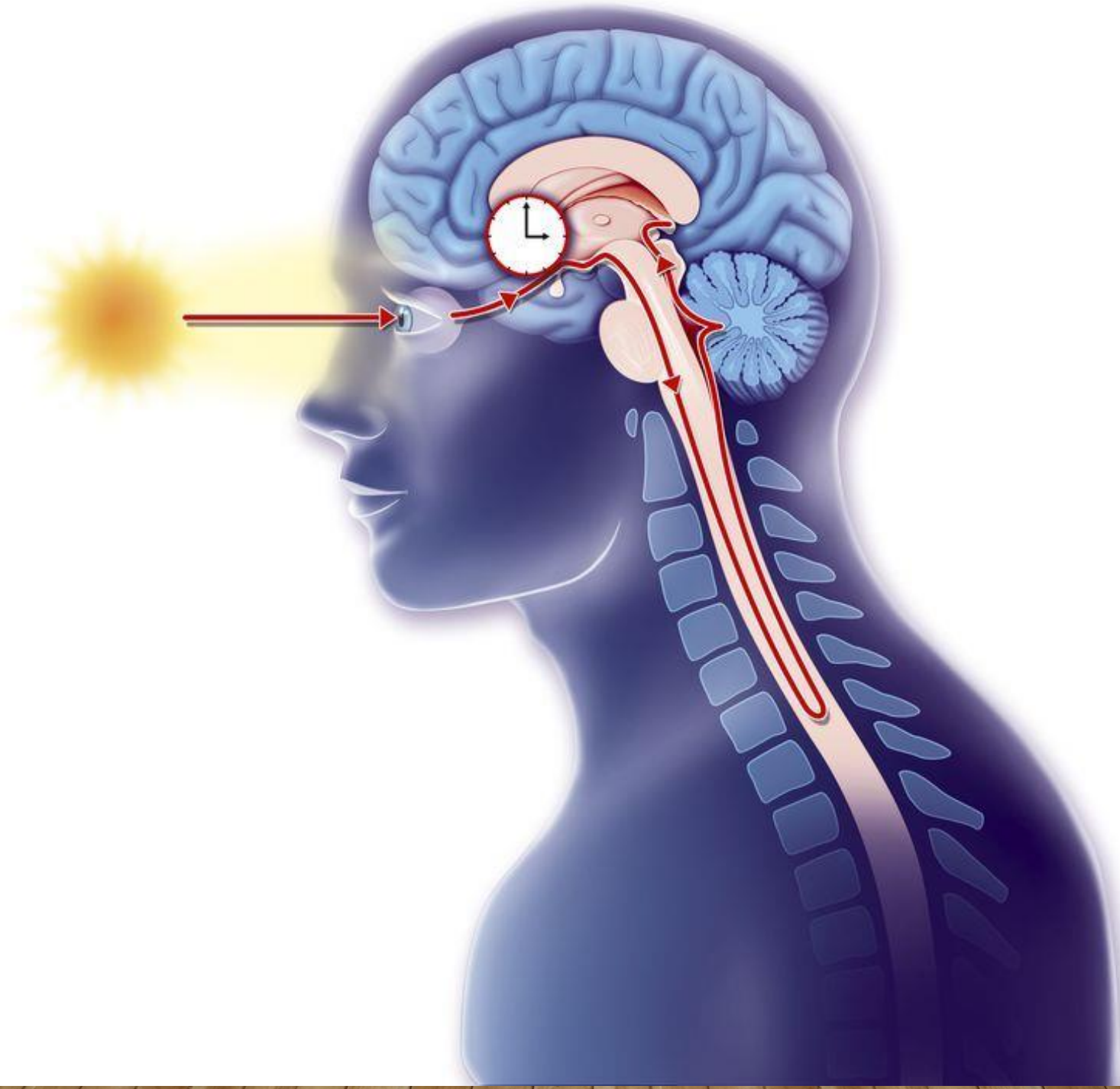
BIOLOGICAL RHYTHMS

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



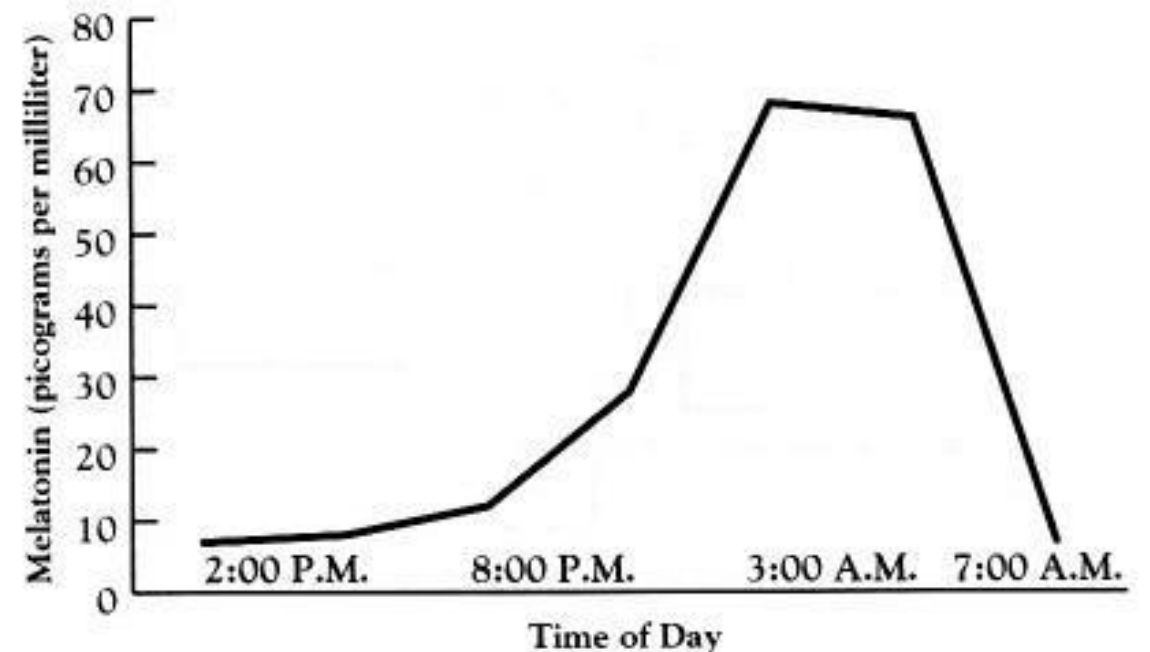
CIRCADIAN RHYTHM

- 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

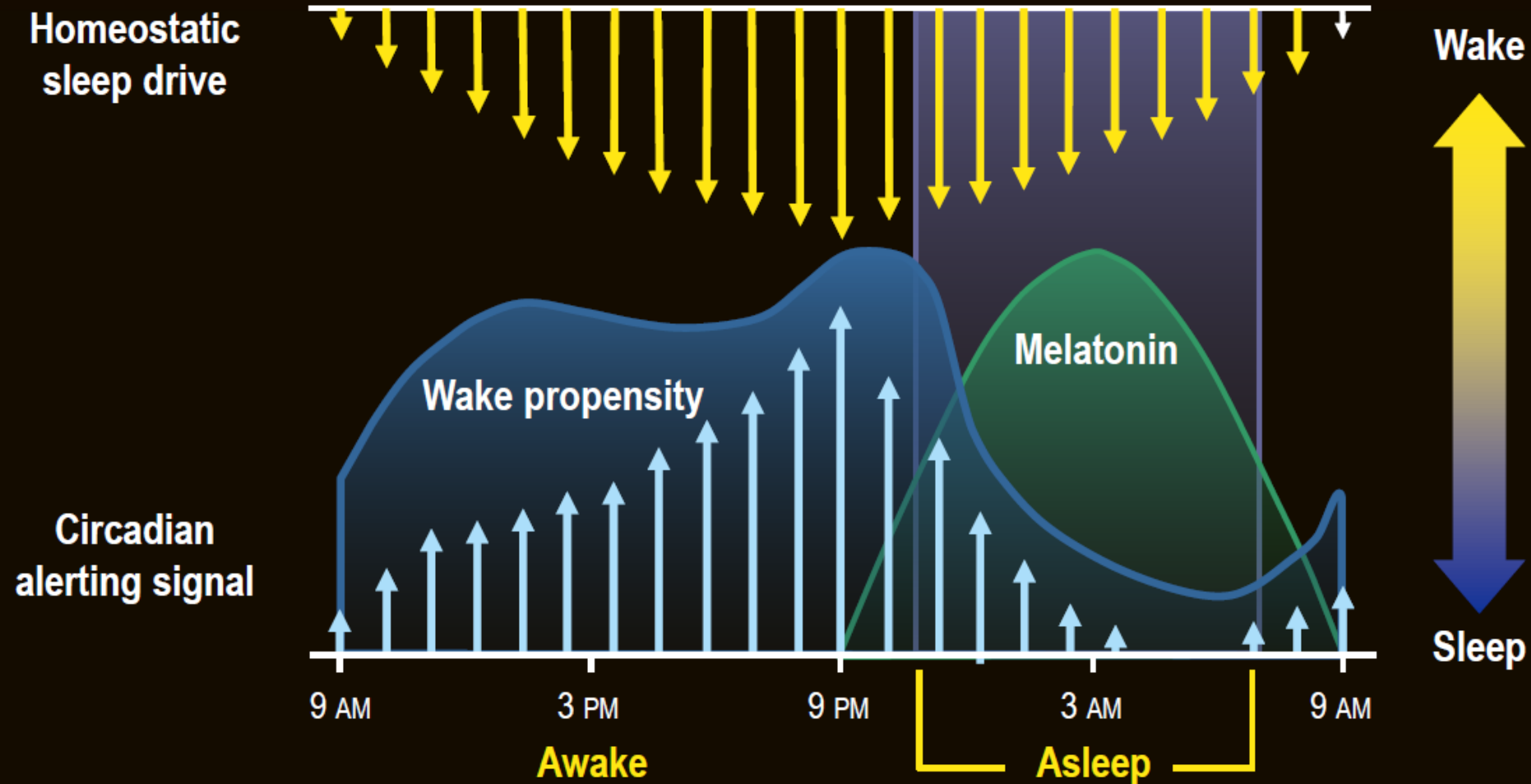


CIRCADIAN RHYTHM

- 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

Sleep/Wake Cycle

Circadian and Homeostatic Process

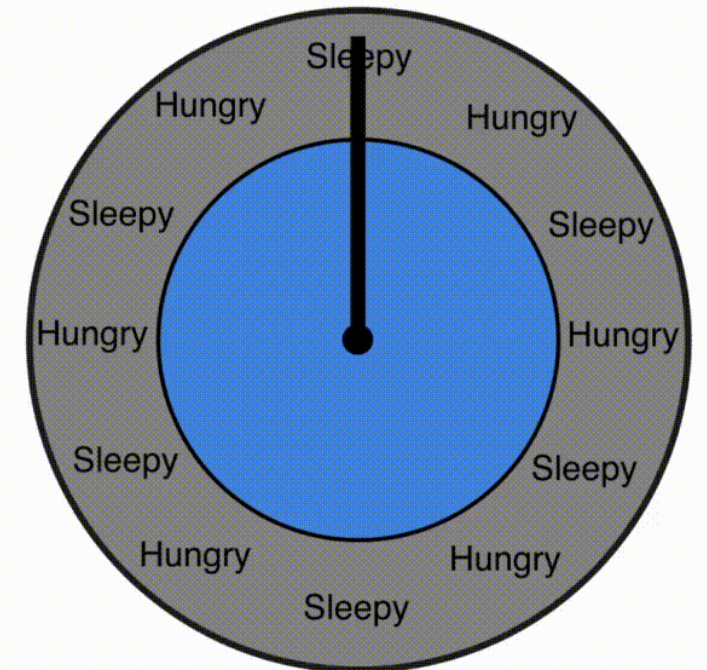


Dijk DJ, et al. *J Physiol.* 1997;505(Pt 3):851-858; Edgar DM, et al. *J Neurosci.* 1993;13(3):1065-1079;
Kilduff TS, Kushida CA. Circadian regulation of sleep. In: Chokroverty S, ed. *Sleep Disorders Medicine: Basic Science, Technical Considerations, and Clinical Aspects.* 2nd ed. Boston, Mass: Butterworth-Heinemann; 1999:135-145.

NORMAL VARIANTS

- Night owl
- Morning lark
- Short sleeper: <6 hrs sleep/night
- Long sleeper: >10 hrs sleep/night
 - All have no sleep/wake complaints

My body clock:



SHIFT WORK SLEEP DISORDER (SWSD)

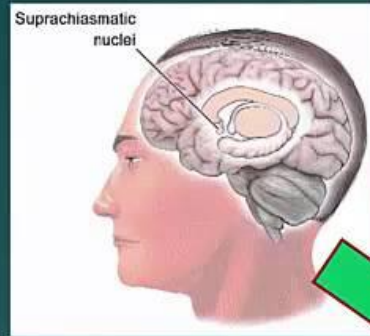


SHIFT WORK SLEEP DISORDER

- 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



+

Discordance

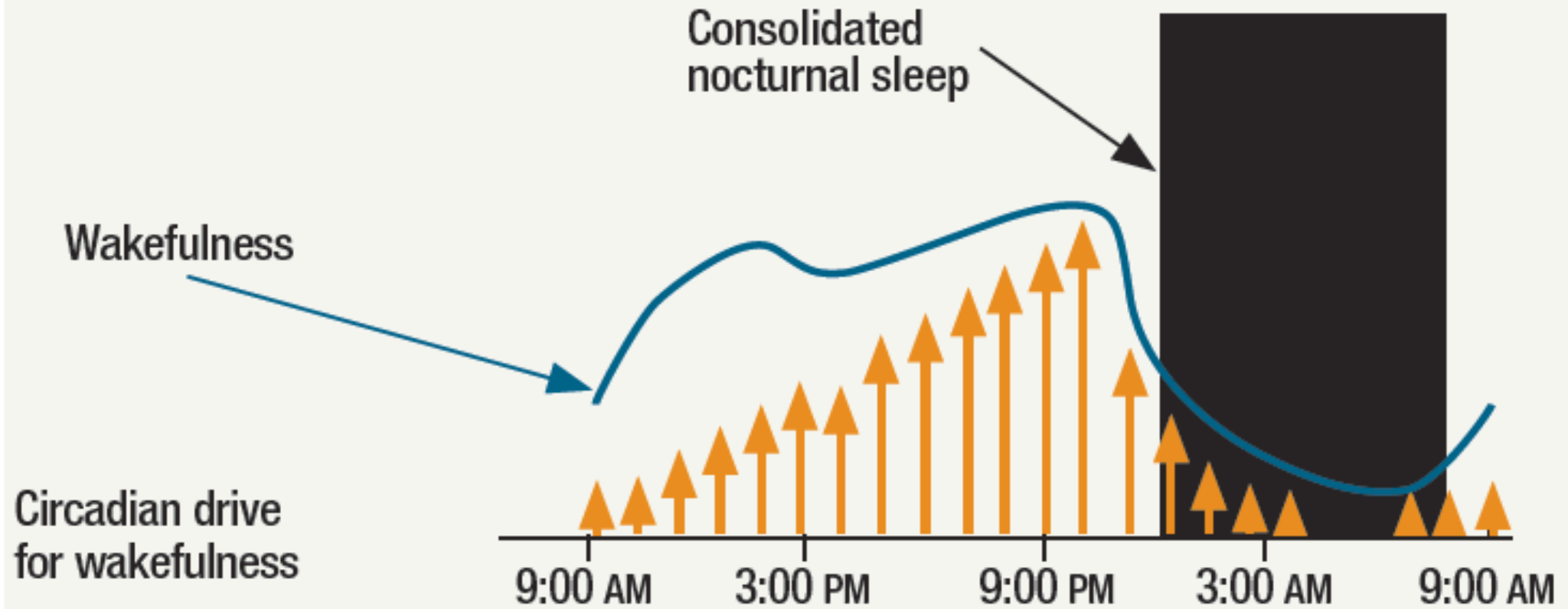
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Zeitgeber

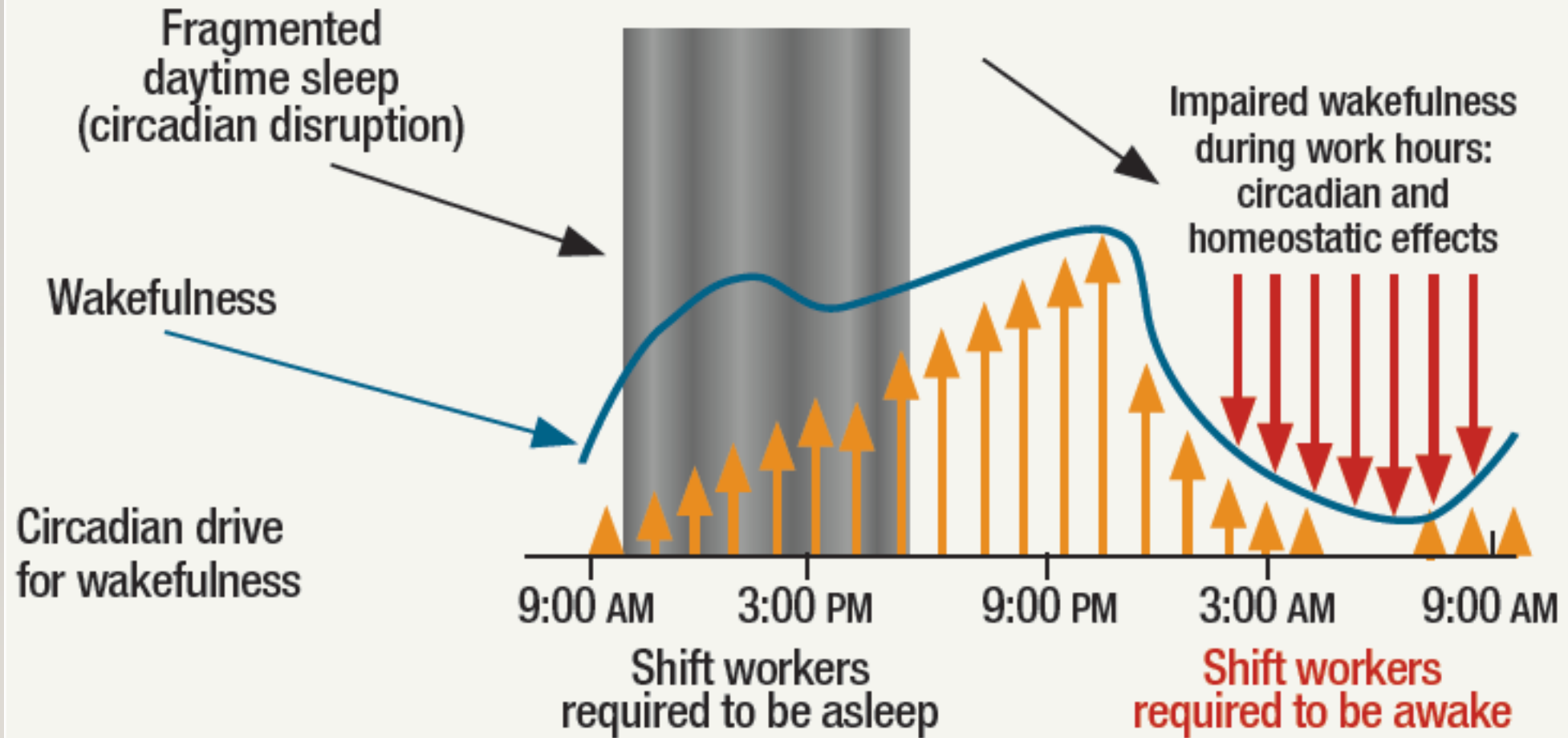


Unhappy Shift-worker

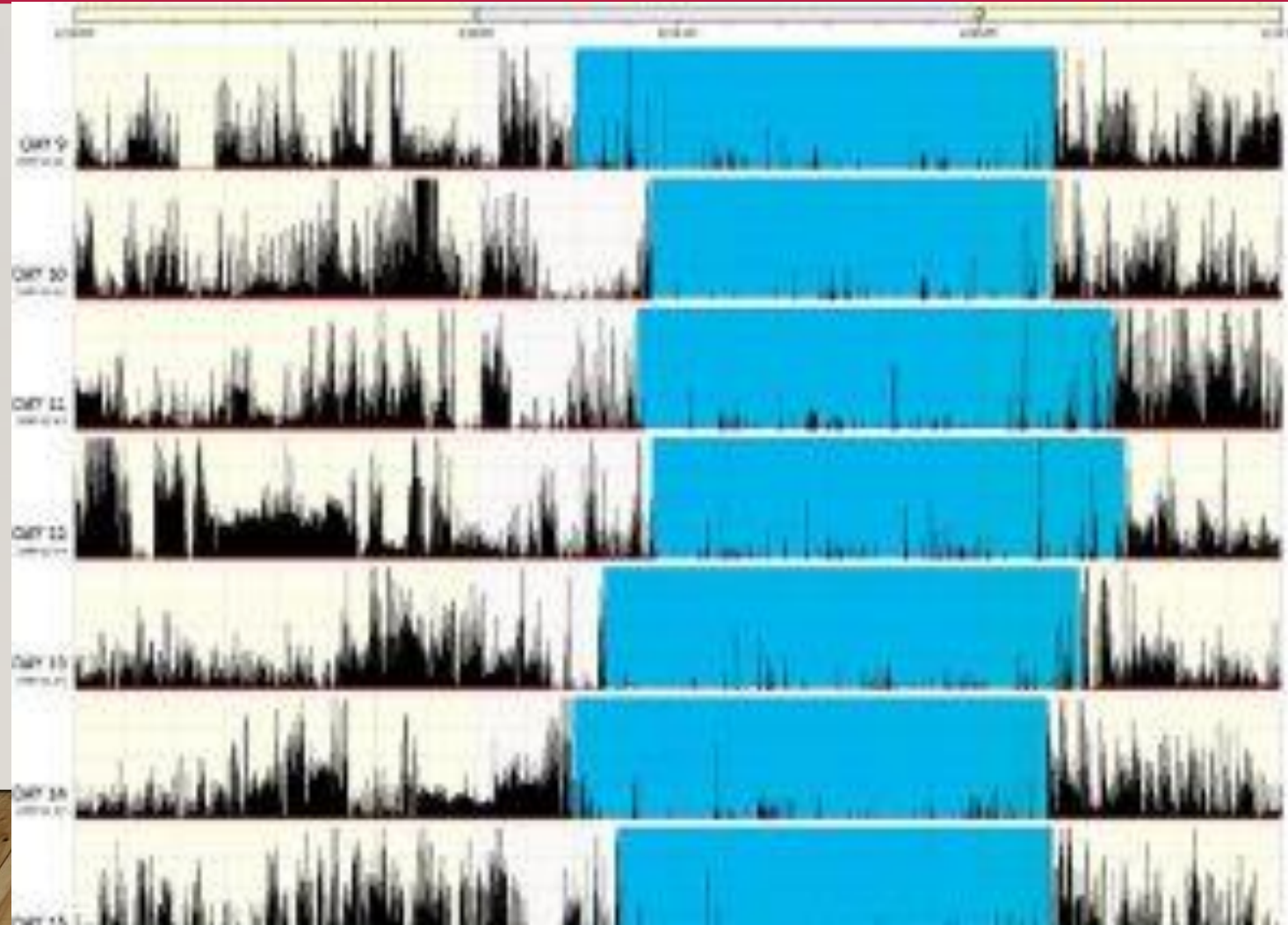
A Day worker

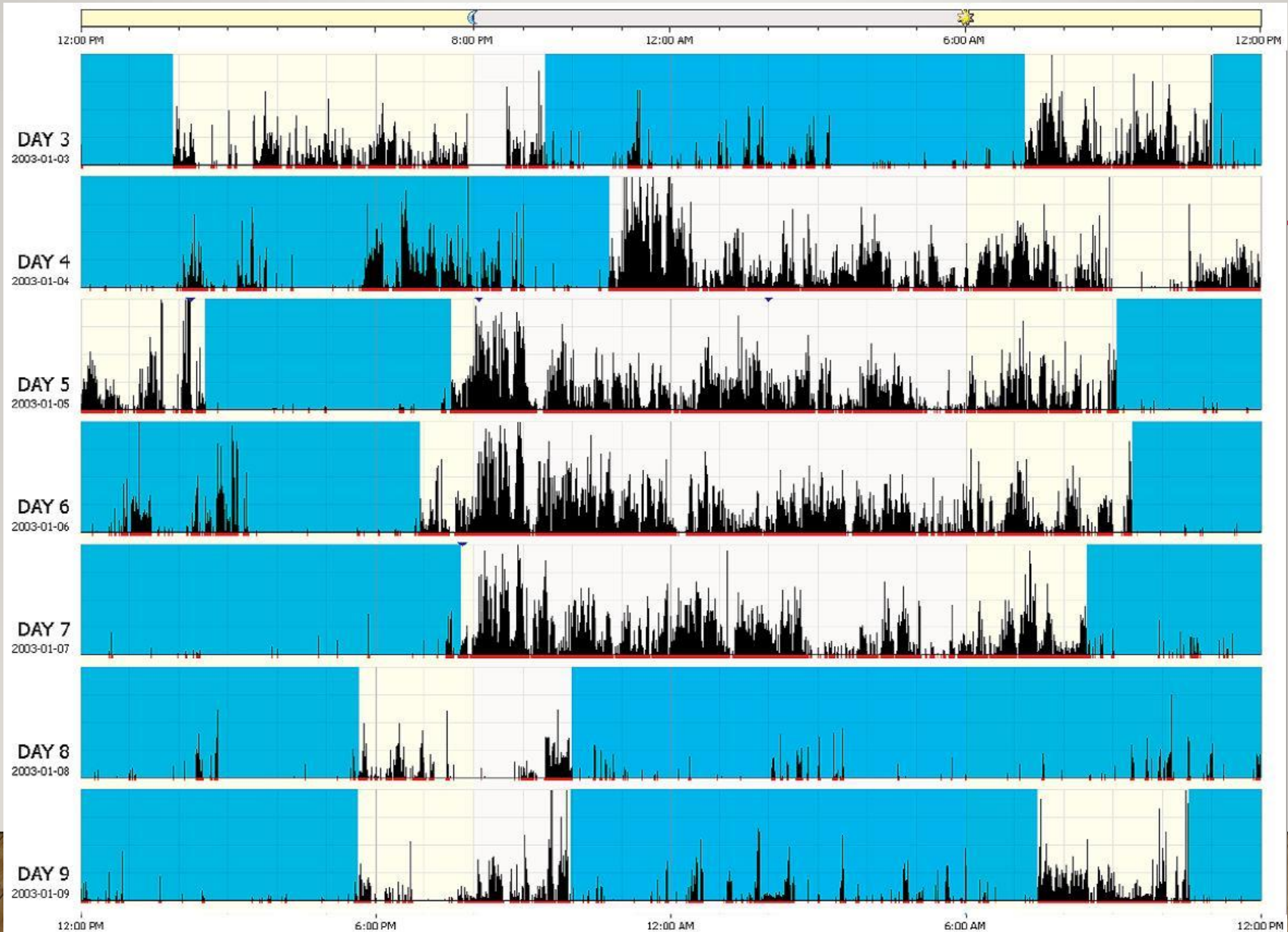


B Night-shift worker



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
 - Female gender: women have decreased average total sleep time than men
 - Rotating shifts: more rapid shift rotations, backward shifts
 - Intrinsic tolerance

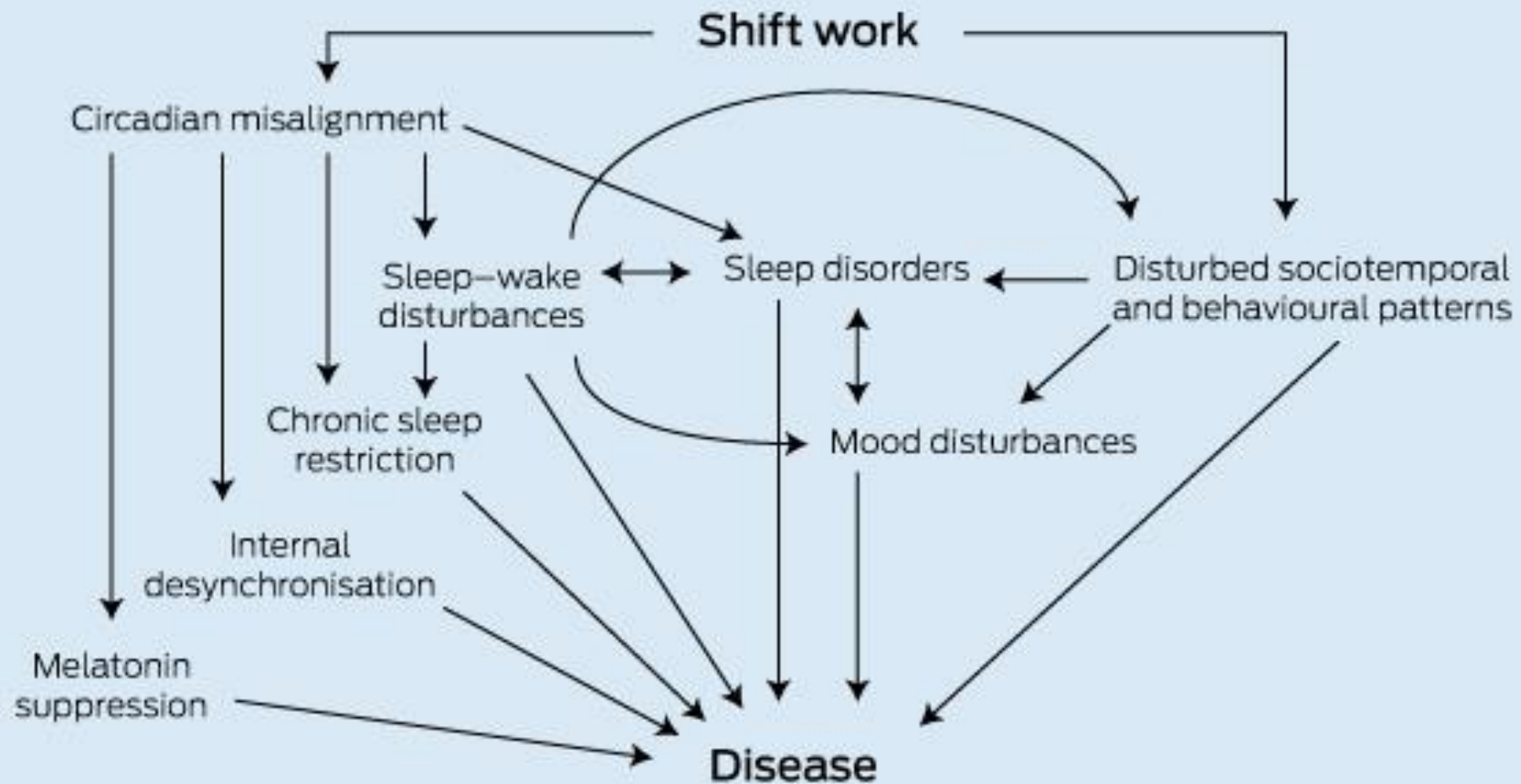


SHIFT WORK SLEEP DISORDER

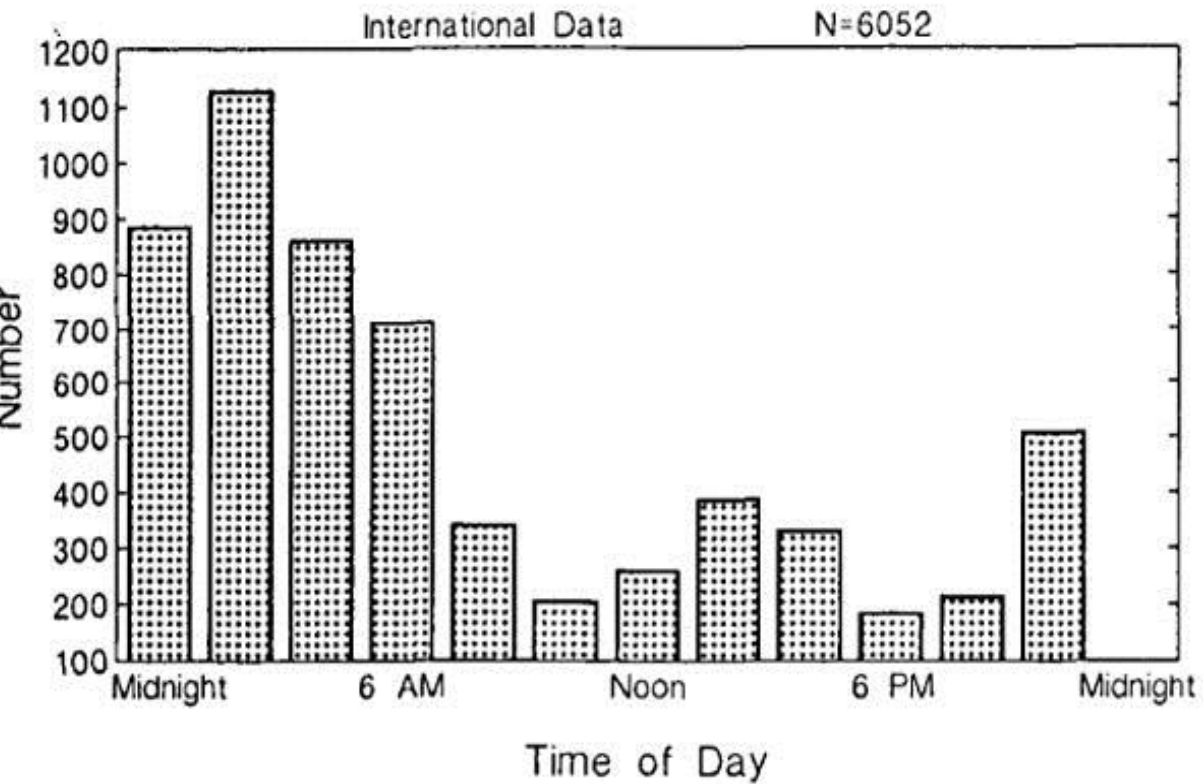
- Symptoms
 - Excessive sleepiness at work
 - Insomnia
 - Fatigue
 - Impaired concentration/cognitive slowing
 - Headaches
 - Irritability/mood changes

SHIFT WORK SLEEP DISORDER

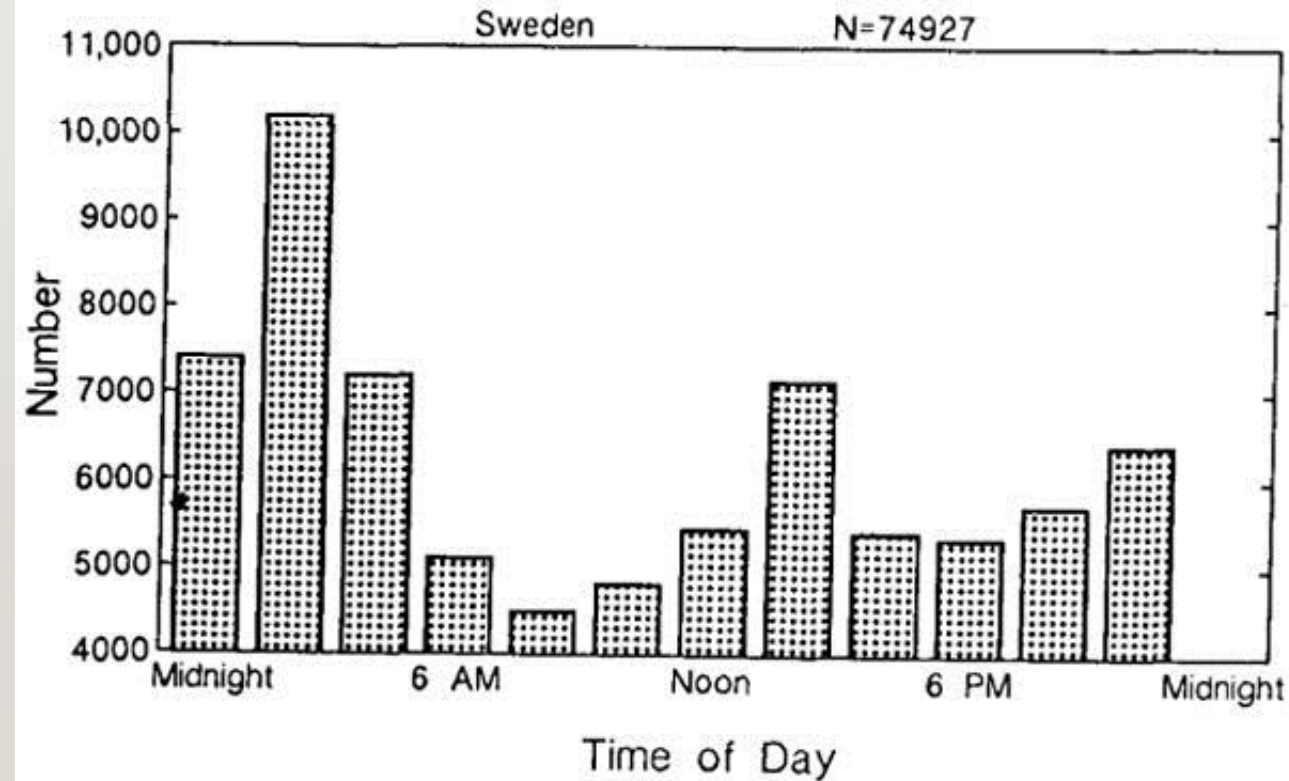
- May lead to:
 - Work-related issues
 - Absenteeism
 - Mistakes/injuries at work, poor job performance
 - Accidents due to drowsy driving
 - Health problems
 - Obesity (leptin/ghrelin)
 - Drug and alcohol dependency
 - Mental health issues (depression, anxiety)
 - Cardiovascular disease
 - Infections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



FATIGUE-RELATED ACCIDENTS



METER READING ERRORS



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 k...
 - into the ship

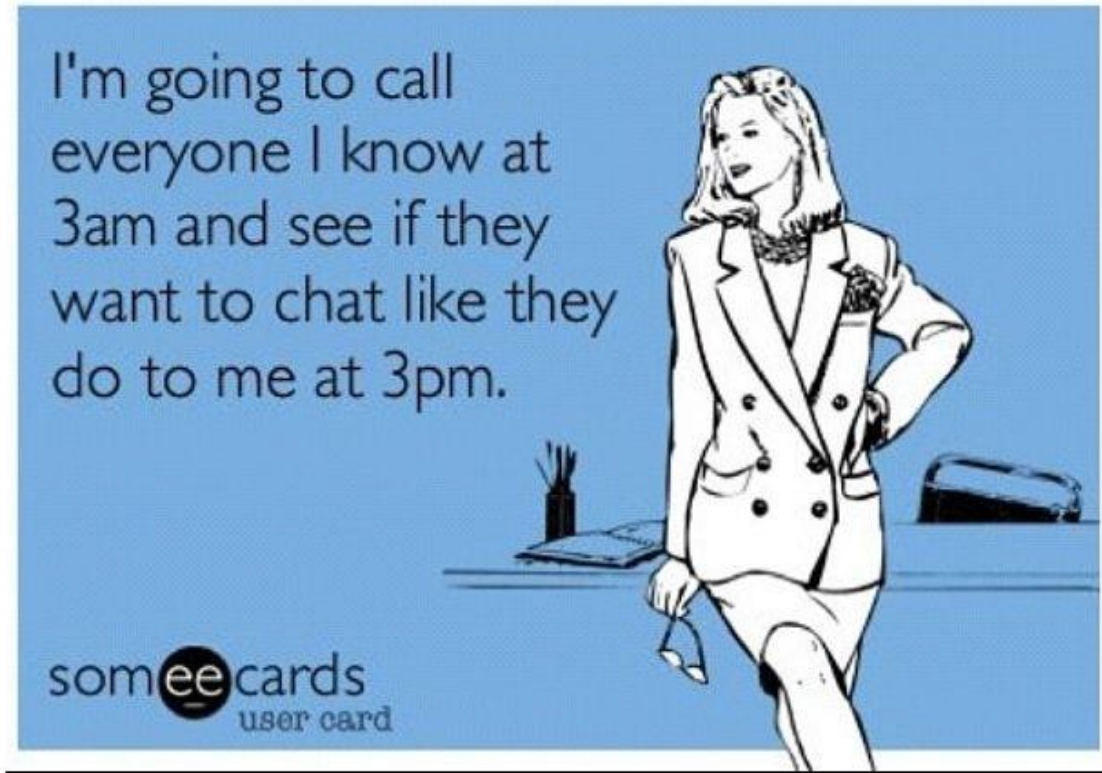


TREATMENT OF SWSD



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

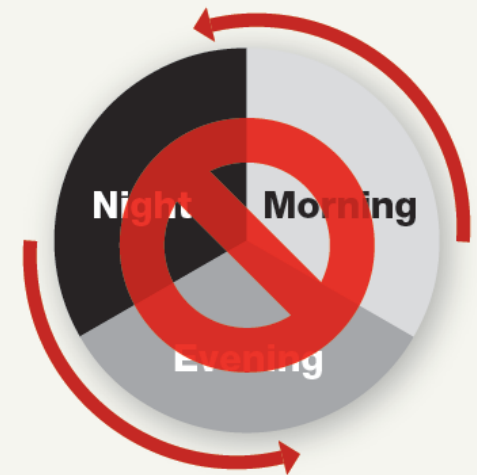
TREATMENT: NON-PHARMACOLOGIC

- 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

CLOCKWISE



COUNTERCLOCKWISE



TREATMENT: NON-PHARMACOLOGIC

Schedule	Sleep Time
Evening Shift (5 p.m. — 1 a.m.)	3 a.m. — 11 a.m.
Night 1 of Transition	5 a.m. — 1 p.m.
Night 2 of Transition	7 a.m. — 3 p.m.
Night 3 of Transition	8 a.m. — 4 p.m.
Night Shift (11 p.m. — 7 a.m.)	9 a.m. — 5 p.m.

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
- ☐ Butabarbital (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?

