



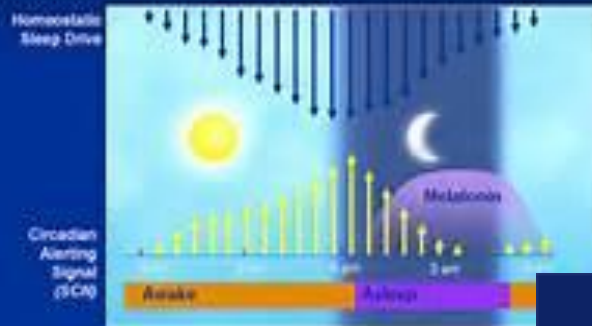
SHIFT WORK

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Objectives

- 1) the role of sleep wake circadian rhythm in Shift Work Disorders
- 2) Potential countermeasures for Shift Work Disorders
- 3) Treatment strategies for Shift Work Disorders

Sleep Wake Cycle: Two Process Model



Rechtschaffen, A., Kales, A. (1968). *Textbook of Sleep Medicine*. Philadelphia: W.B. Saunders Company.
Saper, C.B., Chou, K.R., & Fong, C.T. (2004). *Textbook of Sleep Medicine*. Philadelphia: W.B. Saunders Company.
Takahashi, J. (1973). *The Journal of Neurophysiology*, 36, 303-310.

Excessive Sleepiness Is Modulated by Two Processes: S and C



Process S is homeostatic sleep drive increasing with wakefulness and decreasing with adequate sleep quantity and consolidation.

Process C is the circadian clock modulating sleep and waking.

Achermann. *Aviat Space Environ Med.* 2004;75(Suppl 3):A37.

PHASE RESPONSE CURVE

DELAY
ADVANCE



DELAY REGION:
EVENING LIGHT
SHIFTS SLEEPINESS
LATER

ADVANCE

SLEEPINESS

DELAY

ADVANCE REGION:
MORNING LIGHT
SHIFTS SLEEPINESS
EARLIER



History of Shift Work Disorders

- Sept. 4, 1882
- Electricity at Pearl Station
- Lower Manhattan
- First electric substation
- Changed course of civilization
- Able to see at night
- Work at night
- Since then total sleep time declined
- Avg 6-6.5 hours/night from 9.3 hours

Shift Work

- Currently 1/5 of US population *
- Physicians & Surgeons
- Sleep Tech, EMT, Pharmacist, Firefighters, police, nurses
- Truck drivers, train operators, pilots, taxis
- Airline stewardess, 24 hour superstores, auto workers, security systems, line repairmen

LOOK ON YOUR FACE



**WHEN DAY SHIFT WALKS
IN AND SAYS "GOOD MORNING"**

Shift Work Sleep Disorder Icd-9 327.36

- A. There is a complaint of insomnia or excessive sleepiness that is temporally associated with a recurring work schedule that overlaps the usual time for sleep.
- B. The symptoms are associated with the shift work schedule over the course of at least one month
- C. Sleep log or actigraphy monitoring (with sleep diaries) for at least 7 days demonstrates disturbed circadian and sleep time misalignment.
- D. The sleep disturbance is not better explained by another current sleep disorder, medical or neurological disorder, mental disorder, medication use, or substance use disorder

PUGH



Physiologic Consequences of Shift Work

- Endocrine/ weight gain
 - Leptin, cortisol, insulin resistance
- GI
 - peptic ulcers
- CV
 - HTN, hyperlipidemia, CAD, stroke
- Carcinogenic
 - Breast, colorectal, prostate CA
 - International Agency for Research on Cancer consider shift work as Carcinogen“

When working night
shift gets you down
just remember,
working at night makes
you more likely to die
of cancer and heart
disease.



somee cards
user card

3 mechanisms that shift work affect our sleep

- 1) Circadian misalignment
- 2) Chronic Sleep deprivation
- 3) Melatonin suppression by light during night shift

Circadian Misalignment

- When our daily activities (such as sleeping , eating drinking) are being forced to occur at the wrong circadian phase relative to our internal physiologic rhythms.
- In animal model, chronic shifts or light/dark cycle inversion increase mortality

Sleep Deprivation

- The sleepest time of the night occurs around the temperature minimum (T_{min}) which is usually 2-3 hr before wake time
- Unfortunately, most shift workers their T_{min} remain in the night time (working hours) increasing risk for job accident and the TST during daytime is curtailed because the circadian clock promotes wakefulness in the daytime.

WHAT IT FEELS LIKE



Cop Humor on Facebook

**TRYING TO SLEEP AFTER WORKING A
GRAVEYARD SHIFT**

Sleep Deprivation

- Sleep maintenance insomnia
- Decreased weekly sleep time by 5-10 hours
 - Chronic sleep deprivation
- Daytime sleepiness



Melatonin Suppression by Light at Night

- Melatonin is an antioxidant and has oncostatic properties. Shift workers increase cancer risk because of their innate cancer defenses are compromised
- Melatonin is suppressed in a dose dependent manner depending on the light intensity
- On the other hand, bright light during night can delay melatonin secretion

Factors exacerbate the problem

- Being on call for long periods
- Backwards drifting schedule
 - ie work earlier and earlier
- Erratic schedule
- Maintaining social schedule
 - Significant other and kids
 - Phone calls
 - Errands

Countermeasures

- 1) Stimulant: Caffeine: most widely used stimulant in the world but disrupt recovery sleep and no improvement with alertness near circadian nadir at night. Modafinil or Armodafinil SL still <5 min at 4 and 6 AM and the following day TST only 5.9-5.4 hr
- 2) hypnotic: improve TST but does not translate into night shift alertness
- 3) Melatonin: increase sleep quality and quantity but has to be timed properly



" WITHOUT MY COFFEE, I'D NEVER MAKE IT WORKING NIGHTS. "

Countermeasures

- 4) Naps prior to or at night shift: improve alertness and performance but does not overcome the circadian nadir. Napping during nightshift may give rise to sleep inertia
- 5) Bright light can provide alerting effects especially blue light than long wavelength light. Three 30 minutes of bright light session separated by 15 min of room light at 51 cm distance.
- 6) communicate with employer about shift work disorder is of great importance

Employer

- Keep schedule regular
- Allow enough time between shifts
 - 5 night shifts then 2 days off
- If rotating shift make sure rotating in the delaying direction
- If possible, avoid permanent nights
- Well lit environment
- Regular breaks
- Coffee in work place

Environment

- On way home
- Careful driving
- Sunglasses +/-
- At home
 - Turn off phone
 - Cover windows
 - Set alarm clock
 - Follow same time schedule daily
 - Arrange activities to work schedule



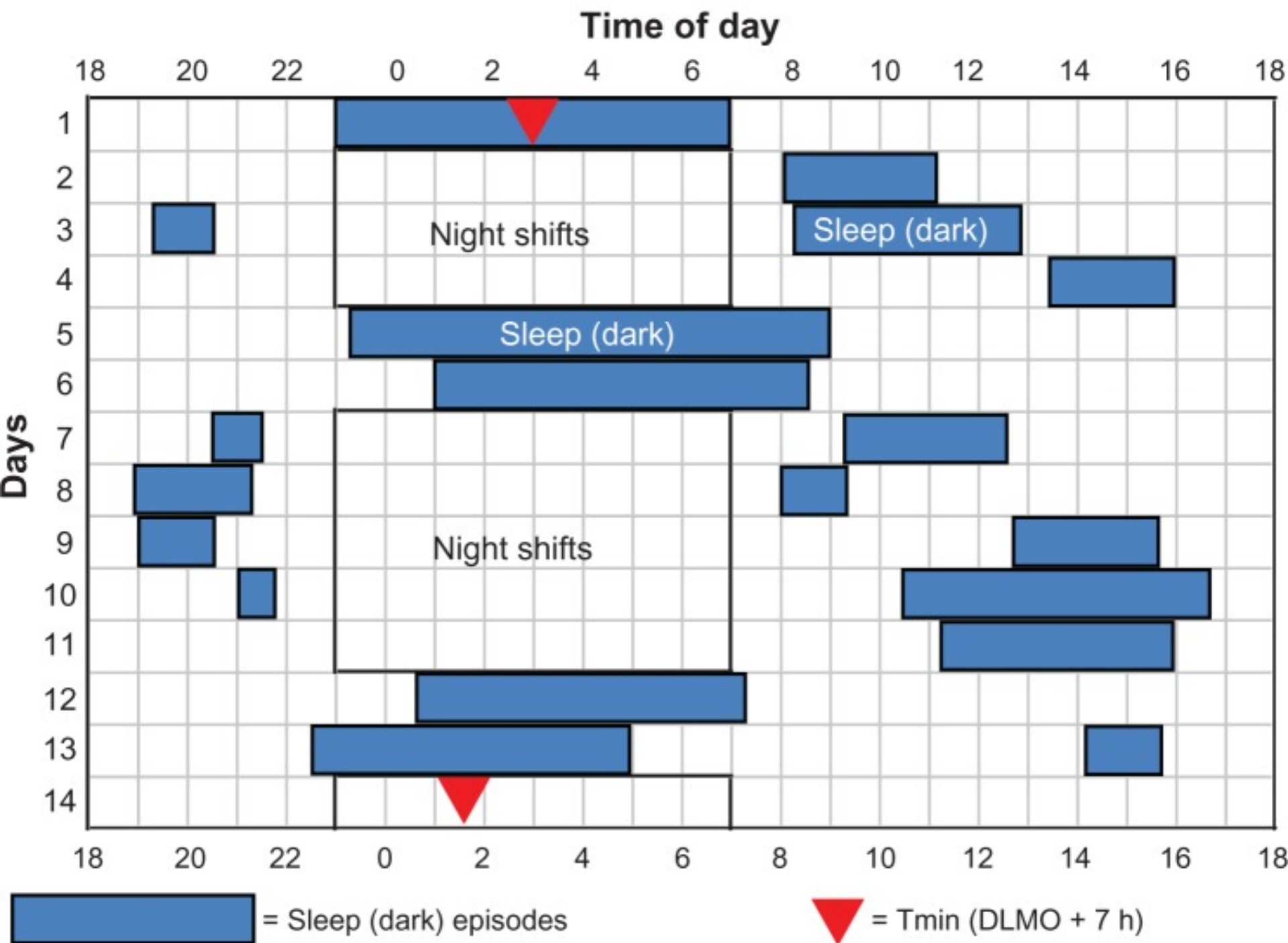
"TWELVE YEARS OF COLLEGE, MEDICAL SCHOOL, INTERNSHIP AND RESIDENCY AND IT NEVER OCCURED TO ME THAT I'D HAVE TO WORK THE NIGHT SHIFT."

Stanford Medical Center

- 49 year old female
- ER physician
- 20 years of shift work
- Tries to go to bed at 7 AM when she gets out of the hospital
- She is extremely tired.
- She would be fighting her urge to doze off at 4 AM which turns out to be her T_{min} tested by DLMO (DLMO + 7 = T_{min})
- But when she got home, She feels like she lost her ability to fall asleep

Stanford Medical Center

- Normal BMI
- Normal physical
- No evidence of OSA or RLS
- Napping daily before her shift
- On day off she would be visiting her grandson



About a Nurse



“I know it’s been a rough shift,
but look at the bright side...
only 7 hours to go.”

Treatment strategies

- 1) reduced circadian misalignment with pulses of light and melatonin to phase delay her T_{min} to her

Problem: Her T_{min} occurs at 4 AM when she would be fighting the urge to doze off. When she get off from work, any exposure to bright light, which is a powerful phase shifter, would further Advanced her circadian clock

Solution #1: Make sure she wear very dark sunglasses when she leave work at 7 AM and whenever going outside during the day

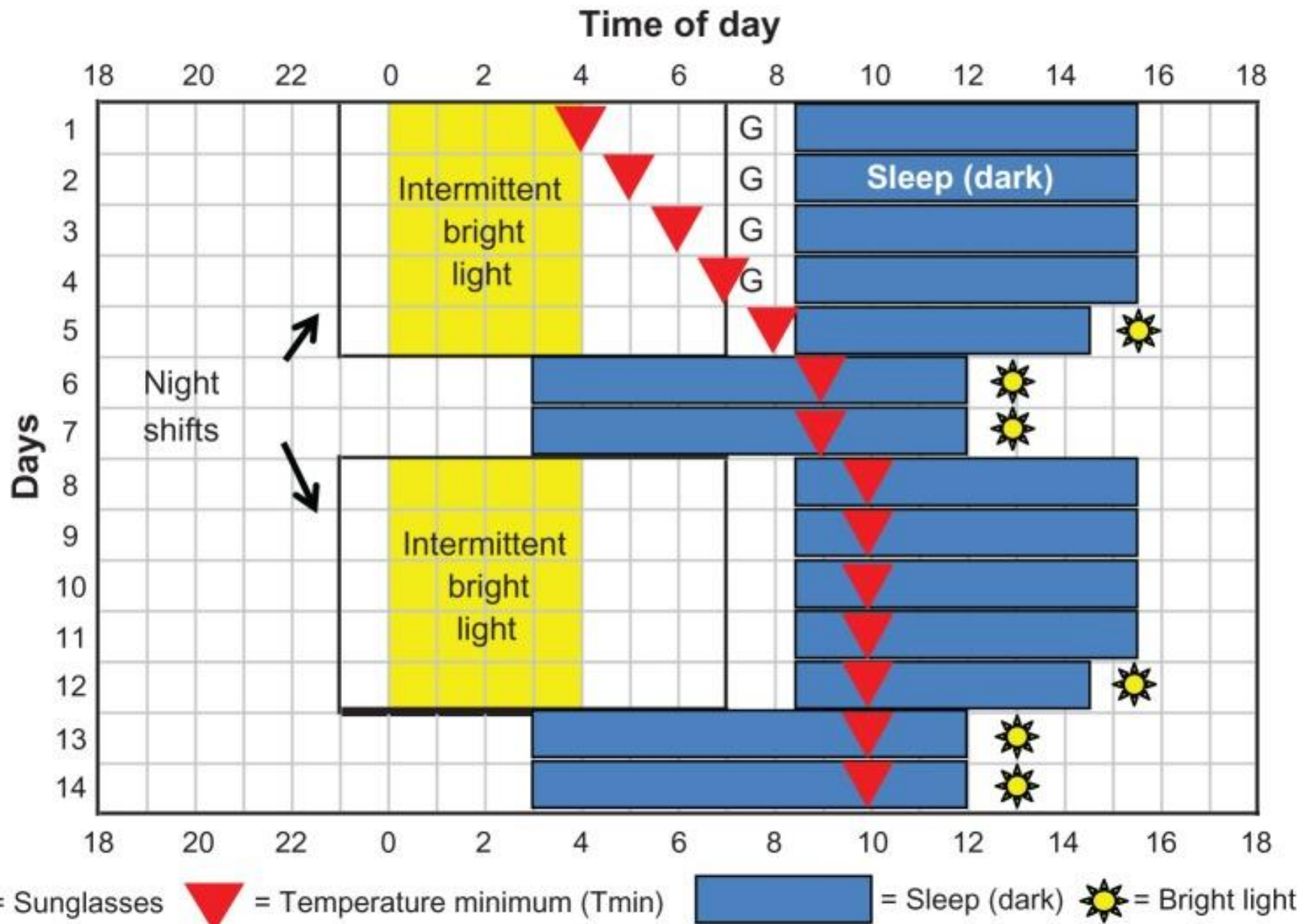
Treatment Strategies

- Solution #2: melatonin 3 mg should be taken in the morning before daytime sleep to delay her circadian clock as long as decrease light exposure in the morning when driving home
- Solution #3: Intermittent bright light pulses is more efficient than continuous light in phase shifting given before T_{min} will delay circadian clock by 1 hour/day with 5000 lux for 20 min when charting for 5 pulses (total of 100 min)
- Solution #4: A strict regular 7 hours for daytime sleep (7 AM to 2 PM) in “darkroom dark”.

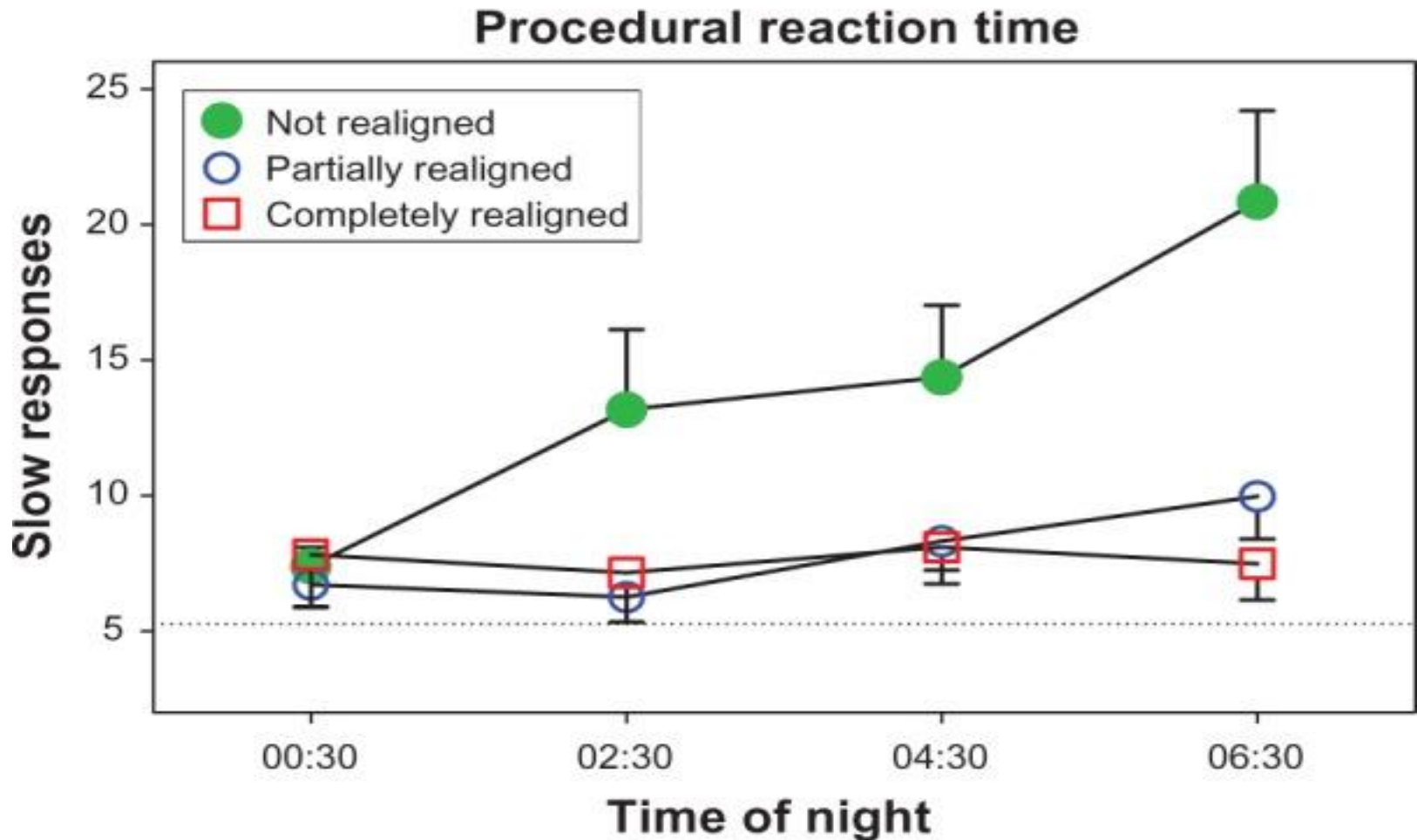
Treatment strategies

- Problem : Shift worker rarely able to align their new circadian rhythm due to changing back to their conventional sleep time on day off
- Solution : Partial realignment strategy is to phase shift T_{min} , the sleepest time, into the first half of the daytime sleep instead of second half as in complete realignment. The goal is to delay T_{min} to where daytime sleep and day off sleep overlap
- During night shift, bedtime from 7 AM to 3 PM then the last day before day off would sleep from 7 AM to Noon to build up a homeostatic sleep pressure on dayoff and day off would sleep from 3 AM to noon

Sleep and light schedule to reduce circadian misalignment in night workers

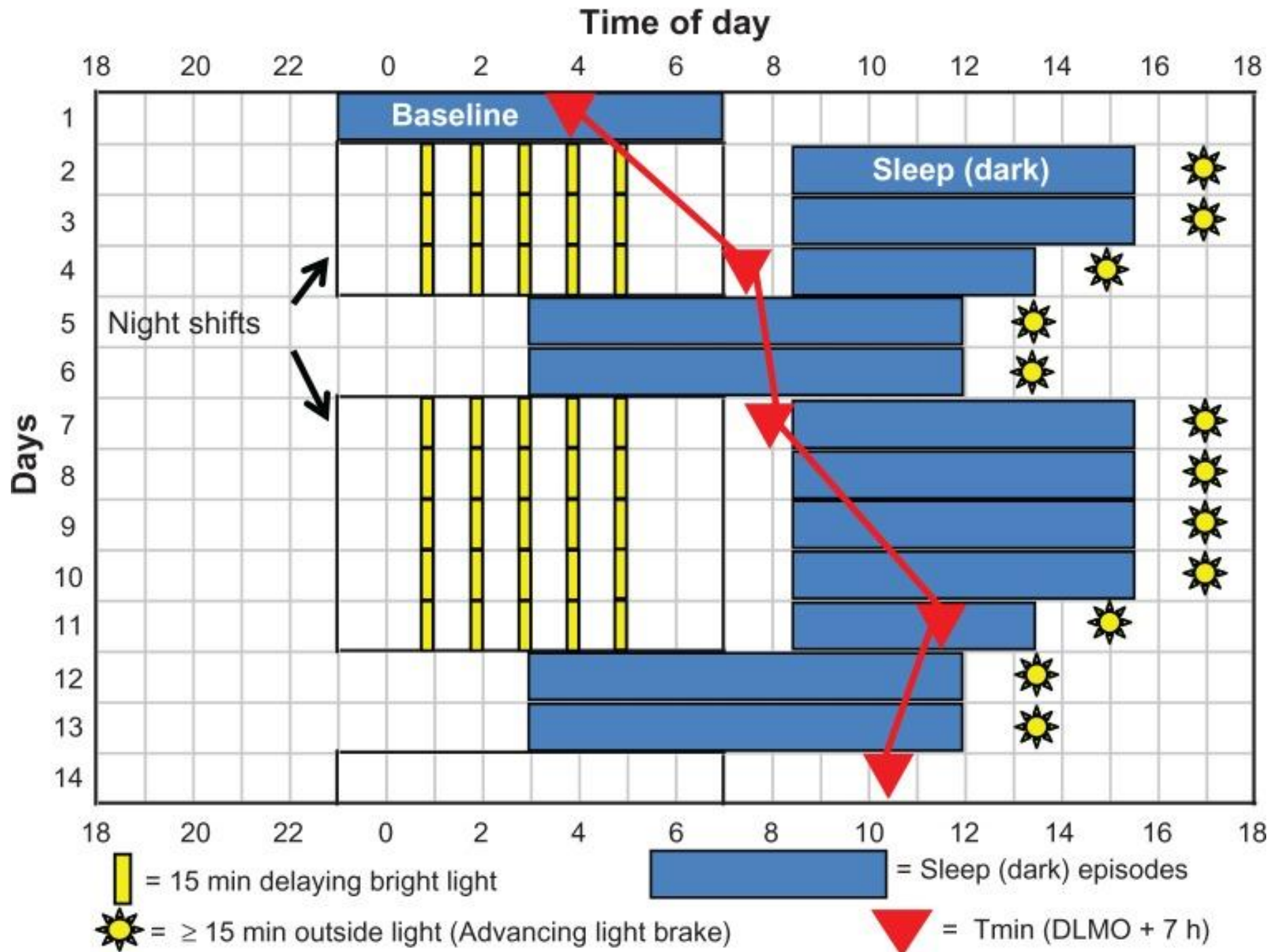


Psychomotor Vigilance Testing



Treatment Strategies

- Problem : phase shift will continue to delay around the clock and might go too far
- Solution: Apply “Light Brake” by going outside for 15 min in the afternoon for bright light exposure within 2 hours of their scheduled wake time
- This creates a balance of forces of push from the phase delaying bright light during the night shift and the pull from phase advancing light brake. Once this goal is reached, circadian clock would remain relatively stable.



Summary

- One in five American are thrust into shift-work
- Cardiovascular and cancer risks have been well established
- Some of the countermeasures commonly used by shift workers may not be sufficient
- It is time to take bold strategies by utilizing the most up-to-date science and technology by combining bright light therapy, melatonin and apply “light brake” to achieve circadian alignment





GET TO WORK WHEN IT'S DARK



LEAVE WORK WHEN IT'S DARK



I remember when I
used to sleep at
night.



“I’ve
forgotten
what it’s like
to have a
normal
sleeping
pattern.”
CURIANO.COM



I've had just the right combination of sleep deprivation and coffee to be convinced that I can infact fly.....on a broom stick.



somee cards
user card

Dear Sleep,
I'm sorry I hated you
when I was little,
now I can't get
enough of you!

FLYINGKIMCHISOUP.CO.NR


DerpCloud.com

working the night shift



is Killing me!!

ICANHASCHEEZBURGER.COM 🍷 🍷 🍷



When people see
you **lying down**,
with your
eyes **closed** they
still ask:
"Are you sleeping?"
"No. I'm **training to die**"
—.-

GIRLFROMPARIS | TUMBLR



About a Nurse

allnurses.com

You're in BIG trouble, Jim. This hospital doesn't allow tattoos!

It's not a tattoo. After a long shift, I went home, fell asleep, and my kid drew on me with a permanent marker.



