AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
SCIENTIFIC ASSEMBLY
1999

Optimal Scheduling Strategies for Emergency Medicine

Pertinent literature on chronobiology and shift work will define the problems related to the practice of emergency. The use of pharmacologic and other therapies as they relate to adaption to changing sleep/wake patterns associated with shift work will follow. A discussion will offer the participant various strategies designed to deal with these problems.

- Review the basic chronobiologic principles related to shift work and scheduling.
- Discuss the literature related to the use of the pineal hormone melatonin, sedative/hypnotic agents, and caffeine as adjuncts to circadian adaption.
- Develop successful scheduling strategies with regard to the staffing of emergency departments.

TH-229
Thursday, October 14, 1999
11:00 AM - 12:55 PM
Room # N242
Las Vegas Convention Center

FACULTY

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OBJECTIVES:

1. To understand circadian rhythms and associated terminology.
2. To understand how circadian rhythms affect physiology and work performance.
3. To learn about stages of sleep and how sleep deprivation affects human performance.
4. To apply knowledge of circadian rhythms in devising shift work schedules.
5. To understand rationale for compromise sleep strategies in shift work
6. To understand how light exposure, exercise, diet and melatonin can be utilized to mitigate the negative effects of shift work.
7. To present alternative proposals in shift scheduling.
8. To review current original research in the field, including the topic of shift length.
9. To review the material presented and discuss practical implications for emergency physicians.

RELEVANCE OF CIRCADIAN RHYTHMS TO EMERGENCY MEDICINE

* Shift work is a fact of life for all emergency physicians, Most have to work different shifts in the normal course of employment, but even the seldom practicing department chairman with a straight daytime schedule considers the effects of shift work when making duty rosters and arranging meetings. Although there is a large body of research which deals with shift work in other industries, it has only recently been addressed in the emergency medicine literature.

  Shift work is a major stressor in emergency medicine. In a study by ACEP's Behavioral Emergencies Committee, members were asked to identify the most stressful aspect of emergency medicine. The most common response was "erratic schedule." Shift changes and scheduling difficulties are often cited as dominant causes of stress and career dissatisfaction in emergency medicine.',' Shift work is a principal reason for the high rate of attrition seen in emergency medicine. Data from ACEP had previously shown a 12% yearly rate of attrition among its members, with fewer than 10% expecting to be practicing emergency medicine in 10 years. With the college=s emphasis on wellness, it appears that our practice life has increased substantially during the past decade. This

suggests that, with proper care, the average full-time clinical practice career in emergency medicine may last almost as long as in other specialties.

CIRCADIAN RHYTHMS -THE BASICS

- Observations about the rhythmic nature of animal functions date back at least to the time of Aristotle, who noted swelling of sea urchin ovaries during the full moon. "Sleep movements" of plants were also noted by the ancient Greeks, who ascribed the phenomena to the presence of sunlight.

  First experiment designed to test circadian rhythms in plants done by de Mairan in 1729, who demonstrated that plant leaves opened in the daytime, even when kept in total darkness. This was the first demonstration of an endogenous biological clock functioning in the absence of *zeitgebers* ("time givers"). Findings confirmed by Duhamel in 1758.

  Concept of *free-running* in biological clocks discovered in 1832 by de Candolle, who placed plants in constant bright light. After a few days, the leaves opened and closed on a 22-hour cycle. This showed the plant had its own independent day length.

  Pittendrigh's experiments with fruit flies showed biological clocks were innate and genetically transmitted. The human biologic clock, however, is poorly developed in the first 3-4 months of life. (Ask any parent,)

  Experiments by many investigators have shown that humans have a free-running 25-hour clock.[3,4] Well controlled studies by Weitzman and Czeisler over 6-month periods showed the 25-hour day to be constant and predictable in all subjects. All species seem to have their own independent day length.

  Some other definitions:

infradian	= > daily (menstrual cycle)
ultradian	= > daily (pulse, respirations)

  Note that these biological rhythms are different from *biorhythms,* which involve the practice of forecasting events by means of intellectual, physical, and emotional "cycles." In actual practice, however, "biorhythms" is being used more and more as a substitute term for biological rhythms

CIRCADIAN PHYSIOLOGY

DAYS, EVENINGS, AND NIGHTS:
SCHEDULING TO MAXIMIZE PRODUCTIVITY

- Hunter in 1778 reported a drop to temperature during sleep, which critics attributed to lack of physical activity. Kleitman found that the temperature cycle is controlled by the biological clock: if a subject is kept at rest in bed and awake for 24 hours, the temperature falls during the night and rises again the next day Further studies by him showed if the subject is kept awake nights and sleep during the day the temperature cycle will eventually transpose to accommodate the new cycle.

* Other physiologic functions follow the temperature cycle. Alertness and potassium excretion have a positive correlation, whereas accretion of growth hormone has a negative association with temperature. Cortisol has its own pattern, but follows a regular circadian cycle.

SLEEP

> *Sleep, that knits up the* ***ravell'd*** *sleave of care,*
> *The death of each day's life, sore* ***labour's*** *bath,*
> *Balm of* ***hurt*** *minds, great nature's second course,*
> *Chief nourisher in life's feast.*
>
> - Shakespeare, *Macbeth,* Act II, Scene I

* Definitions of sleep abound. The old maxim "the more the theories, the less the certainty" still applies:

> "Sleep is a process of regulation of the metabolism and the temporal interrelationships in activities of structures and functional systems." (FAIR)
> - Soviet Sleep Symposium, 1982

> "Sleep, rest of nature, 0 sleep, most gentle of the divinities, peace of the soul, thou at whose presence care disappears, who soothest hearts wearied with daily employments, and makest them strong again for labor!" (GOOD)
> - Ovid, *Metamorphoses*

> "A state of inertia and loss of consciousness of a temporary nature trom which one can easily be aroused." (BETTER)

DAYS, EVENINGS, AND NIGHTS:
SCHEDULING TO MAXIMIZE PRODUCTIVITY

Coleman, 1986[5]

"On the whole, I=d rather be in Philadelphia.≅ (BEST!)
-WC Fields, on his deathbed

Sleep occurs in discrete stages?

Non-REM (NREM) sleep - brain idle, body mobile
Stage 1 -transition period, usually completed within 10 minutes unless sleep disorder present. Brain activity slows and eyes roll slowly from side to side. Most sleep subjects awakened in Stage 1 will claim they are not asleep. Automatic behavior, the rote performance of routine tasks while seemingly awake, may be a special prolonged form of this stage.
Stage 2 - Somewhat deeper sleep, eye movements halt, brain responds to certain level of noise as seen in EEG changes, About half of adult sleep is spent on this stage, but there is less research on this stage than on any other. Stage 2 usually lasts about 20 minutes before progressing to next stage.
Stage **3/4 -** slow wave sleep (SWS), also called delta sleep, is characterized by cortical brain cells firing synchronously in slow large spikes. These stages are considered together because they are difficult to differentiate. Stage 4 is the deepest sleep stage. Most SWS occurs early in the sleep period, so it is often difficult to arouse someone an hour after onset of sleep. About 25% of adolescent sleep is SWS, the percentage declining throughout adulthood until becoming absent in the elderly. Following sleep deprivation, this is the first stage to be made up. This stage is the most vital for physical recuperation, and those deprived of it will complain of fatigue and muscle aches. Growth hormone is secreted during stage 4 sleep.
REM sleep - brain on, body off
Usual onset of first REM episode occurs after 90-120 minutes of NREM sleep. Hallmarks of REM include an EEG pattern similar to wakefulness, dreams, rapid conjugate eye movements, irregular pulse and respiration, increase in 0_2 consumption, increased cerebral blood flow (more than when awake), increased BP, isolated muscle twitches, loss of facial muscle tone, and absent spinal reflexes. REM periods become longer as the night goes on, so you're likely to be in the middle of a dream when the alarm goes off. Absent hypnotics, most sleep periods will have 4-6 REM episodes. Infants spend over 50% of sleep in REM; the percentage declines to about 25% around age 5 and stays fairly consistent throughout life. REM sleep is vital for psychological well-being, and those deprived of it complain of irritability and moodiness.' Since REM sleep is

clustered toward the end of the normal 7-8 hour sleep period, those whose sleep tends to be shorter or more fragmented (such as shift workers) will likely be REM deprived. REM has its own circadian cycle, peaking in early afternoon with nadir around midnight.

* Horne[8] refers to the first three SWS cycles (which occur during the first 3-4 hours and contain the bulk of each sleep period's SWS) as core sleep, with the rest of the sleep period considered "optional" sleep.

  Only about one-third of lost sleep is made up, consisting mostly of missing stage 4 SWS and about half of missing REM sleep. The sensation of sleepiness may have two components: that of missing core sleep (physiologic) and that of missing optional sleep (psychological)

* Sleep researchers measure sleepiness by the *MSLT* (Multiple Sleep Latency Test). The lower the score the more likely a subject is to fall asleep. The MSLT is lower the score the more likely a subject is to fall asleep. The MSLT is lowest around 0300, with a diurnal trough also noted around 1400 (siesta time). A siesta produces better quality sleep than naps at other times, partly because it tends to be rich in REM.

ALERTNESS AND PERFORMANCE

* Alertness is perhaps the greatest concern for industrial shift workers:

  Single vehicle commercial truck accidents increase by a factor of 8 between midnight and 0800, with the peak between 0300 and 0600. This is at the low point of alertness in the biological day, and accident rates are highest despite the fact this is when the fewest trucks are on the road.

  Expressway driving is a good example of low-level performance. German investigators studying autobahn accidents took physiologic readings on night drivers which showed periods of *automatic behavior,* during which time the EEG showed a light sleep pattern and eye blinking ceased. These periods lasted up to 20 minutes and subject recall for events is nil. Similar studies of night workers in railroad, computer, and nursing industries have shown a corresponding tendency. When a sufficient stimulus occurs, the subject becomes awake on the EEG, but there is no anticipation of events while one is on autopilot.

DAYS, EVENINGS, AND NIGHTS: SCHEDULING TO MAXIMIZE PRODUCTIVITY

Major determinants of daytime alertness include circadian phase, total sleep time the night before testing, the amount of SWS sleep before testing, and the regularity of the sleep and work schedule.

It is well established that performance for a wide range of tasks varies with the time of day.[9] Most performance curves can be brought into line with known 24-hour temperature curves. Morning people (larks) who like to go to bed and get up early have their temperature peak usually before noon, Evening types (owls) who like to get things done at night and then sleep in have their temperature peak later, in the second half of the day."

There is a definite relationship between speed, accuracy and reaction time to body temperature. People do best when their temperature is highest (usually the middle of the wakeful period) with poorer performance in the morning and evening."

The higher the memory component of a task, the earlier in the day performance on such a task peaks.[11] The element of memory is sharpest after restorative sleep.

"Post lunch dip" - an interesting phenomenon and an exception to the rules about performance. The precipitous fall in performance that occurs after lunch is not accompanied by a drop in body temperature.'* This does coincide with the MSLT siesta trough.

Resident performance: the last several years has seen much research on sleep deprivation in house officers. A review of 27 articles showed significant decrements in moods and attitudes of house officers as a result of sleep deprivation in all articles. Performance tests requiring prolonged vigilance tended to deteriorate with sleep loss. There were minimal effects on most of the brief psychomotor tests measuring manual dexterity, reaction times, and short term recall.[13]

CHANGING SHIFTS

How can I then return in happy plight,
That am debarr'd the benefit of rest?
When day's oppression is not eas'd by night,
But day by night and night by day oppress'd?
And each, though enemies to either's reign,

DAYS, EVENINGS, AND NIGHTS: SCHEDULING TO MAXIMIZE PRODUCTIVITY

Do in consent shake hands to torture me

- Shakespeare, *Sonnet XXVIII*

• Although shift work has been done throughout history, the invention of the light bulb in 1883 made the practice of shift work feasible and economically desirable. Iron foundries and steel mills were among the first to implement the concept of shift rotation. The murderously difficult work schedules and frequent accidents gave much impetus to the rise of unionism.

* Henry Ford was one of the first industrialists to change from 12 to 8 hour shifts, increasing productivity in the process. Pressures from religious and social leaders in the 1920's helped reduce the average work week from 72.3 to 59.8 hours. The Walsh-Healey Act a few years later established the standard work week at 40-42 hours.

* In the 1980's, about 26% of the male work force and 16% of females had jobs which required some form of shift change. Of all shift workers, 20% report no trouble changing shifts, 60% have moderate hardship, and about 20% have such extreme difficulty that they abandon shift work altogether within a year.

Most people who have little trouble with shift work can be classified as owls on standardized tests. Those intolerant of shift change are more likely to be larks. Aging also disinclines a worker to rotate shifts, with most shift workers noting a marked increased in difficulty after age 40.

* Monk has divided the ill feeling one gets when working different shifts into two separate categories:[14]

circadian disharmony - the "jet lag" malaise one experiences until adaption to a new shift occurs, which may last as long as a week

inappropriate phasing - trying to stay awake or to sleep when the circadian clock says otherwise, as occurs with isolated night shifts

* Research on insects and mammals forced to rotate their sleep/wake cycle show up to 20% decrease in life span.[15]

* Shift workers have a higher rate of accidents on the job, and greater risks of a fatal accident not only on the job but also driving to and from work. Work

accident rates peak on the night shift.

* Coleman's review of 200 studies on shift workers showed 62% complained of a sleep disturbance, compared to 20% of day workers. Shift workers average 5 hours sleep daily when on rotations lasting less than 3 weeks, compared to 8 hours in day workers and in those whose shift rotations last longer than 3 weeks (which gives the body a chance to adjust).

* Many studies show adverse effects of shift work on physical and mental health:[16.17.18.19] Shift workers have 8 times the risk of developing stomach ulcers than those on day shifts. Depression and mood swings are up to 15 times more likely than in non-shift workers. Higher rates of drug and alcohol abuse, altered immune response, increased risk of chronic hypertension, increased cardiovascular mortality (risk worse than smoking a pack of cigarettes per day), increased infertility in women, increased rate of work related accidents and errors, and higher divorce rates than for the general population are also found in shift workers.

CLOCKWISE VS. COUNTERCLOCKWISE

* Traditional shift rotation in industry has been a weekly counterclockwise rotation. This has been the most common form of shift rotation since early this century, but has fallen out of favor because research has shown it leaves the biological clock in tatters. This type of shift rotation is known variously as the Southern Swing, the Dow Schedule, the Hoover Schedule, the Hanford Schedule, etc.

Why are weekly counterclockwise rotations undesirable?

1. Human free-running cycle is 25 hours, making it easier to delay sleeping than advancing it. The internal clock adjusts easily to a 2 hour sleep delay or a 1 hour advance, but little sleep will be had if sleep time is suddenly advanced 8 hours to accommodate the Southern Swing. (In like fashion, its easier to adjust flying west across time zones than it is flying east.)

2. Shift workers on counterclockwise rotations take 1-2 weeks to reset their biological clocks, so the weekly change of the Southern Swing means the worker never gets a chance to adjust to the new shift.

3. Weekly shift changes are enormously disruptive of family and social life

* Czeisler and Coleman studied shift workers at a potash plant in Utah in the early 1980's. This plant used the weekly counterclockwise schedule, and the study was commissioned when the plant personnel director found that the most common complaint his workers had was shift work. The researchers studied differing directions and lengths of rotations.

Based on preliminary findings, a 3-week clockwise rotation was tried for a period of 2 years. With the new schedule, productivity increased 20% and there was marked improvement in job satisfaction and sick time. Employee acceptance of this schedule after 1 year was 60%, growing to 90% after 2 years [20]

* Czeisler's study of the Philadelphia Police Department, which had been using the Southern Swing, showed over half had sleeping difficulties and 25% had an accident the preceding year. After a year of the 3-week clockwise rotation, accidents decreased by 40%, use of alcohol and hypnotics dropped 50%, and there was a marked drop in sleep disturbances.*'
Chronobiologists now recommend clockwise shift rotation. with at least a 1 month period when on long rotations to permit circadian stabilization.-

SCHEDULING STRATEGIES

* Many shift workers favor 12 hour shifts, and this is quite common in many emergency physician groups. Most industries on 12-hour shifts rotate weekly, but even when the rotations are of greater length it takes longer to reset the biological clock across a 12 hour change than it does for an 8 hour adjustment. In a demanding job such as emergency medicine, there is a tendency to fatigue in the last few hours of a 12 hour shift, especially if they occur on a new night rotation when alertness would be down anyway.

* A 1991 study of North Carolina ACEP members (n=387) revealed that a vast majority preferred 8 over 12 hour shifts. Over half (58%) of those working 12 hour shifts preferred some other shift length, while only 2% of those working 8's wanted a different shift length. No matter what length of shift was actually worked, most physicians cited 8 hour shifts as the most desirable.[49]

* There is almost no mention in the literature about 24 hour shifts, a peculiar form

of torture that all except emergency physicians have the sense to avoid. Common sense (sic) would suggest its use be reserved for low-volume ED's (less than 11,000 annual census), where the physician can reasonably expect to get 3-4 hours of uninterrupted core sleep.

* Many European shift workers use what is known as the French System, which features a clockwise rotation through all the shifts over 3 successive days, on the theory that it is too difficult to reset the biological clock so the sooner you get it over with the better. Circadian fatigue during night shifts is a definite problem with this method.

• The circadian "gold standard" for any industry requiring continuous coverage has been to work the same shift all the time. Some groups are now paying a premium to have physicians work nights exclusively. Several emergency physician megagroups are now offering day shifts exclusively to those with 1 O-l 5 years of continuous service. Relatively few physicians opt for the former category, and few qualify for the latter. Those working a nioht shift exclusively must maintain the same sleep period, even during nights off, to avoid disrupting their biological clock. Since daytime light is such a powerful zeitgeber, nocturnal entrainment will be lost after 2-3 days unless this rule is followed. Most emergency physicians resist this idea, as it makes it difficult to participate in daytime family and social functions, or to be involved in medical staff activities, etc.

Objection to losing out on daytime activities is the primary reason some physicians also disparage the notion of monthly rotations, but in both cases there is a compromise of *anchor sleep,* which minimizes circadian desynchronization. Anchor sleep is a period of at least 4 hours during which one sleeps every day while on a particular shift rotation. For example, if you (theoretically) sleep from 0800 to 1600 after working nights and from 0400 to 1200 on days off, the overlapping interval from 0800 to 1200 constitutes anchor sleep. Sleeping until noon is preferable to sleeping all day for most people with families or other daytime commitments. By sleeping through at least half of the time normally reserved for sleep, circadian rhythms are "anchored" to a particular schedule and minimally disrupted.

* Some emergency physicians, such as Michaels[24] and Thomas,[25] have advocated a single night *shift system,* wherein each member of a group works a solitary night shift attached to "normal scheduling." This works better for large groups, but a group of 4 people would still wind up working at least every fourth night. Again, the issue of circadian fatigue during those single night shifts can be

problematic.

* In general, those who espouse the solitary night shift solution agree with Monk that the hazards of circadian disharmony outweigh the problem of inappropriate phasing, whereas the opposite is true for those who champion long rotations on a particular shift. It is important to note that the practice of weeklv shift rotation, whether clockwise or not is universally condemned in the recent literature.

* Whitehead, Thomas, and Slapper[26] have proposed a system (Thomas schedule) which combines longer night shift rotations with isolated night shifts. One member of the group works a month (or longer) on nights, while the other group members work isolated night shifts on his nights off. Small groups could work this system with little difficulty, and it would be very attractive in a group where even only one member preferred working nights. Younger physicians, physiologically better able to withstand night shifts, may respond favorably to a pay bonus in return for permanent night work.

  Logistically, the Thomas schedule works less well with 12 hour shifts precisely because there are more nights off for the physician on long night rotation. The person on nights for the month should not have more than two consecutive nights off at any point in the schedule, lest reentrainment to diurnal rhythms occur. Additionally, 12 hour shifts are more difficult than 8's for the physicians on short night rotation because of inappropriate phasing.

* For those working short stretches of nights there is the compromise of split *sleep* periods. Since the short rotation will not allow for effective shift of the sleep/wake cycle, the goal is to prevent body rhythms from shifting and still stay awake and alert during the night. Sleep in two 4-hour periods adjacent to your normal sleep time. If you normally sleep from 2300 to 0700 and your night shift falls during that time, sleep for 4 hours immediately before and after work. Sleeping close to the beginning and the end of the normal sleep period maintains consistency in zeitgebers.

  After working an isolated night shift, go to sleep as soon as possible after work and force yourself to get up after 4 hours. This way you'll be sleepy at your normal bedtime and will be able to sleep all night. Sleeping longer than 4 hours after working will significantly retard the next nights sleep, likely causing REM deprivation if none needs to be up early for day shift the next morning.

* Alternative scheduling solutions:

DAYS, EVENINGS, AND NIGHTS: SCHEDULING TO MAXIMIZE PRODUCTIVITY

Slow creep
Midshift 8's
Split nights
Japanese catnap

PREVENTIVE COUNTERMEASURES

*** Sleep Hygiene:**

Noise B There are individual differences. Some need quiet to fall asleep, while others fall asleep best when listening to music or watching TV." Sensitivity to noise is higher with ~~age~~[28,29] and the female sex.[30] Occasional loud noise disturbs sleep even in people who do not remember the noise in the morning. It increases the number of awakenings and increases the amount of stage 1 sleep. Wearing earplugs, soundproofing the bedroom, and using white noise may increase sleep in noisy environments.[31]

Temperature B The ideal room temperature has not been determined. However temperatures > 24C (75F) seem to disturb sleep in humans,[32] temperatures less'than 22C were found to cause more emotional and unpleasant dreams.[33]

Weather B Are rainy days good for sleeping? Very high and very low barometric pressures were associated with increased sleepiness during routine EEG's.[34]

Mattress B The sleep surface seems irrelevant for sleep, however it may be important for orthopedic reasons.[35-37]

Diet B Although there is not a direct correlation between caloric intake and sleep, those who awaken early might try a bedtime snack. Milk products seem to improve sleep.[38] Diet should be balanced and in harmony with circadian rhythms. Start "day" with high protein meal, switching to complex carbohydrates toward bedtime. Maintaining regular meals during the waking period aids in sleep and in general alertness. Avoid caffeine and alcohol near bedtime.

Exercise B Athletes have more SWS than non-athletes, which has led researchers to conclude that a steady exercise program deepens sleep.[39] However, those one day exercise binges may not deepen sleep that night. The time of day is important as exercise in the afternoon or early evening has more effect than exercise in the morning or late evening.[31,41] So moderate exercise in the afternoon or early evening is recommended, especially if carried out over months. Exercise improves health and reduces stress. Vigorous aerobic exercise after awakening was shown to decrease the

time needed to shift the circadian sleep/wake cycle from 8 to 1.5 days in one animal study.[40]

Bedroom B Use the bedroom only for sleep and sex: avoid work, worry, and exercise.

Sleep behavior B Develop and practice a regular sleep ritual. Sleep only as much as you need to be alert during wakefulness. If you do not fall asleep in 30 minutes, then get out of bed and do an activity conducive to sleep (e.g., read, watch T.V.). Keep sleep time sacred, and minimize care-giving responsibilities.

Napping B The role of napping is somewhat controversial. It by most investigators to be restorative and useful in promoting alertness during following night work. Napping before work seems to provide some subjective benefit, and most researchers feel it at least does no harm. It is suggested that at least 20 minutes elapse between awakening and starting work, sot that sleep *inertia* has dissipated. (This phenomenon is readily noticed by those who nap at work and must respond quickly to an emergency. Power naps of 45-60 minutes can be helpful to maintain alertness. Napping for longer than two hours during day shifts can be detrimental as it affects the next night's sleep. If prior to a night shift, then a longer nap is useful. Nap in an environment conducive to sleep.

Bright Light Exposure - Exposure to bright light shifts the temperature nadir, changes the pattern of plasma cortisol concentration, effects subjective assessment of alertness, and improves cognitive performance in human subjects.[42-46] Shift workers exposed to 1000 lux ambient light had significantly higher levels of alertness and better cognitive performance across an 8-hour shift than shift workers in I-20 lux or 100 lux ambient light.[34] Before daytime sleep, avoid bright light. After daytime sleep, spend l-2 hours outside in bright sunlight.

* Pharmacologic Considerations

Alcohol B Although a single drink can help tense people fall asleep,[47] alcohol actually causes poor sleep instead of ameliorating it. Alcohol decreases the proportion of REM sleep, replacing it with what is essentially Stage 2 "filler." Chronic alcoholics may approach 100% REM sleep during withdrawal, suggesting that DT's may be a form of breakthrough REM. Alcohol causes greater sleep fragmentation, increasing the number of sleep stage changes per night from 40-50 to over 100. Also, alcohol consumption makes nocturia more likely.

Caffeine and nicotine B Both of these are known CNS stimulants and should be

avoided at least 4 hours before bedtime. They increase sleep fragmentation.

Sleeping pills B There are no miracle drugs to solve the shift work problem. As triazolam (Halcion) was being developed, there were great hopes for it because of its short half life (1.5 to 2 hrs). It is supposed to have less of a hangover and as long as it is used infrequently its efficacy does not seem to diminish over time. There is no clear objective evidence this benzodiazepine is free of the drawbacks common to other drugs in this class, including the problem of drug dependence.[48] Probably the best choice for a hypnotic in shift work is diphenhydramine.

Melatonin B No adverse side effects, LD_{50} in the stratosphere, improved sleep architecture, more growth hormone secretion, boosts immune response, fights jet lag, effective in promoting sleep, cheap and available without a prescription: what=s not to like about melatonin? Despite the old adage that if it seems to good to be true it probably is, melatonin=s benefits are real and have no demonstrable downside, except perhaps the exuberance of its proponents.[50] Is it useful in emergency medicine? Two recent studies looked at this question. One found that melatonin was of modest benefit to EP=s working a fast rotating schedule, but did not study those working long stretches of nights.[51] Subjects had improved alertness on night shifts. The other study found no objective benefit in paramedics working 4-6 night shifts in a row,[52] which is not a recommended sceduling strategy. Both groups= average ages were younger than 40, when night work becomes more difficult.
Should you take melatonin? Probably yes, especially during entrainment to a long stretch of nights. It won=t hurt during short stretches either. The older you are the more likely the benefit. Recommended dose: 3-6 mg.

OPERATIONAL STRATEGIES

Social life - Social life is important for the shift worker, helping to relieve stress by maintaining close ties with family and friends. Planning for quality social time is a vital as planning for work.

Physical Activity - The best method for maintaining wakefulness is physical activity. When you fell tired, physically do something (walk around, talk to someone, etc.)

Environmental Stimulation - Use lighting and other stimuli to make the Emergency Department an activating environment during night shifts. Engage in interactions with others. Avoid monotonous, boring work. Vary activities.

Pharmacologic Considerations - Use caffeine strategically. Don’t use it immediately

after starting a night shift or after a nap. Use it at the 0200-0500 circadian trough. Cease caffeine use 3 hours before retiring.

Japanese Catnap B If possible to arrange it with your work associates, schedule a nap in the middle of each night shift (45-60 minutes). Try to nap in an environment conducive to sleep.

CONCLUSIONS

1. **The shorter the shift the better.**

2. **Concept of isolated night shifts has gained widespread acceptance. Difficult logistically for most small groups to use exclusively, but a viable option for large groups. One night shift better than two. Brevity of the night shift rotation doesn't disrupt circadian rhythms.**

3. **Thomas schedule (one physician on long night rotation, others working isolated nights) best for most groups. No more than two nights off in a row for person on long night rotation.**

4. **Shift rotations best done in clockwise direction, with one month minimum time per rotation recommended.**

5. **Sleep in darkened room, minimize disruptions. Melatonin may improve sleep quality.**

6. **For those unable to maintain consistent sleep patterns, use of compromise strategies such as anchor sleep and napping may mitigate circadian disruptions.**

7. **Start "day" with high protein meal, switching to carbohydrate toward bedtime. Avoid caffeine and high calorie/high fat junk food before sleep. Eat meals regularly.**

8. **Bright light (10,000 lux for 2 hours after rising) is a useful adjunct for adjusting to new shifts.**

9. **Get regular exercise. Vigorous aerobic exercise after rising diminishes time needed to adjust to new shifts. Regular exercise in the afternoon or early evening can improve nocturnal sleep. Avoid heavy exertion just before sleeping.**

10. **Work with family and friends to plan regular quality time together.**

11. **Don't try to live a day shift life style while working night shifts! Hold administrative meetings early in the morning or late in the afternoon when working night shifts.**

12. **You and you alone are responsible for your health and well-being. Stand up for your circadian rights and live longer and happier!**

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