

Sleep Deprivation and Fatigue

I. Causes of Fatigue and sleepiness

In residents because of the schedules, calls, night float fatigue, or “excessive daytime sleepiness”, may be due to a variety of factors.

These may exist singly or in combination and include:

- **Too little sleep** (an average of 8.2 hours of sleep each night is required for most adults)
- **Fragmented sleep** (such as interruption by frequent phone calls or pagers or by residents who share the same on call room, the need to follow up on patients or to supervise more junior trainees or the drive back and forth to the hospital...)
- **Circadian rhythm disruption** (such as occurs with night float work in which there are predictable mismatches between circadian and endogenous rhythms of asleep and awake).
- **Other conditions that may masquerade as fatigue:** (such as anxiety, depression, stress, thyroid disease, other medical conditions, medication side effects, burnout, or career dissatisfaction)
- **Primary sleep disorders** (such as obstructive sleep apnea, narcolepsy, restless leg syndrome or insomnia)

II. Signs and Symptoms of Sleep Deprivation

Psychomotor function after 24 without sleep is equivalent to a blood alcohol content of 0.08%, a level recognized legally as inebriation. As is true with alcohol, one cannot depend on the individuals to perceive their own degree of impairment. Studies confirm residents, as true of other individuals, can't adequately evaluate their own degree of sleepiness. Furthermore, the ability to recognize "sleepiness" declines the sleepier someone is. One of the first skills lost is the ability to do something quickly: you may be able to compensate but if the task requires a quick response, errors are more likely.

Even if one sleeps two hours less sleep than "normal" they can have a sleep debt which in turns leads to performance impaired. Significant sleep debt may occur if sleep is sub-optimal over as few as 2-3 nights. Disruption in sleep also leads this impairment.

Sleep debt requires several consecutive full nights of sleep for adequate recovery, depending upon the number of days during which the sleep debt was accumulated as well as the individual's susceptibility and ability to "recover".

Of particular significance for residents, perhaps, is sleep inertia, the confusion and dysfunction that occurs upon awakening from deep sleep during deep NREM sleep, sleep in the middle of the night, or following a period of sleep deprivation. This may occur after as brief an interval as 30 minutes of sleep. This disorientation may include a period of amnesia for the period of awakening. The impairment from sleep inertia may be greater than that from sleep loss. Opinions in the sleep medicine field differ on the significance of sleep inertia.

Characteristic symptoms of sleepiness may be unrecognized. These include:

- Repeatedly yawning and nodding off during conferences

- Increased number of "microsleeps " . . . a few seconds of "sleep" the "awake" resident may not even recognize
- Increased tolerance for risk
- Passivity
- Inattention to details
- Decreased cognitive functions
- Irritability
- Motor vehicle collisions (or near misses)
- Increased errors

III. Adverse Effects of Sleep Deprivation

Sleep deprivation results in adverse physiologic changes such as hypoxemia, insulin resistance, increased sympathetic activity, a blunted arousal response, immunologic changes, increased appetite, weight gain and diminished motor coordination. It impairs cognitive processes resulting in diminished attention, vigilance, decision-making, and memory. It increases tolerance for risk and decreases motivation for learning.

Acute and chronic sleep loss also effects job performance where fatigue has been linked to errors resulting in serious accidents. In the United States, it is estimated to be responsible for 15-20% of transportation accidents, more than attributed to drugs and alcohol combined.

- **Sleep Debt: Could you have one and not know it?**

Most people don't accurately assess how sleepy they are. You may be chronically tired and not know it. The easiest way to determine if you have a sleep debt: If you sleep two or more hours extra on your days off compared to work days, you're carrying some "sleep debt" and your body is trying to "recover" lost sleep.

- **The Literature on Sleep, Fatigue and Residents**

- *Sleepiness*: A multicenter survey of residents in a variety of specialties suggests that residents have Epworth Sleepiness Scale values comparable to patients with diagnosed sleep disorders such as sleep apnea and narcolepsy. (You can check the scale at the end of this handout to assess your tendency for sleepiness).

- *Impaired Attention*: Sustained attention and vigilance tasks were impaired **equally** when residents were exposed to a heavy call schedule versus light call schedule with a blood alcohol level of 0.04-0.05g%.

- Internal medicine house staff found that 64% were chronically sleep deprived; many admitted to dozing while writing notes (69%), reviewing medication lists (61%), interpreting labs (51%), and writing orders (46%). In-service training exam scores among family practice residents correlated with their amount of "sleep" prior to the test. Internal medicine residents post-call were less accurate in ECG interpretation.

- Emergency Medicine residents documented fewer components of a history and physical examination depending upon their shift. They also performed less well during a simulation of intubation skills.

- Surgical residents demonstrated more errors and required more time than usual during simulations of common procedures. Measured postoperative complications increased by 45% for resident surgeons for those procedures they performed the day following their night on call.
- *Cognitive and Procedural Abilities Decline:*
 - One study noted that residents working on a traditional schedule (>24 hours worked when on call) made 36% more serious medical errors and 6 times as many diagnostic errors as compared to their colleagues whose work hours were limited to 16 hours while on call.
 - Twenty percent of anesthesia residents indicated that sleepiness prevented them from performing clinical duties and 12% attributed errors to fatigue.
 - Another study of anesthesia residents found objective evidence of sleepiness when residents were tested after their "normal" (not post-call or on-call) sleep period. The same residents were tested again after allowing 2 extra hours in bed. The sleepiness improved and normal scores were obtained, implying **that residents sleep deprive themselves even in a non-call situation.**
- *Emotional Impact of Sleep Deprivation:*
 - Individuals are generally less tolerant, patient. They can't "read" emotional content of other faces and themselves have flatter emotional responses. They may not have "as much perspective" as when rested and may respond disproportionately to circumstances and events
- *Resident Well-Being:*
 - Needle stick accidents increase by 50% at night (compared to the day), increasing the risk of exposure to blood borne pathogens. A study performed with surgical residents after implementation of the new work hour rules suggested that there were less mood disturbances than prior to the new rules.
- *Motor Vehicle Collisions Increase:*
 - Pediatric house officers were more likely than faculty to fall asleep while at the wheel either while driving or stopped at a traffic light (49% of the residents vs. 13% of the faculty) and more likely to have a motor vehicle accident (20 vs. 11). **Most incidents occurred post-call.**
 - Nearly 60% of ER residents reported a near miss motor vehicle collision, 80 percent of which followed their work on a night shift. The risk increased with the number of night shifts they did per month.
 - Residents who worked longer than 24 hours were 2.3 times more likely to have a motor vehicle accident.

IV. Prevention/Treatment/Management of Fatigue

It is probably inevitable there will be some sleep loss and fatigue in the course of medical training. However, it must be managed so it doesn't interfere with resident well-being, education, patient care and safety.

The prevention, treatment, and management of resident fatigue are therefore a shared responsibility of accrediting bodies, GME, residency programs, faculty, and residents.

Please check below the Residents' Responsibilities:

- *Driving home:* Post-call is a particular concern for the safety and well-being of residents. It takes 4 seconds to drive off the road and have a motor vehicle collision. Four-second "micro sleeps" are

common in sleepy residents. Trainees may want to live close enough that they don't have a long drive post-call. (more below)

- **Recognize Vulnerability and Symptoms in Residents and Colleagues:** Although there is individual variation, most adults need ~ 8 hours of sleep per night. The impact of too little sleep is cumulative. People typically under-estimate their degree of sleepiness. So as with alcohol, by the time you think you're sleepy you're probably profoundly affected. Your performance level will fall especially with tasks that require a great deal of attention. **Even if you feel you're not at risk, consider that your colleagues may be. Watch out for your fellow residents.**
- **It Is Not Normal to Fall Asleep in a Lecture:** If it is a boring lecture, noted author Dinges says, "You'll be awake and annoyed but not asleep." If you are nodding off or falling asleep this is a major symptom that you're too fatigued. You're experiencing "microsleep." Therefore you can more easily make poor judgments medically and/or sustain a motor vehicle collision when you're driving home post-call.
- **Residents must set priorities for "time off":** Residents should be careful stewards of their time. There is a temptation to cram way too much into the hours free from responsibilities. During off hour pursuits include time for professional reading, family and friends, hobbies, and spiritual and community connections. **Although all these are important, protect your recovery time.**
- **Moonlighting:** Both internal moonlighting and external moonlighting count in duty hour limits. For programs which allow moonlighting, program directors will need to have a way to know when, how frequently and for what duration external moonlighting is occurring. Residents and program directors need to carefully evaluate moonlighting opportunities so as not to compromise their limited time to obtain rest missed as a part of residency training. Nighttime moonlighting in particular may not be appropriate given its likely contribution to sleep debt.
- **Report duty hours honestly:** The ACGME-i Requirements place professional expectations on residents and faculty: "Residents and faculty must demonstrate an understanding and acceptance of their personal role in...honest and accurate reporting of duty hours, patient outcomes, and clinical experience data." Some GME programs at AUBMC require residents to report duty hours through Myevaluations.com, and GME requires residents to report duty hours yearly through the GME Resident Survey. Please be honest. Your Program and AUBMC need to know where there are potential issues, patient volume or acuity that may keep you here over hours. This documentation is necessary to advocate for additional resources to help all of us care optimally for patients.

V. Practical Strategies on Alertness Management/Fatigue Mitigation

To minimize the impact of fatigue:

- Develop healthy sleep habits
 - Keep to a routine when possible. Going to bed and arising about the same time may help.
 - Get adequate exercise but avoid it directly before sleep.
 - Eat right. Try not to go to bed hungry; however eating a large meal within 3 hours of sleep may keep you awake.
 - Make the bedroom comfortable with appropriate mattress, pillow, cooler temperature, sound and lighting level.
 - Develop relaxation rituals before sleep such as reading, meditation, or listening to music. Your workday may have been extremely intense. You may come home to

additional responsibilities, even enjoyable ones, such as spending time with a significant other or children. Decompressing helps sleep.

- Optimize sleep environment: cool, quiet, dark
 - Protect sleep time. Turn off the phone. Ask your family/significant others, friends to help you. Try not to incur a sleep debt from non-work activities
 - Get light exposure when you're awake
- Protect sleep time on your days "off"; engage your family/housemates in your need for protected sleep time
 - Drive safely; consider nap before drive home, carpool with another resident
 - Report your duty hours honestly (if there is a problem on a service we need to fix it)
 - Recognize you will probably be more prone to accidents (e.g. needle stick injuries, sharp exposures)
 - Consider the use of prophylactic caffeine
 - Avoid other medications unless prescribed via a regular doctor-patient relationship
 - While on call
 - to combat sleep inertia: Anticipate it, get out of bed, stand up, turn on the lights
 - If possible nap 20-30 minutes every 12 hours; the earlier in a period of sleep deprivation "on call" the better
 - Post call:
 - Aim for 7-8 hours of sleep per night. This is especially true after a period of sleep loss, such as a busy rotation, is anticipated.
 - Make sure you're getting sufficient catch up sleep; at least enough to feel "rested" when you wake up. **Make rest a priority.**
 - If believe (or know) you have a sleep disorder, seek appropriate medical attention and get it treated.

Naps:

- Naps can prevent and ameliorate some degree of fatigue. However, there are some caveats that should be observed.
 - Brief (20-30 minutes) napping prior to prolonged period of sleep loss, such as 24 hours on call, can enhance alertness. Consider a nap prior to a 24-hour period of expected wakefulness.
 - To be therapeutic during a shift, naps should ideally be frequent (every 2-3 hours) and brief (15-30 minutes).
 - Naps work best the "earlier" they are in a period of sleep deprivation. If you can pick just one nap. Get it as early in the period of sleep deprivation as possible. Better to "top off the tank early than wait till very fatigued.
 - Time naps during circadian window of opportunity, between 2-5 a.m. and 2-5 p.m.
 - Longer naps, such as those more than 30 minutes duration may be counter-productive in terms of "sleep inertia". But better to nap than "no nap" and if sleep inertia, then know how to counter sleep inertia, .by: getting upright, getting moving, get upright, bright lights, caffeine, etc.
 - Utilize quiet, environmentally comfortable locations for naps, ideally where there are no other interruptions such as colleagues dictating or using the computer. Hand over beepers and clinical responsibilities to another colleague when possible.

Recognize these are general guidelines and there is a great deal of individual variability to napping.

Safe Driving Post Call/Extended Duration of Work:

- Driving can put you and others at risk. Motor vehicle collisions increase with fewer than 5 hours of sleep. The first ethical principle of physicians “primum non nocere” (first, no harm) applies to all we do as physicians, including driving. It takes 4 seconds to run off the road. Signs of drowsiness include difficulty focusing on the road or keeping your eyes open, nodding off, yawning, drifting from one lane to another, missing exits, and amnesia for some period of the drive.
 - Consider how close you should live to the hospital. It may be appealing to live 30-40 minutes away, but this may increase your risk of driving home post call. Consider living close to the hospital and minimizing driving/commuting time if call will be frequent
 - Avoid driving if you’re tired
 - Consider transportation alternatives, a ride with a friend, public transportation etc. (see below)
 - Chewing gum, loud music, and opening the windows...these strategies don’t work to keep you “awake at the wheel” if you’re tired. Instead, don’t drive!
 - Realize you may not perceive just how tired you are. Even if you feel perfectly well, you are still vulnerable
 - Consider taking a nap before driving home post call; A 20-30 minute nap may be very helpful.
 - Strategically use caffeine
 - Immediately stop driving if you find yourself becoming drowsy. Find a safe location and nap.

Caffeine

- Using caffeine, a central nervous stimulant, “strategically” can help manage fatigue. It is not a sleep substitute. Tolerance quickly develops. If you intend to use caffeine to counteract fatigue, minimize the regular social use of caffeine so that it will be more effective when consumed. Caffeine may modulate symptoms but does not substitute for sleep. The effects of caffeine generally occur within 15-30 minutes. If you use it just before you drive home its stimulant effects may not kick in until you are home and ready to go to sleep. Avoid regular caffeine use (the social use of caffeine) if you plan to use to abate sleepiness. Instead use it for its “drug effect” when you are on call only.
 - 400-600 mg (3-4 cups of brewed coffee) is a usual dose, but some individuals may be overly sensitive to this amount.
 - Consider using caffeine 30 minutes prior to driving home following night call.
 - Useful only for temporary relief of sleepiness. (The benefit typically lasts 3-5 hours)
 - Adverse effects include disruption in sleep quality, tolerance, diuresis and irritability
 - Can minimize sleep inertia symptoms

Other medications/drugs:

- It is important for residents to avoid self-medicating or prescribing casually for colleagues. It is not allowed to self-prescribe or prescribe for a friend/colleague outside of an established doctor-patient relationship. It is far better for residents, as for patients, to have a regular physician who coordinates their care.
 - Sleep medications to increase sleep (sedative hypnotics) or stimulants should be used only after a complete medical/sleep consultation.
 - Do not prescribe for yourself (or a family member, colleague)
 - Melatonin induces sleep onset and may be used for circadian rhythm disturbances. There are few data available to evaluate its use for residents.
 - Sedative hypnotics such as zolpidem (Ambien) and zaleplon (Sonata) and/or behavioral therapy may be prescribed for certain sleep disorders and the military is testing these products for settings of sleep deprivation. They are not indicated for chronic use.
 - Adverse medication effects are common and include headache, drowsiness, disorientation, GI disturbance and dizziness.

- Alcohol should not be used to enhance sleep and disrupts optimal sleep quality.
- Avoid the use of over-the-counter stimulants.
- Stimulants such as methylphenidate (Ritalin), dextroamphetamine (Dexedrine), modafinil, and armodafinil should not be used unless prescribed by one's own personal physician for an appropriate medical condition.
- Alcohol is a drug with documented sleep effects. Try to avoid or minimize. Realize the impact of fatigue and alcohol on performance and driving are cumulative.

THE EPWORTH SLEEPINESS SCALE

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

0 = no chance of dozing
1 = slight chance of dozing
2 = moderate chance of dozing
3 = high chance of dozing

SITUATION	CHANCE OF DOZING			
Sitting and reading	0	1	2	3
Watching TV	0	1	2	3
Sitting inactive in a public place (e.g a theater or a meeting)	0	1	2	3
As a passenger in a car for an hour without a break	0	1	2	3
Lying down to rest in the afternoon when circumstances permit	0	1	2	3
Sitting and talking to someone	0	1	2	3
Sitting quietly after a lunch without alcohol	0	1	2	3
In a car, while stopped for a few minutes in traffic	0	1	2	3

To see how sleepy you are, please check your total score below:

1 - 6	Congratulations, you are getting enough sleep!
7 - 8	Your score is average
9 and up	Seek the advice of a sleep specialist without delay