

Trauma MedEd

Fatigue And Decision Making

As you all know, trauma professionals are expected to perform even if they have not had adequate sleep. This can occur with certain shift schedules, long periods of work, or due to call schedules and duration of call. What do we really know about the effects of sleep deprivation on us?

First, let's consider decision making. Neuroscientists at Duke looked at how we approach risky decisions when we are sleep deprived. A total of 29 adults (average age 22) were studied. They were not allowed to use tobacco, alcohol and most medications prior to sleep deprivation, which lasted for 24 hours. They were given a risky decision making task (a controlled form of gambling), and two other tests while in a functional MRI unit to watch areas of brain activation.

The researchers found that, when well rested, the subjects had a bias toward avoiding loss in the gambling test. After a single night of sleep deprivation, this shifted to pursuing gain. The MRI also showed an increased activity in the reward anticipation parts of the brain. Overall decreased vigilance was noted, but this did not correlate with the shift away from risk avoidance.

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FATIGUE! IT'S NOT NEW!

"...it is high time the fact was recognized that surgeons do indeed become "tired" and perhaps a most critical point in a surgeon's "judgment" will be when he is fit to operate."

WORTHINGTON G. SCHENK, JR., M.D.
Annals of Surgery 161(4):627, 1965
Editorial Comment

TRAUMA CALENDAR OF EVENTS

TRAUMA / CRITICAL CARE SYMPOSIUM

PLACE: SANTA BARBARA COTTAGE HOSPITAL, SANTA BARBARA CA

DATE: JULY 20, 2012

SWAN XX TRAUMA CONFERENCE

LIVERPOOL, NSW, AUSTRALIA

DATE: JULY 27-28, 2012

Bottom line: Sleep deprivation appears to create an optimism bias. Fatigued individuals act like positive outcomes are more likely and negative consequences are less likely. One of the most common and important things that trauma professionals do is to make decisions that may affect patient outcome (e.g. choose a destination hospital, intubate, order and interpret a test, move to the operating room, choose a specific operative procedure). We all have a set of thresholds that help us come to the "right" decision based on many variables. It appears that a single night of sleep deprivation has the potential to skew those thresholds, potentially in directions that may not benefit the patient.

Reference: Sleep deprivation biases the neural mechanisms underlying economic preferences. J Neuroscience 31(10):3712-3718, March 9, 2011.

Fatigue In Prehospital Providers

EMS providers across the country are assigned to a variety of schedules, ranging from shift work to continuous 24 hour service. Overnight duty, rotating schedules, early awakening and sleep interruptions are common. Unfortunately, there are not many studies on the effects of fatigue on EMS. I did manage to find an interesting study from 2012 that I'd like to share.

A group of about 3,000 providers attending a national conference were surveyed using 2 test instruments (Pittsburgh Sleep Quality Index (PSQI) and Chalder Fatigue Questionnaire (CFQ)). The PSQI measures subjective sleep quality, sleep duration, disturbances, use of sleeping meds and daytime dysfunction. The CFQ measures both physical and mental fatigue.

Only 119 surveys were completed, despite the fact that a \$5 gift card was offered (not enough?). The most common certification was EMT-Basic (63%) and most had worked less than 10 years. Most were full-time, with the majority working 4-15 shifts per month. The following demographics were of interest:

- Self-reported good health - 70%
- Nonsmokers - 85%
- Moderate alcohol or less - 62%
- Overweight or obese - 85%

A total of 45% reported experiencing severe physical and mental fatigue at work, and this increased with years of experience. The sleep quality score confirmed this fact. Also of interest was the incidental finding of a high proportion of overweight or obese individuals. Sleep deprivation is known to increase weight, and increased weight is known to increase sleep problems, creating a vicious cycle.

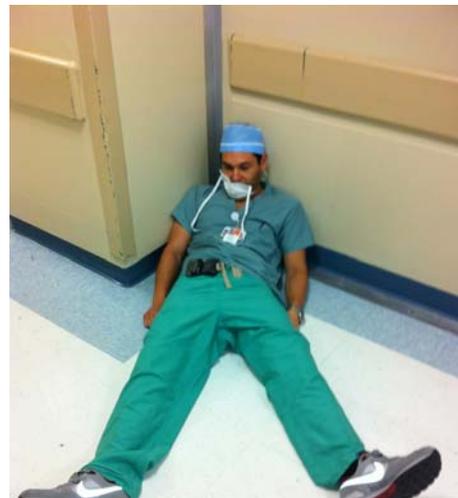
Bottom line: This is a small convenience study, but it was enough to show that there is a problem with fatigue and sleep quality in EMS providers. Federal law mandates rest periods for pilots, truck drivers and tanker ship personnel. The accrediting body for resident physicians has guidelines in place that limit their time in the hospital. Prehospital providers perform a service that is just as vital, so it may be time to start

looking at a more reasonable set of scheduling and work guidelines to protect them and their precious cargo.

Reference: Sleep quality and fatigue among prehospital providers. Prehospital Emergency Care 14(2):187-193, April 6, 2010.

Fatigue And The Trauma Surgeon

The effects of fatigue on the surgeon have been looked at a number of times over the years. Most of this work focuses on resident physicians, however. Another problem with the majority of these studies is that they did not test the surgeon or resident on tasks that reflect real life practice.



A study from Arizona State University used a laparoscopic simulation that tested both psychomotor and cognitive skills that would be called on during real surgical procedures. In addition to the purely manual task of stacking varied sizes of rings using laparoscopic instruments, exercises were developed and validated that tested attention, tracking and other critical components. Monitored parameters included hand and tool movement, smoothness and economy of motion, and time required to complete the task. An overall proficiency score was calculated.

Five residents and nine attending physicians were tested. They were all given 4 practice sessions with the simulator before the study began. Sleep hours and caffeine use during call were recorded using a questionnaire. Each individual was then tested three times prior to being on call and three times post-call.

As would be expected, **attending surgeons showed higher proficiency scores than residents both pre-call and post-call**. However, both groups experienced significant declines in proficiency and significant increases in cognitive errors post-call. Interestingly, attending surgeons made 25% fewer cognitive errors post-call when compared to residents, and their psychomotor skills were unchanged. This suggests that the attendings were focused on skills at the expense of decision making.

Two other interesting items from this paper:

- Errors increased exponentially with subjective reported fatigue in the attending surgeons. This means that **a small amount of attending surgeon fatigue led to a large increase in errors**. The implication is that the older attendings had less reserve, and that their greater skills and experience could be quickly overwhelmed.
- **Caffeine intake had no effect on motor skills or cognitive errors.**

Bottom line: Fatigue from post-call sleep deprivation impedes psychomotor and cognitive functions, as well as performance. Residents are affected more than attending surgeons, but attending performance declines more rapidly as they grow fatigued. As any post-call surgeon knows, activities the day after call should be limited to the mundane to optimize patient safety. And coffee does not make it any better!

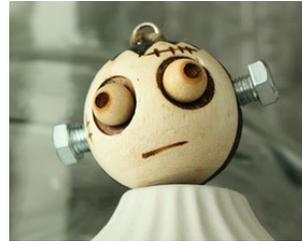
Reference: The effect of fatigue on cognitive and psychomotor skills of trauma residents and attending surgeons. American Journal of Surgery 196(6):8133-820, 2008.

Zoning Out

We've all experienced it. That moment of wandering attention. The semi-blank stare. You can't remember that question you were going to ask. It's the "zoning out" phenomenon. It happens more frequently when you are fatigued or sleep-deprived. What is really happening in your head when you go blank? You're neither asleep nor fully awake.

The University of Wisconsin at Madison has been able to shine a little light on this problem. While we are

awake, neurons in the cerebral cortex fire irregularly, which results in rapid fluctuations on an EEG. As we sleep, the brain alternates periods that look like an awake EEG with periods where the neurons stop firing altogether.



The researchers monitored activity in focal areas of rat brains (tough to extrapolate this one). They found that **after prolonged sleep deprivation, small random areas of the brain would switch off and look like they were asleep. However, the animal appeared to be awake**, and the EEG looked like that of an awake rat. If neurons switched off in the motor strip while tasks were being performed, **performance errors increased dramatically.**

Bottom line: These "tired neurons" may be responsible for attention lapses, poor judgment, mistakes and irritability when we haven't gotten enough sleep, but don't feel sleepy. This phenomenon may represent a global state of neural instability, and individual neurons switch off to save energy or restore themselves.

Reference: Nature 472:443-447, April 27, 2011.

Fatigue And Your Patients

There are generally about 30,000 deaths from car crashes each year. An analysis by the AAA shows that **drowsiness is a factor in about 1/6 of them!** In the early 1990's, NHTSA looked at this problem and found only about 4% of fatal crashes were due to sleepiness.

What gives? Is everybody suddenly a lot sleepier these days? It's actually due to the way it is reported. As you can imagine, it's difficult to figure out if fatigue was the cause after the fact in a fatal crash. The driver certainly can't tell you.

AAA looked at crash rates and applied information it obtained from a driver survey it administered. They found **that 41% of drivers admitted to falling asleep behind the wheel at some point.** And one in ten

admitted to it happening in the past year. The AAA believes that their estimates are far more accurate than the lower NHTSA numbers.



Sometimes our patients tell us that they think they may have fallen asleep at the wheel. You should assume it in anyone who is driving home after a long shift, especially early in the morning.

Educate your patients about the warning signs of fatigue while driving. Everyone knows the obvious ones: **droopy eyes, frequent daydreams, drifting in and out of lanes.** But here are some of the not so obvious:

- Difficulty remembering the last few miles driven
- Frequent yawning
- Restlessness, irritability or aggressiveness
- Frequent scratching and rubbing

Once fatigue becomes a factor, the driver is not only a danger to themselves, but to everyone else on the road as well. The solution: pull off as soon as practical and call for assistance. Caffeinated drinks are overrated and take too long to work!

Sources: American Automotive Association, NHTSA, National Sleep Foundation

Fatigue: Final Words

Fatigue is a major problem for many healthcare providers, from prehospital to those working in post-discharge institutions. Some interesting and underappreciated statistics about work-related injuries and shift work:

- Work related injuries increase on off-shifts. Compared to day shift, 15% more injuries occur

on evenings and 28% more on nights.

- When working long shifts, there is a 13% increase in injuries after 10 hours, and a 30% increase after 12 hours.
- When working consecutive nursing shifts, there is an 8% increase in injury risk the 2nd night, a 38% increase the 3rd night, and a 70% increase the 4th night.

We know sleep deprivation and fatigue are bad. The laundry list of adverse effects is lengthy and includes confusion, memory problems, depression, weight gain, headache, diabetes, cardiovascular disease, and as I've previously discussed, serious performance problems.

What can be done about it? The key is to raise awareness, along with acceptance and implementation of the remedies. Many hospital workplaces **are** doing something about it. Here are some successful interventions that reduce workplace fatigue:

- **Authorize a real break system.** A break is a 30 minute period which is ideally away from the immediate work setting, where there are no disturbances (phone, pager)
- **Ensure effective "handoffs" between co-workers when taking breaks**
- **Encourage workers to identify fatigue in their co-workers and find ways to decrease it**
- **Modify schedules** to adhere to the Institute of Medicine's standards
 - No more than 20 hours of overtime a week
 - Limit the number of 12 hours shifts
 - No double shifts

Some workplaces are unfortunately not as progressive, and the work culture takes pride in showing how individuals can "power through" even when tired. Just remember, this is bad for you and bad for your patients. As we grow older, it becomes even more difficult and dangerous. It's only a matter of time before someone, somewhere goes too far, and they or their patient will end up "dead tired."



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