Sleep and Fatigue Education in Residency

Travis W. Stembridge, MD
Learning Objectives

1. List factors that put you at risk for sleepiness and fatigue.
2. Describe the impact of sleep loss on residents’ personal and professional lives, and on resident and patient safety.
3. Recognize signs of sleepiness and fatigue in yourself and others.
4. Challenge common misconceptions among physicians about sleep and sleep loss.
5. Adapt alertness management tools and strategies for yourself and your program.
Why are residents called residents?
The Scope of the Problem

“How do you brainwash someone? You sleep deprive them. You feed them bad food and you repeat things over and over again. It’s like that kind of covers residency.”

Papp et al, Academic Medicine, 2002
Sleepiness in residents is equivalent to that found in patients with serious sleep disorders.

Papp et al, Academic Medicine, 2002
Mustafa et al, Sleep and Breathing, 2005
Sleep Loss and Fatigue – Addressing the Issue

So why is the problem of sleepiness and fatigue in residency underestimated?
The culture of medicine says:

• Sleep is “optional” (and you’re a wimp if you need it)
• Less sleep = more dedicated doctor

Perception that reducing work hours

• Compromises patient care
• Reduces educational opportunity
What Causes Sleepiness?
Physiologic Factors that Cause Sleepiness

Myth: “It’s the really boring morning conferences that put me to sleep.”

Fact: Environmental factors (passive learning situation, room temperature, low light level, etc) may unmask but DO NOT CAUSE SLEEPINESS.
Conceptual Framework (in Residency)

**EXCESSIVE DAYTIME SLEEPINESS**

- **Insufficient Sleep**
  (on call sleep loss; inadequate recovery sleep)
  (Quantity)

- **Fragmented Sleep**
  (pager, phone calls)
  (Quality)

- **Circadian Rhythm Disruption**
  (night float, rotating shifts)

- **Primary Sleep Disorders**
  (sleep apnea, etc)
Myth: “Like a lot of residents, I only need five hours of sleep, so none of this applies to us.”

Fact: Sleep loss is cumulative; getting less than eight hours of sleep starts to create a “sleep debt” which must be paid off.

Fact: The effects of sleep loss on attention and working memory become evident when individuals are limited to six hours of sleep per night*

*Van Dongen et al, Sleep, 2003
Sleep Deprivation Decreases Attention

Van Dongen et al, Sleep, 2003
Avoid *starting out* with a sleep deficit!

–Even during light or no call rotations, residents do not obtain adequate sleep (average 6.38 hrs)*

*Arnedt, JAMA, 2005*
Adaptation to Sleep Loss

**Myth:** “I’ve learned not to need as much sleep during my residency.”

**Fact:** Sleep needs are genetically determined and cannot be changed.

**Fact:** Human beings do not “adapt” to getting less sleep than they need.*

**Fact:** Although performance of tasks may improve somewhat with effort, *optimal* performance and *consistency* of performance do not! (e.g., post-call performance on a neurocognitive battery does not differ by training year)

*Arnedt, JAMA, 2005*
Sleep Fragmentation Affects Sleep Quality

Young adults

Elderly

Awake
REM
Stage 1
Stage 2
Stage 3
Stage 4

Hours of sleep

ON CALL SLEEP

Morning Rounds

NORM...
Consequences of Sleep Deprivation

- Driving Safety
- Patient Care Professionalism
- Workplace
- Mood & Performance
- Family Relationships
- Health & Well-being
- Learning

Sleep Deprived Resident
“Your own patients have become the enemy...because they are the one thing that stands between you and a few hours of sleep.”

Papp et al, Academic Medicine, 2002
Residents Averaging Less Than Five Hours of Sleep per Night

Were *significantly* more likely to report:

<table>
<thead>
<tr>
<th>Event</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement in a malpractice suit</td>
<td>2.02</td>
</tr>
<tr>
<td>Use of medication to stay awake</td>
<td>1.91</td>
</tr>
<tr>
<td>Serious conflict with other residents</td>
<td>1.86</td>
</tr>
<tr>
<td>Accidents/injuries</td>
<td>1.84</td>
</tr>
<tr>
<td>Making a serious medical error</td>
<td>1.74</td>
</tr>
<tr>
<td>Noticeable weight change</td>
<td>1.59</td>
</tr>
<tr>
<td>Increased use of alcohol</td>
<td>1.52</td>
</tr>
<tr>
<td>Serious conflict with nursing staff</td>
<td>1.47</td>
</tr>
</tbody>
</table>

Baldwin & Daugherty, Sleep, 2004
Average Hours of Sleep per Night Impacts Residency Experience

As Nightly Sleep Increases:

- Satisfaction with residency increases
- Stress rating decreases
- Sense of being “impaired” decreases
- Reports of feeling “belittled or humiliated” decrease

Baldwin & Daugherty, Sleep, 2004
Impact on Patient and Personal Health and Safety
Resident Performance and Fatigue

- Meta-analysis of 20 studies involving residents
  - 24 hour sleep deprivation associated with significant decline in:
    - Vigilance
    - Memory
    - Cognitive performance
    - Clinical performance
  - Magnitude of performance decline
    - Almost one SD overall
    - More than 1.5 SD on clinical tasks

Philibert I. Sleep, 2005
Resident Self-reported Errors by Average Daily Hours of Sleep

Baldwin & Daugherty, Sleep, 2004
Impaired Speed and Errors in Performance: Laparoscopic Surgical Simulator

Pre and post 17-hour overnight call duty in a surgical department (median reported sleep time 1.5 h; range 0-3 h)

Grantcharov TP et al, BMJ, 2001
Residency Specific Data

• **Surgery:** 20% more errors and 14% more time required to perform simulated laparoscopy post-call (two studies)
  

• **Internal Medicine:** efficiency and accuracy of ECG interpretation impaired in sleep-deprived interns
  
  Lingenfelser et al, Med Educ, 1994

• **Pediatrics:** time required to place an intra-arterial line increased significantly in sleep-deprived
  
  Storer et al, Acad Med, 19891
Residency Specific Data

- **Emergency Medicine**: significant reductions in comprehensiveness of history & physical exam documentation in second-year residents
  
  Bertram  N Y State J Med 1988

- **Family Medicine**: scores achieved on the ABFM practice in-training exam negatively correlated with pre-test sleep amounts
  
  Jacques et al J Fam Pract 1990
Intern Sleep and Patient Safety Study

• Randomized trial comparing interns’ alertness and performance on traditional “q3” schedule with 24-30 hour shifts (ACGME-compliant) vs. 16 hr max schedule

• Results: *Twice as many* EEG-documented attentional failures at night on traditional schedule

Between Groups $p=0.02$
Intern Sleep and Patient Safety Study

Results: 36% more serious errors on traditional schedule, including five times as many serious diagnostic errors

Specialties Most Likely to Report Experiences of Sleep Deprivation

1. Neurosurgery 4.06
2. General Surgery 3.65
3. Orthopedic Surgery 3.17
4. Neurology 3.16
5. OB/Gyn 3.10
6. Pediatrics 3.01

Sleep deprivation scale:
1=“Never”; 5=“Almost daily”

Baldwin & Daugherty, Sleep, 2004
Drowsy Driving: Effects of Sleep Deprivation on Physician Safety
Thank you for driving carefully through the village.
Harvard Work Hours, Health, and Safety Study – Methods

- **National survey**: To objectively quantify the work schedules experienced by house staff, and determine if increased hours are associated with increased risk of house staff injury
  - Study of a national sample of house staff
  - 1,417 person-years monthly survey data collected from 2,737 interns nationwide in 2002-2003
  - Monthly surveys
  - Work hours, crashes, and injuries
  - Correlation of work hours and motor vehicle crashes

For each extended duration work shift scheduled per month interns had:

- 8.8% (3.2%-14.4%) increased monthly risk of any motor vehicle crash
- 16% (7.6%, 24.4%) increased monthly risk of a motor vehicle crash on the commute from work

Driving Simulator

Condition effects:
P < 0.001

No effect of sex or training year

Arnedt et al. JAMA 2005
Potential Legal Implications for House Staff and Hospitals

- In New Jersey, “driving after having been without sleep for a period in excess of 24 consecutive hours” now explicitly considered reckless.
- Laws pending in several other states to make drowsy driving a felony.
- Several “high profile” cases in courts accuse hospitals responsible for fatigue-related crashes even after staff have left.
Recognize Signs of Driving While Drowsy

- Trouble focusing on the road
- Difficulty keeping your eyes open
- Nodding
- Yawning repeatedly
- Drifting from your lane, missing signs or exits
- Not remembering driving the last few miles
- Closing your eyes at stoplights
KEEP
RIGHT
Risk Factors for Drowsy Driving

- Driving long distances without breaks
- Driving alone or on a boring road
- Driving at high risk times of day


Driving home post-call
Drowsy Driving: What Does and Does Not Work

• What works:
  – AVOID driving if drowsy.
  – If you are really sleepy, get a ride home, take a taxi, or use public transportation.
  – Take a 20 minute nap and/or drink a cup of coffee before going home post-call 20 minute recovery time.
  – Stop driving if you notice the warning signs of sleepiness.
  – Pull off the road at a safe place, take a short nap.

• What doesn’t work:
  – Turning up the radio
  – Opening the car window
  – Chewing gum
  – Blowing cold air (water) on your face
  – Slapping (pinching) yourself hard
  – Promising yourself a reward for staying awake
Impact on Medical Education

“We all know that you stop learning after 12 or 13 or 14 hours. You don’t learn anything except how to cut corners and how to survive.”

Papp et al, Academic Medicine, 2002
Impact on Medical Education

**Myth:** “If I’m not on call as much, I’ll learn less.”

**Fact:** Study of surgical residents showed more frequent call is associated with *less* participation in operative procedures*

**Fact:** Satisfaction with learning in residency is negatively correlated with average hours of sleep**

*Sawyer et al, Surgery 1999

Studying by osmosis
Bottom Line

You need to be alert to take the best possible care of your patients and yourself.
Recognizing Sleepiness in Yourself and Others
**Myth:** “I can tell how tired I am and I know when I’m not functioning up to par.”

**Fact:** Almost 50% of the time they had actually fallen asleep, anesthesia residents did not perceive themselves to be asleep*.

**Fact:** The sleepier you are, the *less accurate* your perception of degree of impairment.

**Fact:** You can fall asleep briefly (“microsleeps”) without knowing it!

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*Howard et al Academic Med, 2002*
Microsleeps

- Unintentional episodes of sleep, typically between 5-to-14 seconds in duration

**Cause:** Sleep debt, sleep deprivation.

**Behavioral Correlates:** Head nods, drooping eyelids.

- Subjective “unawareness” or “spacing out” sensation

- Extremely dangerous in situations when continual alertness is demanded (driving, operating).


Risser, M. R., Ware, J. C., and Freeman, F. G. Sleep, 2000
The Effects of Sleep Loss are Cumulative

Psychomotor vigilance task (PVT) performance during baseline (B), sleep restriction (P) and recovery (R)

Dinges et al, SLEEP, 1997
Myth: “If I can just get through the night (on call), I’m fine in the morning.”

Fact: Performance declines rapidly after about 15-16 hours of continued wakefulness.

Fact: The period of lowest alertness after being up all night is between 6 a.m. and 11 a.m. (e.g., morning rounds).
Recognize the Warning Signs of Sleepiness

• Falling asleep in conferences or on rounds
• Feeling restless and irritable with staff, colleagues, family, and friends
• Having to check your work repeatedly
• Having difficulty focusing on the care of your patients
• Feeling like you really just don’t care
Alertness Management Strategies
Myth: “I’d rather just “power through” when I’m tired besides, even when I can nap, it just makes me feel worse.”

Fact: Some sleep is always better than no sleep.

Fact: At what time and for how long you sleep are key to getting the most out of napping.
Sleep Inertia

- State of impaired cognition, grogginess, disorientation experienced upon waking from sleep
  - Increased if awakened from slow wave sleep

- Studies suggest severe cognitive impairments lasting up to 10 minutes after awakening*
  - Worse than performance after 26 hr sleep deprivation
  - Residual effects up to two hours

*Wertz, JAMA, 2006
Tassi and Muzet, Sleep Med Rev, 2000
Cognitive Performance on Awakening From Sleep Compared with Subsequent Sleep Deprivation

Wertz et al, JAMA, 2006
Napping

Pros: Temporarily improve alertness.
Types: Preventative (pre-call), operational (on the job)
Length: Short naps should be no longer than 30 minutes to avoid sleep inertia*
Timing: Take advantage of circadian “windows of opportunity” (2-5 am and 2-5 pm)

*Note: individuals who are sleep-deprived may go into deep sleep sooner and thus may be more likely to experience sleep inertia

*Tietzel A, Lack L. SLEEP 2001
Recovery from Sleep Loss

**Myth:** “All I need is my usual five to six hours the night after call and I’m fine.”

**Fact:** Recovery from on-call sleep loss generally takes at least two nights of extended sleep to restore baseline alertness.
Caffeine

- Coffee 95-100 mg
- Tea 14-60 mg
- Soda 30-60 mg
- Energy Drinks 80-200 mg
- No-Doz 200mg

Reduces some sleep-related deficits at doses of 75-100mg
Effects within 15 minutes; half life 3-7 hours
Can disrupt subsequent sleep and has diuretic effects
Healthy Sleep Habits

- Realize that circadian rhythms and sleep needs are non-negotiable
- Go to bed and get up at about the same time every day.
- Develop a pre-sleep routine.
- Use relaxation to help you fall asleep.
- Protect your sleep time; enlist your family and friends!
- Get 7 - 9 hours before anticipated sleep loss
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Healthy Sleep Habits

• Sleeping environment:
  – Cooler temperature
  – Dark (eye shades, room darkening shades)
  – Quiet (unplug phone, turn off pager, use ear plugs, white noise machine)

• Avoid going to bed hungry, but no heavy meals within three hours of sleep.

• Get regular exercise, but avoid heavy exercise within three hours of sleep.

• Avoid using alcohol to help you fall asleep; it induces sleep onset but disrupts sleep later on
Residents Report Using:

**Melatonin**: minimal effect in ER resident studies

**Amphetamines/MPH***: can improve psychomotor performance and promote subjective alertness at 10-20 mg; adverse effects sleep, CV and metabolic/ neuroendocrine measures, high abuse potential

**Modafinil (Provigil)***: Variable improvement performance, alertness, mood at doses 100-400mg; may result in subjective “overconfidence,” disrupted sleep

*Bonnet et al SLEEP 2005*
Operational Measures to Reduce Fatigue
ACGME Common Standards for Resident Duty Hours (2011)

• 80 hour limit/week, averaged over four weeks
• One day in seven off
• Adequate rest (10 hours) between duty periods
• In-house call no more than every 3rd night
• 24 hour limit on continuous duty (+ up to six hours) for transfer of care (16 hours for PGY-1)
• Moonlighting must be approved by the program director—All moonlighting counts against 80 hrs
Work Hour Limits for Physicians in Other Countries

- **European Working Time Directive** (law which applies to practicing physicians & residents in all EU countries)
  - Maximum of **48-56 hours per week** and **13 consecutive hours**

- **New Zealand Employer - Resident Contract**
  - Maximum **72 hours weekly** and **16 consecutive hours**
Work Hour Limits for Other Occupations in the U.S.

- Truckers: maximum 11h continuous driving
- Pilots: maximum 8h per 24 flying domestic routes
- Nuclear Power plant workers: maximum 12h shift
- Train engineers: maximum 12h shift
Adapting to Night Shifts

**Myth:** “I get used to night shifts right away; no problem.”

**Fact:** It takes at least a week for circadian rhythms and sleep patterns to adjust.

**Fact:** Adjustment often includes physical and mental symptoms (think jet lag).

**Fact:** Direction of shift rotation affects adaptation (forward/clockwise easier to adapt).
How to Survive Night Float

• Protect your sleep.
• Nap before work.
• Consider “splitting” sleep into two four hour periods.
• Have as much exposure to bright light as possible when you need to be alert.
• If you want to go home and sleep, avoid light exposure in the morning after night shift (be cool and wear dark glasses driving home from work).
Aviation Standards to Reduce Shift Work Fatigue

- Avoid more than three successive shifts in rotating systems, rotate clockwise.

- Allow adequate rest time between shifts (not < 12 hrs; preferably > 16 hrs).

- Night shifts should be placed at the end of a shift cycle; duration not more than eight hours.

- Allow planned “cockpit” nap (30 min) during first night float shift.
“The Best Laid Plans…”

**Study:** Impact of night float coverage (2 a.m. to 6 a.m.)

**Results:** “protected” interns slept less than controls; used time to catch up on work, not sleep; thus there was no improvement in performance

**Bottom line:** Sleep when you can!

Richardson et al, SLEEP, 1996
Schedule Design Principles

Provide relief for residents:

- Reduce hours and/or workload
  - Limit consecutive work hours to < 16 when possible
- Minimize risk-prone situations
- Maintain opportunities for education
- Support resident well-being
- Create shared responsibility for fatigue management and a “culture of support” in the training program.
- Focus on making things better rather than amplifying past problems.
Maintaining Opportunities for Education

- **Conferences:**
  - Schedule at times where floats can attend also
  - Videotape so residents can watch when more alert
  - Distribute handouts; reinforce messages on rounds

- **Achieving competency: education is about learning how to do something right; not the number of times it is done.**
  - Maintain a curriculum to ensure all material is covered and available in multiple learning formats (formal didactic conferences, rounds, journal reading, etc.)
  - Use simulators and computerized resources
Supporting Resident Well-being

- Schedule rotations so that residents have adequate time to sleep and see family/friends
- Check-in with residents through advisors, surveys, and attending interaction to assess adequacy of schedules and any associations with mood and morale
- Monitor depression and burnout rates
  - Resident depression has been associated with chronic sleep deprivation and increased from 4% to 30% over one year (Rosen, et al, Acad Med, 2006)
  - Up to ¾ of residents report burnout symptoms, with positive associations with increased workload and work hours (Thomas, JAMA, 2004)
In Summary...

• Fatigue is an impairment like alcohol or drugs.

• Drowsiness, sleepiness, and fatigue cannot be eliminated in residency, but can be managed.

• Recognition of sleepiness and fatigue and use of alertness management strategies are simple ways to help combat sleepiness in residency.

• When sleepiness interferes with your performance or health, talk to your supervisors and program director.
“Patients have a right to expect a healthy, alert, responsible, and responsive physician.”

January 1994 statement by American College of Surgeons
Re-approved and re-issued June 2002