Resident Sleep and Fatigue

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Objectives

By the end of this session, participants will be able to:

1. List 4 effects of sleep loss and fatigue
2. List 2 warning signs of fatigue in others
3. List 2 warning signs of fatigue in yourself
4. Describe the most effective way of using naps to combat fatigue
5. Describe the most effective way of using caffeine to combat fatigue

Why are we concerned about resident fatigue?

1. Patient Safety
2. Resident Safety and Well-Being

Fatigue & Safety

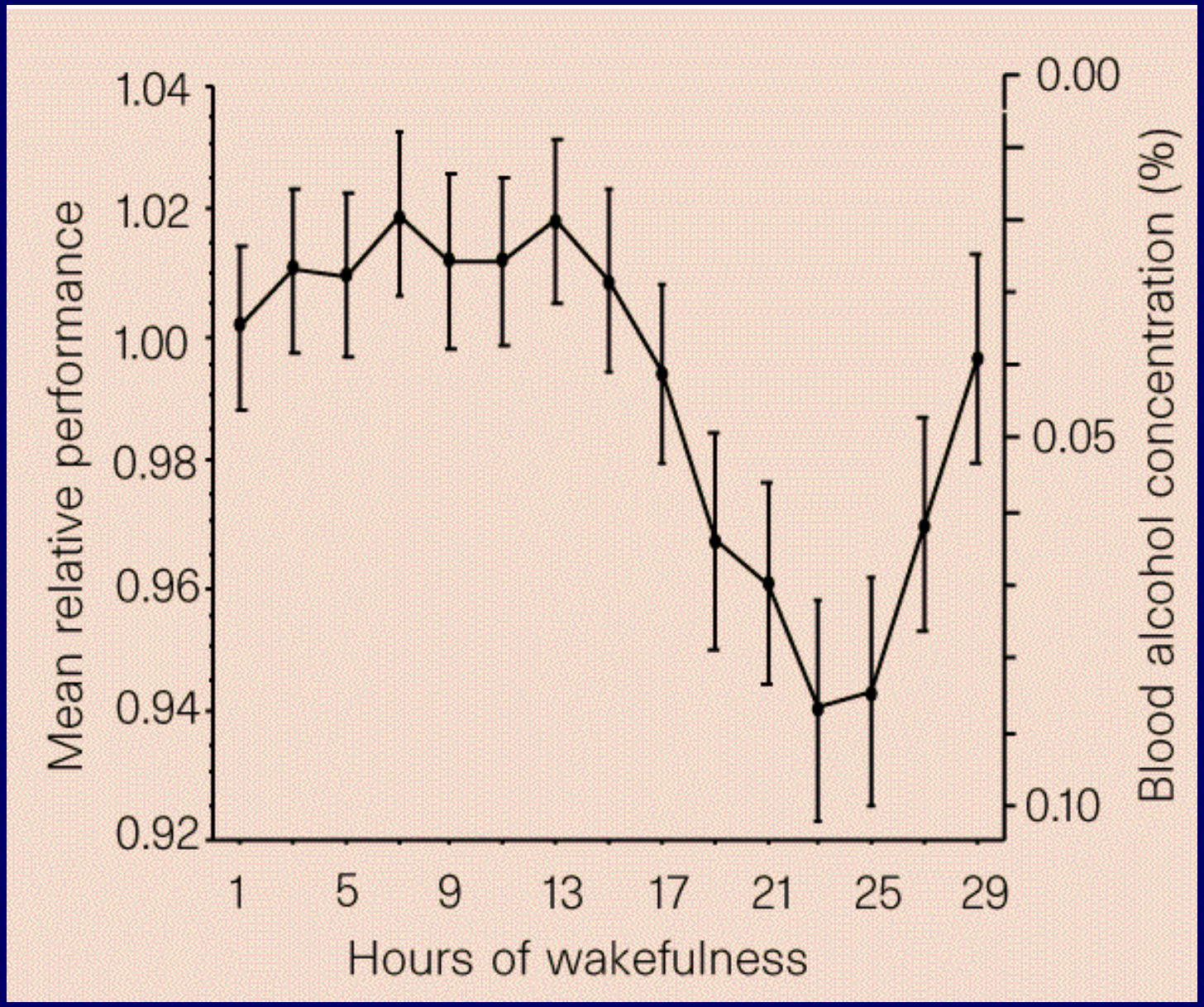
- Faulty decision making by sleep-deprived managers contributed to the untoward launch of the space shuttle Challenger (1986 Presidential Commission)
- Probable cause of the Exxon Valdez grounding was the fatigue of the individual sailing the ship (NTSB)

Fatigue & Safety

- Chernobyl
- Three Mile Island
- 15-20% of transportation accidents (this is greater than drugs and alcohol combined!) (Akerstedt, 2000)

Fatigue & Safety

- Increased tolerance for risk (Shingledecker & Holding, 1974)
- Passivity and avoidance of effort (Graeber, 1988)
- Decreased cognitive function (attention, vigilance, decision-making) (Howard, 2002)
- Psychomotor function comparisons between sleep deprivation and alcohol blood level (Dawson, 1997)



Performance in the sustained wakefulness condition expressed as mean relative performance and the percentage blood alcohol concentration equivalent.

Fatigue & Safety: **Healthcare**

- Slower response time on monitoring tasks for fatigued anesthesia residents (Denisco, et al., 1987)
- Reduced speed/quality in simulated intubation task for emergency physicians (Smith-Coggins, et al., 1994)
- Slower time and more errors in simulated laparoscopic task for surgeons (Taffinder, et al., 1998)
- Reduced alertness, falling asleep, and behavior changes in tasks using a patient simulator (Howard, et al., 1998)

Fatigue & Safety: **Healthcare**

- Higher risk of unintended dural puncture in obstetric epidural procedures at night than during the day (Aya, et al., 1999)
- Increases (45%) in post-operative complications for resident surgeons after a day on call (Haynes, et al., 1995)

Fatigue & Safety: **Residents**

- Needle sticks and exposure to blood borne pathogens (increases by 50% at night)
- Health effects that may result from fatigue
  - Increased risk of obstetrical complications for pregnant residents (Osborn, 1990)
    - Premature labor twice as common
    - Preeclampsia is twice as likely
  - High rates of depression (Valko, 1975)
  - Increased mortality with severe shortening of daily sleep (Kripke, et al., 1979)

Fatigue & Safety: **Residents**

- Increased risk of car accidents:
  - Kowalenko, et al. (2000)
  - Marcus & Loughlin (1996)
  - Steele, et al. (1999)

2006 End-of-Year Survey

%Yes	% No	Question
6	94	I have been involved in a motor vehicle crash this year.
4	96	If yes, were you post-call?
20	80	I have been involved in a near-miss incident (fell asleep at a light, drifted out of my lane, etc.)
61*	39	If yes, were you post call?

*Up 7% from the previous year.

Effects of Sleep Loss and Fatigue

- Voluntary and involuntary sleep latencies shorten
- Microsleeps intrude into wakefulness and cause lapses in attention
- Time-on-task decrements
- Learning and recall deficits
- Working memory and related executive functions decline
- Decreased ability to estimate your own ability to function (Van Dongen, et al., 2003)

The sleepier you are, the less accurate your perception of degree of impairment. Studies show that sleepy people underestimate their level of sleepiness and overestimate their alertness.

Physiology of Sleep & Fatigue

- Every adult has a genetically hard-wired sleep requirement that does not change with age and cannot be trained.
- Sleep is a physiologic drive state similar to hunger or thirst.
- When sleep requirements are not met a “sleep debt” ensues and sleepiness becomes manifest.

Circadian Factors

- Circadian clock located in the supra-chiasmatic nucleus of the hypothalamus
- Clock extremely resistant to change
- Programmed for 2 periods of decreased alertness
  - 3-7 am
  - 1-4 pm (Siesta!)

Lowest point in the cycle making it the period of greatest vulnerability to fatigue-related performance impairment

Recognizing Fatigue (in others)

- Difficultly appreciating a complex situation while avoiding distraction
- Keeping track of the current situation and updating strategies
- Thinking laterally and being innovative
- Assessing risk and/or anticipating consequences
- Maintaining interest in outcomes
- Controlling mood and avoiding inappropriate behavior

Specific Behaviors

- Nodding off
- Lethargy
- Irritability
- Poor coordination
- Difficulty with short-term recall
- Tardiness or absences
- Impoverished speech
- Flattened affect
- Disinhibition

Recognizing Fatigue (in yourself)

- Falling asleep in conferences
- Feeling restless and irritable with staff, colleagues, family, friends
- Having to check your work repeatedly
- Having difficulty focusing on the care of your patients
- Feeling like you really just don’t care

Tools

- Epworth Sleepiness Scale
- Pittsburgh Sleep Quality Index

Epworth Sleepiness Scale

Situation	**Chance of dozing (0-3)**			
Sitting and reading	0	1	2	3
Watching television	0	1	2	3
Sitting inactive in a public place—for example, a theater or 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	0	1	2	3
Sitting and talking to someone	0	1	2	3
Sitting quietly after lunch (when you've had no alcohol)	0	1	2	3
In a car, while stopped in traffic	0	1	2	3
			Total Score	

0 = would never doze
1 = slight chance of dozing
2 = moderate chance of dozing
3 = high chance of dozing

Johns,1991

Strategies to Combat Fatigue

- Naps
- Caffeine
- Good sleep habits
- Other drugs and light therapy

Naps are good!

The Art of Taking Naps

- Planned naps can improve subsequent alertness and performance (Dinges, et al. 1987)
  - Allow up to 45 minutes for sleep (reduces the likelihood of awakening in REM and experience sleep inertia)
  - Don’t take a nap too close to a planned sleep period
  - Allow a 15 minute wake-up period following a nap

Caffeine

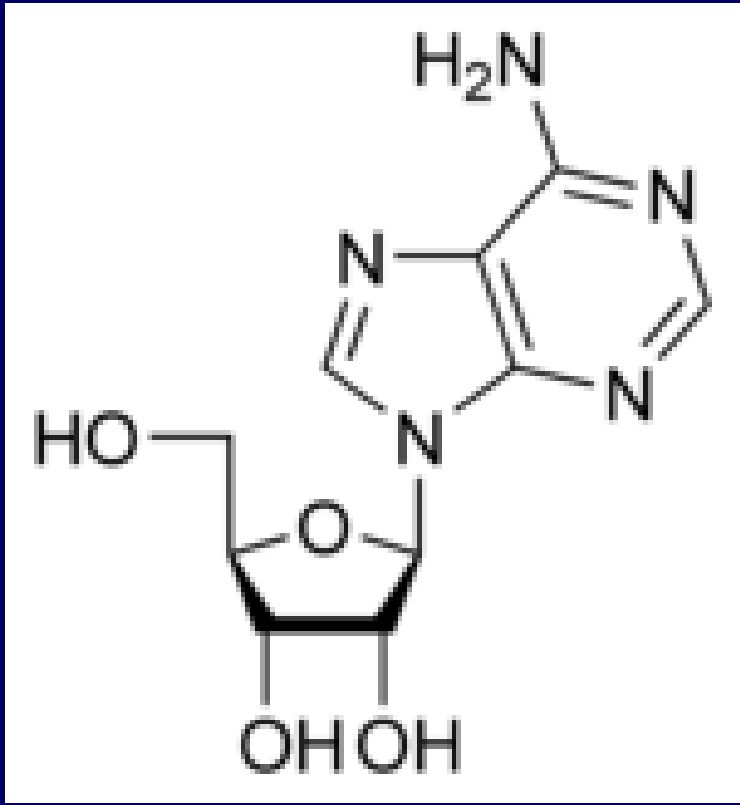
- The strategic use of caffeine involves ingestion at times that will promote alertness and performance during periods of vulnerability.
- A significant performance and alertness boost can be obtained from 200 mg of caffeine, with positive effects at does ranging from 100 to 600 mg.

- Caffeine reaches peak concentrations in the bloodstream 30-60 minutes after consumption.
- Typically takes 4-6 hours for its effects to wear off.

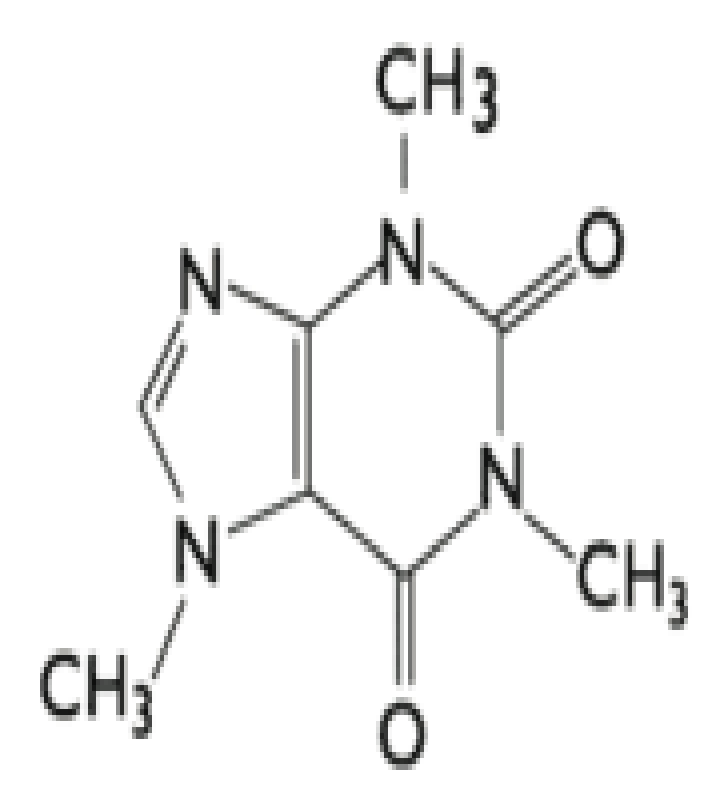
How does caffeine work?

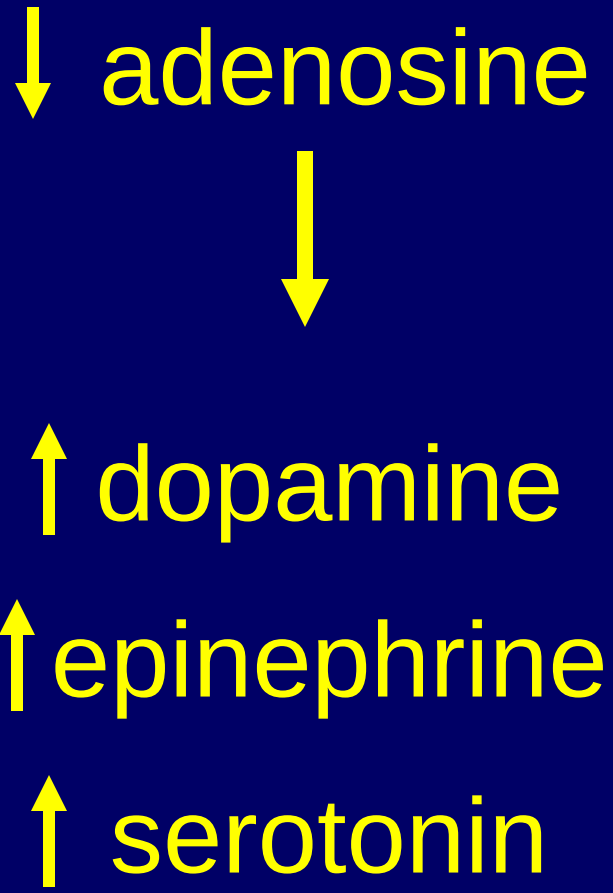
- Ergogenic=increases the capacity for mental and physical labor
- Adenosine antagonist

Adenosine



Caffeine




adenosine
dopamine
epinephrine
serotonin

Caffeine Metabolites

- Theobromine=vasodilator, increases oxygen and nutrient flow to brain and muscles
- Theophylline=smooth muscle relaxant, increases heart rate and efficiency
- Paraxanthine=increase lipolyis, leads to increased glycerol and fatty acids (fuel) in blood

Caffeine Content

Red Bull	80 mg
Jolt	72 mg
Mountain Dew	55 mg
Diet Coke	46 mg
Iced Tea (black)	40-60 mg
Green Tea	35 mg

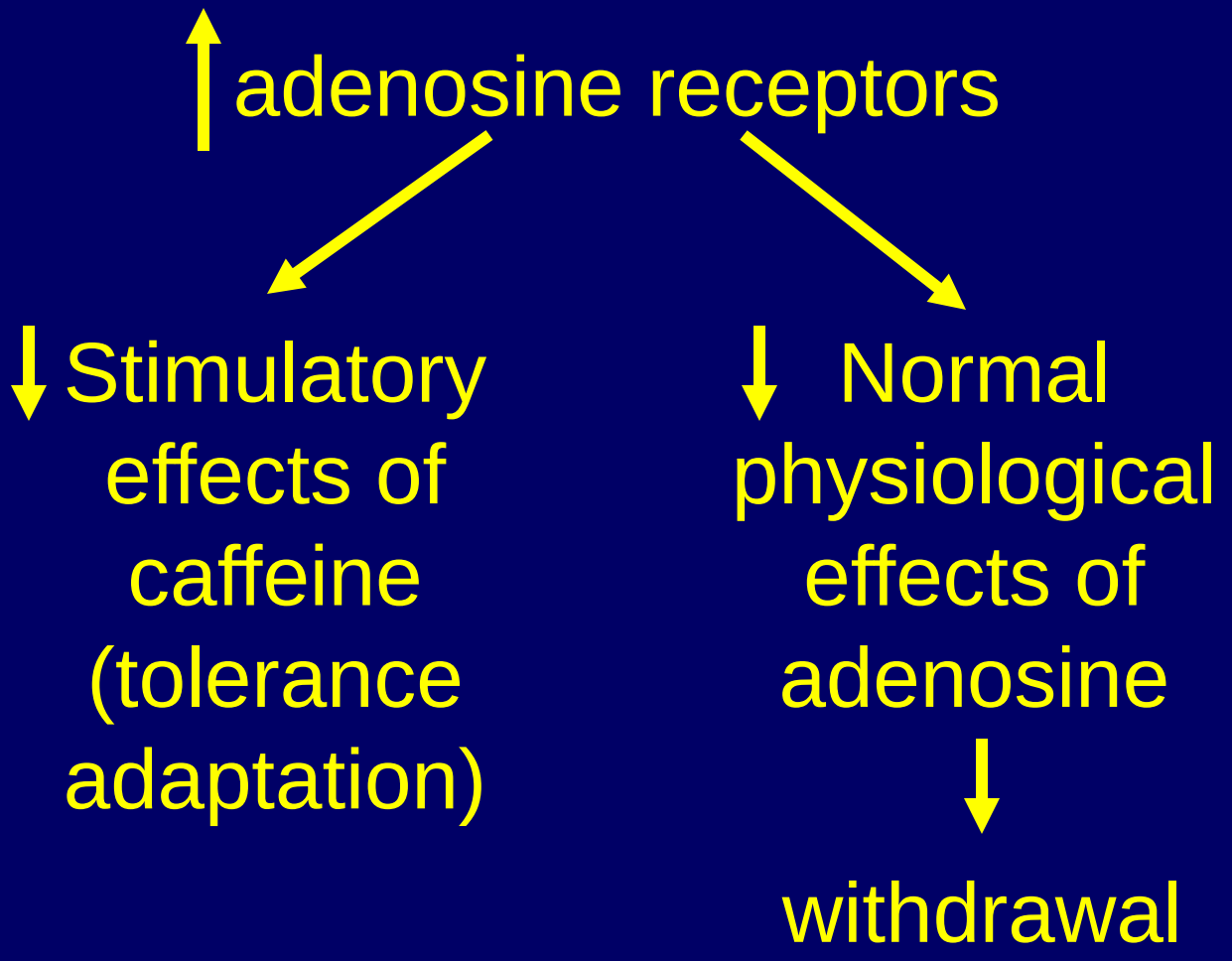
Coffee

Starbucks Vente	550 mg
Starbucks Grande	375 mg
Starbucks Tall	250 mg
Espresso (2 oz.)	100 mg
Instant Coffee	65-100 mg

Other

NoDoz (maximum strength)	200 mg
Excedrin (2)	130 mg
HD Coffee Ice Cream	58 mg
Dark Chocolate (1 oz.)	35 mg
Milk Chocolate (1 oz.)	15 mg

Caffeine Tolerance & Withdrawal



Slow Release Caffeine

- Studies have shown positive effects of slow release caffeine on vigilance and cognitive performance (Beaumont, 2001)

Good Sleep Habits

- Use a pre-sleep routine to provide cues for relaxation and sleep
- Avoid negative sleep cues in the bed and bedroom
- Have a light snack or drink if hungry or thirsty
- Avoid caffeine intake at least 3 hrs before bed
- Avoid exercise within 2-3 hrs of bedtime

- Follow a 30-min “toss-and-turn” rule such that if you are unable to fall asleep in 30 min, get out of bed, engage in some sleep promoting activity, return to bed when ready
- Use relaxation techniques
- Try to get 8 hrs of sleep in every 24 hr period (consider a supplement nap)
- Limit intake of ethanol or nicotine-containing products close to bedtime

Other Drugs and Light Therapy

- Modafinil-schedule IV, nonamphetamine, alertness enhancing drug used in the treatment of narcolepsy (Caldwell, et al., 2000 & Buguet, et al., 1995)
- Melatonin-hormone produced by the pineal gland
- Light therapy-under investigation

80-Hour Work Week

Standard: Duty hours must be limited to 80 hours per week, averaged over a 4-week period, inclusive of all in-house call activities.

In-House Call

Standard: In-house call must occur no more frequently than every 3rd night.

Continuous Hours

Standard: Continuous, on-site duty must not exceed 30 consecutive hours.

Days Free

Standard: Residents must be provided with 1 day in 7 free from all educational and clinical responsibilities, averaged over a 4-week period, inclusive of call.

Hours Off Between Duty Shifts

Standard: Residents must be provided with a 10-hour time period between all daily duty periods and after in-house call.

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