



# Fatigue Problems in Healthcare

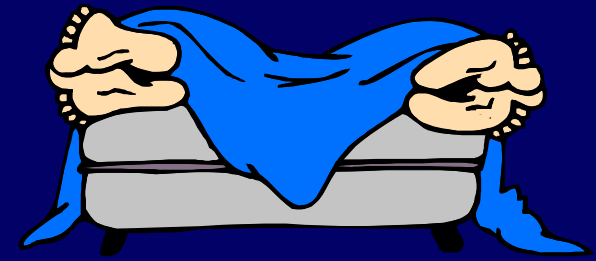
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# Circadian Rhythms and Sleep Requirements



- Humans need, on average, just over 8 hours of sleep every 24 hours
- Without it, accumulation of “sleep debt”, which requires consecutive full nights sleep for recovery
- Energy lows around 3-7 am and 1-4 (3-5) pm<sup>1,2</sup>
- Human’s circadian rhythm is 24.18 hrs
- Disruption of circadian rhythm results in disrupted sleep

# Human Performance Effects

- Increased tolerance for risk<sup>3,4</sup>
- Passivity and avoidance of effort<sup>3,5</sup>
- Decreased cognitive function (attention, vigilance, decision-making)<sup>6</sup>
- Psychomotor function after 24 hours without sleep equivalent to 0.08% blood alcohol<sup>7</sup>
- Contributed to serious accidents<sup>8</sup>
  - Exxon Valdez
  - Bhopal
  - Chernobyl
  - Three mile Island
  - 15 – 20% of transportation accidents, greater than drugs and alcohol combined<sup>9</sup>

# Fatigue Surveys in Health Care

- Rotating shift nurses more likely to report errors than day shift<sup>10</sup>
- Anesthesia residents<sup>11</sup>
  - Sleep on average 6.5 hours/day
  - 20% indicated sleepiness prevented them from performing clinical duties
  - 12% attributed errors to fatigue
- Over 50% of anesthesia caregivers reported errors in judgment from fatigue<sup>6</sup>

# Experimental Evidence of Fatigue Effects in Health Care

- Slower response time on monitoring tasks for fatigued anesthesia residents<sup>12</sup>
- Reduced speed/quality in simulated intubation task for ED physicians<sup>13</sup>
- Slower time and more errors in simulated laparoscopic task for surgeons<sup>14</sup>
- Reduced alertness, falling asleep, and behavior changes in tasks using a patient simulator<sup>15</sup>



# Outcomes Related to Fatigue in Health Care

- Higher risk of unintended dural puncture in obstetric epidural procedures at night than during the day<sup>16</sup>
- Increases (45%) in post-operative complications for resident surgeons after a day on call<sup>17</sup>
- Increased risks to health care providers<sup>6</sup>
  - Increased risk of car accidents after 9<sup>th</sup> hour of work
  - Needle sticks and exposure to blood borne pathogens (increases by 50% at night vs. day)
  - Health effects

# Problems with Fatigue Research in Health Care

- No accepted definition of fatigue<sup>6</sup>
- Lack of objective tests for sleepiness
- Failure to account for chronic sleep loss or sleep debt
- Small sample sizes
- Doctors in training as subjects

# Scheduling in Health Care

- Using NTSB standards, the majority of healthcare errors and accidents would include fatigue as a factor based on work schedule alone.<sup>6</sup>
- Accidents and litigation in health care have lead to calls for changes.
- Libby Zion case – NY State implemented new work hour regulations.
- Similar regulations proposed by public interest organizations (the Public Citizen)

# Proposed Regulations by “Public Citizen”

- A limit of 80 h of work per week
- Limit of 24 consecutive hours worked in one shift
- A limit of on-call shifts to every third night
- A minimum of 10 h off between shifts
- At least one 24-h period off-duty time per week
- A limit of 12 consecutive hours on duty per day for emergency medicine residents working in hospitals receiving more than 15,000 unscheduled patient visits per year
- “Moonlighting” is not mentioned

# Accreditation Council for Graduate Medical Education Standards

- As of 7/1/03, for ACGME accredited residency programs:<sup>18</sup>
  - Maximum of 80 duty hours per week, including in-house call, averaged over 4 weeks. (Possible future exceptions...)
  - One day out of 7 free from responsibilities, averaged over 4 weeks.
  - In-house call no more than once every 3 nights, averaged over 4 weeks.
  - Duty periods of no more than 24 hours, up to 6 additional hours to transfer patients, maintain continuity of care or participate in educational activities.
  - At least 10 hours for rest and personal activities between daily duty periods and after in-house call.
  - In-house moonlight counts toward the weekly limit. Program directors ensure that external and internal moonlighting does not interfere with the resident's achievement of the program's educational goals and objectives.

# Aviation Standards as a Comparison

- 14 CFR Part 121; 14 CFR 135.
  - Pilots flying domestic air carriers, such as major airlines and cargo haulers, who fly large transport aircraft operations (Part 121) may fly up to 30 h/wk, 100 h/mo, and 1000 h/yr.
  - Pilots flying domestic commercial air carriers, commonly referred to as commuter airlines and air taxis (Part 135), may fly up to 34 h/wk, 120 h/mo, and 1200 h/yr.
  - If the scheduled flight time is  $< 8$  h, the minimum rest period in the 24 h preceding the scheduled completion of the flight segment is 9 h. This time ...
  - If the scheduled flight time is 8 or 9 h, the minimum rest period in the 24 h preceding the scheduled completion of the flight segment is 10 h. This time ...
  - If the scheduled flight time is  $> 9$  h, the minimum rest period in the 24 h preceding the scheduled completion of the flight segment is 11 h. This time ...

# Implications and Complications of ACGME Rules

- Financial implications<sup>19</sup>
  - Residents provide inexpensive care (stipend of \$40K/year)
  - Prior to rule, up to 120 hours/week
  - PAs and NPs earn \$70k to \$80k, limited availability
- Continuity of care
- Cultural issues, rites of passage
- Do the rules go far enough?
  - Howard et al.,<sup>20</sup> only a “sleep extended” condition resulted in better performance than post-call.
  - Suggests chronic sleep debt associated with regular hours.

# Is there an answer?

- Creative scheduling
  - Rules don't imply (or recommend) any specific schedule
  - At Duke, implementations different by specialty
  - Are some schedules better than others?
- Education
- Alertness strategies<sup>6</sup>
  - Naps, caffeine, good sleep habits, other drugs, light therapy
- More restrictive recommendations?
- Financial/cost reforms for staffing needs
- Teamwork

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