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Comparing the work and rest hours of United States Navy Sailors with existing maritime regulations

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The Military Climate: Doing More with Less

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Life at sea!

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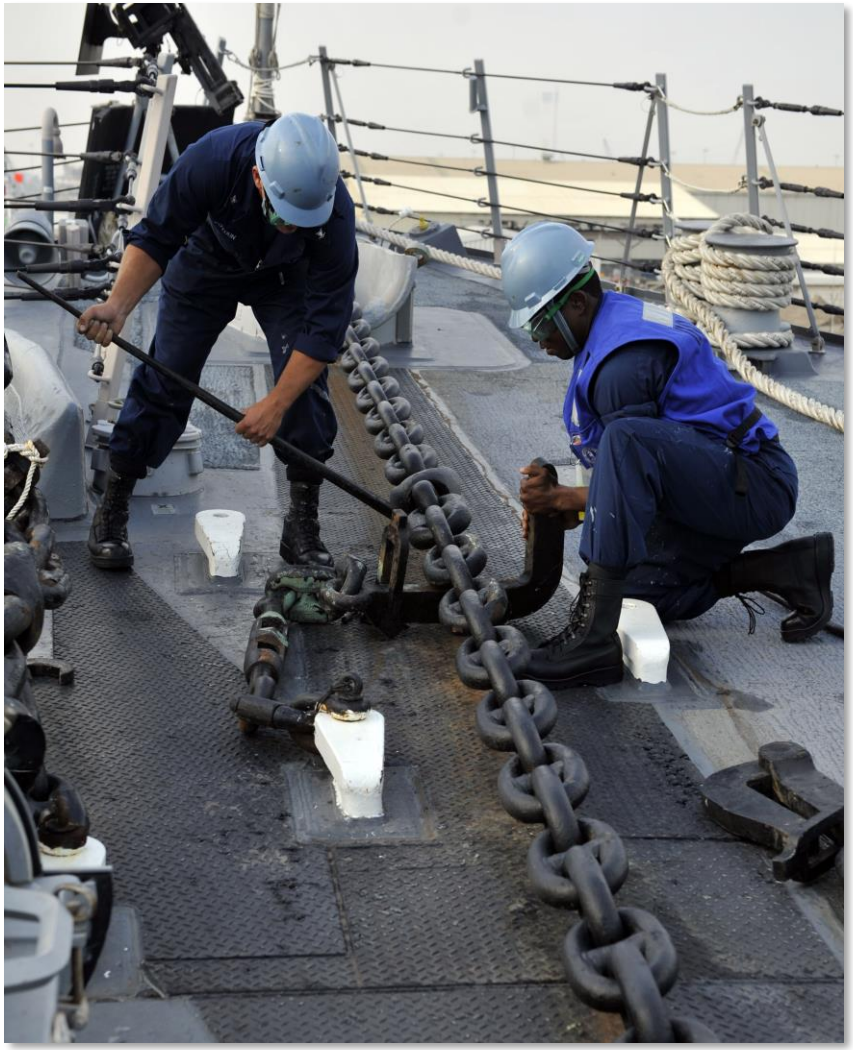
Life at sea!



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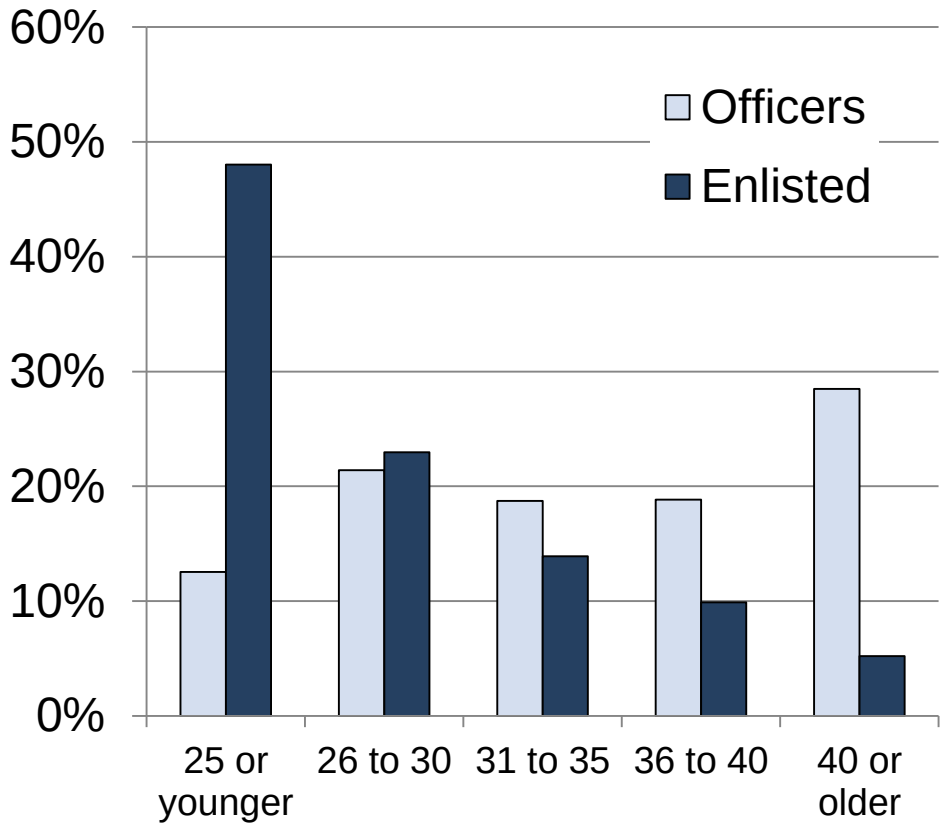
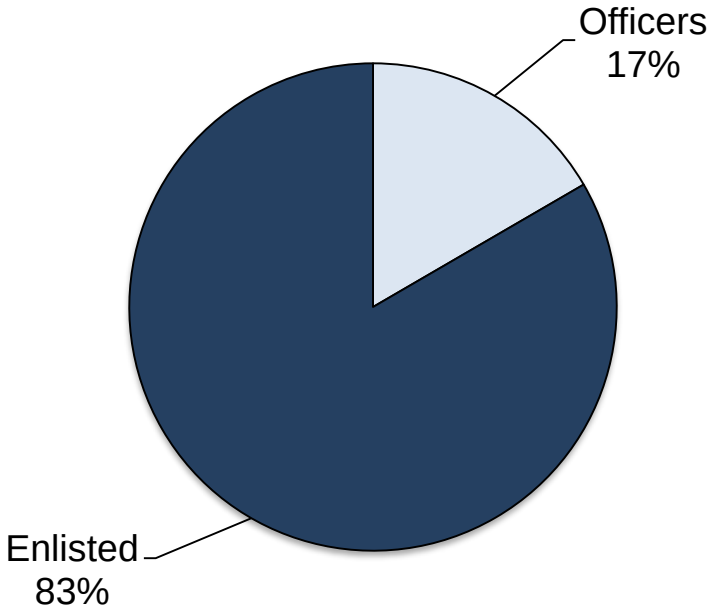
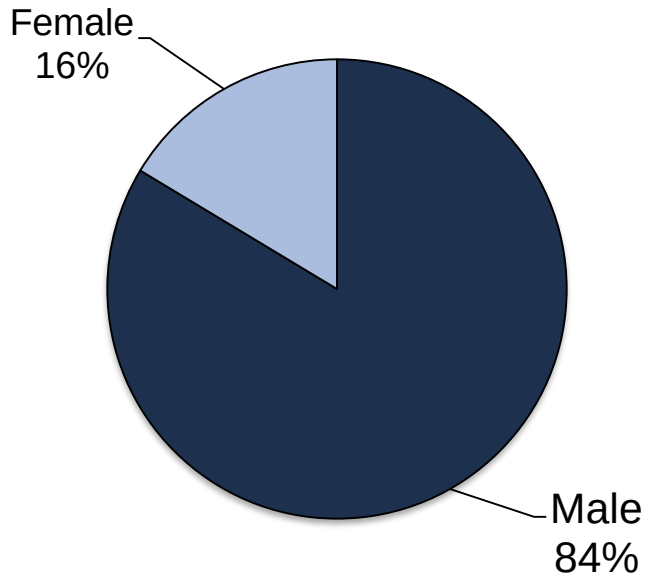
Navy Personnel





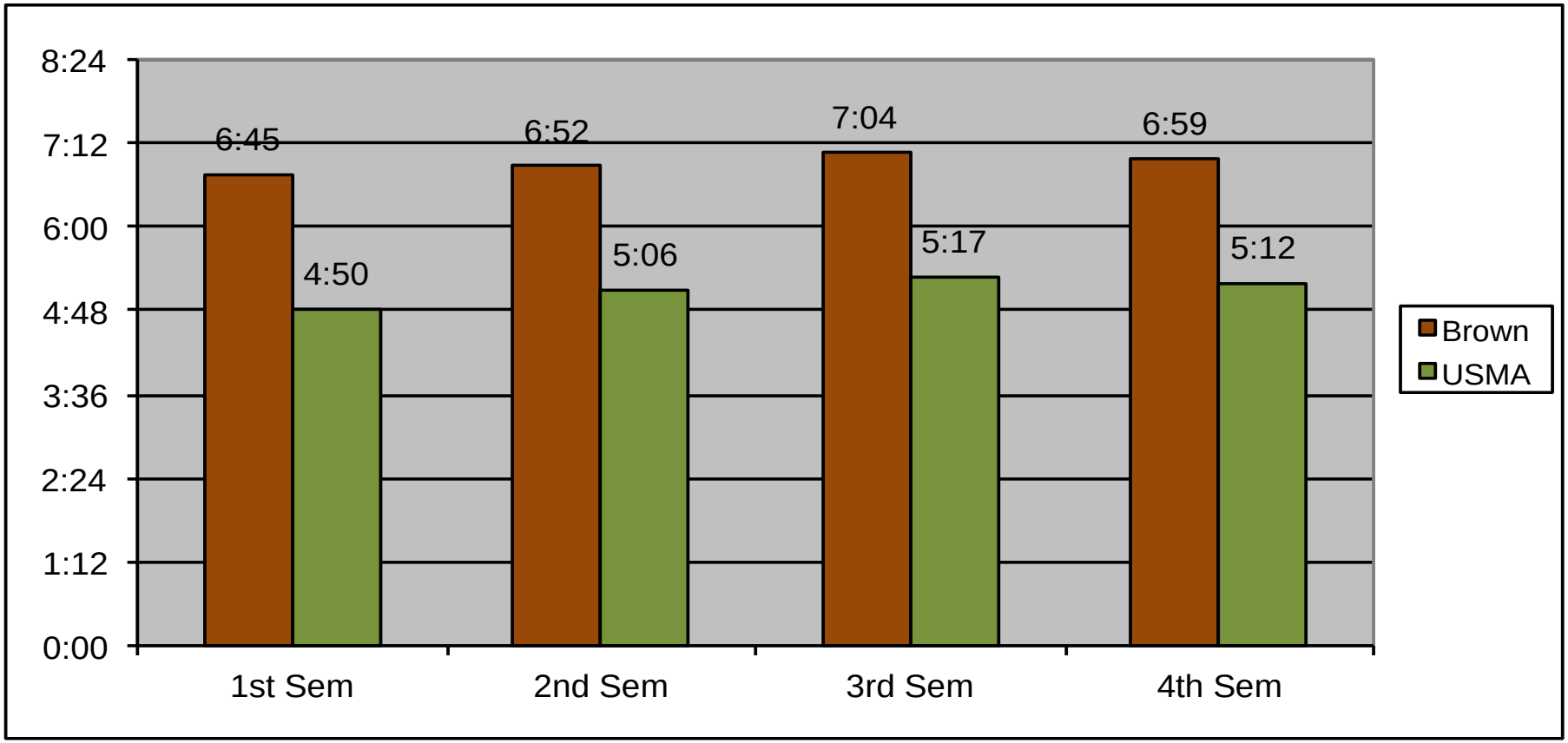


A Population of Shiftworkers and Poor Sleepers

- The US military indoctrinates healthy US adults into a culture of sleep deprivation that persists throughout their careers.
- Like other shiftworkers, members of the military frequently exhibit “circadian scarring” and often engage in “binge sleeping.”
- Based upon scientific findings from research on both civilian and military populations, these sleep practices are associated with decreased performance and long term health consequences.

Sleep debt begins on Day One of Military Service…

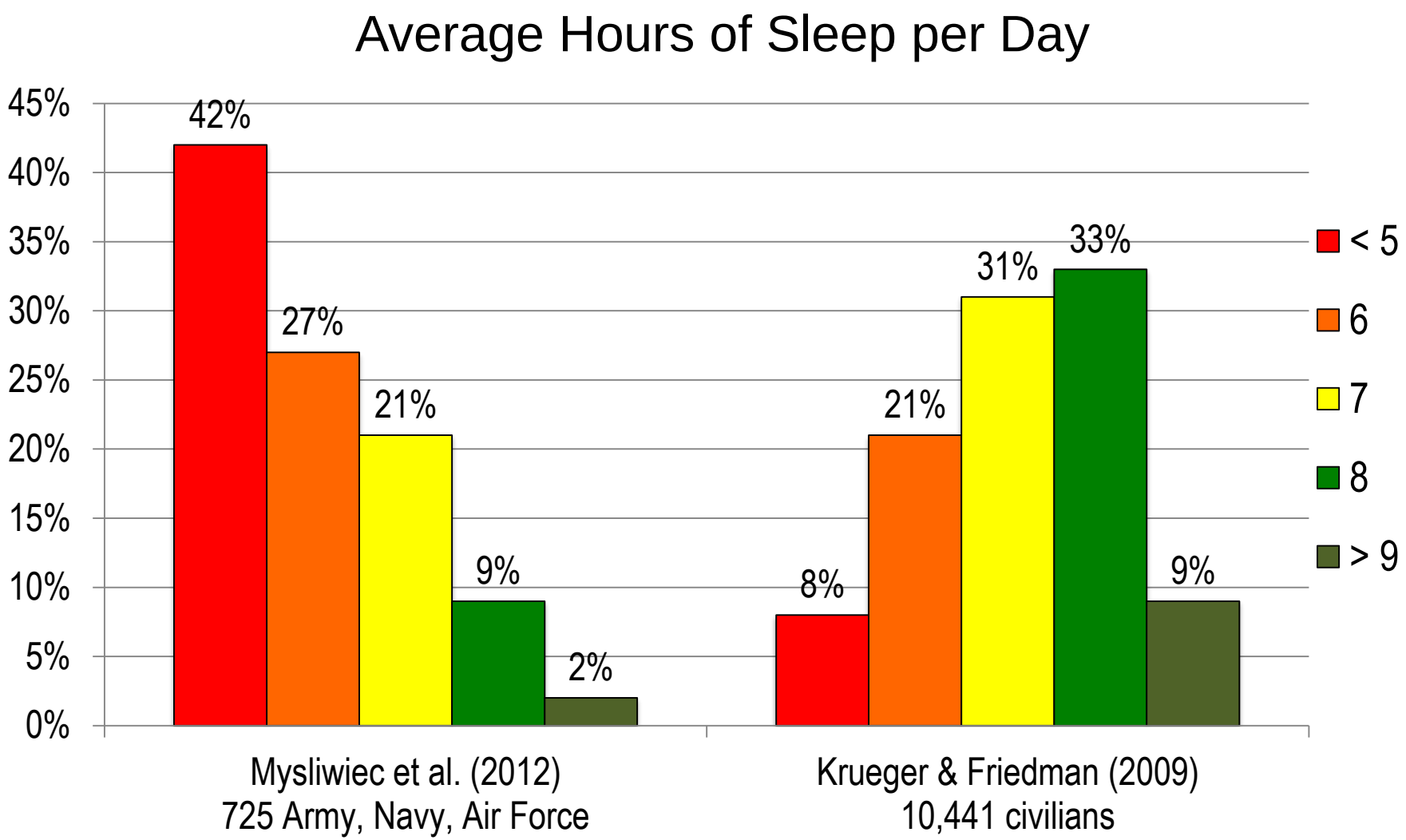
A Comparison of Sleep between Brown University Students and Cadets at USMA, West Point



Note: Brown University data were collected on the Class of 1992 (Fall 1988 – Spring 1990 using self-report. USMA data were collected using actigraphy on the Class of 2007 Fall 2003 – Spring 2005 (Miller, Shattuck, & Matsangas, 2010).

…and continues throughout their careers

Even *non-deployed* military sleep fewer hours than civilians



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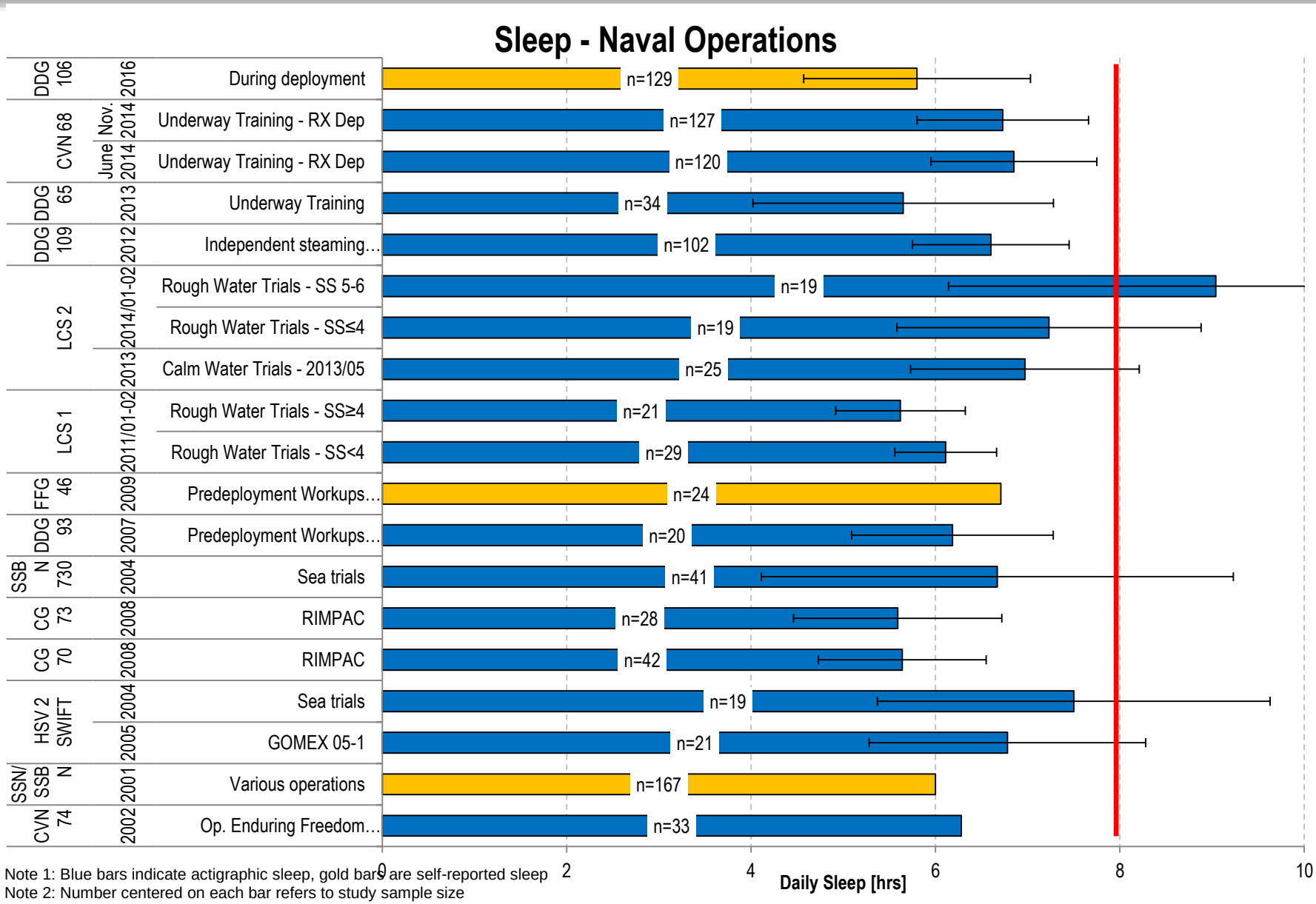
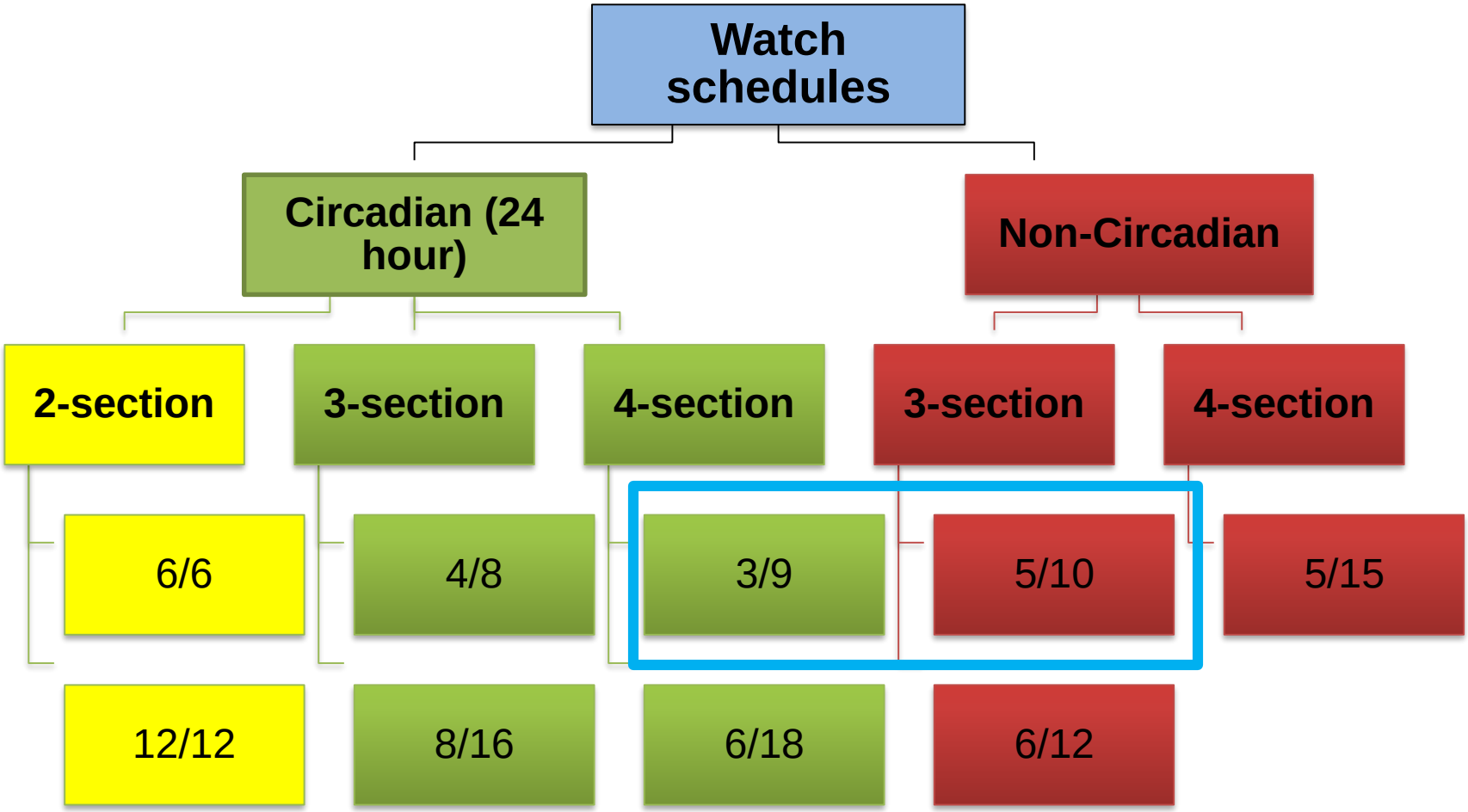
NPS Sleep Studies 2002-2017



Note 1: Blue bars indicate actigraphic sleep, gold bars are self-reported sleep
Note 2: Number centered on each bar refers to study sample size
Note 3: Horizontal lines indicate one standard deviation

Last update: Mar 2017

Shiftwork in U.S. Navy



Workday includes duties other than watchstanding.
Other watchbills may be implemented by the command

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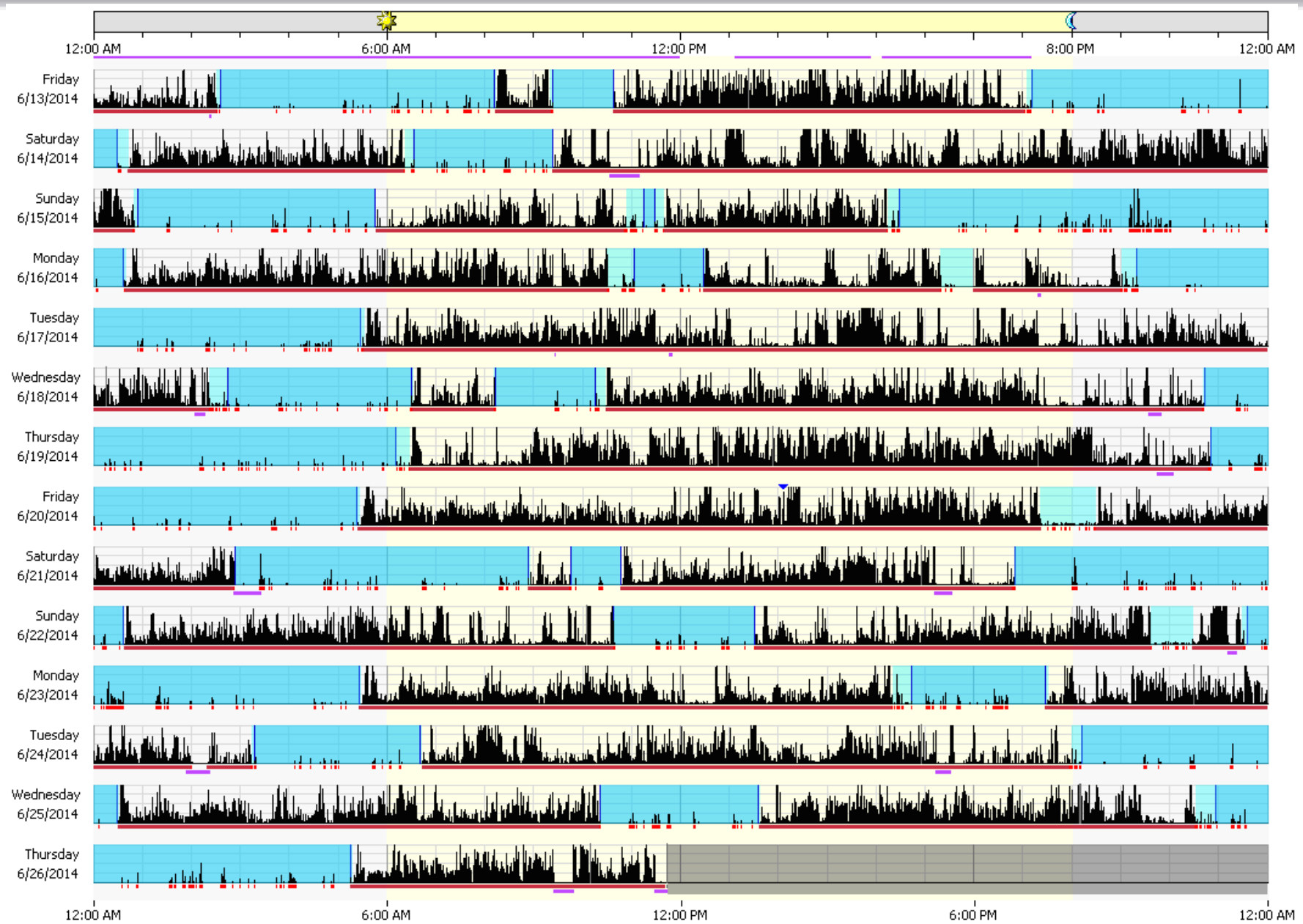
Actigram of a typical work/rest pattern at sea



Problem Statement and Study Goals

Problem Statement

- Crewmembers in the United States Navy (USN)
  - Work long hours with limited opportunities to sleep
  - Are habitual shiftworkers
    - Shifts result in circadian misalignment equating to an 15 or 20-hour day
  - Have no weekends or time for recovery

Study goals

- Compare the work and rest patterns of USN crewmembers with existing maritime regulations
- Investigate the association between the watchstanding schedule and the level of compliance with existing maritime fatigue regulations

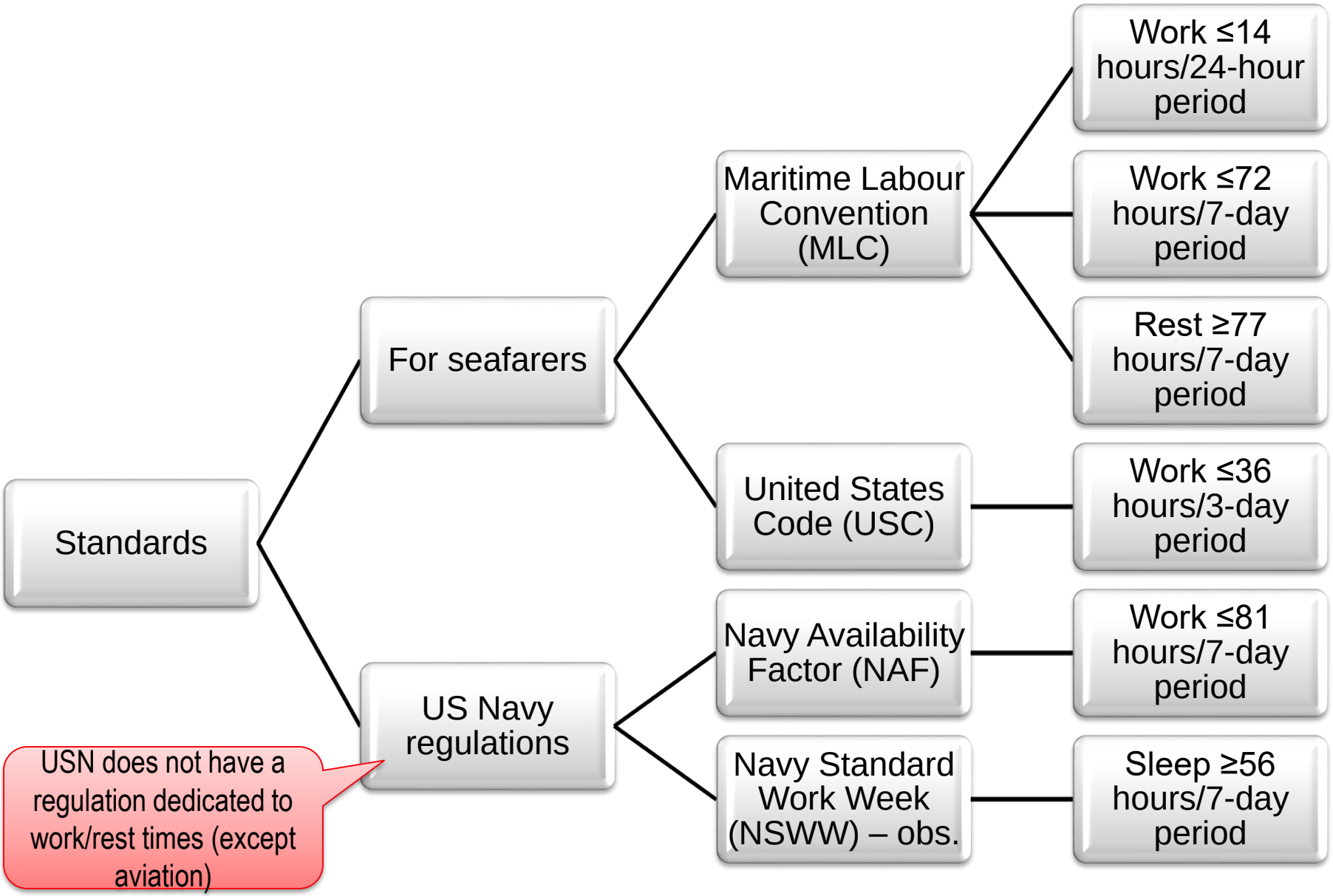
Method

- Retrospective analysis of pre-collected data (N=184)
  - USS NIMITZ (CVN-68) Reactor Department (RX)
    - June 2014: 69 crewmembers using the 5hr-on/10hr-off schedule
    - November 2014: 115 RX crewmembers using the 3hr-on/9hr-off schedule
  - Sleep was assessed with wrist-worn actigraphy and daily activity logs

Method

- Activity log information aggregated in
  - Work and Rest by day (midnight to midnight)
- Work time
  - Watch periods, ship duties, maintenance, training, and service diversion
- Rest
  - Personal time, sleep, and meals

Maritime working standards



Results

- Participants
  - Predominantly young (25.0±3.72 years of age)
  - Male (80%)
  - Enlisted (95%)
- Crewmembers worked ≥14 hours/day for 21% of their workdays
- On a weekly basis, crewmembers
  - Worked ≥72 hours for 75% of their 7-day periods
  - Worked ≥81 hours for 53% of their 7-day periods
  - Rested <77 hours for 23% of their 7-day periods
  - Slept<56 hours (~8-hours/day) for 64% of the 7-day periods
    - From actigraphy: Crewmembers working on the 5/10 schedule slept on average 6.88±0.93 hours/day, compared to 6.68±0.95 hours of sleep for their 3/9 peers.

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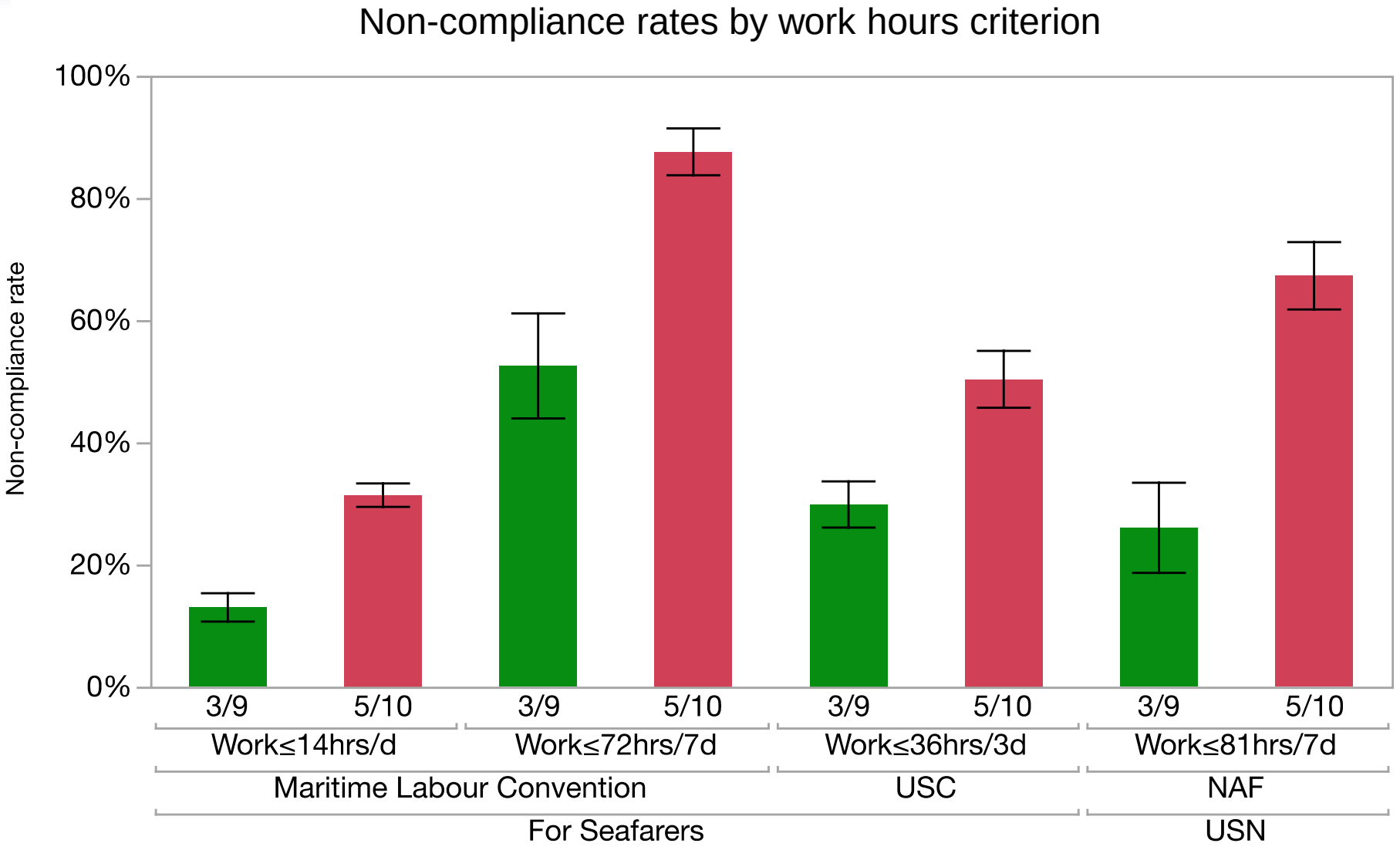
USS Nimitz Results for Work Hours



Vertical lines denote the Standard Error of the Mean

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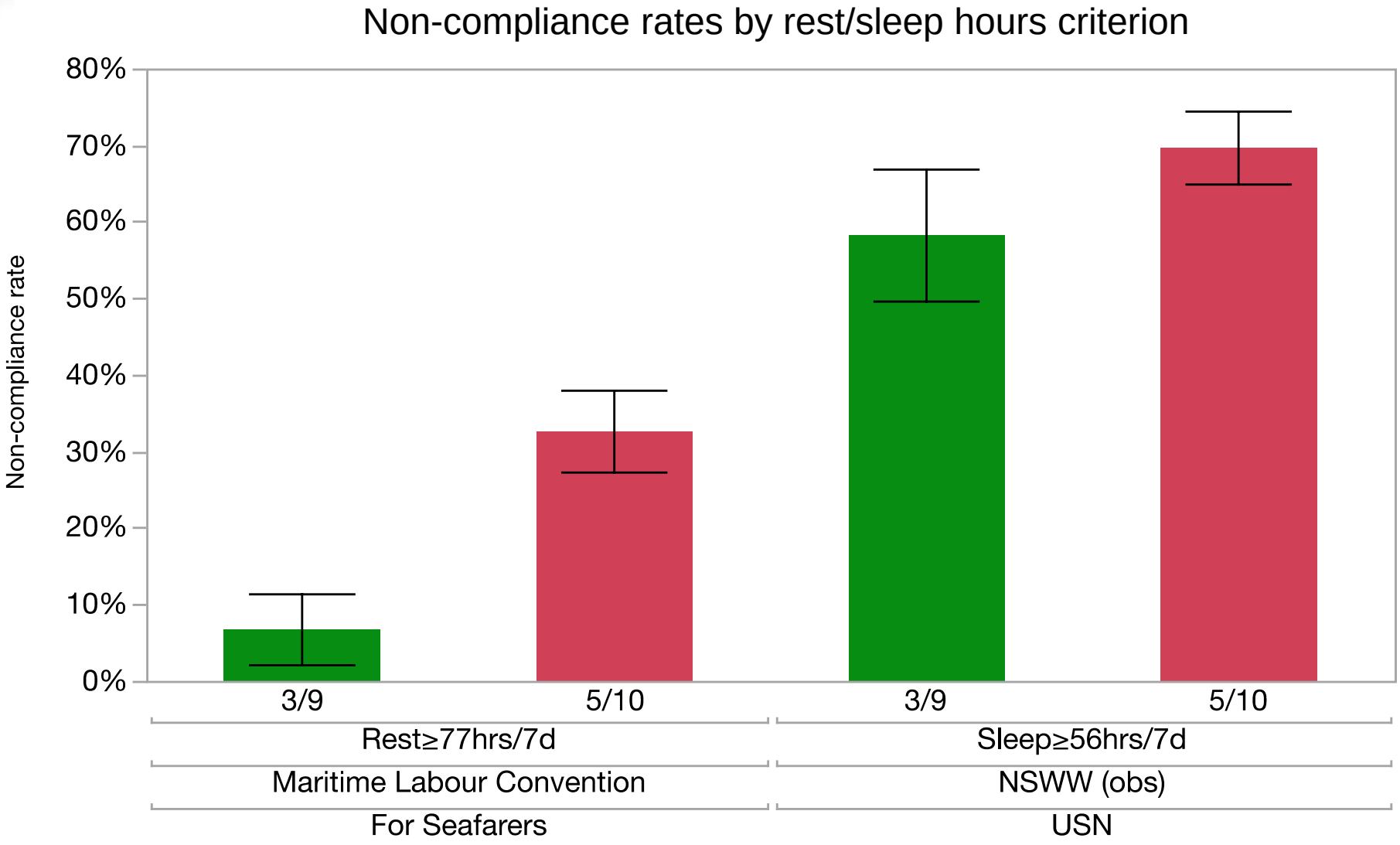
USS Nimitz Results for Sleep/Rest



Non-compliance rate refers to % of crewmembers
Vertical lines denote the Standard Error of the Mean

Conclusions

- This study compared the compliance of crewmembers' work/rest hours with existing regulations. Overall, non-compliance rates were high, up to 88% of the crew!
- Results highlight how crewmembers work long hours with limited opportunities to rest.
- The watchstanding schedules of the crewmembers had a significant impact on the compliance rates.
- In the absence of specific Navy regulations to manage work and rest schedules, the US Navy should consider using standard maritime regulations that include guidance for optimal management of work/rest/sleep patterns.

Questions?

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NPS Crew Endurance Resource Website
http://my.nps.edu/web/crewendurance

Factors Leading to Disrupted Sleep at Sea