



TESTING ALTERNATIVE SHIPBOARD MATTRESSES TO IMPROVE SLEEP AND READINESS IN U.S. NAVY SURFACE

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Background

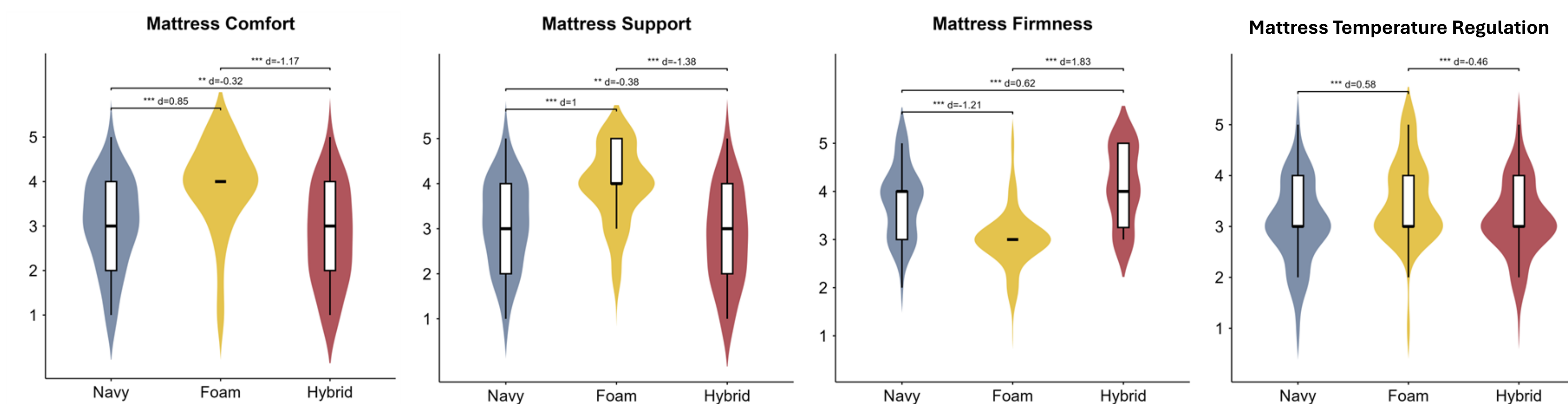
- Sleep is a critical factor for health, performance, and operational readiness.
- Operational surveys reveal one of the top reported factors impairing sleep quality and increasing fatigue among Sailors is an uncomfortable shipboard mattress.
- The U.S. Government Accountability Office included mattress improvement as a priority recommendation to address Sailor fatigue and Navy readiness shortfalls.
- U.S. Naval Surface Forces (SURFOR) requested support from the Office of Naval Research (ONR) for improvements to shipboard mattresses.
- As a modifiable element of the berthing environment, new mattress designs have the potential to improve comfort and sleep quality while maintaining required shipboard specifications met by current standard mattresses.
- In a lab-based pilot study, we previously found that a foam consumer mattress was superior to the Navy innerspring mattress for subjective comfort and sleep quality outcomes.
- Objective:** To further investigate whether mattresses made of alternative materials can impact Sailor comfort and sleep, this study extends the work of our previous pilot study by (1) increasing the sample size and number of testing nights, (2) increasing the variety of mattresses tested, and (3) conducting the study aboard an operational Navy ship.

Methods

- Active duty Sailors (N = 52; 41 males, 11 females) from a U.S. Navy amphibious ship.
- Sailors participated for nine nights on the ship while in port; sleeping three nights each on:
 - Navy standard innerspring mattress
 - Consumer polyurethane foam mattress
 - Consumer foam/coil hybrid mattress
- All mattresses used for testing were new and constructed to the same dimensions.
- Objective sleep was assessed with two wearables: an electroencephalography forehead patch (Compumedics Somfit) and a smart biometric ring (Oura, Gen 4).
- Each morning, Sailors rated their sleep and mattress comfort with a digital questionnaire (Qualtrics).
- Participants were blinded to the mattress conditions, and the order was randomized and counterbalanced.

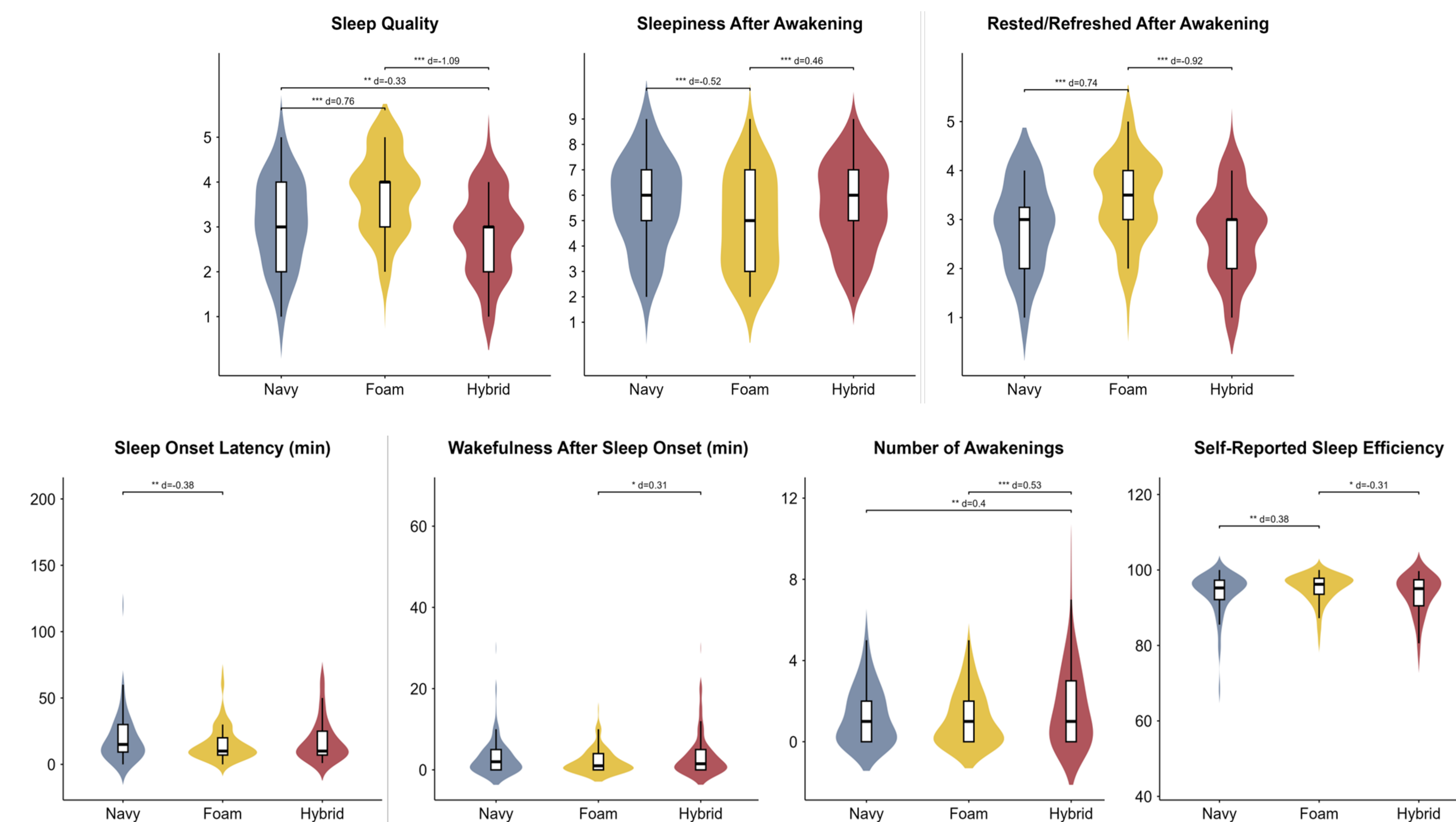
Results

Subjective Mattress Ratings



- The foam mattress was rated more favorably than the other mattresses on all dimensions.
- The Navy mattress was rated more favorably than the hybrid mattress on several outcomes.
- Participants were significantly less likely to report discomfort or pain with the foam mattress compared with the Navy innerspring mattress (odds ratio = 0.08, p < 0.001; data not shown).

Subjective Sleep Ratings



- The foam mattress was rated more favorably than the other mattresses for sleep quality as well as sleepiness and feeling rested/refreshed after awakening.
- The foam mattress was rated more favorably than the Navy innerspring mattress for sleepiness upon awakening, sleep onset latency, and sleep efficiency.
- The foam mattress was rated more favorably than the hybrid mattress for sleepiness upon awakening, number of awakenings, wake after sleep onset, and sleep efficiency.

Results (continued)

- Some subjective sleep outcomes were not significantly different mattress conditions (e.g., time in bed, total sleep time).
- Objective sleep outcomes (e.g., total sleep time, sleep onset latency, sleep efficiency) measured by the Oura Ring and Somfit devices did not differ significantly across the three mattress conditions.
- A range of potential covariates were added to the base statistical models (e.g., demographic, military, and sleep variables), but none of these materially altered the main findings.

Conclusions

- Significant differences were observed for all subjective mattress ratings and most subjective sleep outcomes, favoring the consumer foam mattress over both the Navy standard innerspring and consumer hybrid mattresses.
- These differences remained after controlling for potential confounding factors.
- Objective device-measured sleep outcomes did not differ between any mattresses.
- These results suggest that some mattresses constructed of different materials (but with similar dimensions) may offer improvements over current Navy shipboard mattresses in supporting Sailor sleep and readiness.
- This is consistent with previous survey and lab pilot study results that identified uncomfortable mattresses as a significant and modifiable factor influencing perceived sleep quality, which has implications for operational readiness.
- These findings have already been used to support decisions made by the Science and Technology resource sponsor (ONR) and the operational stakeholder (SURFOR) and are critical to inform our team's continued support of the current line of effort to modernize shipboard mattresses.

Future Directions

- Further work is needed to determine how mattresses can be designed to enhance comfort and sleep while still meeting material, safety, and operational criteria for shipboard use.

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