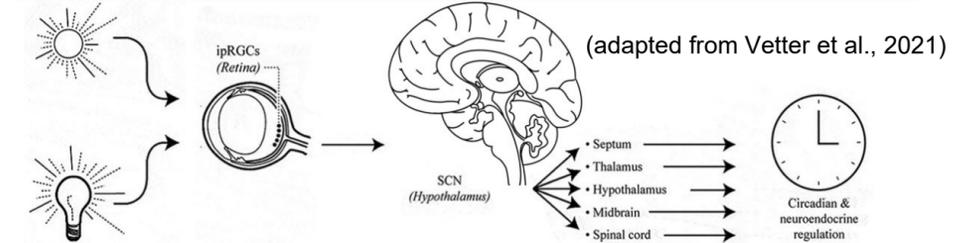


BACKGROUND

- Light has profound physiological impacts, including those contributing to mental health (Burns et al., 2021):
 - direct (e.g. treatment of depression)
 - indirect (e.g. via regulation of sleep and circadian rhythms)
- In addition, relationships between sleep, circadian timing, lighting, and mental health are overlapping and bi-directional, with interactions that are difficult to untangle and challenging to address (Scott et al., 2021).
- Secondary mental health outcomes were used to explore relationships with sleep, chronotype, and light in three recent studies.

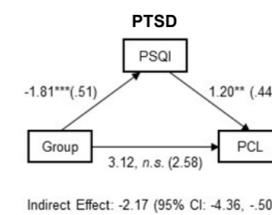
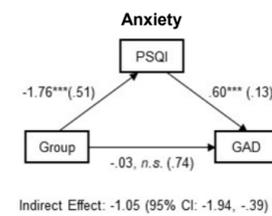
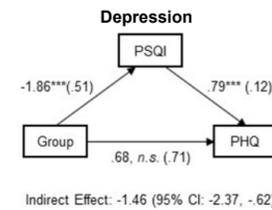
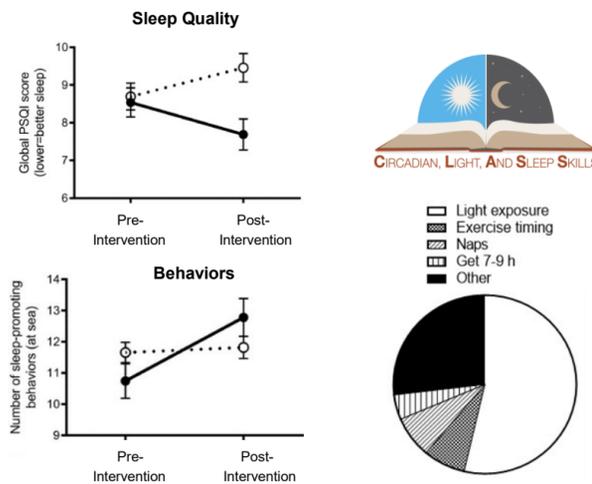


METHODS AND RESULTS

Study 1: Circadian Health Education, Sleep Quality, and Mental Health Outcomes

- In a study of a circadian health education program for Sailors (CLASS-SM) (Harrison et al., 2022), mediation analyses evaluated intervention efficacy in terms of sleep quality and mental health during an underway period (n=150) (Schmied et al., 2022).

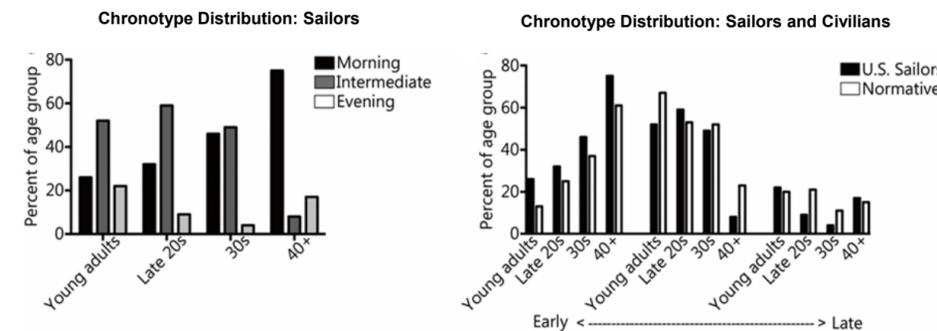
- The lighting component of the program was the most novel aspect to participants and included recommendations for one of the sleep-promoting behaviors that increased most (i.e. participants limited light before sleep).



- Sleep quality was improved in CLASS-SM participants ($p < 0.001$) but there were no differences in mental health ($p > 0.05$) vs the control group; however, the relationship between sleep quality and mental health outcomes was statistically significant, as were the indirect coefficients (all $p < 0.01$).

Study 2: Chronotype, Depression, and PTSD

- Correlations between mental health and chronotype were examined in service members (n=298) (Harrison et al., 2021).
 - “morningness” (early chronotype) and “eveningness” (late chronotype) describe the alignment of one’s schedule preference with the solar cycle.
 - symptoms of depression, anxiety, post-traumatic stress, and sleep disturbances were assessed using validated scales.
- Chronotype in service members skewed towards morningness relative to the distribution in the general population.



	PHQ-8	GAD-7	PCL-5	PSQI Total	PSQI Daytime dysfunction
rMEQ	-0.17**	-0.10	-0.15**	-0.17**	-0.23***

GAD-7 (Generalized anxiety disorder-7 scale), PHQ-8 (8-item version of the patient health questionnaire), PCL-5 (Posttraumatic stress disorder checklist version 5), rMEQ (Reduced morningness-eveningness questionnaire), and PSQI (Pittsburgh sleep quality index). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

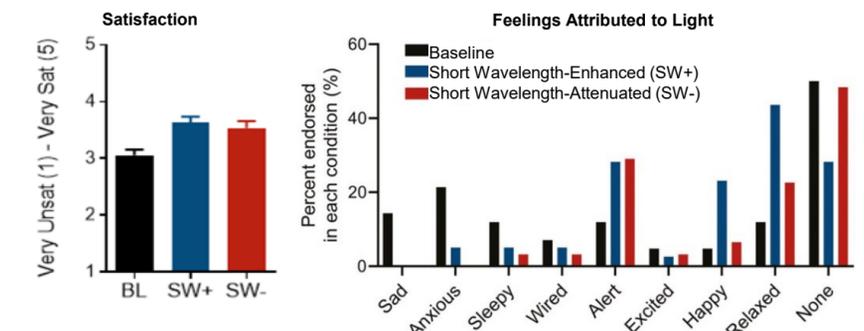
- Eveningness was associated with increased symptoms of depression ($r = -0.17$) and PTSD ($r = -0.15$) (both $p < 0.01$), as well as increased sleep disruption ($r = -0.17$) and daytime dysfunction ($r = -0.23$) ($p < 0.01$ and 0.001 , respectively).

Study 3: Lighting and Mood in Night Shift Workers

- Chi-squared analysis was used to compare mood and feelings in submarine watchfloor personnel working night shift schedules (n=47) across two lighting interventions (short wavelength-enriched, SW+ and short wavelength-attenuated, SW-) and a baseline control condition (BL) (Bessman et al., 2023).



This photo serves as a visual representation of the watchfloor environment. U.S. Navy photo taken by Robin Hicks/Released, Public Affairs NAVCYBERFOR.



- Participants were more satisfied with both lighting interventions versus BL (both $p < 0.001$).
- Fewer people endorsed feeling sad and anxious with both intervention conditions versus BL, and more endorsed feeling happy and relaxed under SW+ (both $p < 0.05$).

CONCLUSIONS

- Sleep quality was associated with mental health and mediated the positive effects of the circadian health education intervention on mental health outcomes.
- Chronotype related to depression and PTSD, with fewer symptoms in morning types.
- Circadian lighting interventions led to enhanced mood and greater satisfaction.
- Understanding sleep, circadian rhythms, light, and mental health may help transform the way we diagnose, monitor, and treat mental health conditions.

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