

Pre-Flight Sleep Quality as a Human Performance Risk Factor in Fighter Pilots of 5th Generation Aircraft

Geoffrey Carl Rodriguez, MBA, Brian Stemper, PhD, Rachel Cutlan, BS,
Katherine Sherman, MS, Hershell Raff, PhD, Keri Hainsworth, PhD
Medical College of Wisconsin – Milwaukee, WI



Background

- Fighter Pilots (FPs)** experience G-forces, helmet load, and sustained posture → cervical pain [1]
- Sleep quality** influences pain thresholds, stress, and recovery [2]
- Sleep in 5th-generation FPs remains **underexplored** [2]
- Study used the **Pittsburgh Sleep Quality Index (PSQI)**, a validated clinical tool, to measure pre-flight sleep quality [3]



Objective:

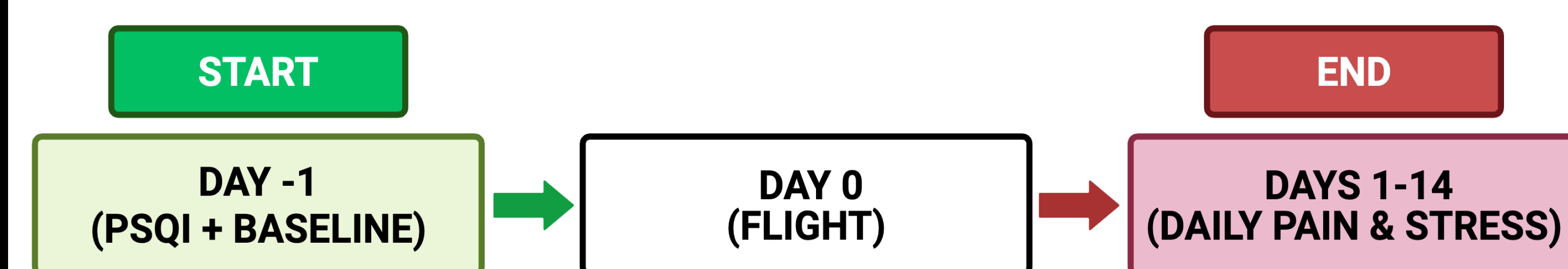
- Assess whether sleep quality predicts post-flight pain and stress intensity**

Methods

- Cohort:** 23 FPs (21M, 2F) flying 5th-generation aircraft
- Sleep Assessment:** Pittsburgh Sleep Quality Index (PSQI) completed day before flight, capturing sleep quality over the prior month
- Pain & Stress Measures:** Self-reported on 0–10 numeric rating scales
- Analysis:** 1) Examined pain and stress intensity in FPs with good vs poor sleep quality; 2) evaluated associations between sleep domains and both pre- and immediate post-flight pain and stress intensity; 3) examined pain trajectories 14 days after flight

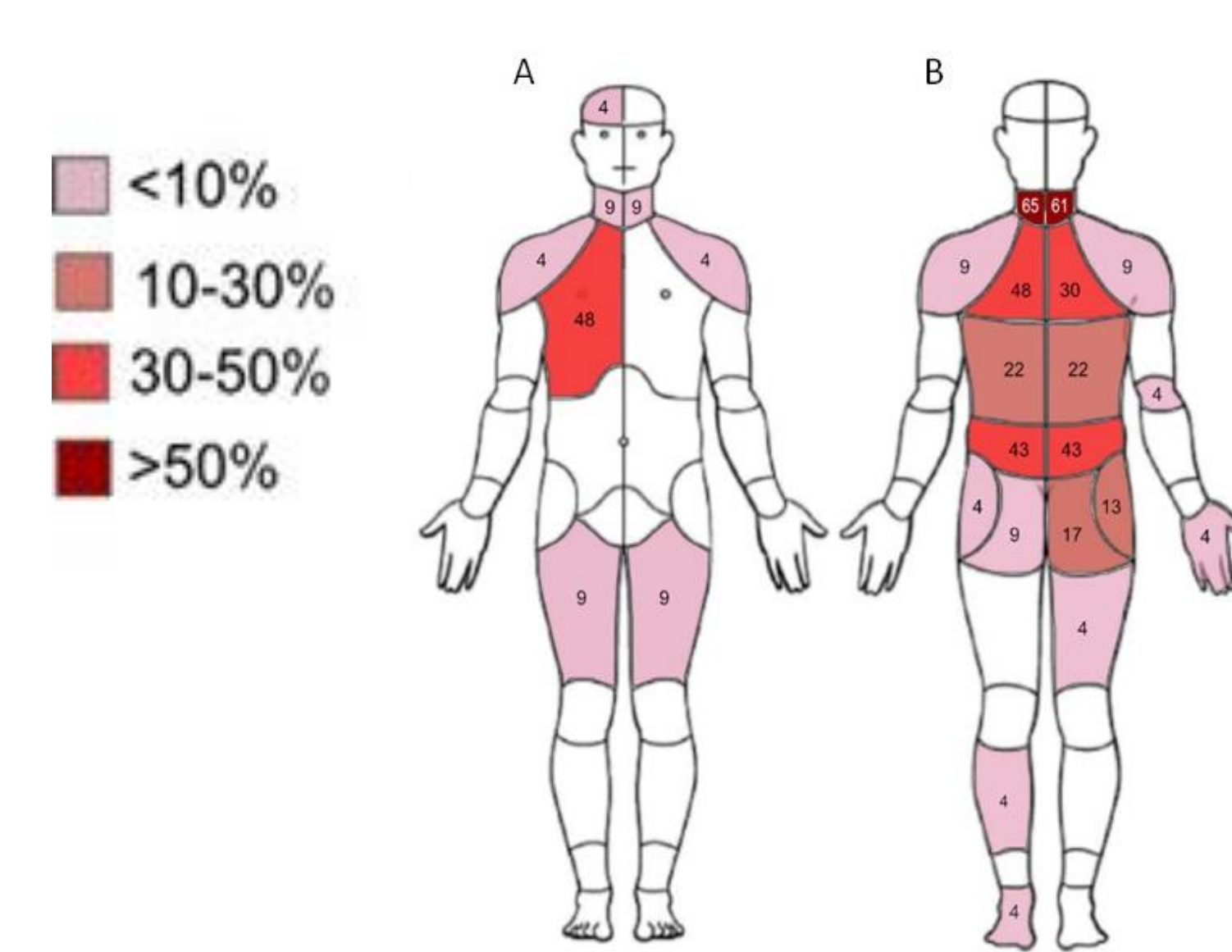
Study Period:

- Reflects a typical 2-week Operational Cycle
- Day -1** → Collected (PSQI + Baseline)
- Day 0** → (Flight Exposure)
- Days 1-14** → Collected (Daily Pain & Stress)



Results

Figure 1: Pain Body Map (Pre-flight)



Most Frequently Endorsed Areas with Pain: posterior cervical spine, posterior thoracic/lumbar back, and anterior chest

Figure 2: Baseline Pain by Sleep Quality

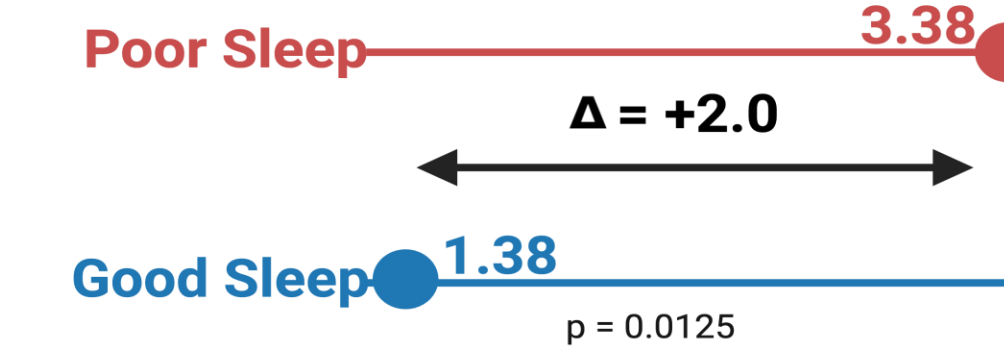


Figure 3: Sleep Domains Associated with Pain and Stress

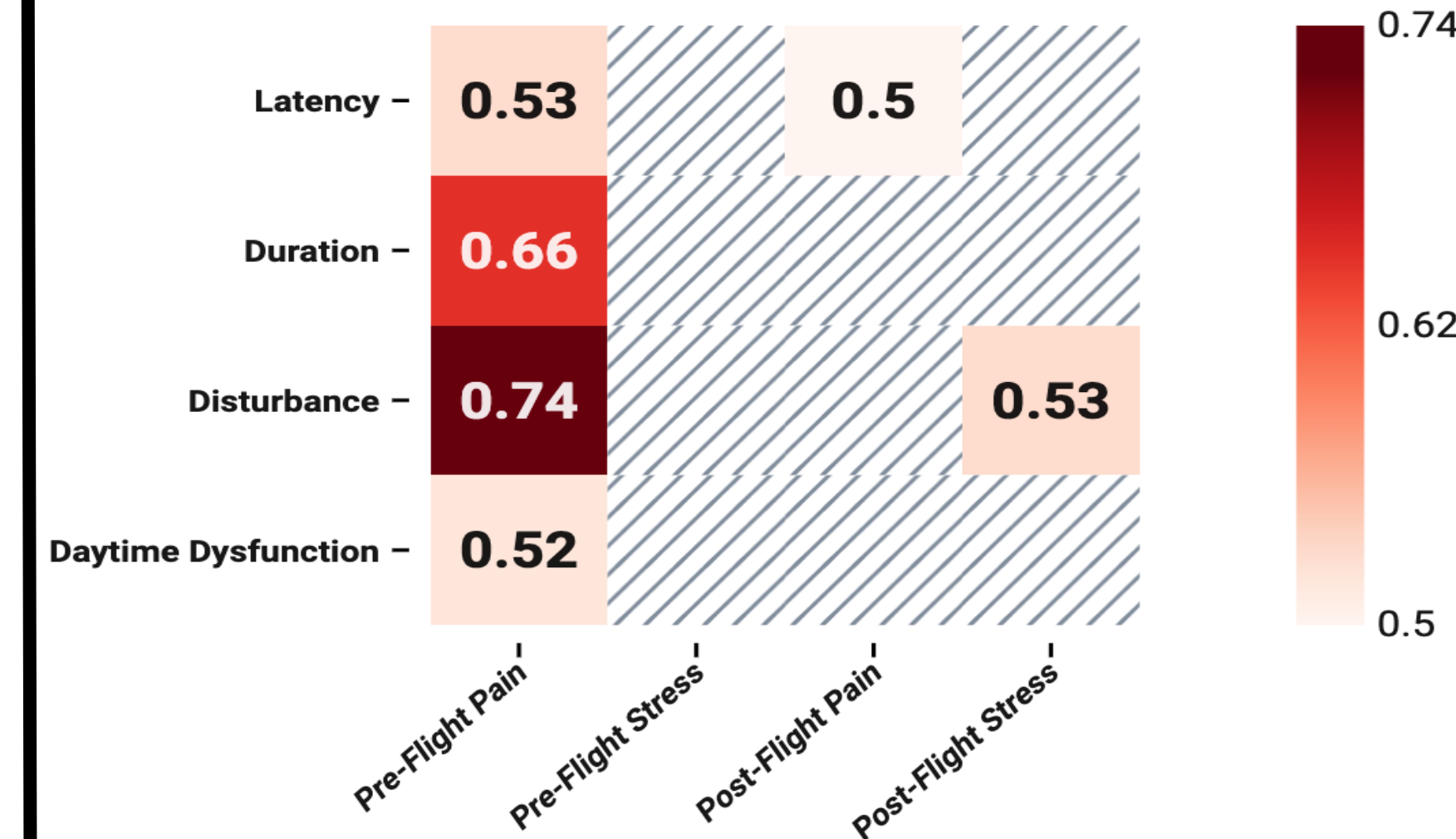
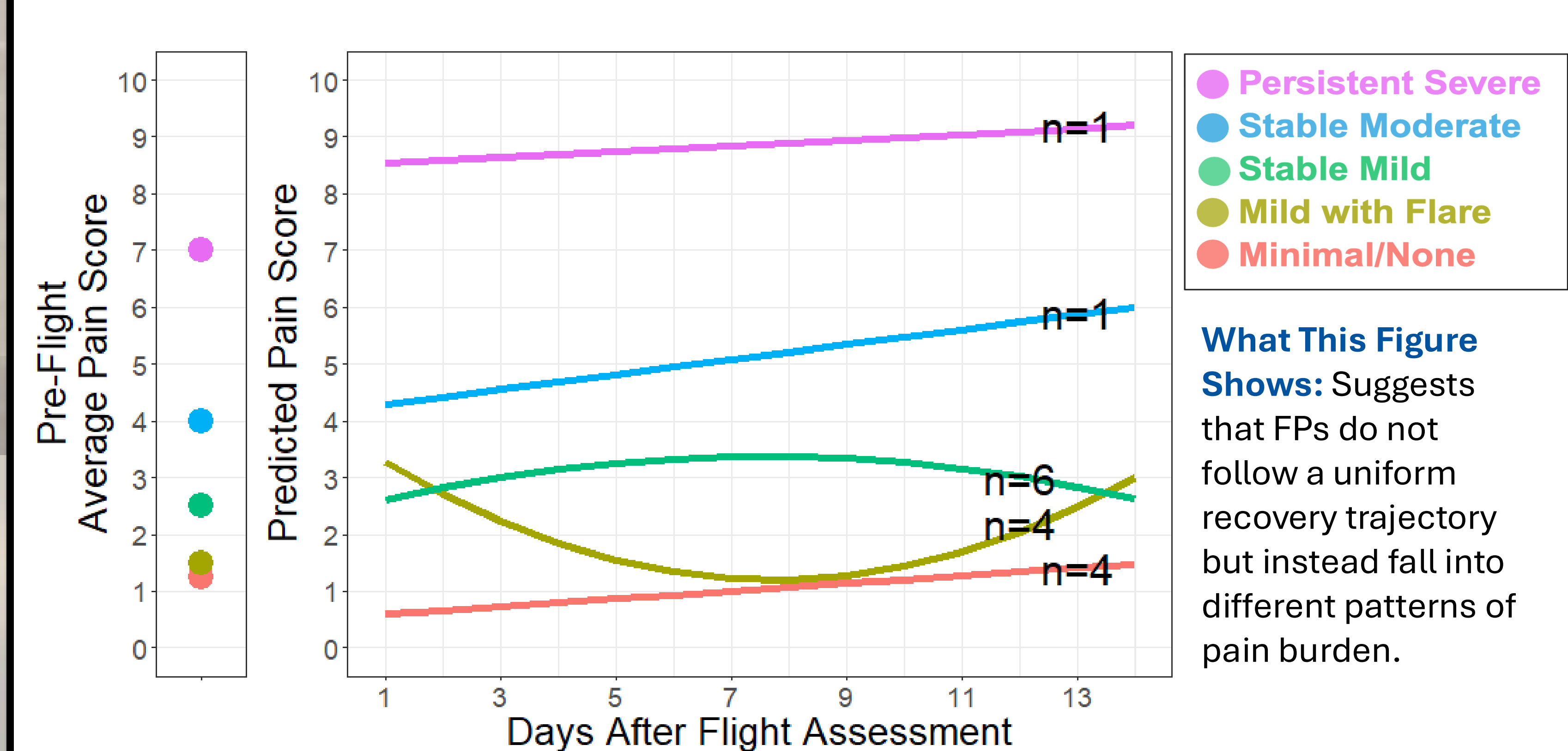
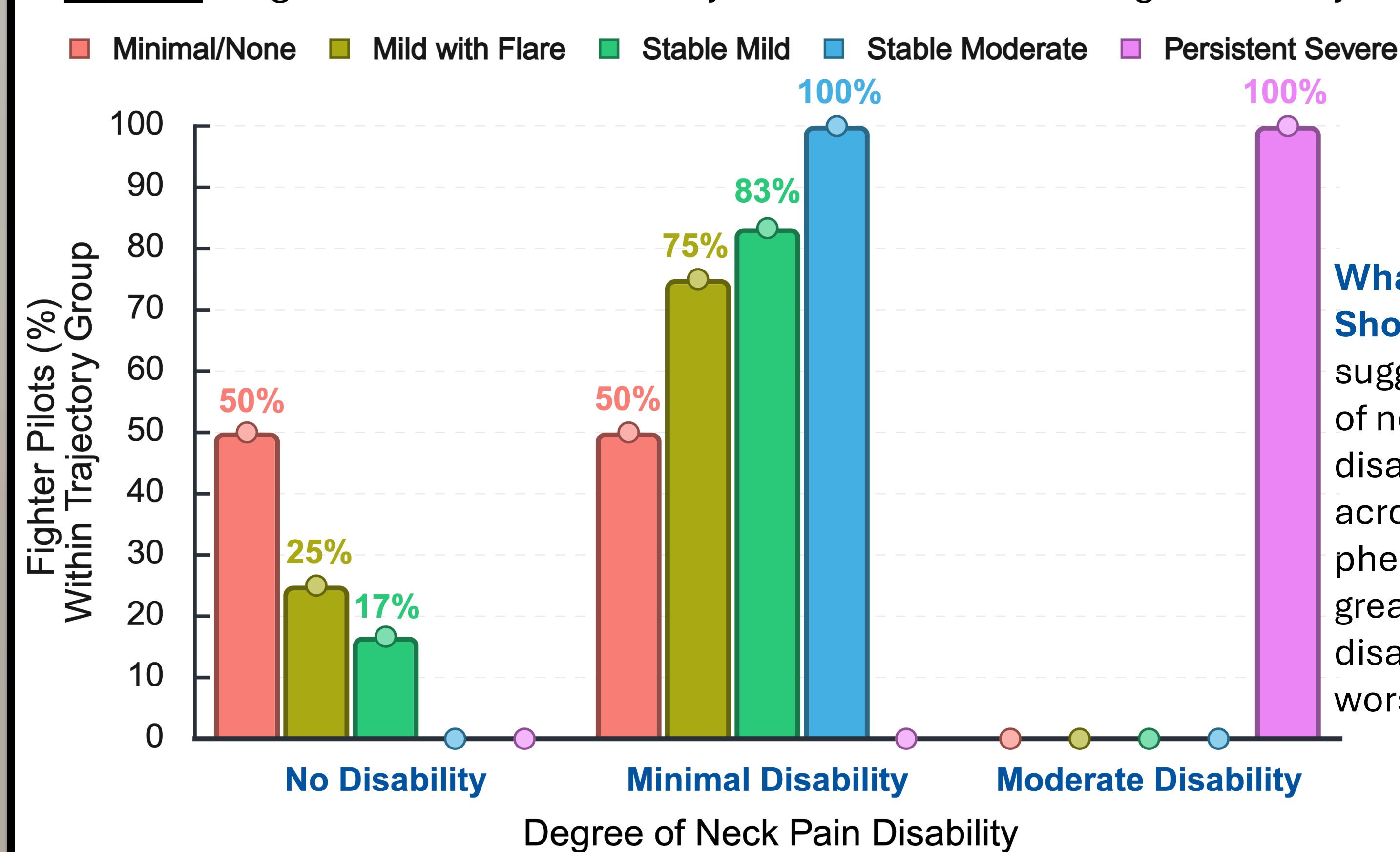


Figure 4: Grouped Pain Trajectories (n=16)



What This Figure Shows: Suggests that FPs do not follow a uniform recovery trajectory but instead fall into different patterns of pain burden.

Figure 5: Degree of Neck Pain Disability Associated with Post-Flight Recovery Patterns



What This Figure Shows: Data suggest that degree of neck pain disability differs across recovery phenotypes, with greater neck pain disability linked to worse recovery.

Discussion

Proposed Sleep-Pain-Recovery Framework in Fighter Pilots



- FPs demonstrated **distinct post-flight pain phenotypes** rather than a uniform recovery trajectory.
- Pain localized to the **cervical, thoracic/lumbar, and chest regions**, consistent with high G-forces, helmet load, and sustained posture.
- Targeting **sleep as a modifiable factor** could reduce high-pain trajectories, improve stress resilience, and enhance mission performance.

Take Home Messages

Future Work: Validate phenotypes in larger cohorts and assess potential underlying sleep-pain mechanisms.

- Distinct pain recovery phenotypes exist in fighter pilots
- Sleep disturbance may amplify pain and stress responses
- Optimizing sleep may improve pilot readiness and safety

References

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Keri Hainsworth
Director, Professor
Email: khainswo@mcw.edu