Occupational Influence on Physical Performance and Sleep Quality in Female US Naval and Marine Corps Aviation Personnel

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ACKNOWLEDGEMENTS

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DISCLAIMER

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This work was funded by the Office of Naval Research (N00014-25-12288). The study protocol was approved by the University of Kentucky Institutional Review Board (#98487) in compliance with all applicable federal regulations governing the protection of human subjects.

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INTRODUCTION

BACKGROUND

- Sex differences in physical performance within the military[1,2]
  - Need for more targeted training programs
- Other factors to consider for more specificity in training prescription
  - Occupational specialty[3]
  - Sleep quality[4]

MCRD San Diego photo courtesy of U.S. Marine Corps (Sgt. Yvonna Guyette | Released)

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INTRODUCTION

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PURPOSE

Examine differences in physical performance characteristics and sleep quality among female servicemembers assigned to US Naval and Marine Corps Aviation

METHODS – PARTICIPANTS

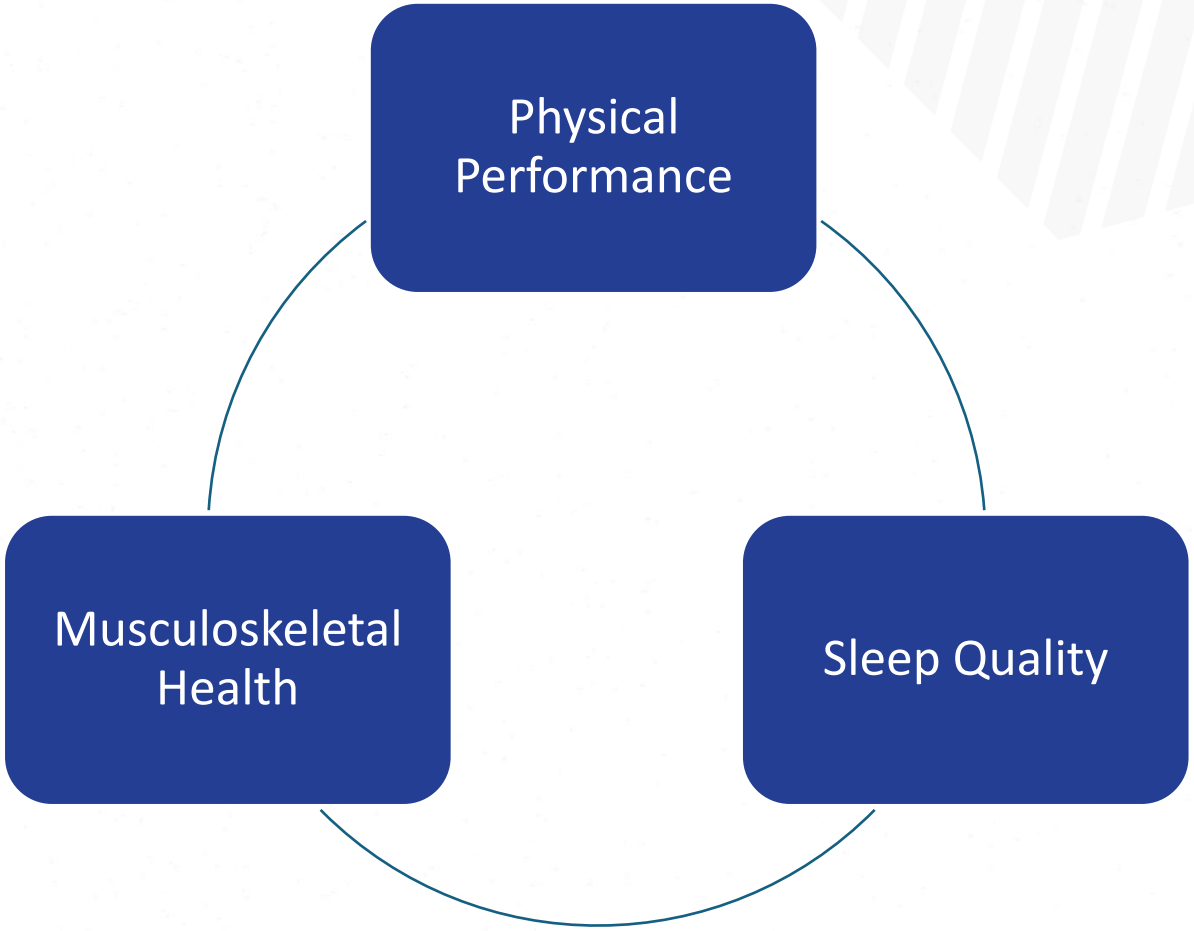
- 62 active-duty female Naval and Marine Corps servicemembers
- Inclusion criteria
  - Assigned to an aviation group
  - Aged 18-55
- Voluntary participation
  - All participants signed an informed consent approved by the University of Kentucky's Institutional Review Board

	PILOTS & AIRCREW (PAC) (n=27)	MAINTAINERS (MT) (n=18)	OTHER SUPPORT (OS) (n=17)
Age (yrs)	26.0±3.9	29.4±6.6	24.5±5.7
Height (cm)	166.3±7.2	165.4±6.2	165.4±11.0
Mass (kg)	65.7±12.0	69.7±10.1	68.7±9.7
Years of Service	3.7±4.4	9.4±5.7	2.5±1.6

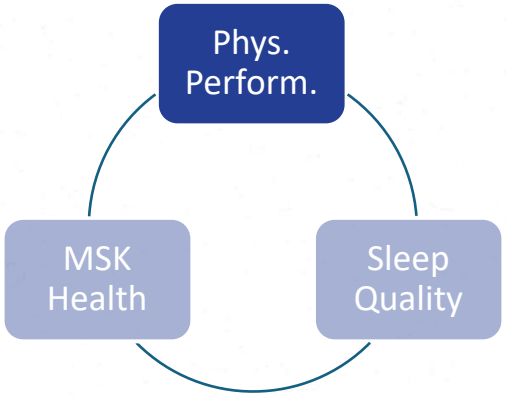
METHODS – DATA COLLECTION AND PROCESSING

- Exploratory sub-analysis of the ***R***estoration ***a***nd ***M***aintenance of Physical and Neurosensory ***P***erformance (RaMP): Naval and Marine Corps Aviation project
  - ONR: N00014-25-12288

- Comprehensive battery of assessments
  - Domains not included in sub-analysis
    - Neurosensory performance
    - Additional psychosocial health measures



METHODS – DATA COLLECTION AND PROCESSING



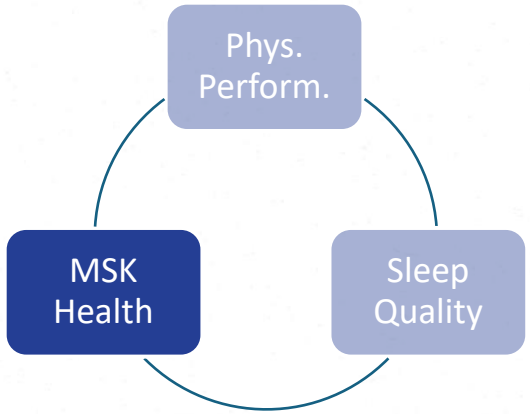
CNATRA photos courtesy of U.S. Navy (ENS Levi Thao | Released)

Bilateral force plates

- Sampling rate: 1000Hz
- Force metrics normalized to body mass

TASK	VARIABLES
Countermovement Jump (CMJ)	• Jump height • Peak concentric force • Peak power • Peak landing force
Isometric mid-thigh pull (IMTP)	• Peak force

METHODS – DATA COLLECTION AND PROCESSING



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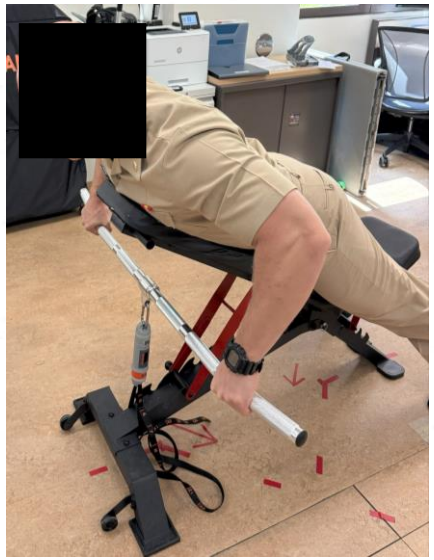


Photo courtesy of NMCSD

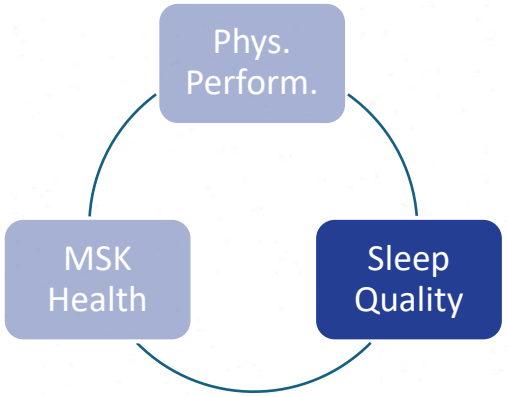
Neck strength and grip strength tasks not pictured.

Fixed frame and wireless dynamometry

- Sampling rate: 100 Hz & 50Hz respectively
- Force metrics normalized to body mass

TASK	VARIABLES
Isometric row • Maximal effort • Fatigued	• Peak force • Fatigued force • Muscular endurance (percent difference)
Neck flexion/ extension	• Strength (peak force)
Shoulder internal/ external rotation	• Strength (peak force)
Grip	• Strength (peak force)

METHODS – DATA COLLECTION AND PROCESSING



*As part of other psychosocial health measures not reported here

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

a) Cannot get to sleep within 30 minutes

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or more times a week_____

b) Wake up in the middle of the night or early morning

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or mo times a weel

c) Have to get up to use the bathroom

Not during the past month_____ Less than once a week_____ Once or twice a week_____ Three or mo times a weel

PSQI - Question 5

TASK	VARIABLES
Pittsburgh Sleep Quality Index[5] (PSQI)	• Total score

METHODS – STATISTICAL ANALYSIS

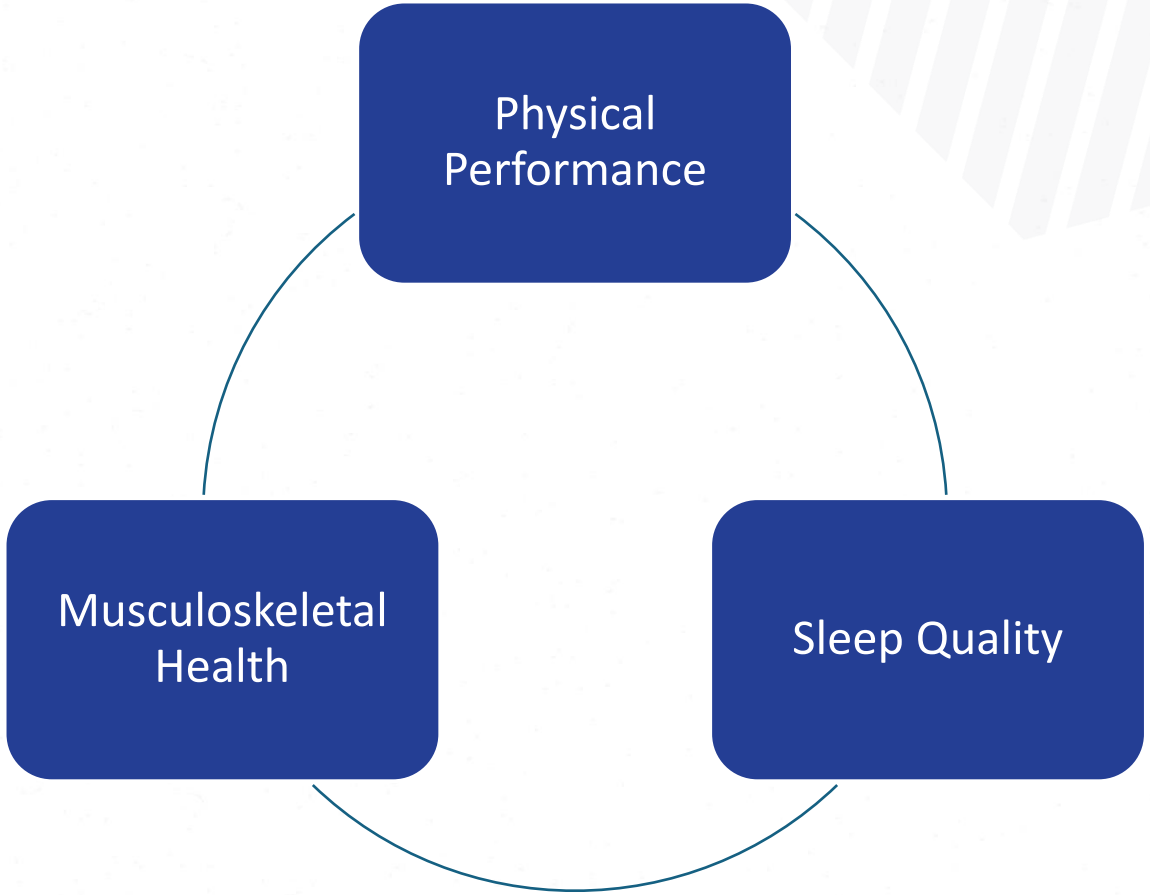
- Normality
  - Shapiro-Wilk
- Occupational specialties comparison
  - One-way ANOVA or Kruskal-Wallis
    - Pilots and Aircrew (PAC) vs Maintainers (MT) vs Other Support (OS)
  - Pairwise comparisons
    - Tukey Post-Hoc
    - Partial η^2 effect size
- $\alpha = 0.05$, a priori

EFFECT SIZE (partial η^2) INTERPRETATIONS	
0.0 - 0.01	Minimal
0.01 - 0.06	Small
0.06 - 0.14	Medium
≥0.14	Large

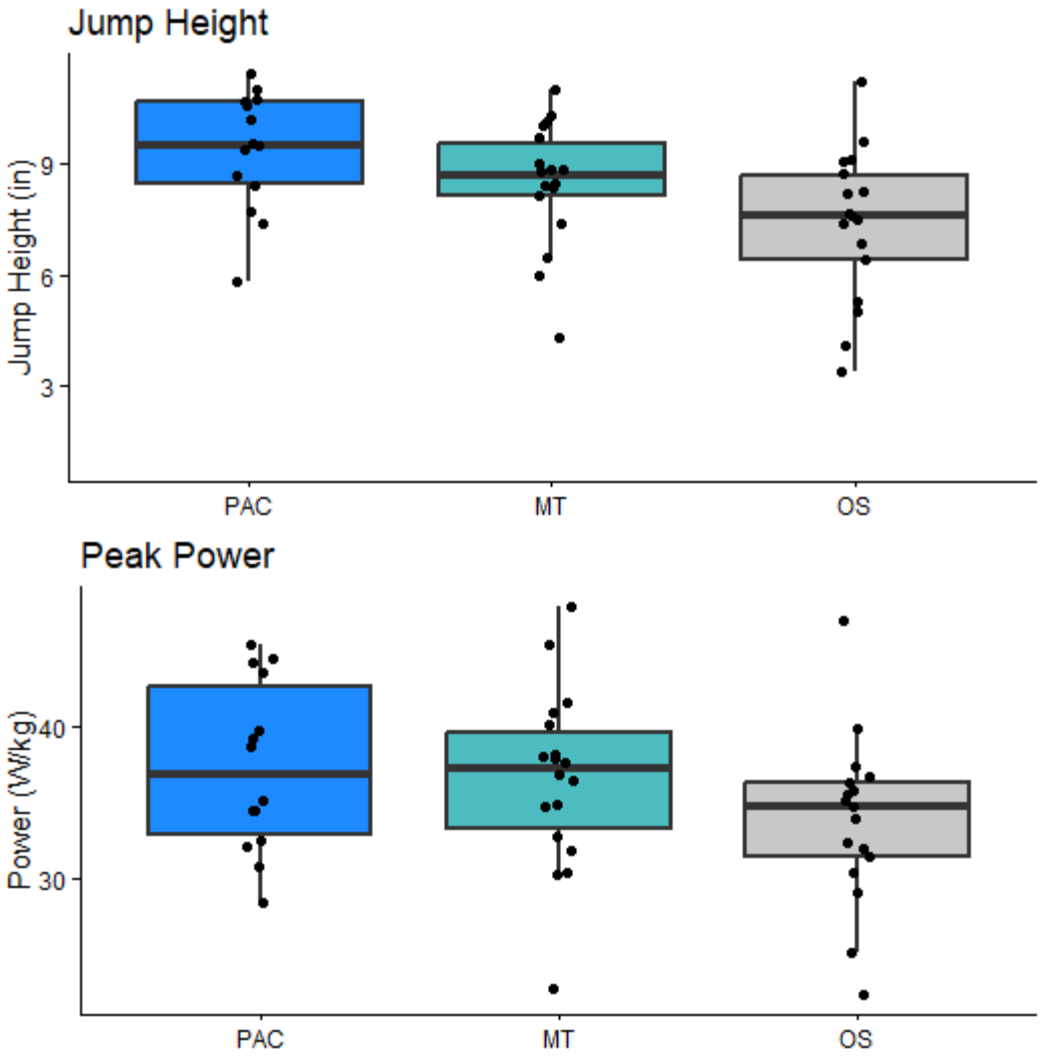
RESULTS

Role had statistically significant effects on

- Countermovement jump (CMJ)
  - Jump height, peak power
- Isometric mid-thigh pull (IMTP)
- Isometric row
  - Fatigued force, muscular endurance
- Neck extension strength
- Shoulder internal and external rotation strength
- Grip strength
- PSQI total score



RESULTS – Countermovement Jump



Jump Height

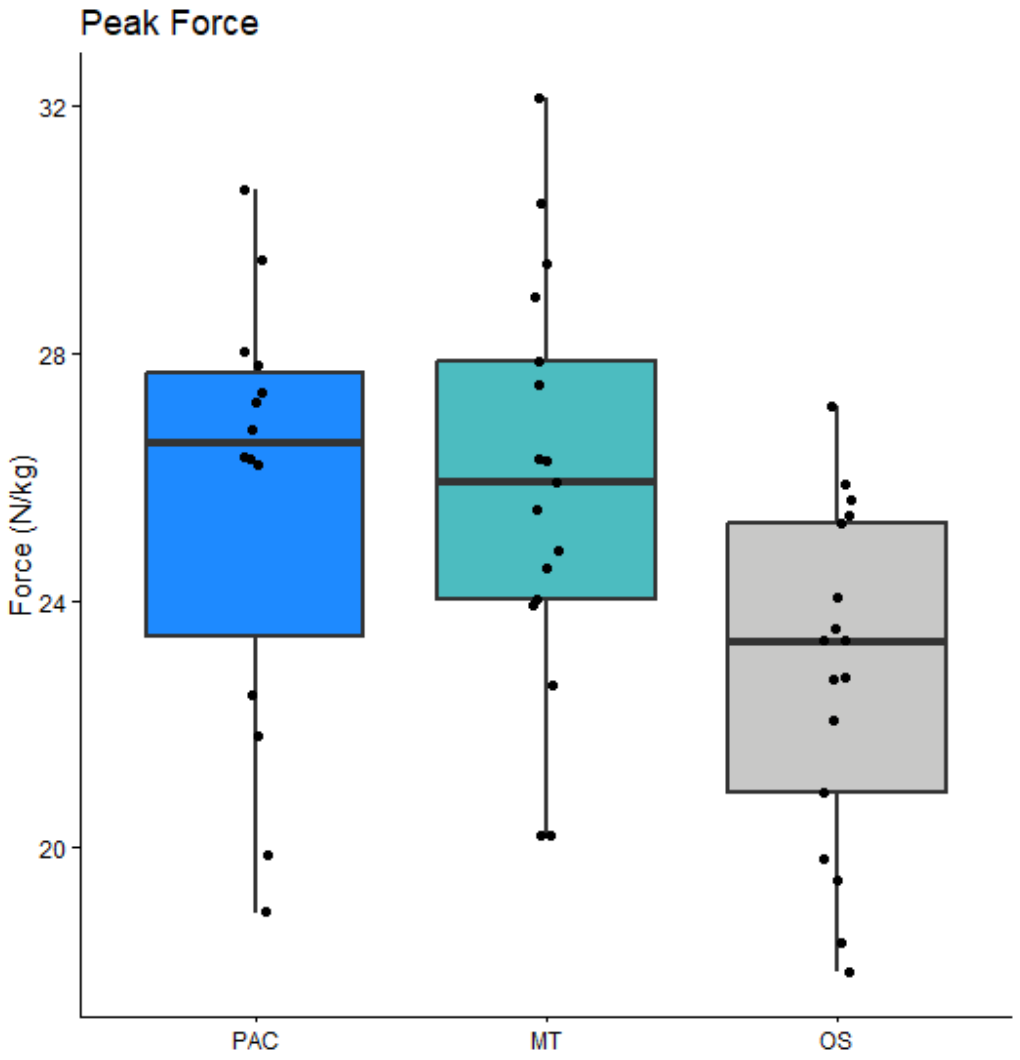
- p=0.001, partial η^2=0.201
- PAC > OS (p<0.001)
  - PAC mean: 9.6in
  - MT mean: 8.5in
  - OS mean: 7.4in

Peak Power

- p=0.037, partial η^2=0.106
- PAC > OS (p=0.028)
  - PAC mean: 38.6W/kg
  - MT mean: 36.6W/kg
  - OS mean: 33.8W/kg

No statistically significant differences in peak concentric force or peak landing force

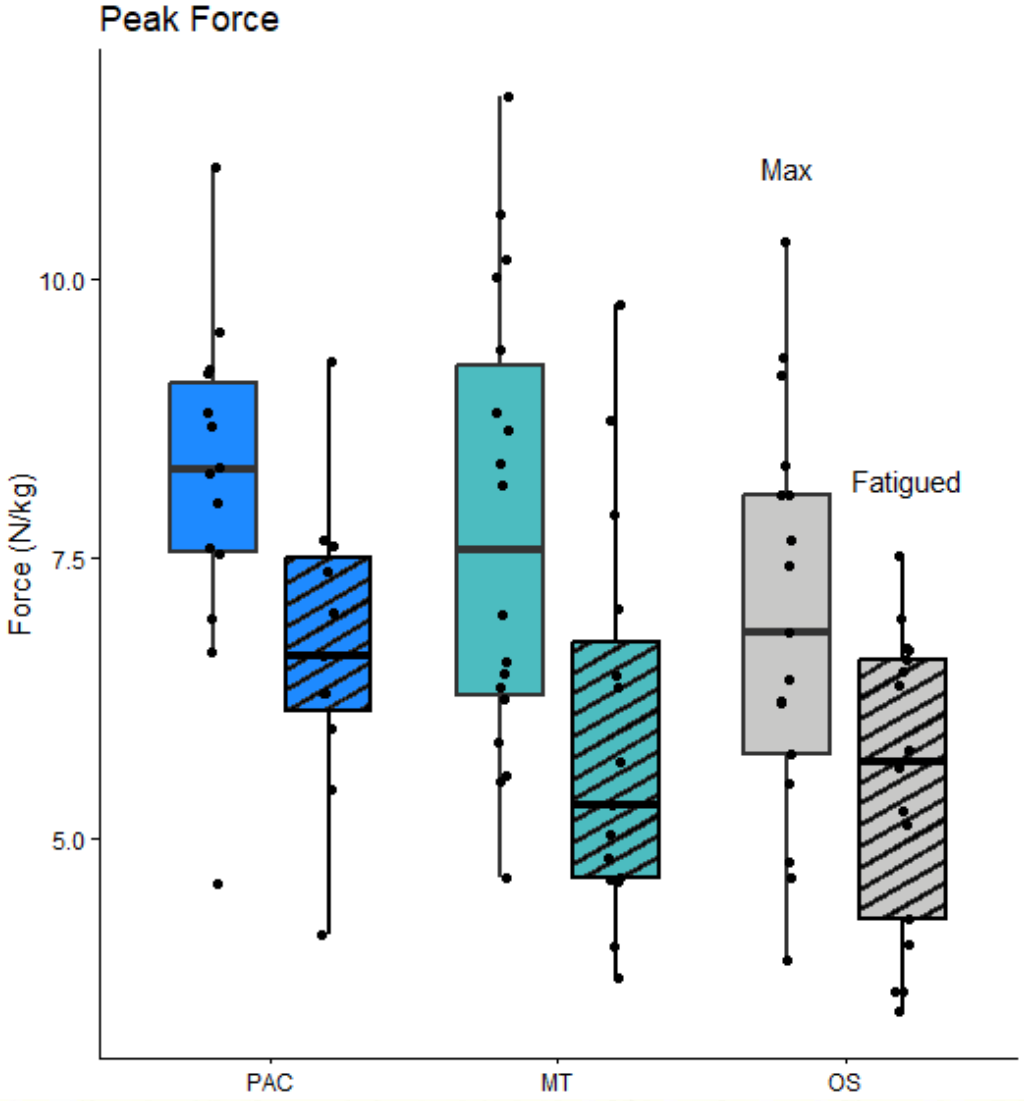
RESULTS – Isometric Mid-Thigh Pull



Peak Vertical Force

- p=0.004, partial η^2=0.175
- PAC > OS (p=0.007)
- MT > OS (p=0.010)
  - PAC mean: 25.7N/kg
  - MT mean: 25.9N/kg
  - OS mean: 22.8N/kg

RESULTS – Isometric Row



Fatigued Force

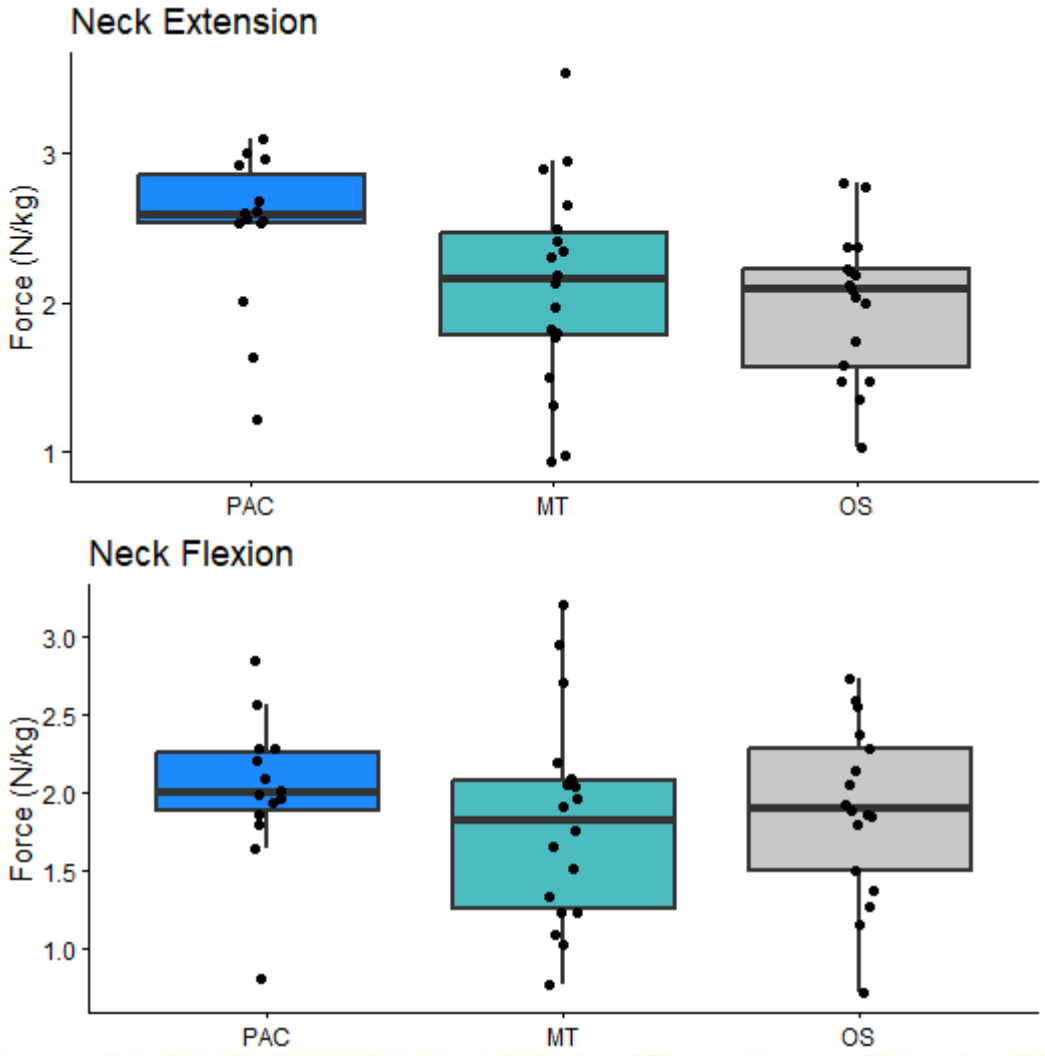
- p=0.005, partial η^2=0.181
- PAC > OS (p=0.005)
  - PAC mean: 6.9N/kg
  - MT mean: 5.9N/kg
  - OS mean: 5.5N/kg

Percent Difference

- p=0.007, partial η^2=0.171
- PAC < MT (p=0.008)
  - PAC mean: 14.7%
  - MT mean: 22.5%
  - OS mean: 20.2%

No statistically significant differences in maximal effort peak force

RESULTS – Neck Strength

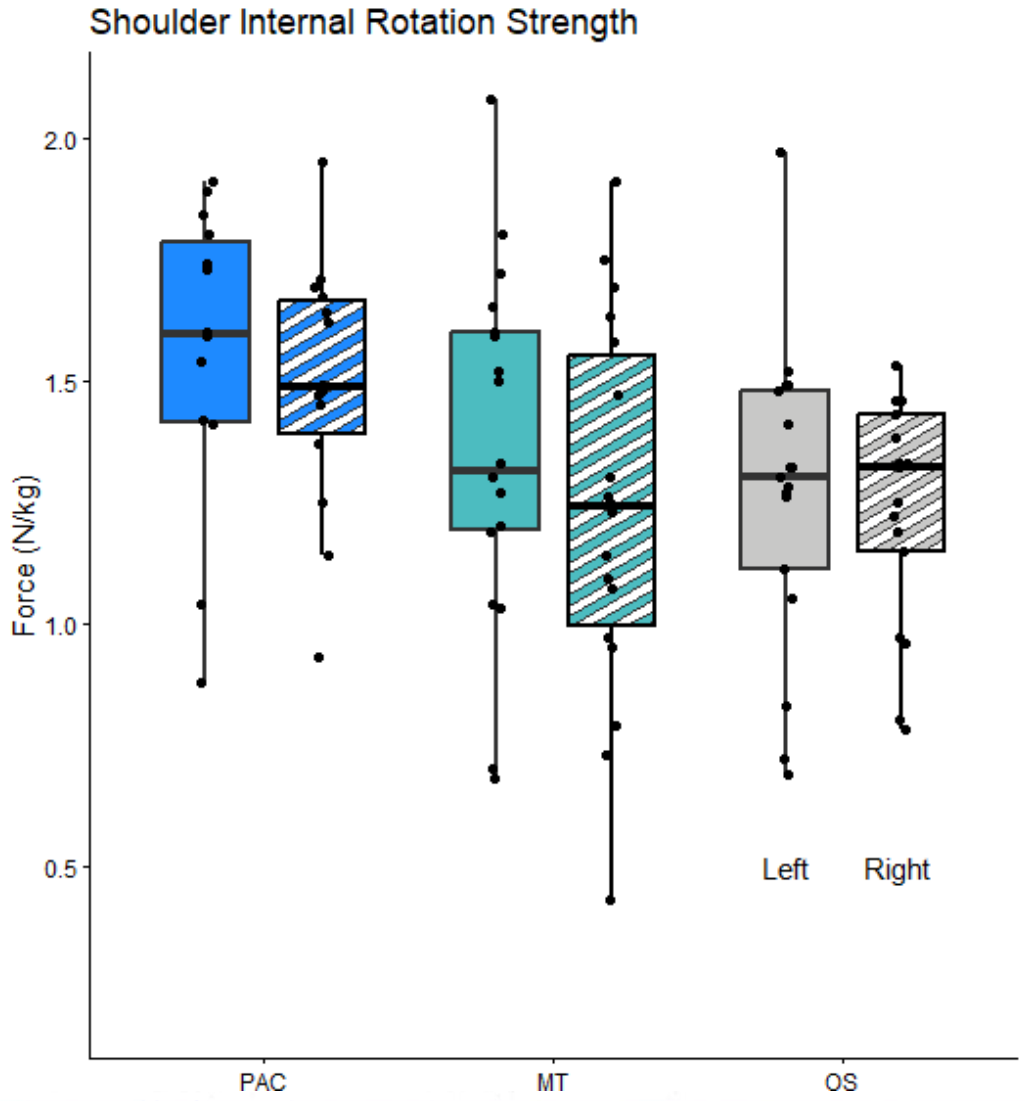


Neck Extension Strength

- p=0.007, partial η^2=0.132
- PAC > OS (p=0.010)
  - PAC mean: 2.5N/kg
  - MT mean: 2.1N/kg
  - OS mean: 2.0N/kg

No statistically significant differences in neck flexion strength

RESULTS – Shoulder Strength, Internal Rotation



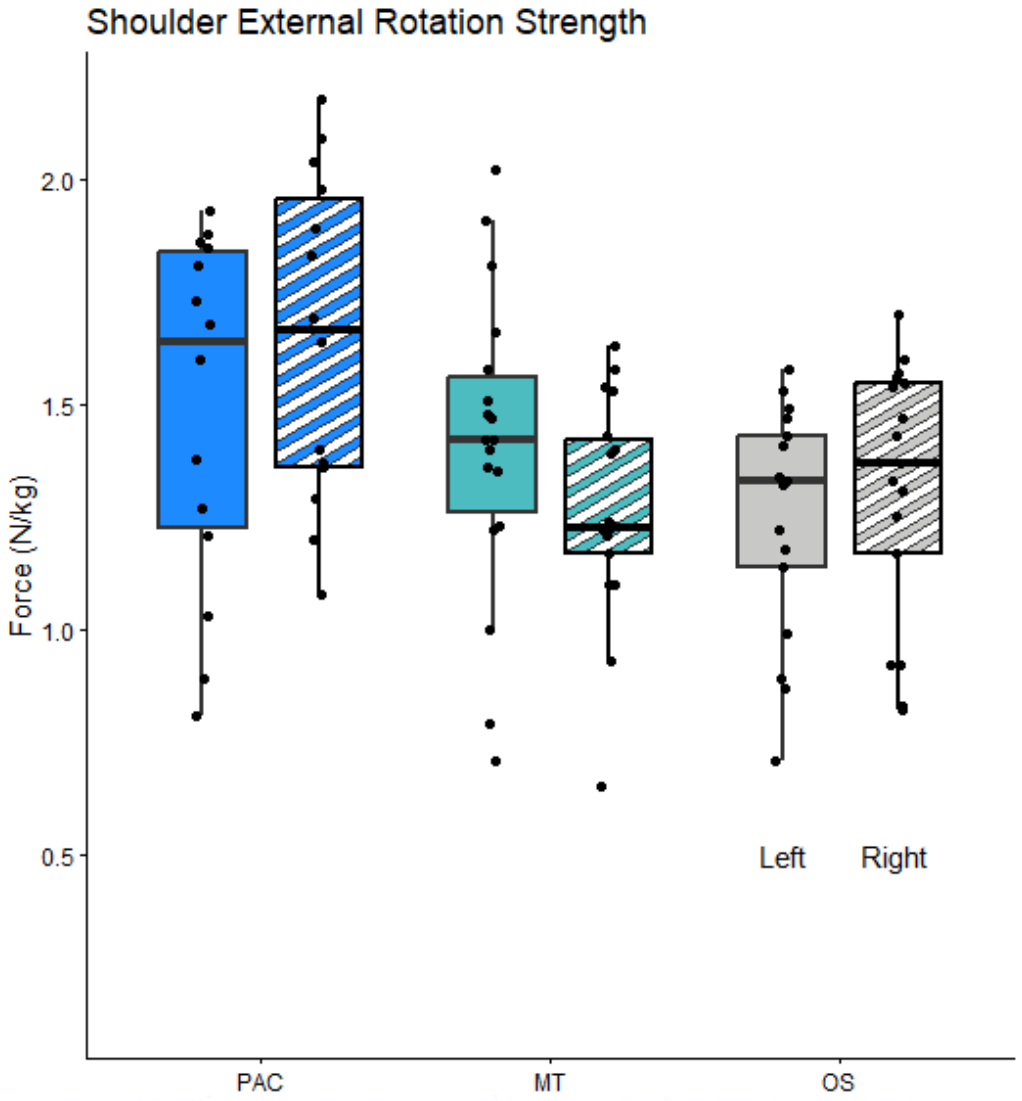
Left

- $p<0.001$, partial $\eta^2=0.214$
- PAC > MT ($p=0.015$)
- PAC > OS ($p=0.001$)
  - PAC mean: 1.7N/kg
  - MT mean: 1.4N/kg
  - OS mean: 1.3N/kg

Right

- $p<0.001$, partial $\eta^2=0.260$
- PAC > MT ($p<0.001$)
- PAC > OS ($p=0.001$)
  - PAC mean: 1.6N/kg
  - MT mean: 1.2N/kg
  - OS mean: 1.2N/kg

RESULTS – Shoulder Strength, External Rotation



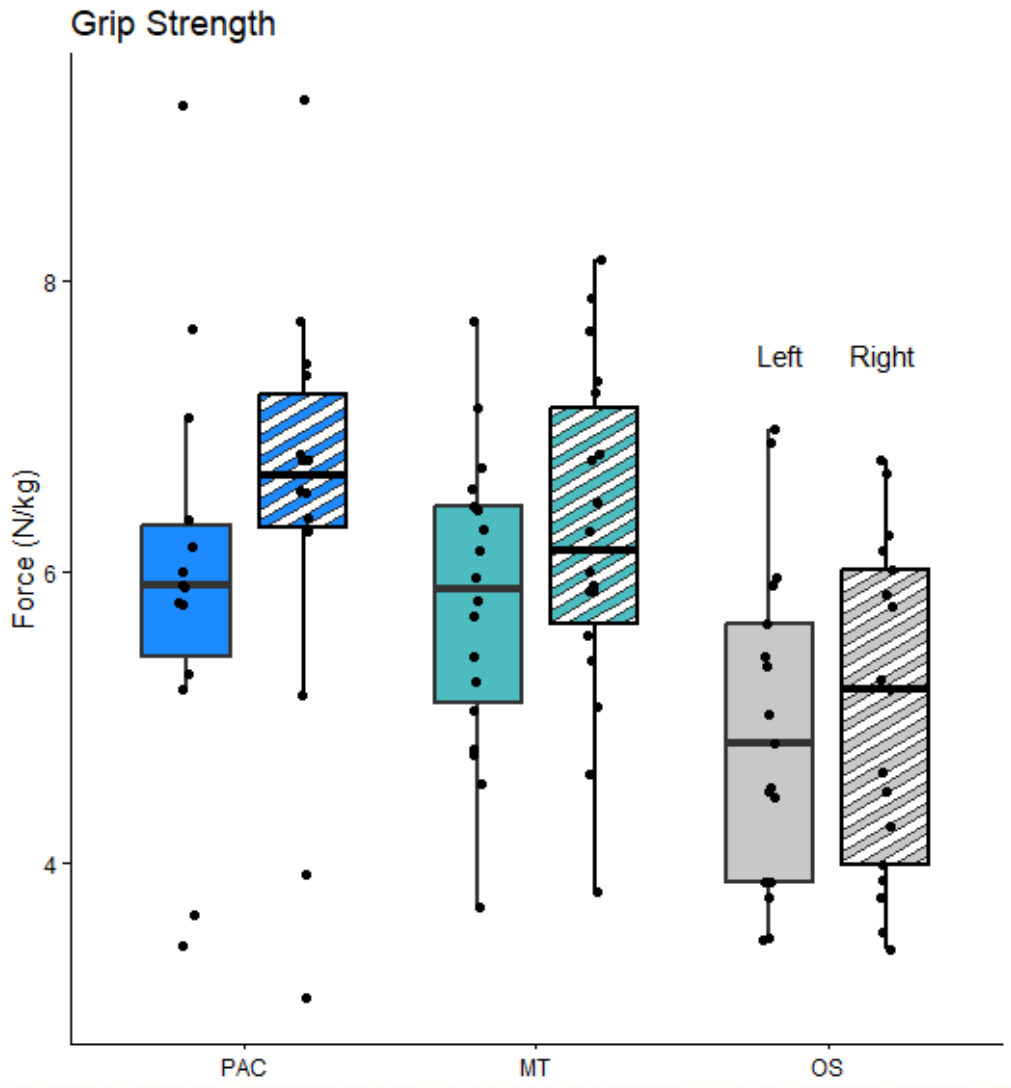
Left

- p=0.017, partial η^2=0.129
- PAC > OS (p=0.001)
  - PAC mean: 1.5N/kg
  - MT mean: 1.4N/kg
  - OS mean: 1.2N/kg

Right

- p<0.001, partial η^2=0.290
- PAC > MT (p<0.001)
- PAC > OS (p=0.001)
  - PAC mean: 1.6N/kg
  - MT mean: 1.3N/kg
  - OS mean: 1.3N/kg

RESULTS – Grip Strength



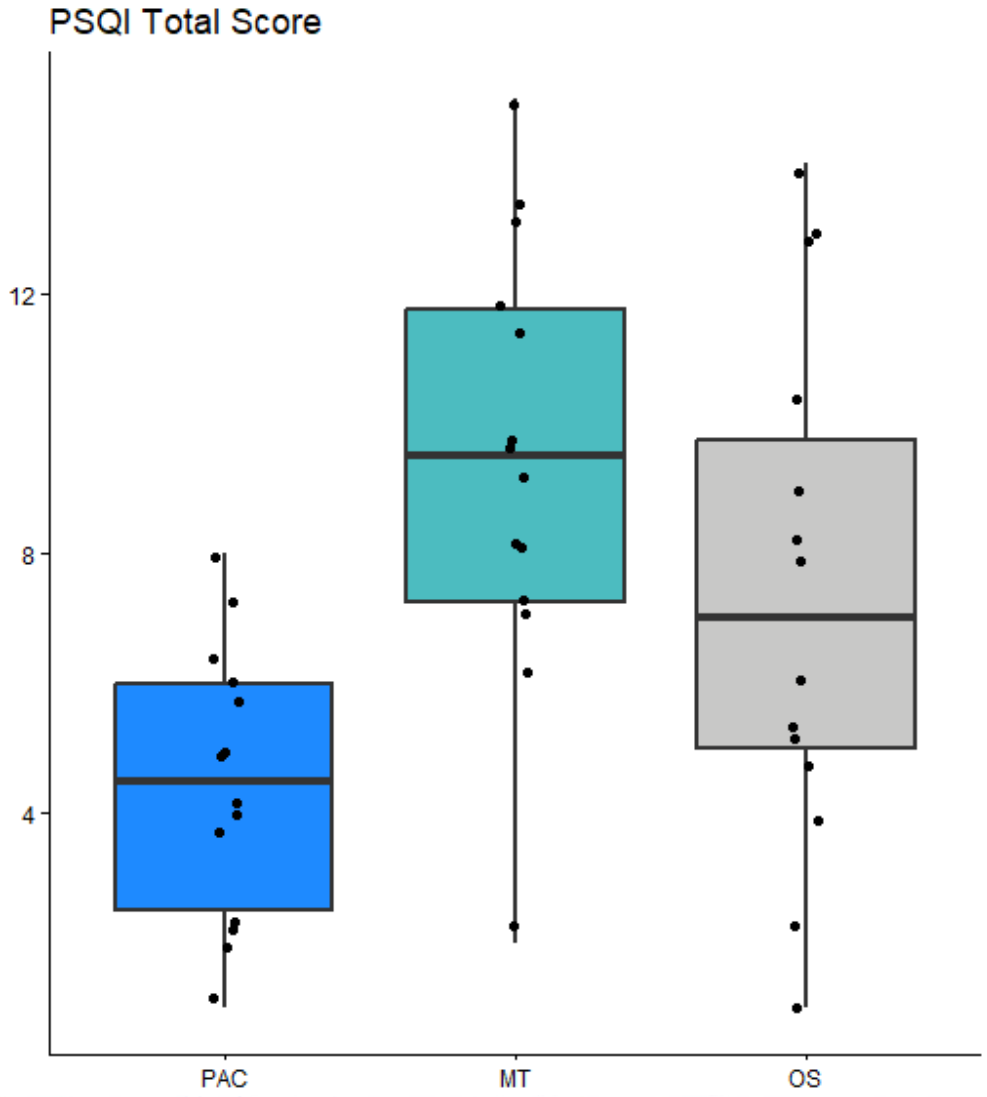
Left

- p=0.042, partial η^2=0.102
- No significant pairwise comparisons
  - PAC mean: 5.8N/kg
  - MT mean: 5.8N/kg
  - OS mean: 4.9N/kg

Right

- p=0.007, partial η^2=0.154
- PAC > OS (p=0.017)
- MT > OS (p=0.013)
  - PAC mean: 6.1N/kg
  - MT mean: 6.3N/kg
  - OS mean: 5.0N/kg

RESULTS – Pittsburgh Sleep Quality Index



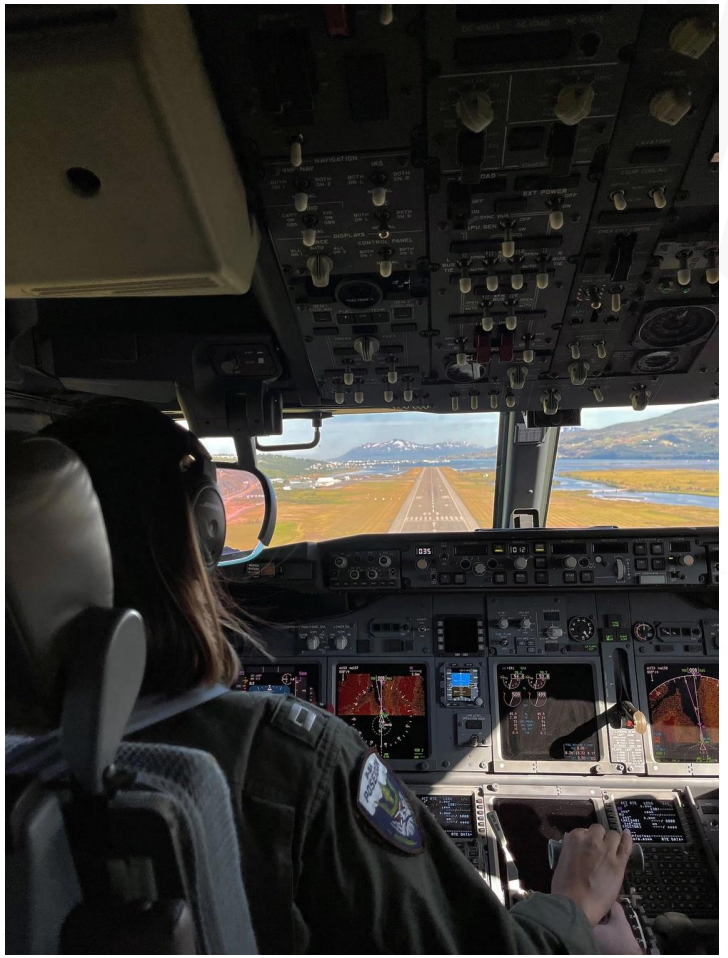
PSQI Total Score

- $p<0.001$, partial $\eta^2=0.310$
- PAC < MT ($p<0.001$)
- PAC < OS ($p=0.018$)
  - PAC mean: 4.3
  - MT mean: 9.4
  - OS mean: 7.4

On average, PAC have good sleep quality (≤5) and MT and OS have poor sleep quality (>5).

RESULTS – Group Difference Summary

- Other Support worst performances overall
- Maintainers and Pilots & Aircrew similar performance across most tasks
  - PAC greater shoulder strength, muscular endurance
- Pilots & Aircrew better sleep quality than Maintainers and Other Support



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DISCUSSION

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- Medium to large effect size of role for all identified differences
- Other Support having the worst performances may not be “red flag”
  - Not necessarily occupationally relevant metrics
- Differences between Pilots & Aircrew and Maintainers did not consider age/years of service
- Exploratory analysis from first year of project

CONCLUSION/SIGNIFICANCE

- Occupational role consideration for physical training programming for female servicemember readiness and MSK health
  - Additional consideration of sleep quality
    - Previous evidence of association with MSK injuries[4]
    - Difference among roles

- Operational readiness performance thresholds likely dependent on occupational duties
  - can inform training prescription along with previously identified sex-specific differences

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Thank you! Questions?

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