

Ward C. Dobbs<sup>1</sup>, Anna K. Jacobson<sup>1</sup>, Michael J. Bruni<sup>1</sup>, Brandon M. Roberts<sup>3</sup>, Andrew R. Jagim<sup>1,2</sup>

<sup>1</sup>University of Wisconsin – La Crosse, Department of Exercise and Sport Science

<sup>2</sup>Sports Medicine, Mayo Clinic Health System, La Crosse, WI

<sup>3</sup>Military Performance Division, US Army Research Institute of Environmental Medicine, Natick, MA

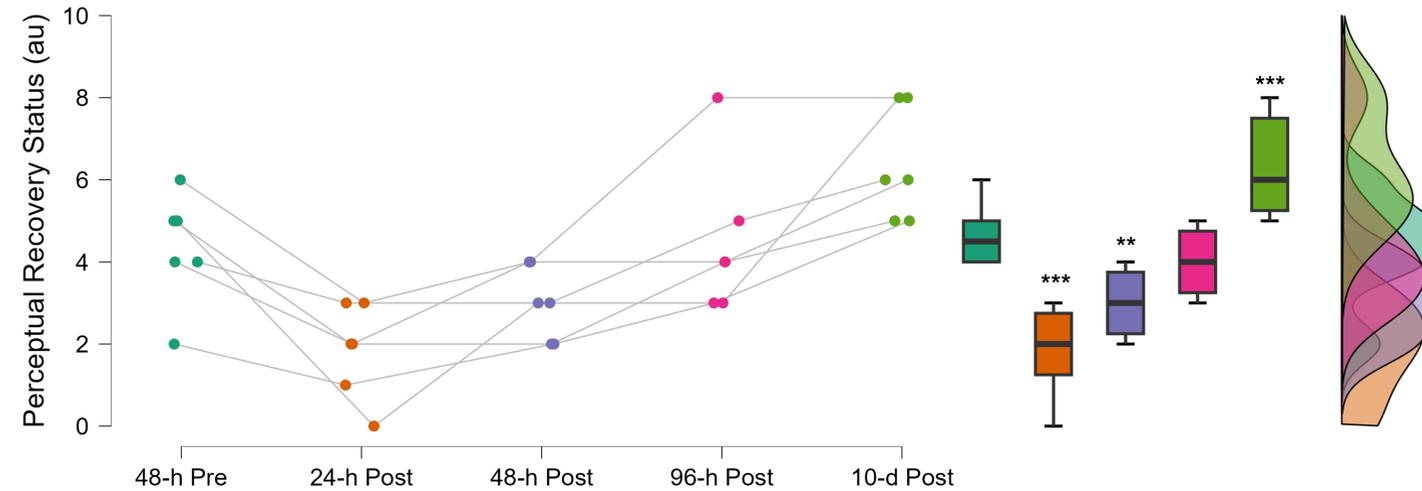
## INTRODUCTION

- The Northern Warfare Challenge (NWC) is a rigorous competition among Reserve Officers' Training Corps (ROTC) cadets that is modified annually and includes a ~22.5- to 27.4-km ruck while carrying a 13.6-22.7 kg pack.
- The Perceptual Recovery Status (PRS) is a scale-based system, recorded by participants indicating their expected recovery and compared to their previous performance.
- The purpose of this study was to observe subjective and objective recovery patterns following the NWC.

## METHODS

- Nine ROTC cadets participated in this study [mean ± SD] [age, 20.8 ± 1.3 years; height, 177.2 ± 6.8 cm; mass, 79.9 ± 8.3 kg].
- Forty-eight hours prior to, as well as 24-, 48-, 96-hours and 10-days following the NWC, cadets attended the human performance laboratory between 0530-0630 to perform a battery of tests following a standardized warmup.
- The testing battery was completed as follows:
  1. The profile of mood state questionnaire to quantify total mood disturbances (TMD).
  2. Fasted blood draw for the measurement of creatine kinase (CK) and c-reactive protein (CRP) on three occasions (48-hours prior to, and 24-, 96-hours post NWC).
  3. A dynamic warmup followed by subjective rating of recovery via the perceptual recovery status (PRS) scale.
  4. Countermovement jumps (CMJ), followed by isometric mid-high pulls (IMTP) on a force plate sampling at 1000 Hz.
- A multilevel model was used to evaluate the change in parameters across time, and repeated measures correlations were used to evaluate the intra-individual association between PRS and other measurements.

## RESULTS



**Figure 1.** Trends in perceptual recovery status. Lines represent the individual responses and box plots represent the mean and standard deviation with the color corresponding to each respective timepoint. \*, significantly different from pre-measurements at the .05 level; \*\*, significantly different from pre-measurements at the .01 level; \*\*\*, significantly different from pre-measurements at the .001 level.

**Table 1.** Descriptive data and repeated measures correlations of variables of each variable to perceptual recovery status prior to and following the Northern Warfare Challenge. Data is presented as mean ± standard deviation unless otherwise noted.

Measurement	48-h Pre	24-h Post	48-h Post	96-h Post	10-Days Post	r (95% CI)
CK (U/L)	32.7 ± 5.8	<b>81.0 ± 28.7***</b>		44.2 ± 26.7		-0.76 (-0.92, -0.36)
CRP (mg/L)	0.69 ± 0.49	<b>15.57 ± 8.50***</b>		3.49 ± 1.72		-0.75 (-0.92, -0.33)
CMJ Braking Force (kg)	136.6 ± 27.7	<b>117.9 ± 21.2***</b>	<b>126.1 ± 16.8*</b>	141.7 ± 12.7	136.3 ± 19.6	-0.59 (-0.76, -0.35)
CMJ Height (cm)	38.6 ± 6.4	<b>34.2 ± 4.5***</b>	<b>34.7 ± 5.6***</b>	37.7 ± 6.6	37.2 ± 7.0	0.54 (0.29, 0.72)
IMTP (kg)	338.0 ± 73.9	<b>300.8 ± 67.4*</b>	<b>304.9 ± 73.2*</b>	326.5 ± 72	336.4 ± 86.1	0.48 (0.21, 0.68)
TMD (au)	6.2 ± 20.5	8.6 ± 17.7	7.9 ± 16.4	-0.13 ± 8.2	-2.4 ± 10.6	-0.40 (-0.63, -0.11)

Abbreviations: \*, significantly different from pre-measurements at the .05 level; \*\*, significantly different from pre-measurements at the .01 level; \*\*\*, significantly different from pre-measurements at the .001 level; CK, creatine kinase; CRP, c-reactive protein; CMJ, countermovement jump; CI, confidence interval; IMTP, isometric midhigh pull; Pre, prior to the Northern Warfare Challenge; PRS, perceptual recovery status; Post, following the Northern Warfare Challenge; r, repeated measures correlation; TMD, total mood disturbances.

## DISCUSSION & CONCLUSIONS

- The NWC significantly reduced physical performance parameters and perceived recovery for up to 48-h and induced significant elevations indicative of systemic inflammation (i.e., CRP). Creatine kinase levels significantly increased but remained well within normal range suggesting minimal muscle damage.

## PRACTICAL APPLICATIONS

- The similar trends between PRS and all other outcome variables following the NWC suggest PRS may be a viable tool for monitoring recovery following an extensive military related training event. Furthermore, the simplicity of the PRS tool warrants utility when access to research grade equipment is not available.



**Figure 2.** Repeated measures correlation matrix (scan me).