NAVAL HEALTH RESEARCH CENTER

Pain sensitivity and processing in Navy High-performance Craft Crewmen: An early indicator of injury risk?

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Background

- Navy High-performance Craft Crewmen (HPCC) operate high-performance crafts on a variety of missions that expose personnel to various sea states and gravitational forces on a non-stable platform.
- High frequency and magnitude loads experienced by HPCC during transit impact musculoskeletal structure, increasing risk of injury and decreased physicality.

Photo courtesy of Getty Images

Background

- Anecdotal reports indicated operator complaints of lower limb and back pain.
- Shock mitigation seats were implemented to reduce the effects of high frequency and magnitude of loading.

Photo courtesy of Getty Images

Background

Prior Efforts

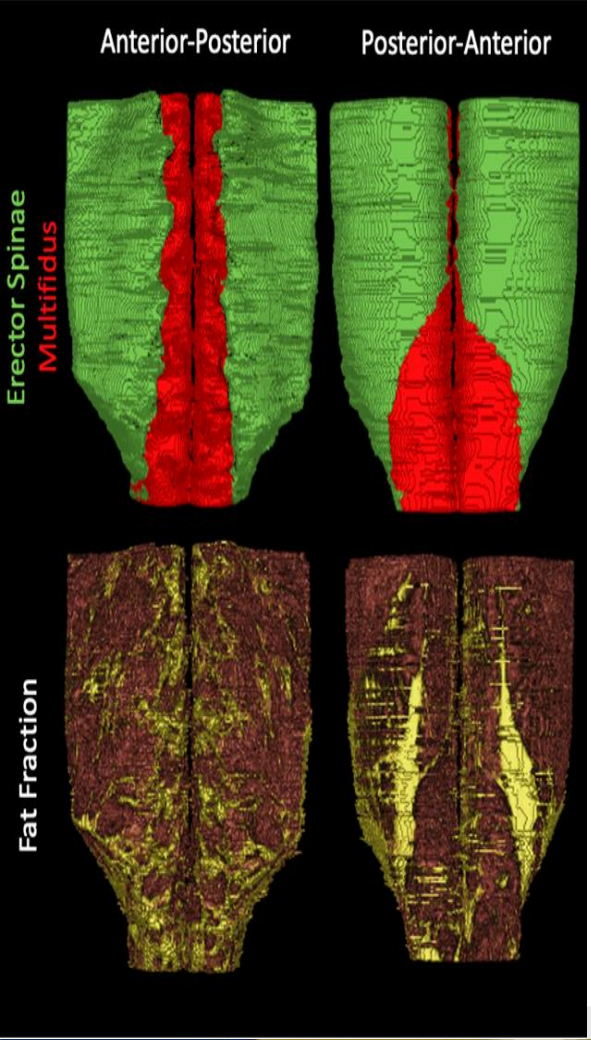
- Evaluated the effects of load on lumbar spine injuries in Marines.
- Developed a vertical magnetic resonance imaging (MRI) protocol for lumbar spine:
  - Quantified kinematics of spine under load
  - Assessed muscular adaptation from chronic load
  - Determined effect of load placement
- Evaluated the effect of operational position on the spine.

Photo courtesy of Getty Images

Goals

1. Quantify impact of high-speed boat operations on lumbar and cervical spine.
2. Associate pain to spine structure.
3. Develop mitigation strategies through “pre-hab” based on data acquired coupled to PT assessments.
4. Create Rest–work cycles to allow for recovery.

Photo courtesy of NHRC



Methods

Participants
Active duty US Navy and US Marines.

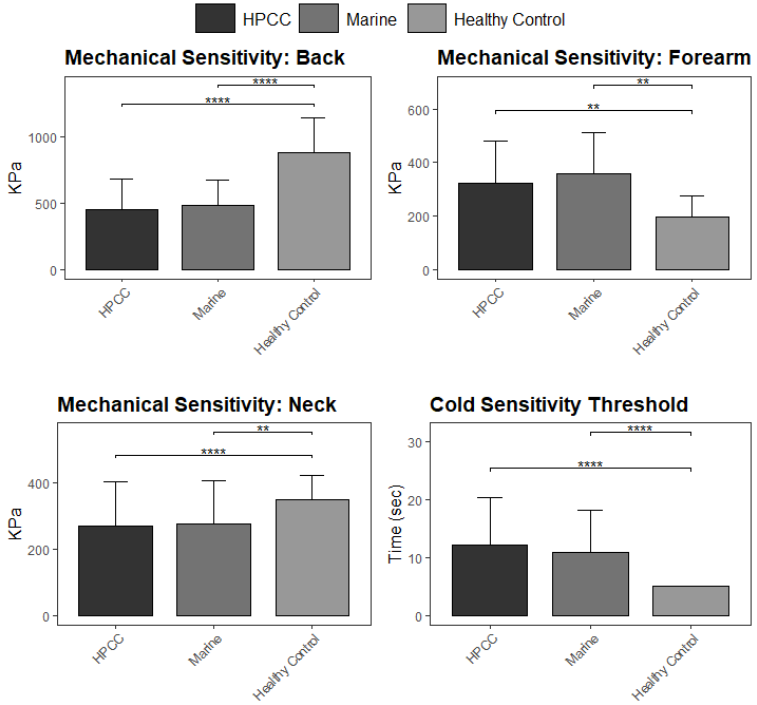
MRI Image
Supine and vertical MRIs in various operational positions.

Pressure Pain Thresholds
Measure of pain sensitivity using pressure algometry of the cervical spine on the dominant side, applied 2-cm lateral to the C3 spinous process.

Photo courtesy of NHRC

Preliminary Results

Pain Sensitivity Measures



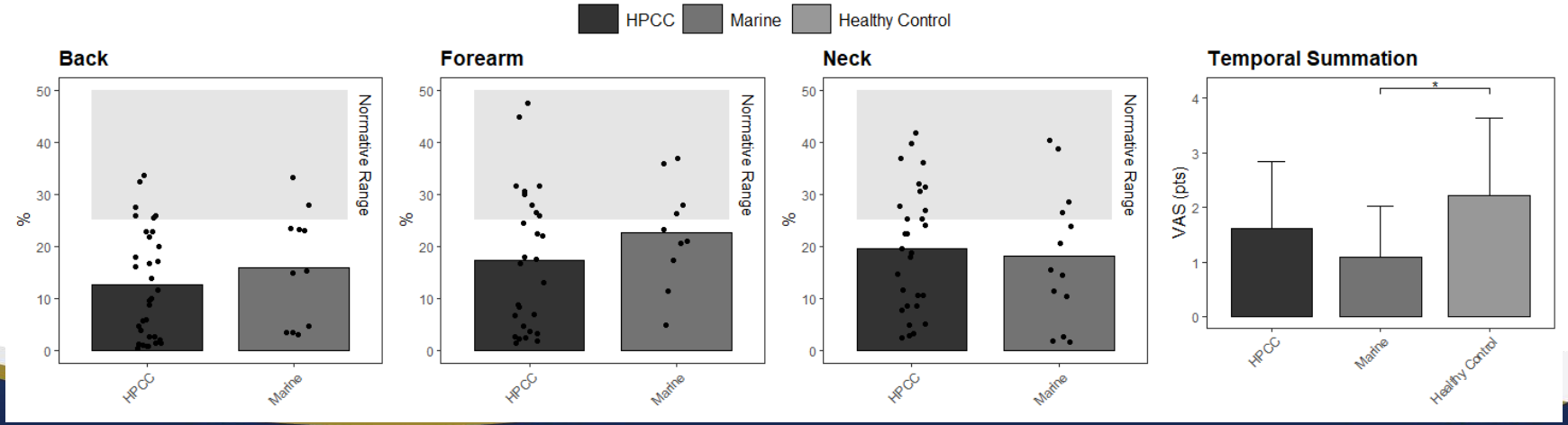
*p < .01; **p < .001; ***p < .0001; ****p < .00001.

- HPCC have **lower mechanical pain thresholds in the back and neck** compared to healthy male civilians.§
- HPCC have **higher mechanical pain thresholds in the forearm** (control site) compared to civilians§
- HPCC have **lower sensitivity to cold water** compared to civilians* and Marines.
- There are no differences between HPCC and Marines for pain sensitivity.

§*Civilian data based on published literature.*

Pain Modulation Measures

- Conditioned Pain Modulation measures the efficacy of the nervous system to inhibit pain (**higher is better**).
- Temporal Summation measures whether the nervous system amplifies pain (**higher is worse**).
- HPCC demonstrate **lower inhibitory efficacy compared to civilian controls** (normative ranges are indicated in grey box) but similar to Marines.
- HPCC demonstrate **lower pain amplification** compared to civilian controls.
- There appear to be **no differences in modulation between HPCC and Marines**.
- There is a wide variation in response.



Next Steps

- Continue data collection to expand on preliminary findings.
- Relate pain data to structural findings from MRI.
- Analyze MRI images for structural differences between HPCC and Marines as well as over time.

Photo courtesy of US Navy

Future

Risks

- None to participant
- May find spinal issue but will direct to Navy Medical provider

Benefits

- Determine impact of occupation on cervical and lumbar spine
- Understand how spine adapts to impacts and changes in muscle structure and physiology
- Target specific muscle groups as well as accessory muscles to stabilize spine
- Determine training implications, pre-hab from PT perspective
- Educate operators on potential impacts
  - Longevity of operator
- Understand impacts to possibly modify training schedule
  - "Crew rest"

Photo courtesy of US Navy

Questions

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