



Musculoskeletal Injury (MSKI) Prevention & Neuromuscular (NMS) Injury Rehabilitation Program

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Impact on Soldier Health and Readiness



Musculoskeletal injuries <u>severely degrade military readiness</u> affecting >50% of Soldiers, account for more than 1 million medical encounters and are responsible for 10 million limited-duty days annually (2018 Health of the Force Report).

Women

Incidence of Injury by Sex and Age, AC Soldiers, 2017

Among AC Soldiers, approximately 1,821 new injuries were diagnosed per 1,000 person-years



56% of Soldiers had a new injury – affected Soldiers averaged more than 3 injuries per Soldier (2018 Health of the Force Report).

Incidence of Injuries per 1,000 Person-Years, AC Soldiers, 2016–2017 The incidence of all new injuries and new overuse injuries decreased slightly in 2017, compared to 2016. Cumulative micro-traumatic musculoskeletal "overuse" injuries All injuries



²⁰¹⁸ Health of the Force Report

71% of all injuries were cumulative micro-traumatic musculoskeletal overuse injuries (2018 Health of the Force Report).



NMS Rehabilitation Operational Drivers



- 52% of combat wounds in the current conflicts include an extremity injury¹
- 1719 amputees from OIF/OEF/OND²
 - 534 Multiple limb amputations
- Total Lifetime cost of care for amputation ~ \$2.5 Billion³



Koebler, J. (2012, May 25). New Prosthetics Keep Amputee Soldiers on Active Duty. Retrieved September 16, 2016, from http://www.usnews.com/news/articles/2012/05/25/new-prosthetics-keep-amputee-soldiers-on-active-duty

American Wounded Making Way To First Aid Station In The Village Of Marne During German Attack. by George Matthews Harding, 1918



- Musculoskeletal injuries are the leading health problem for military service members⁴
 - 1.6 million injury-related medical encounters per year⁵
 - Musculoskeletal injuries account for 76% of medical non-deployable population⁶
- Battlefield orthopedic injuries cause the majority of long-term disabilities⁷
 - Primary condition resulting in disqualification from continued service

1. Belmont et al., J Trauma Acute Care Surg, 2012 2. Amputee Database, EACE, MAR 2018 3. Blough et al. JRRD, 2010 4. Yancosek et al. Curr Opin Rheum 2012



MSKI Prevention: Portfolio Drivers



Overarching Gaps

- The Joint Force lacks sufficient capability/ies to monitor, capture, and assess real-time and longitudinal environmental and personnel data for populations to enable decision-support interventions and to establish a baseline of a population's health, readiness, and performance in the context of operational requirements.
- The Joint Force lacks sufficient understanding of short-term, long-term, and cumulative effects of interrelated and co-/polymorbid physical, cognitive, and psychological health concerns and the optimal intervention strategies and structure of care needed to address them.

UNCLASSIFIED Enclosure 1 Military Operational Medicine (MOM) Capabilities-Based Assessment (CBA) Study



5 July 2017

Sponsor: Deputy Assistant Secretary of Defense, Health Readiness Policy & Oversight (DASD[HRP&O])

Primary Point of Contact: Dr. Terry M. Rauch, Director of Research & Development Policy & Oversight, Office of the Assistant Secretary of Defense of Health Affairs (OASD[HA]); terry m.rauch.civ@mail.mil, (703) 681-8390.

This document contains pre-decisional information for deliberative use during the Military Operational Medicine (MOM) Capabilities-Based Assessment (CBA) sponsored by the Deputy Assistant Secretary of Defense, Health Readiness Policy & Oversight (DASD[HRP&O]]. As such, the information in this report is exempt from public disclosure in accordance with Title 5 USC § 552(b) (5) (Freedom of Information Act Exemption (b) (5)).

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NMS Rehabilitation Portfolio Drivers



- Recent Armed Conflicts
- Leadership Policy and Guidance
- Future Conflicts Scenarios Multi-Domain Battle
- Injury Patterns
- Scientific / Treatment Advancements

Capability Gaps

- Maximize readiness from point of injury through return to duty with the management, treatment, and rehabilitation (MTR) of Neuromusculoskeletal Injuries
- Fully restore function to service members with limb amputation or trauma

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Initial Capabilities Document for Clinical and Rehabilitative Medicine (CRM)



23 March 2017 - FCB Staffing Draft

Proposed MDA: Defense Health Agency

Proposed JSD: JCB Interest

Sponsor: Deputy Assistant Secretary of Defense, Health Readiness Policy & Oversight (DASD[HRP&O])

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NMS Rehabilitation Capability Gaps



Development, Validation, and Optimization of Management, Treatment and Rehabilitation (MTR) Strategies

- Lack understanding of the influence of timing, dose, frequency and intensity of MTR strategies
- Lack evidence of MTR strategies
- Lack understanding of costs associated with MTR strategies
- Lack understanding of the value and feasibility of remote delivery platforms of MTR
- Lack solutions for early management of NMS Injuries

Understand Confounders to Successful MTR

- Lack understanding on the influence of habitual activity and lifestyle
 patterns on NMS Injury MTR
- Lack understanding of military specific factors that contribute to successful MTR
- Lack understanding of how pre-injury physical and mental health influence MTR outcomes
- Lack understanding of factors that contribute to chronic NMS injury
- Lack understanding of how NMS Injury contributes to the development of related comorbidities
- Lack understanding of how acute MTR strategies influence longterm outcomes



Develop and Validate Objective Metrics to Assess MTR Across the Spectrum of Care

- Lack valid metrics to predict readiness and return to duty following NMS injury
- Lack of validated early screening and detection solutions for NMS Injury
- Lack a clinician administered objective functional performance screen that can be used throughout the continuum of care



Active Investments MSKI Prevention



Military-Relevant Musculoskeletal Injury Screening & Prediction Tools

- Identify components of military training and operations contributing to increased risk for musculoskeletal injury.
- Identify biochemical, genetic, psychosocial and physiological mechanisms contributing to musculoskeletal injury.
- Develop occupation-specific screening tools for career Service members in physically demanding military occupations to identify those at-risk and mitigate impact on military readiness.

Musculoskeletal Injury/Re-injury Risk Mitigation Strategies

- Assess the impact of embedding providers with military units (physical therapists, athletic trainers, etc.) with military units on injury rates, healthcare utilization, and career progression.
- Identify/reduce barriers to self-reporting of musculoskeletal injury in order to promote early treatment, mitigation of re-injury risks, and improvement of military readiness.
- Develop targeted strategies and wellness programs to mitigate injury associated with Service members by modifying physiological and/or psychosocial activities.
- Develop knowledge (e.g., findings for policy makers) and materiel products that mitigate musculoskeletal injury risk and promote Service member readiness.



Active Investments NMS Rehabilitation



- Restoring Warfighters with Neuromusculoskeletal Injuries Research Award (RESTORE)
- Focus Areas
 - Solutions to accelerate recovery and restore Warfighter performance in training and operational environments
 - Objective support tools to enable providers to assess function and performance throughout treatment and predict long term outcomes
 - Solutions that accurately diagnose neuromusculoskeletal injuries in training and operational environments to optimize management and treatment decisions
 - Pain management strategies following acute and/or chronic neuromusculoskeletal injury that are fast-acting, long-lasting and free of adverse side-effects
 - Optimization of Warfighter performance following limb trauma or loss, for example:
 - Prosthetic and Orthotic Solutions
 - Intuitive Control and Sensation
 - Interface
 - Interoperability
 - Prescription and Training
 - Regenerative Rehabilitation Solutions
 - Peripheral Nerves
 - Skeletal Muscle
 - Bone



Questions/Concluding Comments



For further questions please contact:

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Active Investments NMS Rehabilitation (P&O)



SBIR Topics

- Automated Framework for the Design of Passive Prosthetic & Orthotic Interfaces
- Technology to Allow Warfighters with Musculoskeletal Injuries to Continue to Operate During Recovery
- Optimize Performance and Mitigate Falls in Warfighters with Lower Limb Trauma and/or Loss

Core Funded Projects (Broad Agency Announcement)

- Intuitive Control and Sensation
 - A Novel Approach to Upper-Extremity Amputation to Augment Volitional Motor Control and Restore Proprioception
 - An Osseo-Neural Transtibial Prosthesis with Efferent-Afferent Neural Control
- Metrics to Assess MTR
 - Orthopaedic Rehabilitation Training System (ORTos) for Improved Patient Compliance and Rehabilitation Monitoring in Lower Extremity Trauma
- Objective Standardized Metrics
 - Evaluating Mobility Interventions in the Real World

Congressional Special Interest Programs

Intuitive Control and Sensation

- A Novel Approach to Lower Extremity Residual Limb Revision to Augment Volitional Motor Control, Restore Proprioception, and Reverse Limb Atrophy
- The Functional Importance of Powered Wrist Flexion for Transradial Prosthetic Users
- Comparative Effectiveness of Upper Limb Prostheses and Component Effects
- Restoring Sensation with a Neural-Enabled Prosthetic Hand System for Daily Use: A Multisite Clinical Trial
- Evaluating the Impact of Prosthetic Device Features on the Experience of Prosthesis Use
- MTR Strategies
 - Ultrasound-Assisted Stabilization of Active Collagen for Enhanced Patellar Tendon Repair
 - REV-ERB Antagonists for Treatment of Muscle Injuries
- Interface
 - Comparative Effectiveness of Socket Casting Methods: Improving Form and Fit
 - A Pilot Clinical Trial to Assess the Effect of Transfemoral Socket Design on Hip Muscle Function
 - Do Adaptable Sockets Improve Military Performance?
- Metrics to Assess MTR
 - Clinical Assessment of Vertebral Bone Quality Using Direct Biomechanical and Textural Analysis via Digital Tomosynthesis
- Prescription Practices
 - Optimal Selection of Prosthetic Knee and Foot Combination for Improving Walking and Standing Performance in Transfemoral Prosthesis Users
- Objective Standardized Metrics
 - Direct Quantification of Balance Amongst Limited Community Ambulators Using Microprocessor Prosthetic Knees
- Understand Confounders
 - Single Nucleus Expression Profiling of Human Sciatic Nerve After Traumatic Amputation: Predicting Pain and Functional Outcomes