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A workshop, titled “Return to Duty (RTD) Toolkit Expert Panel Workshop,” was held at Fort Detrick, MD, on 16–17 February 2017. Sponsored by the U.S. Army Medical Research and Materiel Command’s (USAMRMC’s) Military Operational Medicine Research Program (MOMRP), the workshop objectives were: 1) to agree on operational tasks/assessments to be included in or excluded from the RTD Toolkit Manual, 2) to identify any additional tasks and clinical assessments for inclusion in the RTD Toolkit Manual, and 3) to agree on a method to categorize operational tasks/assessments in the toolkit. This report contains the workshop presentations, comment highlights, and an overall summary of the workshop outcomes.

15. SUBJECT TERMS
return-to-duty, fitness-for-duty, traumatic brain injury, neurosensory injury, rehabilitation

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Introduction

This report is a record of the proceedings of the third (and final) in a series of workshops, held on 16–17 February 2017, in which experts (clinicians, occupational and physical therapists, psychologists, and researchers) were assembled to provide guidance toward the goals of the U.S. Army Medical Research and Materiel Command’s (USAMRMC’s) Military Operational Medicine Research Program (MOMRP) Task Area P1, “Return-to-Duty Standards and Strategies After Neurosensory Injury.” Previous workshops were held in September 2012 and September 2015. (Estrada, Crowley, and Stokes, 2013, and Thornson et al., 2016, respectively)

This research task area is focused on injury effects on human neurosensory function, including those resulting from blast, blunt, and ballistic threats. The aim of Task Area P1 is to provide validated standards and strategies enabling accurate, safe, and rapid decisions regarding the return of Soldiers to military occupations after neurosensory injury. To this end, Task Area P1’s capstone effort is to publish a Toolkit (reference manual) of best practices and validated return-to-duty (RTD) assessments (batteries and discrete assessment tools) for far-forward and clinical use in determining readiness to return to duty following neurosensory injury. The primary objective of the toolkit is to provide clinicians and decision makers with resources to supplement those currently available. Specifically, these additional resources will provide information regarding military functional performance.

Workshop Objectives

The primary objectives of the workshop were: 1) to agree on operational tasks/assessments to be included in or excluded from the RTD Toolkit Manual, 2) to identify any additional tasks and clinical assessments for inclusion in the RTD Toolkit Manual, and 3) to agree on a method to categorize operational tasks/assessments in the toolkit.

In accordance with the workshop goals, the following were solicited from the experts:

a. agreement on operational tasks/assessments to be included in or excluded from the RTD Toolkit Manual;

b. identification and agreement of any additional tasks and clinical assessments for inclusion in the RTD Toolkit Manual;

c. agreement on categorization of operational tasks/assessments into domains;

d. agreement on level of detail in a Condensed (version) RTD Toolkit;

e. agreement on tasks/assessments to be included in a Pamphlet (version) RTD Toolkit;

f. agreement on level of detail in the Pamphlet (version) RTD Toolkit; and

g. a request for information on proposed additional tasks/assessments for inclusion in the RTD Toolkit Manual.
Workshop Sessions – Day 1, 16 February 2017

0900 – 0945 Welcome and Introductions – Maj Ed Edens (PhD), USAARL Aircrew Health and Performance Division Chief

Return-to-Duty Toolkit
Expert Panel Workshop

MAJ Ed Edens, Ph.D.
Art Estrada, Ph.D.
Amanda Kelley, Ph.D.

US Army Aeromedical Research Laboratory

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Comment highlights and discussion summary:

Maj Edens welcomed the attendees to the workshop. He thanked everyone for their attendance and continued support of the MOMRP Task Area addressing RTD following neurosensory injury.
Workshop Goals

- **Ultimate goal** of TA P1 is to produce a toolkit usable by clinicians and RTD decision makers for making fitness for military duty decisions
- Agreement on operational tasks/assessments to be included in or excluded from the RTD Toolkit Manual
- Identification and agreement of any additional tasks and clinical assessments for inclusion in the RTD Toolkit Manual
- Agreement on categorization of operational tasks/assessments into domains
- Agreement on level of detail in the Condensed RTD Toolkit
- Agreement on tasks/assessments to be included in a RTD Toolkit Pamphlet
- Agreement on level of detail in the RTD Toolkit Pamphlet
- Distribution of packets for information on proposed additional tasks/assessments for inclusion in the RTD Toolkit Manual

Workshop Purpose and Objectives

- **How to accomplish**
  - Review all eligible Toolkit tasks
    - Discuss scientific evidence supporting each task
    - Present any updated results since last workshop
  - Present clinical assessments currently in use
    - Discuss any that should be included or excluded
    - Discuss any additional assessments for inclusion
    - Discuss current practices
  - Discuss the three Toolkit products

Comment highlights and discussion summary:

Dr Kelley presented to the group an overview of the goals for the workshop focusing on the main objectives as well as discussing goals for follow-up materials with the group. During discussion, it was clarified that the goal of the toolkit is to provide supplementary tasks for
medical providers to use at their discretion.

1000 – 1040 Task Area Overview – Dr. Arthur Estrada, USAARL Science Program Administrator

MOMRP Task Area P1
Return-to-Duty Standards and Strategies After Neurosensory Injury

Task Area Overview
Arthur Estrada, Ph.D.
Task Area Manager

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TA P1 Description

Task Area P1 develops validated standards and strategies enabling accurate, safe, and rapid decisions regarding the return of Soldiers to military occupations after neurosensory injury.

It addresses the need for research aimed at providing evidence-based criteria for standards to determine the level of operational competence and performance of a Warfighter after injury. The need for RTD assessment criteria includes the spectrum of injury and disease experienced by U.S. Soldiers, Airmen, Sailors, and Marines. This research task area is focused on injury effects on human neurosensory function, including those resulting from blast, blunt, and ballistic threats.

TA P1 Research Gaps

<table>
<thead>
<tr>
<th>REQUIREMENT (Proponent)</th>
<th>Objectives and Products (Material or Knowledge)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Near-Term (FY17-19)</td>
</tr>
<tr>
<td>Force Health Search (FHIS) – MOM</td>
<td>P1: Publish and distribute RTD Toolkit to TTA partners and other stakeholders for use and reference by clinicians and RTD decision makers.</td>
</tr>
<tr>
<td>ICD for Human Dimension</td>
<td>P1: Publish and distribute RTD Toolkit to TTA partners and other stakeholders for use and reference by clinicians and RTD decision makers.</td>
</tr>
<tr>
<td>Associated Gap #29: Insufficient ability to develop, validate, and implement measures to assess/evaluate a Soldier's cognitive, physical, and social readiness for normal based on such factors as MOS, location in Army (active, deployment, contain), and health status permanent profile.</td>
<td>P1: Publish and distribute RTD Toolkit to TTA partners and other stakeholders for use and reference by clinicians and RTD decision makers.</td>
</tr>
</tbody>
</table>
TA P(1) Funding History

<table>
<thead>
<tr>
<th>FY</th>
<th>$K</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2251</td>
</tr>
<tr>
<td>2011</td>
<td>2455</td>
</tr>
<tr>
<td>2012</td>
<td>1644</td>
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<td>2013</td>
<td>2013</td>
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<td>2014</td>
<td>1134</td>
</tr>
<tr>
<td>2015</td>
<td>1134</td>
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<tr>
<td>2016</td>
<td>235</td>
</tr>
<tr>
<td>2017</td>
<td>229</td>
</tr>
<tr>
<td>2018</td>
<td>234</td>
</tr>
<tr>
<td>2019</td>
<td>TA Ends</td>
</tr>
</tbody>
</table>
Task Area P1

16 February 2017
UNCLASSIFIED
TA P1 Highlighted Deliverables and Transitions

<table>
<thead>
<tr>
<th>Capability Transferring</th>
<th>Knowledge or Material Product (if any)</th>
<th>Transitions To</th>
<th>Agreement (TIA/CTN, etc.) Completed</th>
<th>Transition Target Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publish a toolkit (reference document) of best practices and validated RTD assessments (batteries and discrete assessment tools) for far-forward and clinical use in determining fitness for duty following neurosensory injury</td>
<td>K</td>
<td>1. Defense and Veterans Brain Injury Center (DVBI), 2. Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE)</td>
<td>1. TIA – Yes, 2. TTA – Yes</td>
<td>FY17</td>
</tr>
<tr>
<td>Publish feedback report following the collection and analysis of feedback and validation data from Toolkit users.</td>
<td>K</td>
<td>1. Defense and Veterans Brain Injury Center (DVBI), 2. Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE)</td>
<td>1. TIA – Yes, 2. TTA – Yes</td>
<td>FY18</td>
</tr>
</tbody>
</table>

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TA P1 FY18 Project

Task Area Title: Return-to-Duty Standards and Strategies After Neuromuscular Injury

<table>
<thead>
<tr>
<th>Proposal Title (Number)</th>
<th>Rank</th>
<th>PI</th>
<th>Lab</th>
<th>Milestone</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determinants of successful return-to-duty and reintegration: A toolkit for assessment (15000)</td>
<td>1</td>
<td>Dr. Amanda Kelley</td>
<td>USAARL</td>
<td>1. After 6 months, data collection and analysis for the RTD Toolkit validation will be complete and the research team will re-deploy the revised RTD Toolkit to end-users with implemented improvements. 2. Publish toolkit, present findings, and meet obligations of TTA.</td>
<td>$234K (6.3)</td>
</tr>
</tbody>
</table>

Funding: 6.3 Total = $234K

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Recent Project (19300) Accomplishments

Part 1: Military Functional Assessment Program (MFAP) Longitudinal Study
- Closed study enrollment in May 2016 with 51 participants
- Completed 6-month follow-up data collection in November 2016 with 20 participants (31 lost to attrition or non-response to follow-up attempts)
- Analyzed 6-month follow-up data which show that performance ratings on four of the MFAP tasks are predictive of overall self-reported performance levels and self-satisfaction. The relationship is positive such that higher MFAP performance ratings correspond to higher levels of performance and self-satisfaction.
- Analyzed baseline data which shows that six MFAP tasks correlate highly to performance requiring judgment and decision making, as well as the ability to work under stress. The findings support prior research on the construct validity of the nine MFAP tasks.

Part 2: Deliver RTD Toolkit
- Maintained TTA’s with Defense and Veterans Brain Injury Center (DVIBIC) and Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE)
- Holding 3rd (Final) RTD Expert Panel Workshop on 18-17 February 2017

TA P1 Recent Accomplishments

- Peer Reviewed Publications
- Presentations
- Knowledge Products – Recommendations delivered to USAAMR:
Full List of TA P1 Publications/Presentations From October 2010 to September 2016


16 February 2017

Full List of TA P1 Publications/Presentations From October 2010 to September 2016 (cont.)

Full List of TA P1 Publications/Presentations From October 2010 to September 2016 (cont.)


16 February 2017

UNCLASSIFIED
List of AMMP Grant Publications


16 February 2017 UNCLASSIFIED
TA P1 Final Objective:

Produce a Toolkit
Comment highlights and discussion summary:

Dr. Estrada provided an overview of the history of the task area and projects funded under this task area. He also reviewed the outcomes of the prior workshops. The project described on slide 13 was discussed further with respect to available data validating the device in an RTD setting. Dr Estrada clarified that validation data has not yet been established and that the device outcome is subjective in the sense that it is influenced by the patient’s level of motivation to complete the task. LTC Kristy Casto stated that the device had shown sensitivity to balance dysfunction and Traumatic Brain Injury (TBI). However, the link between performance on the visual-vertical test, as well as other relevant tests including audiograms, and functional impairment has not yet been shown.
1130 – 1200  Discussion of the Normal Trajectory for those with Persistent Post Concussive Symptoms Vice Acute Concussion – Ms. Katherine Helmick (RN), Deputy Director of DVBIC
U.S. DoD Worldwide Numbers for TBI

DoD Numbers for Traumatic Brain Injury Worldwide — Totals

2000-2016 (Q1-Q3)

- Penetrating: 5,045
- Severe: 3,733
- Moderate: 32,434
- Mild: 294,010
- Not Classifiable: 21,826

Total: 357,048

Source: Defense Health Agency
Prepared by the Defense and Veterans Brain Injury Center (DVBI)

All DoD TBI Incidence

Over 80% of all TBIs are diagnosed in the Non-deployed setting
82.5% of all TBIs are mild / concussion

Source: Defense and Veterans Brain Injury Center (DVBI)
Top 10 MTF’s : TBI Care
Q3 CY 16 Snapshot

Military Treatment Facilities — Top 10 MTFs for Direct Care Medical Encounters by Service

Traumatic Brain Injury (TBI)
(Memorandum: TBI Updated Definition and Reporting, April 6, 2015)

DoD Definition:
A traumatically induced structural injury or physiological disruption of brain function as a result of an external force, that is indicated by new onset or worsening of at least one of the following clinical signs, immediately following the event:

- Any period of loss of or decrease of consciousness, observed or self-reported (LOC)
- Any loss of memory for events immediately before or after the injury (PTA)
- Any alteration in mental status (confusion, slowed thinking, disorientation) (AOC)

DoD definition parallels standard medical definition of Centers for Disease Control, World Health Organization, American Academy of Neurology, and American Congress of Rehabilitation Medicine
Neuroimaging following Mild Traumatic Brain Injury in the Non-Deployed Setting: Acute, Sub-Acute and Chronic

Table 4.2
Neuroimaging Recommendations following TBI

<table>
<thead>
<tr>
<th>Modality</th>
<th>Acute (1-7 days post injury)</th>
<th>Sub-Acute (3-65 Days post injury)</th>
<th>Chronic (6 Months or greater post injury)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>Usually Recommended</td>
<td>Usually Recommended</td>
<td>Usually Recommended</td>
</tr>
<tr>
<td>MRI</td>
<td>Usually Recommended</td>
<td>Usually Recommended</td>
<td>Usually Recommended</td>
</tr>
<tr>
<td>PET</td>
<td>Usually not recommended</td>
<td>Usually not recommended</td>
<td>Usually not recommended</td>
</tr>
<tr>
<td>SPECT</td>
<td>Usually not recommended</td>
<td>Usually not recommended</td>
<td>Usually not recommended</td>
</tr>
</tbody>
</table>


“Medically Ready Force...Ready Medical Force”

Mandatory Event Screening & Reporting

- Any service member in a vehicle associated with a blast event, collision, or rollover
- Presence within 50 meters of a blast (inside or outside)
- A direct blow to the head or witnessed loss of consciousness
- Exposure to more than one blast event (the service member’s commander shall direct a medical evaluation)

Mandatory 24-hour downtime* & medical evaluation

* Commanders may delay or postpone 24-hour downtime based on mission requirements

*Reference: Department of Defense Instructions (DoD) 6490.11
Concussion / mTBI Screening and Assessment

Military Acute Concussion Evaluation (MACE)

Concussion Management Algorithms

Impact of mild TBI on Warfighter

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Manifestation</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Failure to sleep at night</td>
<td>Poor marksmanship</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td>Decreased energy</td>
<td>Decreased situational awareness</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Slower reaction time</td>
<td>Difficulty performing quickly under time pressures</td>
</tr>
<tr>
<td>Dizziness / balance</td>
<td>Difficulty negotiating uneven terrain</td>
<td>Difficulty multi-tasking such as driving a vehicle</td>
</tr>
<tr>
<td>problems</td>
<td>Easily distracted</td>
<td>while listening to instructions via radio</td>
</tr>
<tr>
<td>Visual disturbance and</td>
<td>Difficulty processing multiple sources of</td>
<td>Performance difficulties can affect self-esteem and</td>
</tr>
<tr>
<td>light sensitivity</td>
<td>information</td>
<td>confidence</td>
</tr>
<tr>
<td>Ringing in ears</td>
<td>Interpersonal problems</td>
<td>Fear of performing in certain operational environments</td>
</tr>
<tr>
<td>Slowed thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty finding words</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety / depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irritability / mood swings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DHA
DoD RTD Standards: Acute and Chronic

The Progressive Return to Activity clinical recommendations provide primary care managers and rehabilitation providers with guidance regarding how service members can incrementally return to pre-injury activity following an acute concussion. The two detail:

- Education interventions after diagnosis
- The parameters for physical and cognitive rest
- A standardized, staged approach for increasing physical and cognitive activities to optimize recovery
- Recommendations for progression, regression and referral

To download or order hard copies, visit drieb.doe.mil/resources/progressivereturn-to-activity

**PRIMARY CARE MANAGER SUITE**

This suite of tools provides an initial framework for gradually increasing service member activity after concussion.

Each suite includes:
- Clinical guidance
- Clinical support tool
- Provider educational slide deck
- Patient education products

**REHABILITATION PROVIDER SUITE**

This suite of tools is for more symptomatic service members referred by primary care managers to rehabilitation providers.

---

**General Principles**

- Six stages of progression from Stage 1: Rest to Stage 6: Return to pre-injury activity

- After an education intervention for all patients, those with few and mild symptoms are managed by a Primary Care Manager and follow a self-guided staged recovery

- Utilize the Neurobehavioral Symptom Inventory (NSI) for tracking symptoms

- List key activities for participation and activities to avoid at each stage

- Patients who are more symptomatic or who fail to progress are referred to rehabilitation providers for a more intensive, clinician-directed, daily-monitored recovery
Stages of Progressive Activity

<table>
<thead>
<tr>
<th>Rehabilitation Stages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Rest (minimum 24 hours)</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Light Routine Activity</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Light Occupation-oriented Activity</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Moderate Activity</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Intensive Activity</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Unrestricted Activity</td>
</tr>
</tbody>
</table>

Return to Activity Educational Brochure

What is a Concussion?
A concussion is a head injury from a blow or jolt to the head that:
- Briefly knocks you out (loss of consciousness), or
- May affect your ability to remember information before, during or after the event (post traumatic amnesia), or
- Makes you confused, slows you down, or
- Makes you act like you are drunk.

A concussion is also known as mild traumatic brain injury (mTBI).

This brochure will help you to recover as quickly and safely as possible. Each stage is designed to help you gradually return to your normal routine. While you're transitioning, you may have to stay in one stage longer than another if your symptoms do not go away. Do not rush your progress.

DHA is the operational component of the Defense Health Agency for Psychological Health and Traumatic Brain Injury.
Persistent Post Concussion Symptoms

<table>
<thead>
<tr>
<th>Physical</th>
<th>Cognitive</th>
<th>Behavioral/Emotional</th>
<th>Vestibular/Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Attention</td>
<td>Feeling</td>
<td>Dizziness</td>
</tr>
<tr>
<td>Nausea</td>
<td>Memory Problems</td>
<td>Anxious</td>
<td>Difficulty with Balance</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Poor Concentration</td>
<td>Depressed</td>
<td>Hearing Disorders</td>
</tr>
<tr>
<td>Sleep Disturbance</td>
<td>Delayed Processing Speed</td>
<td>Agitated</td>
<td>Difficulties</td>
</tr>
<tr>
<td>Visual Disturbance</td>
<td>Impaired Judgment</td>
<td>Irritable</td>
<td>Tinnitus</td>
</tr>
<tr>
<td>Neuroendocrine Disorders</td>
<td>Decreased Executive Functioning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Symptoms in red are the most common after concussion*
Rehabilitation Provider

Daily monitored approach
For individuals who are not progressing as expected
No progress in 7 days
Per Primary Care Manager judgment

Rehabilitation Provider Clinical Support Tool

Neurobehavioral Symptom Inventory (NSI) completed at onset of Stage 1.
Note any symptoms rated above 1 (mild).
Comment highlights and discussion summary:

Ms. Helmick’s presentation generated discussion with respect to the course of care patients’ engage in currently and how this effort mirrors the progressive return to activity approach. Discussion included identification of the challenges associated with self-reported symptoms and attempts to incorporate more objective measures (e.g., Automated Neuropsychological Assessment Metrics). Unfortunately, these objective measures are not being
used as widespread as originally intended. This discussion highlighted the particular gaps in the current approach and where this effort, in part, can address these including an enhanced level of objectivity and a “cookbook” approach that is easy to use for low-experienced medical providers.

1100 – 1130 Pathways to Disseminate Best Practices in DoD – Ms. Katherine Helmick (RN), DVBIC Deputy Director
Distribution of Veteran Population
(09/2015 US Census, projected)

DVBIC Sites Strategically Located to Engage Providers and Patients (FY 15)
How Does DVBIC Operate?  
People. Contracts. Locations.

HQ Staff
- TBI Center of Excellence
- Government - 9 GS, 2 MIL, 1 PHS onboard
- CTR - approximately 70

DVBIC HQ
- Clinical Affairs
- Education
- Research
- Chief of Staff

Director
- Senior Medical Advisor

DVBIC Network Sites
- Military / DoD
  - Camp Pendleton
  - Camp Lejeune
  - Fort Belvoir
  - Fort Bliss
  - Fort Bragg
  - Fort Carson
  - Fort Drum
  - Fort Gordon

- Medical Affairs
  - Joint Base Ft. Leonard-Wood
  - Landstuhl Regional Medical Center
  - Naval Medical Center San Diego
  - San Antonio Military Medical Center
  - Walter Reed National Military Medical Center

- Veterans Affairs
  - Minneapolis VA
  - Palo Alto VA
  - Richmond VA
  - San Antonio VA
  - Tampa VA

“Medically Ready Force...Ready Medical Force”

DVBIC Pillars of Effort

Centers of Excellence
- Clinical
- Service Members
- Veterans
- Families

U.S. Army
- A Global Force for Good

U.S. Navy

U.S. Air Force

USMC

“Medically Ready Force...Ready Medical Force”
TBI Pathway of Care

“Medically Ready Force...Ready Medical Force”

DVBIC Strategic Initiatives

Further advance the level of care across the enterprise
- Knowledge translation for research findings
- Educate and train to accepted standards

Standardize care delivery
- Reduce geographic and service variations in care

Obtain standardized health outcomes data from across the MHS
- Allows for inter-site comparison to identify outliers in efficacy and identification and dissemination of best practices

“Medically Ready Force...Ready Medical Force”
Clinical Affairs Division

- Develop Clinical Recommendations State of the Science; Knowledge translation
- Perform TBI surveillance and health outcomes
  - Quarterly Reports to DoD
- Care coordination through Recovery Support Program

<table>
<thead>
<tr>
<th>DVIRC is leading collaborations to advance evidence-based care</th>
<th>Date</th>
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<tr>
<td>Headache Symptom Management</td>
<td>Feb 2016</td>
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<tr>
<td>Management of Sleep Disturbances Following Concussion/Wild TBI</td>
<td>Jun 2014</td>
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<td>Progressive Return to Activity Following Acute Concussion/Wild TBI: Guidance for the Primary Care Manager in Deployed and Non-deployed Settings</td>
<td>Jan 2014</td>
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<tr>
<td>Progressive Return to Activity Following Acute Concussion/Wild TBI: Guidance for the Rehabilitation Provider in Deployed and Non-deployed Settings</td>
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<td>Neuroimaging Following Mild TBI in the Non-Deployed Setting</td>
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<td>Assessment and Management of Visual Dysfunction Associated with Mild TBI (in collaboration with the Vision Center of Excellence)</td>
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<td>Assessment and Management of Dizziness Associated with Mild TBI</td>
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<td>Indications &amp; Conditions for Neuroendocrine Dysfunction Associated with Mild TBI</td>
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<td>Military Acute Concussion Evaluation (MACE) and Clinical Management Algorithms</td>
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<td>Dec 2009</td>
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<td>Sep 2012</td>
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“Medically Ready Force... Ready Medical Force”

Education and Training

Provides evidence-based knowledge about TBI through educational programs, activities and resources

- Producing state-of-the-science joint education and training resources that contribute to the standard of care
- Educating and training clinical providers with end state of changing provider behavior

Regional Education Coordinators (RECs) network provide TBI outreach and training

- Increases awareness of TBI across the care continuum to maximize access to care
  - Reached an estimated 283,221 service members in FY 2015
  - Fulfills service mandatory training requirements at some DVIRC sites

“Medically Ready Force... Ready Medical Force”
Dissemination and Outreach

• The aims of this phase are to increase stakeholder awareness of newly developed products through training, education, and outreach; scientific communication; and press.

• Communication channels identified during products development are leveraged to follow promotion and distribution plans for broad dissemination.
Comment highlights and discussion summary:

Discussion included suggestion of creating a common website where the tools can be available. While effectively using technology is a platform for some, others, particularly those outside of the country, may not have access to the necessary bandwidth. Therefore, mechanisms for dissemination need to include web-accessible platforms as well as formats that are appropriate in the combat environment. Another discussion point included the ability to use these tools in multiple locations (considering resources and availability) so as to minimize the possibility of the Soldier being removed from family and their unit, which impacts recovery.
Overall Purpose of Toolkit

- Existing reference documents (e.g., OTSG mTBI Toolkit) for use by clinicians in RTD decision-making include:
  - Screening tools for detection of mTBI symptoms
  - Patient-oriented outcome instruments to qualify functional abilities
- Lack of assessment of military-specific functional performance
- This toolkit product will serve as a companion and supplement to existing reference documents by providing military-specific tasks and dual-task conditions

RTD Toolkit Products

- Three products that will vary in the level of detail
  - RTD Toolkit Manual
    - Includes "annotated bibliography" style description of assessments/tools
    - Audience: Researchers and Clinicians
  - Condensed RTD Toolkit Manual
    - Includes one or two bullet points on assessments/tools
    - Audience: Clinicians, more in-depth perhaps for unique cases
  - RTD Toolkit Pamphlet for clinicians/providers
    - Includes "best" assessments organized by purpose and domain
      » Clinical assessment tools
      » Military-specific tasks
- All products will include "5-star rating system" based on scientific evidence and SME opinion on utility
Purpose of Products

- Purpose of the Toolkit is to aid RTD decisions
  - Purpose is NOT diagnosis of concussion
  - Purpose is NOT treatment following concussion
- All products will have brief intro describing:
  - Purpose of each version
  - Methods used to determine assessments included
    - Note that the complete manual will include a detailed section on how military-specific tasks were developed and evaluated

RTD Toolkit Products

- Organized by domain:
  - Vestibular
  - Neurocognitive
  - Mental Health
  - Vision/Oculomotor
  - Auditory
  - Military-specific
- Definitions of each domain and functional constructs will be included
RTD Toolkit Products

- Following slides are examples of format, content, and level of detail for each toolkit product
  - Requesting feedback on format
    - User-friendly?
    - Easy to understand?
  - Requesting feedback on content
    - What info would you want if you picked up this product?
  - Requesting feedback on level of detail/content provided for each product
    - How much detail to provide in each product?

- Example task is for reference only

RTD Toolkit Product #1: Complete Manual

Task: Virtual Convoy Operations Trainer (VCOT)
Description: In this task, a Soldier completes three exercises in a virtual reality simulation convoy trainer. The exercises include serving as a 50cal gunner and communicating a SALUTE report, serving as a driver, including identification of RPGs and IEDs, and serving as vehicle command (VC) communicating with squad and radio communication to Tactical Operations Center (TOC).
Source: Military Functional Assessment Program (MFAP)
Equipment needed:
Access to Virtual Convoy Operations Trainer
Time to administer: 60-90 minutes per group of 3 participants
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring/interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

Vestibular demands identified: Virtual reality goggles utilized for the task can create dizziness both from vestibular response but also secondary response to anxiety from realism.

Summary of Experimental Results:

Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
Construct validity evidence: Correlated with dizziness handicap inventory and dynamic visual acuity
Predictive validity evidence: Correlated with subjective perceived satisfaction and performance levels 6-months post-MFAP
Experimental evidence with military population: Yes

SME ratings:
- Usability/ease of administration – ★★★★★
- Results valid for RTD determination – ★★★★★

Reference citations:

RTD Toolkit Product #2: Condensed Manual

Task: Virtual Convoy Operations Trainer (VCOT)
Description: In this task, a Soldier completes three exercises in a virtual reality simulation convoy trailer. The exercises include serving as a 50cal gunner and communicating a SALUTE report, serving as a driver including identification of RPGs and IEDs, and serving as vehicle command (VC) communicating with squad and radio communication to Tactical Operations Center (TOC).
Source: Military Functional Assessment Program (MFAP)
Equipment needed: Access to Virtual Convoy Operations Trainer
Time to administer: 60-90 minutes per group of 3 participants
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring/interpretation: Scored on scale of 1 (Independent) to 5 (Dependent) [Appendix A]
Vestibular demands identified: Virtual reality goggles utilized for the task can create dizziness, both from vestibular response but also secondary response to anxiety from realism.
SME ratings:
- Usability/ease of administration – ★★★★★
- Results valid for RTD determination – ★★★★★

Reference citations:
Comment highlights and discussion summary:

In response to Dr. Estrada’s presentation of the proposed format and content of toolkit products, discussion of the instruction for how a clinician should use this information for a complex patient occurred. Ideally, a mathematical algorithm weighting and combining outcomes on these measures would yield a binary yes/no with respect to RTD. However, the data to support such an effort does not currently exist. The discussion focused on the goal of providing the RTD decision maker with as much information as possible regarding whether it is reasonable to expect the patient to perform to standard. Future research isolating the predictive relationship between a simulated environment and a real-world environment as well military occupational specialty (MOS) specificity for the toolkit tasks were suggested.
Military Functional Assessment Program

- 10 military-relevant tasks are performed by Soldiers following head injury rehabilitation for ratings.
- Four professionals rate task performance according to standards within their fields of specialization
  - Non-commissioned officer (NCO) rates military performance standards
  - Occupational therapist (OT) rates global function
  - Physical therapist (PT) rates physical strength, agility, and balance
  - Mental health counselor (MH) rates anxiety level and psychological level of independence
- All raters collaborate on a single overall level of independence score.
MFAP Tasks

Task: Warrior task battle drill
Description: This task is a collection of individual and independent subtasks including physical tasks, and Drill & Ceremony (D & C) procedures (e.g., donning gas mask within Army standard of 9 seconds, Mission-Oriented Protective Posture suit, casualty evacuation, leading following commands).
Source: Military Functional Assessment Program (MFAP)

Equipment needed:
- Clipboards
- Mission-Oriented Protective Posture suit
- Gas mask

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

Summary of Experimental Results:
- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with dizziness handicap inventory
- Predictive validity evidence: Correlated with subjective perceived performance level at 6 months post-MFAP completion
- Experimental evidence with military population: Yes

MFAP Tasks

Task: HMMWV Egress Assistance Trainer
Description: This task includes a 30-minute class preparation on rollover crashes and procedures followed by three egress exercises from a simulated HMMWV (high mobility multipurpose wheeled vehicle) rollover while wearing kit (Body armor and helmet). The SOLDIER serves a different role in each exercise (e.g., Vehicle Command (VC), driver, medic).
Source: Military Functional Assessment Program (MFAP)

Equipment needed:
- Access to HMMWV Egress Assistance Trainer

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

Summary of Experimental Results:
- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with dizziness handicap inventory
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes
MFAP Tasks

Task: Land Navigation Prep
Description: This task is composed of classroom instruction using PowerPoint slides and hands-on application (e.g., plotting points on map).
Source: Military Functional Assessment Program (MFAP)

Equipment needed:
- PowerPoint class on land navigation to include familiarization with terrain features, legend, scale, how to plot a point, measure the distance between two points, shoot an azimuth using map and protractor, shoot a back azimuth, measure distance on a road, and identify key landmarks on a map using pre-plotted points listed within the PowerPoint presentation through hands-on practical exercises

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]
Summary of Experimental Results:
- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with sensory organization test
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

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MFAP Tasks

Task: Land Navigation
Description: In this task, Soldier must execute a land navigation task including three points.
Source: Military Functional Assessment Program (MFAP)

Equipment needed:
- Map
- Compass
- Protractor
- 3x5 notecard
- non-permanent marker

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]
Summary of Experimental Results:
- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with sensory organization test ($r(33) = -0.39, p = 0.024$)
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes
MFAP Tasks

**Task:** Virtual Convoy Operations Trainer (VCOT)
**Description:** In this task, a Soldier completes three exercises in a virtual reality simulation convoy trainer. The exercises include serving as a 50cal gunner and communicating a SALUTE report, serving as a driver, including identification of RPGs and IEDs, and serving as vehicle command (VC) communicating with squad and radio communication to Tactical Operations Center (TOC).
**Source:** Military Functional Assessment Program (MFAP)

**Equipment needed:**
- Access to Virtual Convoy Operations Trainer

**Time to administer:**
**Administration instructions:** See SOP [Appendix E]
**Scoring instructions:** Scoring based on performance with respect to leading and following drills

**Scoring Interpretation:** Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

**Summary of Experimental Results:**
- **Reliability evidence:** MFAP overall absolute average agreement ICC = 0.82
- **Construct validity evidence:** Correlated with dizziness handicap inventory and dynamic visual acuity
- **Predictive validity evidence:** Correlated with subjective perceived satisfaction and performance levels 6-months post-MFAP
- **Experimental evidence with military population:** Yes

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MFAP Tasks

**Task:** Engagement Skills Trainer 2000 – Weapons Qualification
**Description:** In this task, service member must zero weapon on the EST 2000 and complete 40-shot qualification task

**Source:** Military Functional Assessment Program (MFAP)

**Equipment needed:**
- Access to Engagement Skills Trainer 2000

**Time to administer:**
**Administration instructions:** See SOP [Appendix B]
**Scoring based on performance with respect to leading and following drills

**Scoring Interpretation:** Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

**Summary of Experimental Results:**
- **Reliability evidence:** MFAP overall absolute average agreement ICC = 0.82
- **Construct validity evidence:** Correlated with dizziness handicap inventory, dynamic visual acuity, and sensory
- **Predictive validity evidence:** NA
- **Experimental evidence with military population:** Yes

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MFAP Tasks

Task: Engagement Skills Trainer 2000 — Shoot/No-Shoot Scenarios
Description: In this task, service member completes a set of collective, interactive videotaped scenarios with the marksmanship trainer that place Soldier in lifelike shooting scenarios requiring on-the-spot judgment.
Source: Military Functional Assessment Program (MFAP)
Equipment needed:
- Access to Engagement Skills Trainer 2000

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]
Summary of Experimental Results:

- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with dizziness handicap inventory
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

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MFAP Tasks

Task: Medical Simulation Training Center — Mass Casualty Scenario
Description: This task is composed of three phases, each increasing in environmental stress (Crawl-Walk-Run). This real-time simulation task is completed individually in a medical training environment where service member must treat life-like mannequins. These mannequins cannot move on their own in the first phase. In the second and third phases, the mannequins are powered electronically to perform ‘life-like’ movement.
Source: Military Functional Assessment Program (MFAP)
Equipment needed:

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]
Summary of Experimental Results:

- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with dizziness handicap inventory and sensory organization test
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

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MFAP Tasks

Task: Medical Simulation Training Center – Tactical Mission Scenario
Description: This task is a group activity where the squad completes a real-time simulation
under field conditions involving ambush with paintballs (squad is capable of returning fire
with paintball rounds). The squad must move casualties out of combat IED lanes to a safe location
and address injuries.
Source: Military Functional Assessment Program (MFAP)
Equipment needed:
- paintball guns
- paintballs
- safety glasses (for remains providers too)
- aid bags
- IED simulator
- 50 cal simulator
- OFFOR

Time to administer:
Administration instructions: See SOP [Appendix B]
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

Summary of Experimental Results:
- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with dexamethasone inventory, dynamic visual acuity, and sensory organization test
- Predictive validity evidence: Correlated with subjective perceived satisfaction and
  performance level 6-months post-MFAP
- Experimental evidence with military population: Yes

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MFAP Tasks

Task: Tactical Combat Casualty Care
Description: This task consists of classroom instruction on basic life support primarily using
PowerPoint slides and a quiz post-activity.
Source: Military Functional Assessment Program (MFAP)
Equipment needed:

Time to administer:
Administration instructions:
Scoring instructions: Scoring based on performance with respect to leading and following drills
Scoring interpretation: Scored on scale of 1 (independent) to 5 (dependent) [Appendix A]

Summary of Experimental Results:
- Reliability evidence: MFAP overall absolute average agreement ICC = 0.82
- Construct validity evidence: Correlated with scores on the Repeatable Battery for
  Neuropsychological Assessment
- Predictive validity evidence: Correlated with subjective perceived satisfaction level 6-
  months post-MFAP
- Experimental evidence with military population: Yes

16 February 2017
MFAP Longitudinal Study

- Completed enrollment and 6-month follow-up data collection
- 12-month follow-up data collection will be complete in May 2017
  - Small number of respondents, data analysis will be descriptive only
- Limitations
  - Attrition rate was very high
  - Did not receive operational performance data in follow-ups despite strong efforts

MFAP Longitudinal Study

- Correlational analyses with clinical assessments and MFAP data support previous findings regarding construct validity
- Significant correlations between self-report performance level at 6 months and...
  - Performance on tactical combat casualty care task
- Significant correlations between self-report satisfaction level at 6 months and...
  - Performance on land navigation
  - Weapons qualification
  - Tactical mission scenario performance (real-time simulation under field conditions involving ambush, paintball, treatment of a casualty)
Comment highlights and discussion summary:

Mark Showers described the Military Functional Assessment Program (MFAP) tasks as well as walked through the experience of the patient. Discussion included the need to examine clinical assessments used following concussion when specific symptoms have emerged. Ms. Helmick pointed out that headache and sleep are additional symptoms that need to be addressed in the toolkit products. At present, the tasks cover multiple domains but not necessarily reflect headache or sleep function. None of the tasks have been designed for that purpose. Dr. Estrada pointed out that the toolkit products are not designed to replace the RTD decision maker or medical provider but rather to provide additional information with respect to function and performance.
Assessment of Military Multitask Performance (AAMP)

- Battery of functional dual-tasks and multitasks that simulate the neurosensorimotor, cognitive, and exertional demands of Soldiers
- Development followed military stakeholder inquiry, expert consultation, lit review
- Inter-rater reliability, convergent/discriminant validity, and known-groups validity examined
- Refined task battery to five best tasks

AAMP Tasks

Task: Charge of Quarter Duty
Description: Soldier is challenged to develop and execute a work plan for completing an array of interleaving tasks (supply inventory, PVC foot stool assembly, providing information to superiors, prospective memory tasks) associated with his/her hypothetical assignment to Charge of Quarters Duty.
Source: Assessment of Military Multitasking Performance (AAMP)
Equipment needed:
- Blue painter's tape
- Tape measure
- Clipboard
- Administration manual and scoresheet
- Stopwatch
- Pencils
Time to administer: Approximately 30 minutes
Administration instructions: See Administration manual
Scoring/interpretation: Scored on scale of 0 (does not do task) to 2 (100% accurate)
Summary of Experimental Results:
- Reliability evidence: ICCs range from 0.88–0.99
- Construct validity evidence: Correlated with Tower of Hanoi (planning), Neuropsychological Assessment Battery attention module, Comprehensive Trail Making Test (executive function)
- Predictive validity evidence: N/A
- Experimental evidence with military population: Yes
AAMP Tasks

Task: Run-Roll-Aim
Description: The SM completes a high level mobility task with multiple maneuvers while carrying a simulated weapon. Manuevers are used by a computer concepr with a hand-held remote controlled side advance. The task requires a rapid start, avoiding a "trip wire" obstacle, performing a 3-5 second rush, combat rolling, searching for visual targets through simulated weapon scope, rapid lateral dodging and lunar guidance.

Source: Assessment of Military Multiskilling Performance (AAMP)

Equipment needed:
1. Stepstool
2. Clipboard and Score sheet
3. Simulated weapon
4. Scope designed for birdie's view mounting on weapon
5. Adjustable headprends and waistband to mount infrared sensors (strapped onto each)
6. Normal internal sensors and wireless access point for data collection with computer lap top.
7. Power point presentation of targets and cues
8. Remote to advance Powerpoint visual cues targets during task
9. 3'x10' floor mat for landing zone after 3-5 second rush, visual scanning components, and combat rolls (mat should be secured as necessary to the floor so that it doesn't move)-ready
10. 3'x12' cones to set up "trip wire" obstacle (obstacle created by test card stretched between the two cones)
11. Taped strips down middle of floor mat to indicate landing zone after 3-5 second rush and taped X on right and left (1/4 feet from either side of the center) to mark approximate end point for combat rolls

Time to administer: Approximately 15 minutes

Administration instructions: See Administration manual

Scoring instructions: See Administration manual

Scoring Interpretation: Errors accuracy, number of cues required, time to complete

Summary of Experimental Results:

- Reliability evidence: ICCs range from 0.87 – 0.99, Test errors ICC = 0.64
- Construct validity evidence: Correlated with Neuropsychological Assessment Battery attention module and Comprehensive Trail Making Test
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

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AAMP Tasks

Task: Illinois Agility Test - packing list
Description: The Illinois Agility Test requires running distances of 300' with rapid direction changes and navigation of obstacles in a serpentine pattern during the middle part of the obstacle course. A memory task is also completed. Then both the agility task and the memory task are performed at the same time. Accuracy of memory recall and time to complete the agility task are measured in single and dual-task conditions.

Equipment needed:
- Colored masking tape to mark start and end points of agility course
- Clipboard and Score sheet
- Stepstool
- 6 cones
- Adjustable headbands and waistband
- NexGen internal sensors and wireless data collection per and laptop

Time to administer: Approximately 12 minutes

Administration instructions: See administration manual

Scoring instructions: See administration manual

Scoring interpretation: Words Recalled Correctly, Word Errors, Agility Test Time, Agility Course Errors

Summary of Experimental Results:

- Reliability evidence: ICCs range from 0.85 to 0.89
- Construct validity evidence: Correlated with Wide Range Achievement Test (reading skills, Neuropsychological Assessment Battery attention module, Tower of Hanoi (planning)
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

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Comment highlights and discussion summary (Note that discussion occurred the following morning with Dr. Maggie Weightman on the phone):

Dr. Maggie Weightman, a member of the research team that developed the Assessment of Military Multitask Performance (AAMP) battery presented by Dr. Kelley, clarified that the six full tasks were evaluated at Fort Bragg, NC, but only four tasks had data to support known-groups validity. Two of these tasks were dual-task and two were multi-task. She stated that the tasks able to discriminate between groups included both cognitive and physical components.
while still emphasizing the need for further testing and refinement before these tasks would be ready for use in any diagnostic capacity. Further discussion included the need for establishing predictive validity and reliability.


Dynamic Marksmanship Tasks

- 4 dynamic shooting tests adapted from clinical balance tests, based on:
  - Reliability
  - Pilot findings from mTBI patients
  - Ability to detect temporary vestibular insult

Dynamic Marksmanship Tasks

Task: Traverse Beam and Shoot
Description: Walk on narrow beam parallel to screen, fire as many accurate shots as possible at target
Source: Dynamic Marksmanship Battery
Equipment needed: Balance platform, marksmanship trainer
Time to administer:
Administration instructions:
- Participant instruction: Goal is to walk across the beam as quick as possible while accurately hitting all targets
- EST Scenario:
  3 lane configuration
  4 targets from left to right
  Targets appear at 25m
Scoring instructions: Scoring based on performance with respect to shot radius, reaction time, accuracy, root mean square error, and throughput (shots per second)
Scoring/interpretation: Higher scores indicate poorer performance
Summary of Experimental Results:
- Reliability evidence: Test-retest reliability ranges from $r = 0.33 - 0.58$ (accuracy, reaction time, etc.)
- Construct validity evidence: Sensitive to induced vestibular disturbance (accuracy, rms, and reaction time)
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes
Dynamic Marksmanship Tasks

Task: Kneel and shoot
Description: Perform kneeling portion of marksmanship battery with a narrow stance (knee to heel)
Source: Dynamic Marksmanship Battery
Equipment needed: Balance platform, marksmanship trainer
Time to administer:
Administration instructions:
- Participant instrum ents:
  - Stay aimed at target until next pop up
  - Kneel at location (90 inches from screen)
- EST Scenario:
  - 1 target at a time, 10 targets total, targets appear at 75m
  - Target appears at extreme of arc wide
  - Target up for 2 seconds, 2 seconds between targets
Scoring instructions:
- Scoring based on performance with respect to shot radius, reaction time, accuracy, root mean square error (rms), and throughput (shots per second)
Scoring/interpretation: Higher scores indicate poorer performance

Summary of Experimental Results:
- Reliability evidence: Test-retest reliability ranges from $r = 0.53 - 0.75$ (accuracy, reaction time, rms, shot radius)
- Construct validity evidence: Sensitive to induced vestibular disturbance (accuracy, reaction time, rms, shot radius)
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

18 February 2017

Dynamic Marksmanship Tasks

Task: Pickup and shoot
Description: Pick up weapon from floor, aim and shoot at target at top of screen as quickly as possible; place weapon back on ground and await instructions to pick up and shoot again
Source: Dynamic Marksmanship Battery
Equipment needed: Balance platform, marksmanship trainer
Time to administer:
Administration instructions:
- Participant instrum ents:
  - Pick up rifle with 2 hands;
  - Center behind projector;
  - Make sure participant has some pitch in waist;
  - Start facing perpendicular to screen;
  - Must keep eyes on rifle all the way down
- EST Scenario:
  - 1 lane configuration
  - 1 target at top of screen, 2 shots
Note:
- altitude: 7 and -3
- targets appear at 40m
Scoring instructions:
- Scoring based on performance with respect to shot radius, reaction time, accuracy, root mean square error, and throughput (shots per second)
Scoring/interpretation: Higher scores indicate poorer performance

Summary of Experimental Results:
- Reliability evidence: Test-retest reliability ranges from $r = 0.28 - 0.47$ (accuracy, shot radius)
- Construct validity evidence: Sensitive to induced vestibular disturbance (accuracy, shot radius)
- Predictive validity evidence: NA
- Experimental evidence with military population: Yes

18 February 2017
Comment highlights and discussion summary:

No discussion at this point.

1505 – 1545  Presentation of Clinical Assessments and Discussion – Dr. Amanda Kelley, USAARL Research Psychologist; Dr. Arthur Estrada, USAARL Science Program Administrator

Clinical Assessments

- Clinical assessments currently used in the RTD setting will be included in the toolkit products
- Next, we present an initial list of assessments to be considered for inclusion by domain
Vestibular

- Sensory organization test
- Dynamic Visual Acuity
- Dizziness Handicap Inventory

Vision/Oculomotor

- Visual screening – reaction time and speed
- Function vision survey
- Visuospatial construction index
- King-Devick
- Pupillary Light Reflex
Auditory

Note that Auditory slide was blank.

Neurocognitive

- Neuropsychological assessment battery
- Repeatable battery for the assessment of neuropsychological status (RBANS)
  - Immediate memory index
  - Language index
  - Attention index
  - Delayed memory index
  - Total scale
Comment highlights and discussion summary:

Discussion during this presentation included active participation from the attendees with respect to revising the list of clinical assessments to be included in the toolkit products. Dr. Estrada suggested addition of the King-Devick and pupillary light reflex tests for vision assessment. Ms. Helmick proposed the addition of assessments for headache and sleep disturbances as these are common symptoms experienced by this patient population and influence performance. It should be noted that Ms. Helmick stated that headache is the number
one complaint that prevents someone from returning to duty. Dr Panker suggested inclusion of literature on assessments with respect to feasibility, training, treatment, space, speed, and accuracy while also highlighting that the unique quality of this product will be ecologically relevant tasks beyond what is currently available.

LTC Kim raised a question without respect to the audience of the toolkit and what we can offer for primary care providers (rather than rehabilitation providers). COL Fondy elaborated on this by stating that the resources required for many of the tasks make it unrealistic for use in a clinic setting. It was agreed that modification of the tasks for this purpose is possible but would require additional research to support the feasibility, validity, and reliability. The tasks most likely to be useful for this setting include those that are dual-task, both cognitive and physical.

An additional point of the discussion referenced future research. Dr. Estrada clarified that the toolkit product will provide enough detail for future researchers to continue refining and testing the tasks. It was suggested that the toolkit products could be considered a first version and future research would allow for updated versions to follow in the future. Ms Helmick also suggested future research evaluating the tasks at locations where rehabilitation services are not as readily available as they are at Fort Campbell, KY, where much of the current research has occurred.

Workshop Sessions – Day 2, 17 February 2017

Review of Day One and Goals – Dr. Amanda Kelley, USAARL Research Psychologist; Dr. Arthur Estrada, USAARL Science Program Administrator

Discussion Summary:

In response to the Day 1 discussion, a table presenting the 20 military functional tasks was generated for use during this day’s discussion (Appendix). In presenting this document to the group, Dr Kelley clarified that the main goal for the day is to discuss the tasks with respect to inclusion as well as inclusion of assessments for headache and sleep disturbances. The document presented summary information on each task with respect to feasibility, military relevance, scientific support for the reliability and validity of the tasks, and what they intend to measure. She clarified that the term “face-validity” is used in the table to represent tasks that may not have sufficient scientific support as of yet, but appear to be taxing a particular domain and are military relevant.

Development of Auditory Fitness for Duty Standards (presented by Dr. Douglas Brungart)

Slide deck not available.

Presentation and Discussion Summary:

Dr Brungart presented his current research efforts with respect to auditory fitness for duty. He presented a study in which participants were required to work as a team and experimentally manipulated the level of hearing ability through use of a helmet that functions similarly to a hearing aid but with the reverse effect. He noted that participants were blind to the manipulation and were not aware of the hearing deficit at the onset of the task. Participants were able to use any method to communicate including hand signals. He noted that the results are not yet published and are not releasable. Through discussion, he was able to provide insight as to auditory assessments currently available to be considered for toolkit inclusion.
Discussion of toolkit details:

This session was an open discussion on the format, content, and intended audience of the toolkit products. Dr Estrada opened the discussion by stating that the toolkit products are intended to supplement clinical decision making and not provide a “fail-safe” screening for RTD. The toolkit will provide the clinician or decision maker with additional information previously unavailable regarding military functional performance but will not replace the expertise required to evaluate each unique case as a whole. Dr Brungart and COL Fondy brought up two avenues for future research to pursue: 1) for the tasks that do not have an Army standard to use as criteria for performance need established normative data for a means of comparison; and 2) the tasks need to be refined and evaluated for use in clinics and by physician assistants (to minimize resources required for the tasks as well as provide standards to guide interpretation of performance). Ms Helmick shared a list of currently used clinical assessments focusing discussion on the Neurobehavioral Symptom Inventory. She stated that this inventory is the primary tool used in TBI clinics “for the clinician to work on symptom management and evaluate for sleep, headache, difficulty concentrating, etc.” There were no objections to the inclusion of this assessment. The group discussed inclusion of the following assessments:

1. Insomnia Severity Index (ISI): Symptoms of sleep disturbance (Morin, Belleville, Bélanger, & Ivers, 2011)
2. Headache Impact Test (HIT-6): Headache severity and negative impact on global functioning (Kosinski et al., 2003)
4. Mild Brain Injury Atypical Symptom Scale (mBIAS): Symptom over-reporting/exaggeration based upon the acknowledgment of symptoms not associated with mild TBI (Cooper, Nelson, Armistead-Jehle, & Bowles, 2011)
5. Neurobehavioral Symptom Inventory (NSI): Symptoms associated with vestibular, somatosensory, cognitive, and affective difficulties (King et al., 2012)
6. Overall Anxiety Severity and Impairment Scale (OASIS): Symptoms of anxiety and impact on daily functioning (Norman, Hami Cissell, Means-Christensen, & Stein, 2006)
8. Victoria Symptom Validity Test (VSVT): Effort on cognitive testing is evaluated through the VSVT (Slick, Hopp, Strauss, & Thompson, 1997)
9. MicroCog Assessment of Cognitive Functioning: A computerized assessment that evaluates the major functional domains including:
   - General cognitive functioning
   - General cognitive proficiency
   - Information processing speed
• Information processing accuracy
• Attention and mental control
• Reasoning and calculation
• Memory
• Spatial processing
• Reaction time

The group did not reject any of these assessments and agreed to pare down the list, if necessary, in a follow-up teleconference. The group also agreed to an additional “chapter” in the toolkit, which will address headache and sleep disturbances titled “Physiological.”

A large portion of this discussion centered on the definition of RTD and whether an intermediary step between “rehabilitation” and “deployable” should be considered. Specifically, Dr Panker posited a “return-to-training” step where a service member may not necessarily be ready to deploy but is making significant progress and is able to return to the training environment. While the toolkit products are not intended to redefine the RTD process, this discussion was of interest with respect to a way forward for the overall objective of improving RTD decision making.

Consensus and the Way Forward:

The group discussed the grouping of the available tasks and assessments to the following domains (each domain serving as a “chapter” in the toolkit): vestibular, vision/oculomotor, auditory, neurocognitive, physiological, and mental health. The group identified four assessments to be included in the vestibular chapter. These are the sensory organization test, dynamic visual acuity (Neurocom) test, dizziness handicap inventory, and a subset of questions from the neurobehavioral symptom inventory. This provides two objective and two subjective measures for this toolkit chapter. For the vision chapter, five tests (two subjective and three objective) were identified including the Nova Southwestern University College of Optometry oculomotor test, King Devick, vestibular oculomotor test, pupillary light reflex test, and visual spatial construction index. For the auditory chapter, four assessments (two subjective, two objective) were identified: Callsign Acquisition Test, modified rhyme test, hearing handicap inventory, and speech quality questionnaire.

At this point in the discussion, the group decided to move on to discussing the military-specific tasks in the interest of time. The group agreed to complete the assessments list for the remaining three chapters through follow-up e-mail correspondence.

The discussion began with a focus on the level of resources required for the tasks. The group agreed to include all of the tasks but to present them in the toolkit in such a way that they are ordered by level of difficulty to conduct/administer. Considering this, the group agreed that the Warrior Task Battle Drills and Tactical Combat Casualty Care tasks were the least resource intensive and still clearly military-specific. COL Fondy also suggested that the Tactical Combat Casualty Care task could be modified to induce stress and thus provide mental health information. Dr Brungart suggested an additional avenue for future research which is to develop an algorithm that pools across tasks.
**Closing Remarks**

The lists of assessments for inclusion were reviewed one final time and the group agreed to follow-up using email correspondence and teleconferences. Dr Panker suggested only producing two toolkit products: a full manual and a pamphlet. Drs Estrada and Kelley agreed. At this point, COL McGurk joined the group for the final discussion. He provided his vision for an occupational cognitive assessment test (similar to the currently used occupational physical assessment test) that can be used for RTD as well as a variety of other settings including initial evaluation at recruiting stations.

**Workshop Summary**

The workshop presentations and discussions highlighted the efforts conducted with the overall objective of developing tasks and instruments intended to aid RTD decision makers. The tasks presented attempt a novel undertaking: to link clinical outcomes with functional impairment in a military setting.

While a number of challenges with respect to RTD decision making still exist, many of which were discussed at length during this workshop, the toolkit product in development will serve as an additional information source for RTD decision makers. Most importantly, the tasks included that effectively link clinical outcomes to functional impairment are truly unique and will provide observable, previously unavailable information to medical providers and ultimately unit leadership.

In discussion of the components that lead to successful RTD, one particular point of interest that has not yet been addressed systematically is the motivation and self-perceptions of the individual. Throughout the workshop, the distinctions between subjective and objective tests, subjective meaning the test outcome being influenced by the degree to which the patient or service member is motivated to complete the task, were highlighted. All of the tasks discussed for inclusion in the toolkit are indeed subjective. We must wonder, however, how successful a Service member who is not motivated to perform well will be beyond their functional capabilities. One could argue that objective tests, while important in many contexts, are not essential in this setting given that RTD success will ultimately be a strong reflection of self-motivation. Similarly, self-perceptions are important to consider as well given that negative self-perceptions may be linked to depression or anxiety and are evident in one’s performance. We must consider the level of motivation and confidence exhibited by these patients as well in order to promote their success.

Ultimately, the goal is to provide the best information possible to RTD decision makers. Often, the task of making such a determination falls on the medical provider. The RTD decision maker has to integrate multiple pieces of information to make their decision: the occupational hazards associated with the patient’s duties with respect to re-injury, safety of the patient with respect to performance of duties, as well as the patient’s ability to perform within their unit. Ideally, this decision is formed in consideration with three perspectives: the medical provider’s observations (physical exam and consult), objective occupational testing (including tasks such as those to be included in the RTD toolkit), as well as unit-level observations. Incorporating these three pieces to the puzzle takes into account the health of the individual, the safety of the individual and his/her unit, and the unit’s mission. At present, an exemplar of this approach is ongoing at the National Intrepid Center of Excellence (NCoE; Fort Campbell, KY). The
Military Functional Assessment Program (MFAP) incorporates multiple medical providers (occupational therapists, physical therapists, mental health providers) and an NCO in the decision making process. While the resources required for this program prohibit widespread application, there are a number of components that can be adapted for use in a variety of settings. In particular, there is an opportunity for future research to adapt the successful tasks included in the MFAP and modify them for use in a setting with limited resources. The same idea is true for the dynamic marksmanship tasks. Ultimately, these tasks could be adapted such that the marksmanship trainer is not necessary for administration and a smaller, portable device, such as a balance platform, could be incorporated. The opportunities for future research to advance these tasks and provide additional scientific support for their use are substantial and have the potential to improve RTD decisions.

**Conclusions**

The main finding of this workshop is that the work conducted thus far has not only provided additional tools for RTD decision makers but has also opened the door for future research to refine and fine-tune these tools. We have provided previously non-existent options to further educate the RTD decision maker, additional information to process when considering the complexity and individual uniqueness of each case. This has ultimately yielded the opportunity to minimize the possibility of error in these decisions, which translates to a safer and more effective force.
References


members-symptoms-following-concussion


## Appendix A: Acronym List

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAMP</td>
<td>Assessment of Military Multitask Performance</td>
</tr>
<tr>
<td>AHPD</td>
<td>Aircrew Health and Performance Division</td>
</tr>
<tr>
<td>AOC</td>
<td>Alteration of Consciousness</td>
</tr>
<tr>
<td>AUDIT</td>
<td>Alcohol Use Disorders Identification Test</td>
</tr>
<tr>
<td>BACH</td>
<td>Blanchfield Army Community Hospital</td>
</tr>
<tr>
<td>CT</td>
<td>Computed Tomography</td>
</tr>
<tr>
<td>DAPS</td>
<td>Detailed Assessment of Posttraumatic Stress</td>
</tr>
<tr>
<td>D &amp; C</td>
<td>Drill &amp; Ceremony</td>
</tr>
<tr>
<td>DCoE</td>
<td>Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DVBIC</td>
<td>Defense and Veterans Brain Injury Center</td>
</tr>
<tr>
<td>EST</td>
<td>Engagement Skills Trainer</td>
</tr>
<tr>
<td>FFD</td>
<td>Fitness-For-Duty</td>
</tr>
<tr>
<td>FHS</td>
<td>Force Health Status</td>
</tr>
<tr>
<td>HIT-6</td>
<td>Headache Impact Test</td>
</tr>
<tr>
<td>HMMWV</td>
<td>High Mobility Multipurpose Wheeled Vehicle</td>
</tr>
<tr>
<td>ICC</td>
<td>Intra-Class Correlation Coefficient</td>
</tr>
<tr>
<td>IED</td>
<td>Improvised Explosive Device</td>
</tr>
<tr>
<td>ISAW</td>
<td>Instrumented Stand and Walk</td>
</tr>
<tr>
<td>ISI</td>
<td>Insomnia Severity Index</td>
</tr>
<tr>
<td>KT</td>
<td>Knowledge Translation</td>
</tr>
<tr>
<td>LOC</td>
<td>Loss of Consciousness</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>MACE</td>
<td>Military Acute Concussion Evaluation</td>
</tr>
<tr>
<td>mBIAS</td>
<td>Mild Brain Injury Atypical Symptom Scale</td>
</tr>
<tr>
<td>MEDCOM</td>
<td>U.S. Army Medical Command</td>
</tr>
<tr>
<td>MFAP</td>
<td>Military Functional Assessment Program</td>
</tr>
<tr>
<td>MH</td>
<td>Mental Health</td>
</tr>
<tr>
<td>MOMRP</td>
<td>Military Operational Medicine Research Program</td>
</tr>
<tr>
<td>MOS</td>
<td>Military Occupational Specialty</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
</tr>
<tr>
<td>mTBI</td>
<td>Mild Traumatic Brain Injury</td>
</tr>
<tr>
<td>MTF</td>
<td>Military Treatment Facility</td>
</tr>
<tr>
<td>NCO</td>
<td>Non-Commissioned Officer</td>
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<tr>
<td>NICoE</td>
<td>National Intrepid Center of Excellence</td>
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<tr>
<td>NSI</td>
<td>Neurobehavioral Symptom Inventory</td>
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<tr>
<td>OASIS</td>
<td>Overall Anxiety Severity and Impairment Scale</td>
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<tr>
<td>OT</td>
<td>Occupational Therapist</td>
</tr>
<tr>
<td>OTSG</td>
<td>Office of the Surgeon General</td>
</tr>
<tr>
<td>PET</td>
<td>Positron Emission Tomography</td>
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<tr>
<td>PHQ-9</td>
<td>Patient Health Questionnaire</td>
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<td>PT</td>
<td>Physical Therapist</td>
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<tr>
<td>PTA</td>
<td>Post-Traumatic Amnesia</td>
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<tr>
<td>RBANS</td>
<td>Repeatable Battery for the Assessment of Neuropsychological Status</td>
</tr>
<tr>
<td>RECs</td>
<td>Regional Education Coordinators</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>--------------</td>
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<tr>
<td>RPG</td>
<td>Rocket-Propelled Grenade</td>
</tr>
<tr>
<td>RTD</td>
<td>Return-To-Duty</td>
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<tr>
<td>SM</td>
<td>Service Member</td>
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<tr>
<td>SME</td>
<td>Subject Matter Expert</td>
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<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>SPECT</td>
<td>Single-Photon Emission Computerized Tomography</td>
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<tr>
<td>TA</td>
<td>Task Area</td>
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<td>TBI</td>
<td>Traumatic Brain Injury</td>
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<td>TOC</td>
<td>Tactical Operations Center</td>
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<tr>
<td>TTA</td>
<td>Technical Task Agreement</td>
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<td>VAMC</td>
<td>Veterans Affairs Medical Center</td>
</tr>
<tr>
<td>VC</td>
<td>Vehicle Command</td>
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<tr>
<td>VCOT</td>
<td>Virtual Convoy Operator Trainer</td>
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<tr>
<td>VSVT</td>
<td>Victoria Symptom Validity Test</td>
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<td>USAARL</td>
<td>United States Army Aeromedical Research Laboratory</td>
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<tr>
<td>USAMRMC</td>
<td>US Army Medical Research and Materiel Command</td>
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<td>WRAIR</td>
<td>Walter Reed Army Institute of Research</td>
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<td>WRNMMC</td>
<td>Walter Reed National Military Medical Center</td>
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</table>
Appendix B: Attendee List

**Workshop Participants**

COL Dennis McGurk  Research Area Director, MOMRP
Dr. Douglas Brungart  Chief Scientist, Walter Reed National Military Medical Center (WRNMMC)
LTC Kristen Casto  Staff Audiologist, Headquarters Department of the Army, Office of the Surgeon General (OTSG), Sensory Research Division
MAJ Edward Edens  Division Chief, Aircrew Health and Performance Division (AHPD), U.S. Army Medical Command (MEDCOM), U.S. Army Aeromedical Research Laboratory (USAARL)
Mr. Bradley Erickson  Research Program Coordinator, MEDCOM, USAARL
Dr. Art Estrada  Transition Assistance Program Manager, Science Program Administrator, MEDCOM, USAARL
COL Susan Fondy  Chief, Flight Physical Review and Disposition, MEDCOM HQ, Fort Rucker
Dr. Emma Gregory  Research Psychologist, Defense and Veterans Brain Injury Center (DVBIC)
Ms. Katherine Helmick  Deputy Director, DVBIC, U.S. Army Medical Research and Materiel Command (USAMRMC), Defense Centers of Excellence (DCoE)
LTC Michael Kim  Occupational Therapist, OTSG
Dr. Amanda Kelley  Research Psychologist, MEDCOM, USAARL
Ms. Melody King  Lead Research Technician, MEDCOM, USAARL
MAJ Chris Long  Research Psychologist, MEDCOM, USAARL
Dr. Donald Marion  Senior Clinical Consultant, USAMRMC, DCoE
Dr. Stephanie Panker  Traumatic Brain Injury (TBI) Program Director, OTSG
Mr. Mark E. Showers  TBI Occupational Therapist, MEDCOM, Blanchfield Army Community Hospital (BACH)
LTC James Truong  Research Optometrist, MEDCOM, USAARL
Dr. Josh Wilk  Task Area Manager, Walter Reed Army Institute of Research (WRAIR)
Dr. Maggie Weightman  Sr. Scientific Advisor, Courage Kenny Research Center (participated via teleconference)

**MOMRP Support Staff**

MAJ(P) James McKnight  Principle Advisor and Military Attaché, MOMRP
Dr. Richard Shoge  Medical Research Program Manager, MOMRP
Leidos Staff

Dr. Janet Hsu  Biomedical Scientist, Leidos
### Appendix C: Summary table of Military-Specific Tasks

<table>
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<tr>
<th>Task</th>
<th>Vestibular</th>
<th>Cognitive</th>
<th>Vision</th>
<th>Auditory</th>
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<td>Face</td>
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<tr>
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<td>validity</td>
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<tr>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>with RBANS</td>
<td></td>
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<td><strong>AMMP</strong></td>
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<td>CQ Duty</td>
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<td>Low resources, 30 min</td>
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<td></td>
<td>with NAB, CTM, Tower of Hanoi</td>
<td>validity</td>
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<td>Run-Roll-Aim</td>
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<td></td>
<td></td>
<td>Moderate equipment</td>
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<td>validity</td>
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<td>Illinois-Agility</td>
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72
<table>
<thead>
<tr>
<th>Test-Packing List</th>
<th>validity</th>
<th>with NAB, reading skills, planning</th>
<th>validity</th>
<th>resources</th>
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<td>Instrumented Stand Walk-Grid Coordinates</td>
<td>Face validity</td>
<td>Correlated with reading skills, NAB</td>
<td>Face validity</td>
<td>Low resources</td>
</tr>
<tr>
<td>Load Magazine – Radio Chatter</td>
<td>Correlated with Reading skills, NAB</td>
<td>Face validity</td>
<td>Face validity</td>
<td>Low resources</td>
</tr>
<tr>
<td>Patrol-Exertion</td>
<td>Correlate to reading and planning skills</td>
<td>Face validity</td>
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**DYNAMIC MARKSMANSHIP**

<table>
<thead>
<tr>
<th>Traverse Beam And Shoot</th>
<th>Sensitive to vestibular insult</th>
<th>Face validity</th>
<th>EST-2000</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kneel And Shoot</td>
<td>Sensitive to vestibular insult</td>
<td>Face validity</td>
<td>EST-2000</td>
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<tr>
<td>Pick-Up And Shoot</td>
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<td>Face validity</td>
<td>EST-2000</td>
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<td>Walk And Shoot</td>
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<td>Face validity</td>
<td>EST-2000</td>
<td>Yes</td>
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