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Evaluation of the Military Functional Assessment Program: Inter-rater Reliability of Task Scores

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14. ABSTRACT

The Military Functional Assessment Program (MFAP) is a 10-task (based on Basic Soldier Skills) assessment program used to help determine whether a Service member is prepared to return-to-duty. Performance on the tasks is rated by a non-commissioned officer (NCO), occupational therapist, physical therapist, and mental health provider. The purpose of this study was to evaluate the reliability of NCO MFAP ratings using vignettes describing the 10 tasks. Participants were 30 NCOs naïve to the MFAP. Results suggest good overall consistency on average yet inspection of individual tasks suggest that the land navigation task yielded the most consistent ratings. Improvement to the instructions provided for rating the MFAP tasks may be appropriate for enhancing consistency.

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Table of Contents

List of Tables

List of Figures

Introduction

Military operations during Operation Enduring Freedom and Operation Iraqi Freedom (OEF and OIF) have resulted in significantly higher rates of traumatic brain injury (TBI) among Soldiers as compared with previous wars (Scherer & Schubert, 2009), mainly due to the prevalence of improvised explosive attacks. Severe brain injuries are less common than the milder forms of TBI, given adequate protective gear, yet the milder forms are more difficult to diagnose and therefore treat. Severe cases of TBI are more straightforward in their clinical presentation, whereas mild TBI (mTBI) symptoms are often invisible in their presentation, causing many cases to go undiagnosed until sequelae occur later in the form of persistent symptoms (e.g., headache, fatigue, dizziness, concentration problems, anxiety), or post-concussive syndrome (PCS), which can be ongoing (Management of Concussion/mTBI Working Group, 2009). Such symptoms of mTBI can result in long-lasting deficits that significantly impact a Soldier's ability to complete mission-critical tasks, making it imperative that providers accurately and reliably determine if a Soldier is capable of and ready to return-to-duty (RTD), or if he or she requires further rehabilitation and treatment, or medical discharge (Jones, Leppma, & Young, 2010; Kelley et al., 2013). Standard clinical assessments, upon which the Army has traditionally relied, have not been adequately investigated in terms of the mission-critical consequences of mTBI, specifically the complex cognitive and neurosensory requirements of effective military functioning in the field. Military RTD assessments must take into account the unique physical and mental stressors Soldiers face on the battlefield (e.g., combat environments, high workloads, sleep deprivation, fatigue) and the specificity of critical military abilities, such as marksmanship, military vehicle egress, first aid, tactical formations, and land navigation (Kelley et al., 2013).

Background

To address the need for a military-specific assessment tool for RTD, the National Intrepid Center of Excellence Intrepid Satellite-III (NICoE ISIII) located at Fort Campbell, KY, developed the Military Functional Assessment Program (MFAP), which has been utilized since 2008 to assist military and clinical professionals in determining Soldier readiness to RTD following mTBI. The MFAP is 5-day assessment program consisting of 10 independent tasks (adapted from the Soldier Manual of Common Tasks [Warrior Skills Level 1]) and 1 unrated confidence and team building exercise (Table 1). The MFAP exercises have been developed to accommodate a variety of Soldier injuries while maintaining a high enough level of difficulty to reflect active-duty requirements that maximize operational success. By testing Soldiers in a more applied setting, NICoE ISIII staff can better determine a Soldier's ability to function while under the pressure of realistic environmental stressors that approximate actual combat scenarios – elements that can significantly impair performance not otherwise captured by traditional clinical assessments (Helmick, 2012).

A NICoE ISIII staff non-commissioned officer (NCO) rates each Soldier's performance on 10 tasks and gives each task a subjective rating score using a guided rating scale that incorporates subjective (observed independence level [IL] of the patient) and objective (U.S. Army operational performance standards) criteria (Table 2). The ratings are on a 5-point scale and translate to a binary *Pass/Fail* outcome (Table 3). The MFAP occurs following a 12- to 24-week treatment program at NICoE ISIII.

Table 1. Military Functional Assessment Program (MFAP) Tasks and Descriptions

Task Name	Description
Tactical Combat Casualty Care (TCCC)	Class and demonstration on performing basic life support
Warrior Tasks and Battle Drills (WTBD)	Series of physical tasks, drill, and ceremony procedures (e.g., donning gas mask, Mission-Oriented Protective Posture suit, casualty evacuation, leading/following commands)
HMMWV Egress Assistance Trainer (HEAT)	Egress from a simulated HMMWV (high mobility multipurpose wheeled vehicle) rollover while wearing protective gear after adequate half-hour class preparation
Land Navigation Preparation (LNP)	Class exercise preparation for land navigation
Virtual Convoy Operations Trainer (VCOT)	Complete virtual reality simulation in convoy trainer, including SALUTE report, identification of RPGs and IEDs
Land Navigation (LN)	Execute prepared land navigation task
Engagement Skills Trainer 2000 (EST) – Weapons Qualification	Zero and qualify with the appropriate weapon, tested by occupational therapist on functions of the weapon
EST - Shoot/No-Shoot Scenarios	Collective interactive videotaped scenarios with the marksmanship trainer that place Soldier in lifelike shooting scenarios requiring on-the-spot judgment
Medical Simulation Training Center (MSTC) - Mass Casualty Scenario	Trauma Lanes – Individual activity, real-time simulation in a medical trainer, treating lifelike mannequins
MSTC - Tactical Mission Scenario	Combat/IED Lanes – Group activity, real-time simulation under field conditions involving ambush with paintballs, treatment of a casualty
Ropes Confidence Course (*not rated*)	Complete a ropes obstacle course (team-building)

Table 2. MFAP NCO Grading Sheet and Operational Assessment Criteria

Independence Level (IL) Rating Scale**	
1	Independent; no adaptations: SM (service member) is able to complete all of the tasks making up the activity safely, without modification/compensations, and within reasonable time. No cues required (Exceeds Course Standards)
2	Independent; with adaptations/modifications: SM requires increased time to complete tasks, use of compensatory strategies/techniques, indirect verbal guidance or gestural guidance. (Meets Course Standards).
3	Acceptable level of Assistance: SM requires no more help than direct verbal assistance or physical assistance. SM performs at a level that is acceptable based on rank/experience. Will benefit from additional training. (Marginally Achieves Course Standards).
4	Unacceptable level of Assistance: SM requires that a part of the task (<25%) be completed for them by clinician and/or SM performs at a level that is unacceptable based on his/her rank and/or experience (Failed to Meet Course Standards).
5	Dependent: SM requires that 25% or more of activity be done for them by clinician. SM requires psychological intervention. SM unable to complete task due to physical restrictions/limitations. (Failed to Meet Course Standards).

Note. An IL score of 1, 2, or 3 corresponds to a *Pass* and an IL score of 4 or 5 corresponds to a *Fail*.

Table 3. MFAP NCO Grading Sheet

NCO Grading Sheet	Date	IL	Pass/fail	Comments *(attention, visual skills, hearing/language skills, memory, multi-tasking, planning, organization, sequencing, flexibility, prediction, problem solving, self-monitoring, judgment, safety)*
Name:				
Eagle first responder review				
WTBD				
HEAT				
VCOT				
Land Navigation Prep				
Confidence Course				
Land Navigation Course				
EST				
MSTC/TC3				
Tactical Mission Scenario				

The NCO rates performance on all of the tasks and additional ratings are provided on a subset of the tasks by an occupational therapist (OT), physical therapist (PT), and mental health (MH) counselor. The OT rates global functioning; PT rates physical strength, agility, and

balance; and MH counselor rates anxiety level and psychological level of independence. All raters collaborate at the end of the week to derive a single overall IL score based upon each of their respective operational assessment criteria. Task-specific rating scores based on the IL criteria provided in Table 2 are collected from all raters and reported on the MFAP Final Results Reporting Sheet (Figure), which includes an overall *go/no-go/stop* determination for each task, the number and percentage of tasks passed, a general level of independence score (LOI), and recommendation for RTD, among other findings. All scores on the final sheet are based on a collaborative decision made by all four MFAP raters.

Activity	MIL	PT	OT	MH	go/no-go/stop
1. Tactical Combat Casualty Care (TCCC)		■		■	go/no-go/stop
2. Warrior Task Battle Drill (WTBD)				■	go/no-go/stop
3. HMMWV Egress Assistance Trainer (HEAT)					go/no-go/stop
4. Virtual Convoy Operator Trainer (VCOT)					go/no-go/stop
5. Land Navigation Preparation (LNP)		■		■	go/no-go/stop
6. Ropes Confidence Course	■		■		go/no-go/stop
7. Land Navigation				■	go/no-go/stop
8. EST Weapons Qualification					go/no-go/stop
9. EST Shoot/No-Shoot Scenerios					go/no-go/stop
10. MSTC- Mass Casualty Scenario					go/no-go/stop
11. MSTC- Tactical Mission Scenario					go/no-go/stop

Number of activities PASSED out of /11 Percentage PASSED: % General Level of Independence (LOI):_____ RTD: Yes / No Mental Health LOI Rating:_____	Physician Note: Signature:_____

Figure. MFAP final results reporting sheet.

In order to determine whether this program has potential for widespread implementation, the validity and reliability of the assessment program needs to be established. Inter-rater reliability, the extent to which ratings are consistent across raters (Hallgren, 2012), cannot be determined with the observed data collected at NICoE ISIII as part of another study (Kelley et al., 2013) given that the raters interact with the patients during the 12 to 24 week treatment program and are thus subject to bias. Therefore, the present study was designed to assess reliability of the NCO ratings using vignettes describing hypothetical performance of the tasks rated by U.S. Army NCOs unfamiliar with the MFAP and treatment program at NICoE ISIII.

Method and Materials

This descriptive study examined the inter-rater reliability among groups of 30 NCOs rating a hypothetical Soldier's performance outlined in a vignette (narrative). Each vignette described a Soldier's performance completing 1 of the 10 rated MFAP exercises outlined in Table 1. Participants completed a total of 10 vignettes. This study was reviewed and approved by the U.S. Army Medical Research and Materiel Command's Institutional Review Board.

Participants

Study participants were 30 U.S. Army NCOs (15 were Active Duty, and 15 were National Guard). The mean age was 38.10 years (*SD* = 8.32) and the mean length of time in service was 15.43 years (*SD* = 8.86). Rank and Military Occupational Specialty (MOS) data are provided in Table 4. Given the nature of the study and potential for bias on the part of those who had personal experience with RTD following a TBI in the military, participants responded to a short series of questions gauging their own TBI history. Five participants indicated having been previously diagnosed with a TBI, of which four were mild and one was severe and two responded to having experienced more than one concussive event. Of those five, four stated that the TBI occurred while serving in the military (all were allowed to RTD) and four responded that they did not require rehabilitation prior to RTD (data missing for one participant). Overall, 14 participants indicated having known someone who was diagnosed with a TBI, five of which responded that the individual did not RTD.

Table 4. Frequencies of Rank and MOS for Study Participants

Rank	**Frequency (percent)**
E5	11 (36.7)
E6	12 (40.0)
E7	4 (13.3)
E8	3 (10.0)
MOS (description)	
68W (health care specialist)	8 (26.7)
68K (medical laboratory specialist)	5 (16.7)
42A (human resources specialist)	3 (10.0)
13B (cannon crewmember)	3 (10.0)
25U (signal support systems)	2 (6.7)
92Y (unit supply specialist)	2 (6.7)
15P (aviation operations specialist)	1 (3.3)
31B (military police)	1 (3.3)
35F (intelligence analyst)	1 (3.3)
68A (biomedical equipment specialist)	1 (3.3)
68U (ear, nose, and throat specialist)	1 (3.3)
88H (cargo specialist)	1 (3.3)
88M (motor transport operator)	1 (3.3)

Materials

Participants completed a brief demographic and TBI history questionnaire (Appendix A). The vignettes and task instructions were developed by an assembled group of experimental psychologists, U.S. Army NCOs, and an OT and NCOIC from NICoE ISIII currently working with the MFAP program. Each vignette described the performance of a hypothetical Soldier who had undergone rehabilitation at the NICoE ISIII and was participating in the MFAP. Each vignette described one of the tasks and provided brief information about the hypothetical Soldier (including time in service and rank). The details on the Soldier were included so as to give context for the rater in determining the level of performance expected for a Soldier of that

rank/time in service. The vignettes contained all the relevant and important cues (as determined by the NCOIC and OT at NICoE ISIII) upon which to base their ratings when considering the IL of the Soldier and whether or not he or she had performed the exercise to Army operational standards. The guidelines published by Barter and Renold (1999) were followed when developing the vignettes. Specifically, the team ensured to remove potential confounds by describing a Soldier using ethnically and gender- neutral language and names. Also, any potentially "leading" language such as adjectives indicating quality of performance was avoided. The vignettes were developed based on the experiences of the NCOIC and OT at NICoE ISIII rating Soldiers completing the MFAP to ensure that the scenarios were plausible and realistic. Instructions and the 10 vignettes are provided in Appendices B and C, respectively.

Procedure

Informed consent was obtained for all participants prior to study procedures. The participants were then given the set of written instructions for review regarding completion of the vignette ratings as well as information on the MFAP. The participants then completed the set of 10 vignettes (in random order). For each vignette, participants rated the hypothetical Soldier's performance outlined in the vignette using the same rating scale used by the Fort Campbell NCOIC. Additionally, they identified which cues in the vignette indicated positive or negative performance and influenced their rating. Space was provided for any additional comments.

Quality Control and Statistical Analysis Approach

All data (both the ratings and qualitative data) were inspected to identify any quality concerns (e.g., participant inattention). Specifically, variances in ratings per participant were inspected such that a lack of variance may suggest the rater did not attend to the task and rather gave the same rating for each task.

The intraclass correlation coefficient was computed using a two-way mixed model for absolute agreement. Individual vignettes were analyzed using two methods: percent agreement and average pairwise percent agreement. Given that these measures of agreement do not capture the ordinal nature of the rating scale, ratings were coded as *pass* (rating of 1, 2, or 3) and *fail* (ratings of 4 or 5) as defined in Table 2. Note that more sophisticated measures of reliability were not appropriate since the participants rated one single case per task. All statistics were calculated using SPSS version 19.0 and ReCal online reliability statistics calculator (Freelon 2010, 2013). All qualitative data was summarized and categorized to determine the most salient positive and negative cues contributing to participants' ratings.

Results

Inspection of the data did not indicate any need to remove data due to quality concerns or participant inattention. Overall rater agreement was assessed using an intraclass correlation coefficient, the result of which suggests a high degree of reliability (using commonly referenced cut-off criteria provided in Hallgren, 2012). The average measures ICC was 0.82, 95% CI [0.62, 0.95], $F(9, 261) = 5.83$, $p < 0.001$. Levels of agreement for individual tasks with respect to

pass/fail outcomes were acceptable for 5 of the 10 tasks (using a cut-off value of 80% average pairwise percent agreement as published by Neuendorf, 2002) (Table 5).

Table 5. Reliability Statistics for Individual Tasks

Task Name	Percent Agreement	Average Pairwise Percent Agreement
TCCC	83.33	71.26
WTBD	90.00	81.38
HEAT	100.00	100.00
LNP	93.33	87.13
VCOT	73.30	59.54
LN	100.00	100.00
EST - Weapons Qualification	86.67	76.09
EST - Shoot/No-Shoot Scenarios	83.33	71.26
MSTC - Mass Casualty Scenario	53.33	48.51
MSTC - Tactical Mission Scenario	96.67	93.33

Participants provided qualitative data identifying the positive and negative behavior cues for each vignette. The responses were reviewed and categorized (Tables 6-15). Note that number of responses identified in the tables exceeds 30 in some cases because participants were allowed to provide more than one cue or comment for each vignette.

Table 6. Participant Responses to VCOT Task Vignette

Positive (*n* = 39)	**Frequency (%)**
Successfully completed mission	11 (28.2)
Properly engaged targets	9 (23.1)
Correctly identified IED's	4 (10.3)
Communicated SALUTE report successfully	4 (10.3)
Scanned sectors	4 (10.3)
Maintained proper driver speeds	4 (10.3)
Followed protocol	3 (7.7)
Negative (*n* = 36)	**Frequency (%)**
Did not communicate enemy combatives	8 (22.2)
Got lost	7 (19.4)
Soldier needed a break	7 (19.4)
Poor decision making	6 (16.7)
Needed additional guidance	5 (13.9)
Failed some tasks	3 (8.3)
Rationale given for score (*n* = 16)	**Frequency (%)**
Experience an issue	14 (87.5)
Poor decision making	2 (12.5)

Table 7. Participant Responses to WTBD Task Vignette

Positive (*n* = 58)	**Frequency (%)**
Soldier performed to standard at D&C	29 (50.0)
Properly performed 50 meter Skedco	9 (15.5)
Successfully completed 3-5 second rushes	9 (15.5)
Used command voice	7 (12.1)
Soldier completed mission sucessfully	5 (8.6)
Successfully led group during PT	4 (6.9)
Negative (*n* = 37)	**Frequency (%)**
Unsuccessful donning mask	18 (48.6)
Incorrect marching movements	15 (40.5)
Missed 2 of 18 marching movements	4 (10.8)
Rationale given for score (*n* = 15)	**Frequency (%)**
Unsuccessful donning mask	6 (40)
Needs more practice/training	6 (40)
Soldier met the standard	3 (20)

Table 8. Participant Responses to EST Shoot/No-Shoot Task Vignette

Positive (*n* = 31)	**Frequency (%)**
No civilian casualties	12 (38.7)
Scored well shooting	10 (32.3)
Properly Performed Sports	9 (29.0)
Negative (*n* = 13)	**Frequency (%)**
Hit friendly target	10 (76.9)
Soldier shooting "I don't know"	3 (23.1)
Rationale given for score (*n* = 13)	**Frequency (%)**
Scenarios are stressful and mistakes will occur	13 (100)

Table 9. Participant Responses to EST Weapons Qualification Task Vignette

Positive (*n* = 23)	**Frequency (%)**
Successfully qualified	16 (69.6)
Soldier able to zero weapon	5 (21.7)
Did not need assistance	2 (8.7)
Negative (*n* = 19)	**Frequency (%)**
Inconsistent aim	9 (47.4)
Soldier expressed dissatisfaction	8 (42.1)
Let magazine fall	2 (10.5)
Rationale given for score (*n* = 12)	**Frequency (%)**
Met standard	7 (58.3)
Needs additional training	3 (25.0)
Been in service 7 years, should shoot better	2 (16.7)

Table 10. Participant Responses to HMMWV Task Vignette

Positive (*n* = 19)	**Frequency (%)**
Performed well	7 (36.8)
Appeared attentive throughout	5 (26.3)
Accounted for all personnel and equipment	4 (21.1)
Followed proper procedure	3 (15.8)
Negative (*n* = 27)	**Frequency (%)**
Needed assistance to complete	12 (44.4)
Did not check for unlocked door	10 (37.0)
Wrong medical treatment choice	5 (18.5)
Rationale given for score (*n* = 15)	**Frequency (%)**
Inexperience a factor	13 (86.7)
Needs more training	2 (13.3)

Table 11. Participant Responses to LNP Task Vignette

Positive (*n* = 21)	**Frequency (%)**
Properly found and corrected errors	11 (52.4)
Scored well on learning exercise	10 (47.6)
Negative (*n* = 22)	**Frequency (%)**
Made mapping errors	10 (45.5)
Needed assistance	8 (36.4)
80% score on post test	4 (18.2)
Rationale given for score (*n* = 9)	**Frequency (%)**
Made mistakes but corrected them quickly	7 (77.8)
Soldier has enough experience not to make mistakes	2 (22.2)

Table 12. Participant Responses to LN Task Vignette

Positive (*n* = 20)	**Frequency (%)**
Plotted all three points correctly	16 (80.0)
Found all points and met standard	4 (20.0)
Negative (*n* = 21)	**Frequency (%)**
Needed assistance to complete	16 (76.2)
Errors in land nav	5 (23.8)
Rationale given for score (*n* = 8)	**Frequency (%)**
Needed minimal assistance	6 (75.0)
Had errors but corrected	2 (25.0)

Table 13. Participant Responses to MCS Task Vignette

Positive (*n* = 12)	**Frequency (%)**
Properly assessed consciousness	3 (25.0)
Completed all tasks	3 (25.0)
Maintained bearing throughout	3 (25.0)
Successfully called 9 line medivac	3 (2.05)
Negative (*n* = 17)	**Frequency (%)**
Paused and needed prompting	8 (47.1)
Did not return to tourniquet	4 (23.5)
Required assistance	3 (17.6)
Did not assess consciousness	2 (11.8)
Rationale given for score (*n* = 9)	**Frequency (%)**
Needs more training	7 (77.8)
Needed assistance to complete task	2 (22.2)

Table 14. Participant Responses to TMS Task Vignette

Positive (*n* = 17)	**Frequency (%)**
Properly delegated tasks to squad	7 (41.2)
Successfully communicated objective to squad	7 (41.2)
Successfully completed the mission	3 (17.6)
Negative (*n* = 25)	**Frequency (%)**
Lost command and control of the group	12 (48.0)
Needed prompting from moderator	7 (28.0)
Left casualty untreated	6 (24.0)
Rationale given for score (*n* = 6)	**Frequency (%)**
Soldier not responsible for insubordination of squad	4 (66.7)
Mission completed despite problems	2 (33.3)

Table 15. Participant Responses to TCCC Task Vignette

Positive (*n* = 22)	**Frequency (%)**
Correctly answered 7 of 10	16 (72.7)
Shared experience with class	6 (27.3)
Negative (*n* = 27)	**Frequency (%)**
Did not stay on topic	8 (29.6)
Turned away from gruesome injury	8 (29.6)
Expressed disagreement with unrelated regulation	6 (22.2)
Did not score well	5 (18.5)
Rationale given for score (*n* = 3)	**Frequency (%)**
Shows possible PTSD	3 (100)

Discussion

The findings of this study suggest a high degree of reliability in NCO ratings of MFAP task performance overall. This suggests that on average, the group of ratings were consistent and in agreement for the 10 vignettes. Evaluation of each MFAP task individually suggests that the level of agreement is acceptable for the WTBD, HEAT, LNP, LN, and TMS tasks.

The VCOT vignette included three iterations of the task where the Soldier served in varied roles. Specifically, the Soldier served as a 50 caliber gunner, a driver, and a vehicle commander. Multiple positive and negative cues were identified by the participants and the most consistent comment was with respect to the lack of experience of the Soldier described. The ability of participants to name multiple positive and negative cues suggests that the task

described may be too complex and require more detailed instructions for raters. Overall, the level of agreement for this vignette was fairly low.

The WTBD vignette described a Soldier leading drill and ceremony (D&C), as a Soldier in formation during the D&C event, completing a 50 m SKEDCO drag with casualty, completing 3-5 second rushes, and leading a group during PT. Army standards for these tasks are well known to all NCOs, and it is expected that an NCO could easily recognize whether execution is correct. Consistency in the rating of this task was acceptable and approximately half of the sample identified the same positive cue (performed to standard as PT leader) and the same negative cue (mistakes during D&C).

The EST – Shoot/No-shoot task described three scenarios completed by the Soldier. In the first scenario the Soldier hits 40/44 during a sector of fire drill. The second scenario consisted of a shoot/no-shoot judgment task in which a friendly was shot, and the third a shoot/no-shoot judgment task which was performed well by the Soldier. It is interesting to note that while three volunteers noted a negative response to the Soldier shooting a friendly, 13 comments in the response section stated that scenarios utilizing the EST 2000 can be set up as stressful events and mistakes will occur. In addition to using the EST 2000 for weapons qualification practice, many units (e.g., Military Police) use the simulator for training Soldiers in the stressful situations they may encounter. Consistency in ratings for this task was low.

The EST – WQ vignette described a Soldier zeroing their weapon and qualifying on a 40-shot qualification range. While many of the negative comments denoted shooting problems, a large proportion of participants noted the same positive cue. Consistency in ratings for this task was low.

The HEAT vignette described a Soldier instructing a 15-minute class on rollover crashes and procedures followed by three egress exercises in a simulated HMMWV (high mobility multipurpose wheeled vehicle) rollover while wearing protective gear. The Soldier served a different role in each exercise (e.g., TC, driver, medic). Consistency in ratings was acceptable and a large number of participants identified the same positive and negative cues for the task. Majority of the participants also cited inexperience in their comments.

The LNP vignette described a Soldier receiving classroom instruction, completing hands-on application, and completing a "check-on" learning exercise. It is interesting to note that the participants did not agree as to whether a particular cue was negative or positive. In the vignette, the Soldier completes the check-on learning exercise with a score of 80% correct. Ten of the participants cited this as a positive cue whereas four cited it as a negative cue. This may have affected the ratings, yet the level of agreement with respect to *pass/fail* was acceptable.

The LN vignette described a Soldier plotting three points, completing a pace count, and then locating all three points. Consistency in ratings was acceptable and majority of the participants identified the same positive cue (successful plotting) and same negative cue (assistance needed). Overall, the design of this vignette was simple in that the Soldier was successful with minimal assistance and the majority of all comments reflected that.

The MSTC-MCS vignette described a simulation task with three phases (increasing in realism and complexity) in which a Soldier provides medical care to lifelike mannequins. During the first phase the mannequins are set and do not move. In the second and third phase, the mannequins are programmed to move on their own. In Phase 1, the area is well lit, no smoke/fog, minimal pre-recorded combat sounds, minimal bleeding, and a static (non-moving) mannequin. In Phase 2, there is some fog, moderate volume of combat sounds, moderate bleeding, and a minimal kinetic movement (moving) mannequin. In Phase 3, the combat sounds are loud; there is maximum bleeding, maximum kinetic movement mannequin, no light beyond headlamp/flashlight, and visibility of 2 ft. The task is quite complex which may have contributed to low consistency in ratings. However, participants were fairly consistent in their identification of positive and negative cues.

The MSTC-TMS vignette described a simulated wartime scenario in which the Soldier and their armed (with paintball equipment) squad is ambushed and comes under fire. The squad must move casualties to a safe location. Consistency in ratings was low. Nearly half of the participants identified "loss of command and control" as a negative cue whereas four participants who identified this cue stated that the Soldier cannot be held responsible for insubordination. This lack of consensus with respect to leadership responsibility may have contributed to the ratings but did not appear to diminish agreement with respect to *pass/fail* outcomes below an acceptable level.

The TCCC vignette described classroom instruction of basic life support. The level of consistency in ratings was low, yet a majority of the participants identified the same positive cue. There were a large number of negative cues identified as well. Three participants cited signs of possible post-traumatic stress disorder as a negative cue.

Limitations and future studies

The findings in this report are limited given the lack of variability in the vignettes by task. Additional vignettes for each task would have yielded a richer dataset and allowed for additional reliability statistics to be calculated. The measure of average pairwise percent agreement for individual tasks is generally not recommended to be the sole statistic used to determine reliability but is appropriate as a supplement to the overall intraclass correlation coefficient computed. This study only evaluated the reliability of ratings by NCOs and future work further evaluating the reliability of the MFAP will need to address ratings from the OT, PT, and MH.

Conclusions

The results of this study support the reliability of ratings from the MFAP overall. However, evaluation of each individual task suggests an acceptable level of consistency in ratings for five of the tasks. This suggests that piecemeal administration of MFAP tasks may not at present be sufficiently reliable with respect to ratings. Reliability could likely be improved with efforts like more detailed instructions for each task.

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Appendix A: Demographics and TBI History Questionnaire

U.S. Army Aeromedical Research Laboratory

Demographic Data Form

Title of Protocol: *Evaluation of the Military Functional Assessment Program (MFAP): How reliable are subjective NCO ratings of Soldier performance*?

Instructions: Please answer the following questions.

Part I: Basic demographic data:

1) Rank Please specify E5 through E9: _____

2) Age What is your age? ____

3) MOS Please specify your MOS. _____

4) Service Are you (*please circle one*): **Active Duty**, in the **Reserves**, or in the **National Guard**?

5) Time How much **time in service** do you have? ____years

Part II: History of Head Trauma or Concussion

Have you ever been diagnosed with traumatic brain injury or a concussion? Yes **/** No *(circle one)*

If YES, was this head trauma classified as: **Severe** / **Mild** *(circle one)*

Was there more than one concussive event that occurred? **Yes** / **No** *(circle one*)

Did this/these event(s) occur while you were serving in the military? **Yes** / **No** *(circle one*)

Were you able to return to duty (RTD)? **Yes** / **No** *(circle one*)

If YES, did you receive rehabilitation before you were able to RTD? **Yes** / **No** *(circle one*)

Have you known anyone diagnosed with traumatic brain injury or concussion?

Yes / No *(circle one)*

If YES, was s/he able to recover and return to duty? **Yes** / **No** *(circle one)*

Appendix B: Task Instructions

The Military Functional Assessment Program (MFAP) is used to assist military and clinical professionals in determining Soldier readiness to RTD following mTBI. The program is a five-day evaluation including 10 military-specific tests of a Soldier's ability to perform basic military skills (e.g., marksmanship, first aid, land navigation, tactical maneuvers). NCOs rate Soldier performance during the MFAP using the rating scale provided below. During the tests, the NCO may provide verbal prompts (cues) or assistance to participants if necessary. For example, during the land navigation task, the Soldier may need assistance with plotting his/her points. Likewise, the Soldier may adapt or modify procedures to task completion. The amount of assistance required helps determine the Soldier's readiness (when more assistance is required the Soldier is less ready to return to duty).

Your job is to read the attached description of a Soldier performing one of the 10 tasks. Using the information in the description, you will then assign a rating or "grade." Please use the rating guidelines below. After providing the rating, you will list the "cues" or information from the description that you used to determine your rating, labeling whether the information is positive or negative (good or bad performance). There is also space for you to provide any additional comments.

The Soldier in each scenario has gone through an mTBI rehabilitation program for 12 weeks. The Soldier is performing the task while a moderator observes, intervening only if essential. The moderator, as used in the following scenarios, indicates the presence of an NCO on location who observed the Soldier's performance. The scenario will indicate when the moderator intervenes.

*	Independent; no adaptations: Soldier is able to complete all of the tasks making up the activity safely, without modification/compensations, and within reasonable time. No cues required. (Exceeds Army Standards).
*	Independent; with adaptations/modifications: Soldier requires increased time to complete tasks, use of compensatory strategies/techniques, indirect verbal guidance or gestural guidance. (Meets Army Standards).
*	Acceptable level of Assistance: Soldier requires no more help than direct verbal assistance or physical assistance. Soldier performs at a level that is acceptable based on rank/experience. Will benefit from additional training. (Marginally Achieves Army Standards).
**	Unacceptable level of Assistance: Soldier requires that a part of the task (<25%) be completed for them by clinician and/or Soldier performs at a level that is unacceptable based on his/her rank and/or experience. (Failed to Meet Army Standards).
**	Dependent: Soldier requires that 25% or more of activity be done for them by clinician. Soldier requires psychological intervention. Soldier unable to complete task due to physical restrictions/limitations. (Failed to Meet Army Standards).

*A rating of "1", "2", or "3" indicates *PASS*.

**A rating of "4" or "5" indicates *FAIL*.

Appendix C: Vignettes

Name: SPC Snuffy

Time in Grade: 1yr **Time in Service:** 3yr

MOS: 13F (Fire Support Specialist)

Age: 24

School/Deployments: Soldier has deployed once and has attended WLC.

Task: Virtual Convoy Operations Trainer (VCOT)

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).

Soldier was 50cal gunner for the first exercise. Soldier scanned 100% of his sectors of fire and engaged targets with accuracy eliminating a majority of enemy combatants. Soldier called out targets/weapons/activities prior to engaging. Soldier communicated SALUTE report to the VC.

Soldier was the driver for the second exercise. Soldier followed exercise protocol to maintain 25mph combat speed with slight variance. Soldier drove over two enemy combatants. Soldier identified and maneuvered around all potential IEDs during the exercise. Soldier did not communicate enemy combatants to his gunner. Soldier observed his unit TTPs for indirect fire by moving back and out of range until directed otherwise.

Soldier was vehicle command for the third exercise. As task difficulty progressed, the Soldier's response and decision making became delayed. Soldier misguided the driver by taking wrong turns and became lost. Soldier requested to take a break and walk outside the simulator to take a breath. Upon returning to the task, the Soldier required guidance from the TOC to get back on proper route. Soldier completed the rest of the mission successfully.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SGT Campbell

Time in Grade: 4yr **Time in Service:** 8yr

MOS: 88M

Age: 30

School/Deployments: WLC/2 deployments

Task: Warrior Tasks and Battle Drills

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).

Soldier led D&C. Soldier used command voice and performed 16/18 marching and movement drills.

When following D&C commands, Soldier was in step. Soldier demonstrated left turn instead of right movement on two occasions.

Soldier performed 50m SKEDCO drag with casualty. Following completion, Soldier donned gas mask (MOPP gear) in 12 seconds.

Soldier completes 3-5 second rushes. Soldier led group in bend and reach and forward lunge.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SSG Adams

Time in Grade: 1yr **Time in Service:** 10yr

MOS: 11B

Age: 32

School/Deployments: ALC, CLS/2 deployments

Task: Engagement Skills Trainer 2000 – Shoot/No-Shoot Scenarios

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.

Soldier completed a total of three scenarios.

In the first scenario, Soldier covered individual sector of fire. Soldier and squad hit 40/44 foe targets. Soldier performed SPORTS on malfunctioned weapon.

In the second scenario, Soldier completed shoot/no-shoot scenario of an IED blast. Soldier hit first target (man holding DOD badge/friendly). When scenario was paused and Soldier asked to justify firing at target, Soldier responded "He was yelling, I don't know."

In the third scenario, Soldier completed shoot/no-shoot scenario in which Soldier must identify foe targets amongst civilians in a village environment. Soldier did not engage until civilian targets were out of harm's way. Soldier and squad hit 7/8 foes and no civilians were hit.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SGT Spangler

Time in Grade: 1yr **Time in Service:** 7yr

MOS: 92Y

Age: 27

School/Deployments: WLC, CLS/1 deployment

Task: Engagement Skills Trainer 2000 – Weapons Qualification

In this task, service member must zero weapon on the EST 2000 and complete 40-shot qualification task.

Soldier was inconsistent in aim and sight picture and was able to zero the weapon. Soldier stated "I always qualify expert." Soldier hit 15/20 shots in prone supported. Soldier expressed dissatisfaction with performance and let magazine fall and hit the ground. In prone unsupported position, Soldier hit 5/10 shots. In kneeling position, Soldier hit 3/10 shots. Total qualification score of 23 classified Soldier as qualified as marksman.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: PFC Brown

Time in Grade: 4mths **Time in Service:** 1yr

MOS: 42A

Age: 19

School/Deployments: AIT, CLS/no deployments

Task: HMMWV Egress Assistance Trainer

This task includes a 30-minute class preparation on roll-over 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).

SOLDIER completed 30-minute course on potential causes of roll-over crashes and proper procedures in such an event. SOLDIER appeared attentive throughout instruction.

During first roll-over exercise, SOLDIER served role as VC. SOLDIER instructed group to egress following proper procedures. Moderator prompted SOLDIER to perform 0-5-25's. SOLDIER led group to follow out of vehicle. SOLDIER confirmed that all personnel and equipment was accounted for.

During second roll-over exercise, SOLDIER served as driver. Following 180 degree roll-over, SOLDIER did not check whether driver-side door is unlocked. VC instructed SOLDIER to check driver-side door. SOLDIER followed instructions of VC. Once unlocked door was located, SOLDIER followed rest of crew out of vehicle.

[Note: SOLDIER is blindfolded to simulate night-time conditions. Once out of vehicle, blindfold is removed] During final roll-over exercise, SOLDIER served as medic in rear passenger seat. Following roll-over, SOLDIER identified casualty (driver-broken leg). Soldier aided in moving casualty out of vehicle without causing additional injury/harm. Once outside, SOLDIER attempted to provide first-aid treatment. SOLDIER began tourniquet intervention on broken leg. Moderator prompted SOLDIER to re-evaluate treatment choice. Moderator offered suggestion of splinting broken leg to uninjured leg. SOLDIER performed this task.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SSG Jones

Time in Grade: 2yr **Time in Service:** 9yr

MOS: 19D

Age: 29

School/Deployments: CLS, ALC/2 deployments

Task: Land Navigation Prep

This task is composed of classroom instruction using PowerPoint slides and hands-on application (e.g., plotting points on map). During PPT, Soldier responded to Q&A midway through instruction. Specifically, Soldier raised hand and gave a correct answer. Soldier scored 8/10 correct responses on "check-on" learning post-exercise.

During application/activity/hands-on instruction, Soldier worked rapidly and attended to fellow participants and how quickly they are working. Moderator prompted Soldier to repeat 2 plot point locations. Soldier reviewed work with moderator. Soldier found that they had transposed latitude and longitudinal numbers. Soldier fixed error and plots point correctly. Soldier completed familiarization with compass.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SPC Johnson

Time in Grade: 2yr **Time in Service:** 4yr

MOS: 68W

Age: 23

School/Deployments: EMT course/no deployments

Task: Land Navigation

In this task, Soldier must execute a land navigation task including three points. Soldier received instructions and began preparation for task. Soldier plotted 3/3 points on map. Soldier completed pace count. Soldier found first and second points. While attempting to locate the third point, Moderator prompted Soldier to return to second point and re-assess pace count. Soldier followed prompt and found third point. Soldier returns to starting point to complete task.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SGT Anderson

Time in Grade: 2yr **Time in Service:** 6yr

MOS: 92A

Age: 26

School/Deployments: CLS/1 deployment

Task: Medical Simulation Training Center – Mass Casualty Scenario

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 lifelike 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" movements. Between phases, moderator gave review of good and bad points of performance.

In Phase 1 (Crawl), the area is well lit, no Soldieroke/fog, minimal pre-recorded combat sounds, minimal bleeding, and static (no movement) mannequin.

In Phase 2 (Walk), there is a moderate volume of combat sounds, moderate bleeding, minimal life-like movement mannequin, and some fog.

In Phase 3 (Run), the combat sounds are loud, there is maximum bleeding, maximum life-like movement mannequin, no light beyond headlamp/flashlight, and visibility of 2 ft.

In first phase (Crawl), SOLDIER talked to casualty and assessed level of consciousness and injuries. SOLDIER assessed injuries to include chest wound and leg amputation. SOLDIER began dressing chest wound. Prior to completion, SOLDIER switched tasks and began addressing leg amputation. SOLDIER returned to chest wound after finishing the leg amputation. Following completion of addressing all injuries, SOLDIER called up 9-line MEDEVAC.

In second phase (Walk), SOLDIER approached casualty and paused for 5 seconds. SOLDIER did not assess level of consciousness. SOLDIER began applying tourniquet to arm amputation. SOLDIER then moved on to dressing laceration to shoulder. Following completion of addressing all injuries, SOLDIER called up 9-line MEDEVAC.

In third phase (Run), SOLDIER found casualty. SOLDIER paused for 5 seconds while looking at casualty. SOLDIER assessed level of consciousness of casualty. SOLDIER applied tourniquet to leg amputation. SOLDIER began addressing burns on face. Bleeding continued on leg amputation. SOLDIER completed dressing burns and called 9-line MEDEVAC. SOLDIER did not return to tourniquet to check status/continued bleeding. Moderator prompted SOLDIER verbally to recheck all interventions until MEDEVAC platform arrives. SOLDIER returned to tourniquet intervention and stops bleeding.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SSG Jones

Time in Grade: 2yr **Time in Service:** 9yr

MOS: 19D

Age: 29

School/Deployments: CLS, ALC/2 deployments

Task: Medical Simulation Training Center – Tactical Mission Scenario

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.

Soldier is assigned as team leader for group completing task. Group is briefed on scenario. Scenario is a movement to treat casualties. Group begins to maneuver into the lane where they will make contact with enemy Opposition Force (OPFOR). Battle sounds including mortar fire and heavy machine guns. OPFOR fire paintball rounds at group. Two casualties are seen in lane. Soldier maneuvers element to suppress enemy fire to allow team members to move casualties to a safe location. Once moved, Soldier delegates tasks to address injuries of casualties.

Soldier communicates objective to squad. Soldier directs movement to casualties and instructs others to suppress fire. Soldier attempts to maintain squad members' focus on task. As task continues, Soldier observes squad members self-directing and diverting from command. Soldier attempts to give direction to squad members. After two attempts without change and squad members continuing to self-direct, Soldier proceeds to complete task of moving casualties to safe location individually. Soldier gains attention of 2 squad members. Soldier delegates treatment tasks to squad members. Both squad members focus on same casualty. Moderator prompts Soldier to redirect squad member to untreated casualty. Following completion, Soldier calls 9-line MEDEVAC.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

Name: SPC Smith

Time in Grade: 2yr **Time in Service:** 3yr

MOS: 11B

Age: 25

School/Deployments: CLS/1 deployment

Task: Tactical Combat Casualty Care

This task consists of classroom instruction on basic life support primarily using PowerPoint slides. Soldier responded to Q&A midway through instruction. Raised hand and gave a correct answer. Soldier turned away from gruesome image of injury during instruction. Soldier shared a deployment experience related to the instruction with the group. Soldier expressed disagreement with Army regulation changes unrelated to present topic. Soldier scored 7/10 correct responses on "check-on" learning post-exercise.

Rating: _____

Which cues or information influenced your rating? (copy text from above)

Positive:_____

Negative: _____

Comments:_____

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