REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
30/06/2015	Final	2012-2013

4. TITLE AND SUBTITLE
Development of a New Army Standardized Physical Readiness Test: Janurary 2012 through December 2013 (Public Release)

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Public Health Command, Injury Prevention Program, Aberdeen Proving Ground, Maryland, 21010-5403

8. PERFORMING ORGANIZATION REPORT NUMBER
PHR 12-01-0614

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES
The original document was released in 2014 with Limited Distribution; The USAPHC's 2012-2013 activities are part of a still-ongoing collaborative effort referred to as the Soldier Baseline Physical Readiness Requirements Study (SBPRRS). The U.S. Army Training and Doctrine Command (TRADOC) is the designated lead organization for the comprehensive Army study. The U.S. Army Medical Command (MEDCOM) has been tasked to support the planning and execution of the study. Authorization for public release was reecived by TRADOC and approved by APHC in 2015. Original file contains color images.

14. ABSTRACT
The primary objective of the SBPRRS is to recommend "a physical readiness test or tests that accurately predict Soldier performance of Warrior tasks and battle drills (WTBDs)." This report documents the key USAPHC activities and products completed during the 2012 – 2013 timeframe that were performed in support of the SBPRRS and the development of a new Army physical readiness test. Some materials prepared by other organizations (e.g., TRADOC) are included to provide relevant context. Other efforts conducted solely by collaborating organizations (e.g., TRADOC, USARIEM, or USUHS) are not included. For one of its SBPRRS tasks, the USAPHC has also published the associated Public Health Report (# PHR 12-02-0614) "Correlations between Physical Fitness Tests and Perfromance of Military Tasks: A Systematic Review and Meta-analyses", June 2014, DTIC accession # ADA607688 (public release).

15. SUBJECT TERMS
APFT, WTBD, task performance, health standards, fitness for duty, aerobic fitness, strength, baseline soldier study

INSTRUCTIONS FOR COMPLETING SF 298

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
			UU	126	Dr. Bruce H. Jones
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			19b. TELEPONE NUMBER (*Include area code)* 410-436-4655; Usarmy.apg.medcom-phc.mbx.injuryprevention@mail.mil

U.S. Army Public Health Command

Public Health Report

Development of a New Army Standardized Physical Readiness Test

January 2012 through December 2013

PHR No. 12-01-0614

General Medicine: 500A

June 2015

USAPHC

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Development of a New Army Standardized Physical Readiness Test
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1 Summary

1.1 Overview

From 2012 through December 2013 the U.S. Army Public Health Command (USAPHC) supported the Army's initiative to develop a new Army Physical Readiness Test (APRT). The APRT is intended to replace the existing Army Physical Fitness Test (APFT). The APFT includes a timed 2-mile run, 2 minutes of sit-ups, and 2 minutes of push-ups. Despite its existence since 1980, and numerous studies over the decades since, the association of APFT scores to one's physical ability to conduct critical military tasks has not been scientifically validated. The Army has now ordered efforts to ensure scientifically-defensible physical testing standards, to include specialties previously excluded to women (Department of the Army-Headquarters (HQDA) 2012a, HQDA 2012b, HQDA 2013).

The USAPHC's 2012-2013 activities are part of a still-ongoing collaborative effort referred to as the Soldier Baseline Physical Readiness Requirements Study. The primary objective of this study is to determine baseline Soldier physical readiness requirements and to recommend "a physical readiness test or tests that accurately predict Soldier performance of Warrior tasks and battle drills (WTBDs)." (HQDA 2012b) The U.S. Army Training and Doctrine Command (TRADOC) is the designated lead organization for the comprehensive Army study. The U.S. Army Medical Command (MEDCOM) has been tasked to support the planning and execution of the study. MEDCOM support is provided through subject matter expertise (SME) from the USAPHC and the U.S. Army Research Institute of Environmental Medicine (USARIEM). Additionally, the Uniformed Services University of the Health Sciences (USUHS) and the Superintendent United State Military Academy (USMA) have provided SME support.

The USAPHC 2012-2013 activities enhance the scientific evidence necessary to establish a relevant and a validated physical readiness test to support the Army goal to develop a new physical readiness test. The Army-wide comprehensive Soldier Baseline Physical Readiness Requirements Study (SBPRRS) is ongoing, and additional products will build on the products to date.

1.2 Purpose

This report documents the key USAPHC activities and products completed during the 2012 – 2013 timeframe that have resulted from USAPHC responsibilities and tasks to support the development of a new Army physical readiness test. Some materials prepared by other organizations (e.g., TRADOC) are included to provide relevant context. Other efforts conducted solely by collaborating organizations (e.g., TRADOC, USARIEM, or USUHS) are not included.

1.3 Results

Table 1 summarizes the activities and products described in this report. While the activities are presented as sequential efforts over time, some efforts occurred concurrently. The USAPHC is continuing to conduct various efforts described (e.g., systematic review, field studies) and intends to publish additional analyses in the future to provide scientific evidence in support of U.S. Army efforts to develop new physical readiness and performance standards.

Table 1. 2012 - 2013 Activities for the Development of a new APRT

TIMEFRAME	ACTIVITY	IN THIS REPORT
	References	**Appendix A**
	History of U.S. Army Physical Fitness Testing	Section 4.2 **Appendix B**
Preliminary review of impacts and validity of proposed APRT events		**SECTION 5**
January 2012	USAPHC reviewed selected proposed APRT events and associated impacts relative to injuries; prepared talking paper and white paper.	**Appendix C**
March-April 2012	TRADOC requested three groups of SMEs to evaluate the APRT that was to be implemented 1 October 2013 in order to advise decision-makers as to whether to implement the proposed 2012 APRT.	**Appendix D**
August 2012	HQDA organized a video teleconference with Army SMEs from TRADOC, USAPHC and USARIEM, to discuss plans to suspend implementation of proposed APRT pending a more comprehensive study.	Section 5 **Appendix E**
Gender Analyses of APFT and APRT events		**SECTION 6**
September-October 2012	USAPHC analyzed gender-related score differences for APFT and pilot APRT events (presented and discussed during initial October conference).	**Appendices F**, **G**
October 2012	USAPHC participates in TRADOC initial planning conference at Ft. Eustis, VA, also attended by USARIEM, USUHS, and others.	**Appendix H**
Study Plans and USAPHC Systematic Review		**SECTION 7**
November 2012	The TRADOC project lead presented study concept to the TRADOC Chief of Staff for approval – included five phases: first phase was a systematic literature review to be performed by USAPHC.	**Appendix I**
January–June 2013	USAPHC conducted preliminary assessment of Army-relevant tasks and initiated a Systematic Review of the scientific literature; provided interim findings of the review to TRADOC in June 2013.	**Appendix J** and **K**
Identifying Key Warrior Tasks and Battle Drills (WTBDs)		**SECTION 8**
April 2013	USAPHC SMEs participated in a blue ribbon panel sponsored by the National Strength and Conditioning Association and American College of Sports Medicine to rank military tasks and associated fitness tests.	Section 8.2 **Appendix L**
May 2013	TRADOC planning conference focused on deconstruction of various WTBD to identify essential components of physical fitness required to perform the tasks.	Section 8.3 **Appendix M**
May – July 2013	USAPHC provided SME support to TRADOC focus groups at Ft Jackson, SC; Ft Benning, GA; and Ft Leonard Wood, MO to obtain feedback from Soldiers regarding physical demands of key WTBDs.	Section 8.4 **Appendix N**
June 2013	USAPHC provided SME support to initial TRADOC pilot evaluation of proposed field events to simulate key WTBDs (Fort Jackson, SC)	Section 8.5
August 2013	TRADOC presented In-Process Review (IPR) briefing to stakeholders	Section 8.5 **Appendix O**
Fort Carson Investigative Field Study		**SECTION 9**
September 2013	USAPHC provided data collection and analysis support for the TRADOC field study at Fort Carson, CO where Soldiers performed a series of simulated tasks and associated events that represented major components of the essential WTBDs. [This report contains the TRADOC protocol for that field study, a description of the simulated field events and tasks, the ranked scoring of Soldiers perceptions of the physically-demanding tasks after their participation, and also results of the USAPHC analysis of the correlation of events, tasks, ad physical variables.]	Section 9.1 and **Appendix P** **Appendix Q** Section 9.3 and **Appendix R** Section 9.4 and **Appendix S**
Discussion and Conclusions		**SECTION 10**

2 References

See Appendix A for a complete list of reference information.

3 Authority

Under U.S. Army Regulation (AR) 40-5, Section 2-19, the USAPHC is responsible for providing support for Army preventive medicine activities, and to provide Army Commands (ACOMs) the epidemiological support necessary to address force health and readiness requirements. (Department of the Army (DA), 2007). For this study, the USAPHC- representing MEDCOM- is providing the SME support for the TRADOC Baseline Study by providing epidemiological support to better define the scientific relationship between physical fitness testing measurements and current military occupational task requirements as a means to better predict and prevent injuries to Army Soldiers. (HQDA 2012a, HQDA 2012b, HQDA 2013).

4 Introduction

4.1 Mission

The Army Institute of Public Health (AIPH) Injury Prevention Programs (IPP) mission is to identify injury causes or risk factors that can be used in evidence-based initiatives to prevent injuries. Specifically, the AIPH Injury Prevention Program seeks to identify scientific relationships between occupational, physiological, and environmental conditions and physical injuries amongst Army Soldiers through surveillance, epidemiological analysis, field studies, program evaluations, and systematic reviews. Performance on the APFT events has been a long standing measurement used in AIPH epidemiologic evaluations to assess the association between physical fitness and injuries. Defining the scientific relationship between physical fitness testing measurements and current military occupational task requirements is critical to understanding injury risk factors and identifying means to prevent injuries and thus improve overall Army readiness.

4.2 Background

U.S. Department of Defense (DoD) policy requires that “Individual Service members must possess the cardio-respiratory endurance, muscular strength and muscular endurance, together with desirable levels of body composition to successfully perform in accordance with their Service-specific mission and military specialty.” (DoD, 2004). The DoD policy does not define the specific tests or required thresholds for fitness measures; instead it indicates that such measures be tied to successful performance of Service-specific mission or specialty. Each Service establishes its own specific set of fitness tests and standards.

The U.S. Army has utilized various tests of physical fitness since as early as 1940 (See Appendix B). The current APFT was established in 1980 (DA, 2010). It includes a timed 2-mile run, 2 minutes of sit ups, and 2 minutes of push-ups. A Soldier’s scores for the APFT events are based on gender- and age-adjusted standards with a maximum score of 100 points on each event, combining to a maximum score of 300 (DA, 2009; DA, 2010; McCrary 2006). While the APFT has been shown to correspond to types of muscular and cardiovascular fitness (Knapik 1989; USACHPPM 2004, Sharp 1980), the basis for the APFT scoring standards is not entirely clear, in a 1998 inquiry by the U.S. Government Accounting Office (GAO); the Army Physical Fitness School indicated that modified scoring tables were to be implemented in 1999 (GAO, 1998). The revised standards’ minimum passing score was selected as the scores at which 8% of the males and 8% of

the females would fail the events. The maximum scores were the 90th percentile of the gender-based scores. Requirements were then "gradually reduced in 5-year increments as age increases." (GAO 1998).

Though numerous studies of different tests and regression models have been performed over the years; the association the U.S. Army's APFT events to military job task performance or overall readiness has never been scientifically validated (NRC 2006, Harman 2008, Leboeuf 2002, DoD 1999, GAO, 1998, Rayson 2000; Sharp 1980). Many national reports on this concern (NRC 2006, GAO 1998, IOM 1998, GAO 1996) indicate that the ability to meet the APFT standards may not adequately measure one's physical capability to conduct critical military tasks, much less ensure military physical readiness in critical land combat operations. In addition, the DoD and Services have received increasing pressure to ensure scientifically defensible physical testing standards, in particular for military occupational specialties (MOS) which have previously excluded women (HQDA 2013; NRC 2006; GAO 1998; NATO 1997, DOD 1995).

The U.S. Army has evaluated potential new physical tests over the last decade and a 2002 seven-event APRT was proposed though not implemented (U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), 2002). Most recently, a 2012 five-event APRT was proposed. This proposed 2012 APRT included a 60-yard shuttle run, 1-minute (min) rower, standing long jump, 1-min push-up with no rest allowed and a 2-mile run for time. A separate "Army Combat Readiness Test" (ACRT) was also conceptually proposed as a gender-neutral obstacle course field test for assessing task-related physical capability prior to combat deployments. The TRADOC conducted two pilot test evaluations of the APRT and ACRT on samples of TRADOC and U.S. Army Forces Command (FORSCOM) Soldiers. The Injury Prevention Program, USAPHC analyzed TRADOC data from these pilot tests to compare the performance of men and women on each of the test events and to evaluate the correlation of the test events to the three events comprising the current APFT. In August 2012, the Army Chief of Staff (CSA) suspended plans to implement the proposed APRT and ACRT on 1 October 2012 after SME evaluations indicated that the new tests had not been validated. The use of the 2012 APRT as a replacement of the APFT was considered premature. The CSA directed the execution of a more comprehensive scientific study of physical assessments to identify test events that would "more accurately predict Soldier performance of Warrior Task and Battle Drills." The study was also to provide a determination for the "threshold for success… for all Soldiers, independent of age or gender" (HQDA 2012a).

Many of USAPHC activities in 2013 were in support of the Soldier Baseline Physical Readiness Requirements Study (HQDA 2012a, HQDA 2012b, HQDA 2013). The USAPHC conducted these efforts in collaboration with TRADOC (including the TRADOC Initial Military Training-Center of Excellence (IMT-CoE), the U.S. Army Physical Fitness School (USAPFS), and the TRADOC Analyses Center (TRAC)) and SMEs from USARIEM, USUHS, and U.S. Military Academy (West Point). The study design established by TRADOC included five phases. The primary 2013 USAPHC activities included a Phase 1 systematic review of the scientific literature and technical and field support for aspects of Phase 2 (task even identification and selection). Phases 3-5 will involve efforts to evaluate specific tests and ultimately recommend to the VCSA a battery of physical assessments that a) encourages Soldiers to maintain health-related fitness and b) is associated with successful performance of the most physically demanding WTBDs.

5 Review of impacts and validity of 2012 APRT events, February- August 2012

5.1 Scope

Early in 2012, the USAPHC was requested to participate in discussions and provide input to the potential injury related impacts of proposed 2012 APRT and ACRT events. In August 2012, a video teleconference (VTC) organized by Army headquarters described responses of other SME reviews of the APRT. At that time, the USAPHC was made aware of plans to retain the existing APFT pending future tasks pertaining to a comprehensive physical requirements study.

5.2 Results

Appendix C contains the February 2012 USAPHC Talking Points and White Paper summarizing an assessment of injury concerns associated with various proposed events that had be suggested by the VCSA in media interview, including a 4-mile run and a 12-mile road march. In addition to citing increases in injuries with these events, USAPHC recommended that new tests should measure recognized components of health and operational fitness, be safe and easy to administer, and that training for the tests should enhance health-related fitness and minimize injury risk. A tiered approach for assessment of a base level of fitness and additional assessments according to occupational specialty and common military tasks was recommended.

Appendix D provides the USAPHC Executive Summary of the VTC held on August 2012. The discussion from the VTC was the prelude to the formal All Army Activities (ALARACT) 232/2012: Retention of the Army Physical Fitness Test and initiation of Baseline Soldier Physical Readiness Study (HQDA, 2012). This ALARACT formally cited the Baseline Soldier Physical Readiness Requirements study initiative and identified TRADOC as the lead.

Appendix E contains the external SME reviews of the validity of the proposed APRT and ACRT. The USAPHC was provided these reviews to help focus early discussions with the Study collaborators (i.e., TRADOC IMT-CoE, USARIEM, USUHS, USAPFS, and USMA). While the responses and recommendations were quite varied, there was general consensus that the proposed 2012 APRT could not be considered a 'validated' test and therefore was not considered an appropriate replacement to the existing APFT. While some concerns about the appropriateness or fairness of the proposed 2012 APRT could be equally stated about the current APFT, the SMEs recommended a more thorough, systematic, and scientific study that would culminate in recommending a validated battery of physical assessments that would encourage health related fitness and be associated with successful performance of physically demanding WTBDs.

6 Gender Analyses of APFT and APRT events, September - October 2012

6.1 Scope

The TRADOC IMT-CoE organized an initial planning conference at Fort Eustis in October 2012. For its role, the USAPHC had conducted epidemiological analyses of existing data sets that included male and female scores for APFT events as well as proposed APRT events for gender comparison.

6.2 Results

Appendix F and G provide the USAPHC analyses that were prepared for discussion at TRADOC's October 2012 initial planning conference. These analyses demonstrate the proportional differences of males and females that would pass the events in the current APFT and proposed APRT/ACRT using a "gender-neutral standard" with a 10% fail rate applied to the overall male and female scores combined. The 10% fail rate is similar to the existing 8% thresholds that were used to establish the score standards for the current APFT (GAO 1998). For the existing APFT pushup and 2 mile run events, a much higher percentage of females than -males who would fail. The sit ups, however, do not present a gender difference. Though more substantial gender differences are seen with the pilot APRT long jump and pull-up events, the gender impact is much lower for other proposed APRT events (e.g. rower, shuttle and 1/2-mile run (~800 yards)). This analysis demonstrates issues that will need to be considered when evaluating potential fitness assessments for the APRT if standards are to be gender-neutral. Certain events may be considered 'unfair' if they are not made gender specific. Other events, such as sit ups, rower, or short runs (shuttle, 1/2 mile) may be more "gender-neutral."

Appendix H contains the USAPHC EXSUM and briefing presented by the TRADOC lead at the initial planning conference. This presentation describes the overall context and planned goals of the Soldier Baseline Physical Readiness Requirements Study.

7 Systematic Review, November 2012 - June 2013

7.1 Scope

The TRADOC-lead presented the Baseline Soldier Physical Requirements Study concept brief to the CSA on 27 Nov 2012 (See Appendix I). The first phase of the study included a systematic review which was to be completed within 6 months after the initial study plan was approved. The systematic review was to be conducted by the USAPHC, with support from the USUHS. The purpose of the Systematic Review was to conduct a thorough review of the scientific and military literature to summarize the current state of the science as it pertains to the relationship(s) between performance of military tasks, physical fitness tests, and injuries. The review was also to include assessment of the differential effects of age and gender on these associations. The USAPHC was assigned lead for conducting the systematic review. Because the subject area of review was so broad, it was subdivided into four focused areas, each area being assigned to a team of SMEs at USAPHC and USUHS (see Table 2). A complete Systematic review, conducted in line with current scientific guidelines (Moher 2009, IOM 2011), would require well over a year of dedicated time and substantial resources from USAPHC and USUHS. Because the TRADOC timelines were constrained, an expedited review process was negotiated in order to provide interim findings to the TRADOC study team by June 2013. USAPHC and USUHS required additional time to complete the full systematic review and report the findings in a formal report and/or peer reviewed publication. The systematic review plan was finalized and approved in December 2012. The USAPHC was to provide a final briefing by June-July 2013.

Table 2. Systematic Review Subject Areas

Systematic Review Subject Areas		Assigned Personnel
1	Lab and Field Tests to Assess Physical Fitness	Tyson Grier, Morgan Anderson, Tim Bushman (USAPHC)
2	Comparison of Physical Fitness Tests to Job Task Performance	MAJ DeGroot and Veronique Hauschild (USAPHC)
3	Association of Task Performance and Injury	Keith Hauret and Elizabeth Clearfield (USAPHC)
4	Association of Components of Physical Fitness and Injury	Dr. Dianna Purvis, Dr. Pete Lisman, Dr. Sarah Delamotte, and Ms. Kaitlin Murphy (USUHS)

7.2 Method

The Systematic Review process was patterned after the PRISMA guidelines (Moher 2009; IOM 2011; Hemingway 2009) with scientifically supported adjustments for rapid reviews (Ganaan 2010). The databases used included: PubMed®, selected portions of EBSCOhost® (Academic Search Premier), Cochrane Methodology Register, MEDLINE® Biomedical Reference Collection, Comprehensive Nursing & Allied Health Collection, SportDiscus & SportDiscus Full text; CINAHL® & CINAHL Full Text, EMBASE®, and DTICEMBASE proved to be relatively difficult to apply search criteria but useful for specific article look-ups; it was also not completely accessible for free government access so was considered of limited additional benefit to this review. (PubMed is a registered trademark of the U.S. National Library of Medicine.) (EBSCOhost® is a registered trademark of EBSCO Publishing) (MEDLINE® is a registered trademark of the U.S. National Library of Medicine) (CINAHL® is a registered trademark of EBSCO Publishing) (EMBASE® is a registered trademark of Elsevier B.V.) Each subject area required determination on uniquely pertinent search terms but all areas used the following inclusion and exclusion criteria:

- **Document type**. Included were citable studies from military and non-military national and international sources; not included are editorials, presentations or abstracts, drafts or works-in-progress, or restricted or classified materials.

- **Dates**. Sources dated after 1970 up to the present 2013.

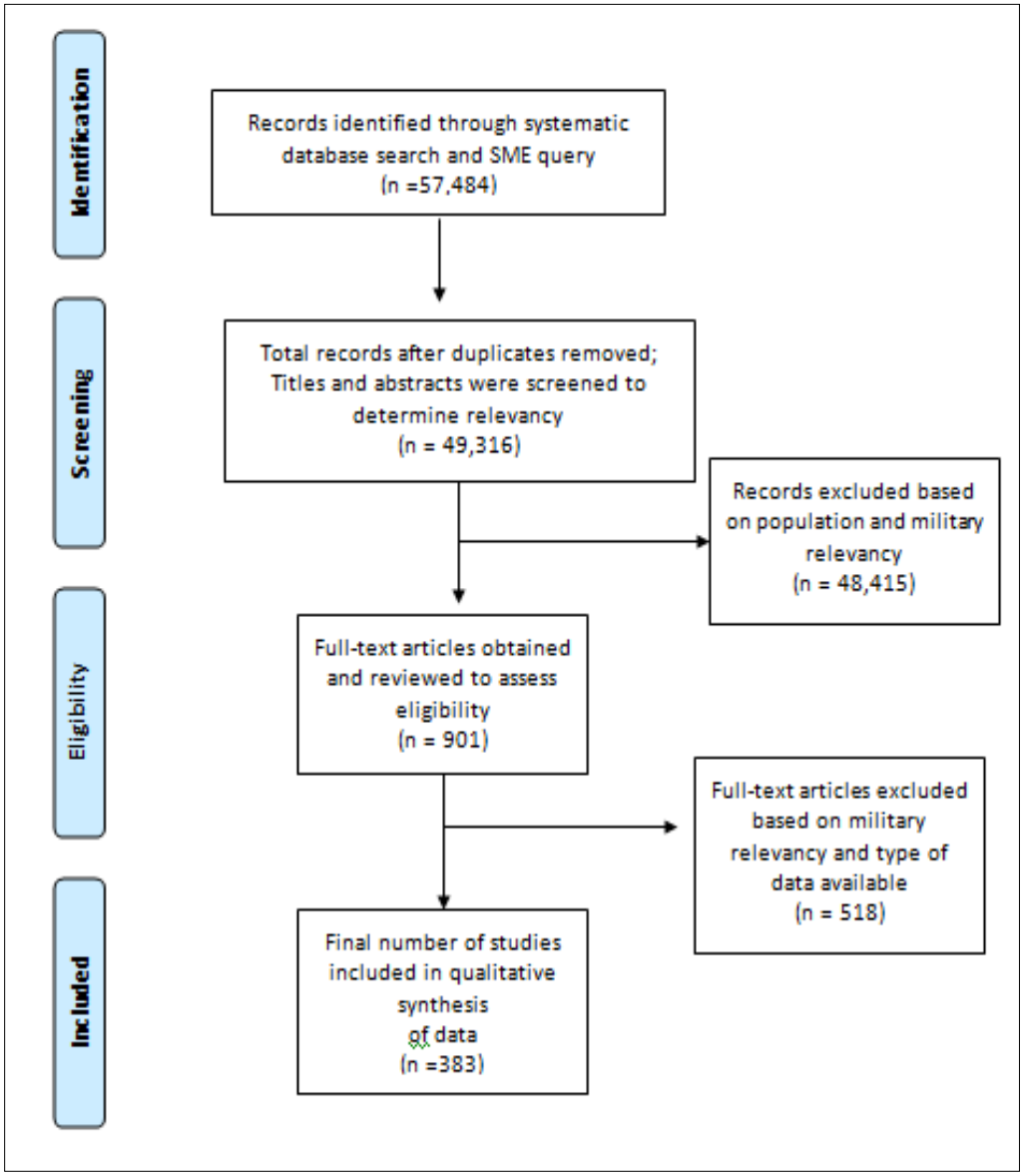
- **Language**. Only English language citations were used due to time and translation resource limitations.

- **Population characteristics**. Only human studies on healthy adults (> 18 $\leq$ 65 years) were included. Studies on children, infants, elderly, or disabled/ill persons were excluded, as were animal, in vivo, or theoretical biomechanical or engineering studies.

- **Military Relevance**. Because the literature review included a variety of studies of occupational populations (e.g., firefighters police, athletes, and other occupations), it was critical provide a construct determining what might be relevant to the military and especially the physical demands of Army Soldiers. A preliminary review of selected military-focus documents (e.g., NATO 2009; DA 2009) was used to identify types of common and relevant military physical tasks. Appendix J summarizes the findings of the preliminary review that served as a basis for determining inclusion and exclusion of articles during the systematic review process.

7.3 Results

Figure 1 demonstrates the breadth of the systematic review process. From over 57,000 articles and reports initially identified as potentially relevant at the start of the review, less than 400 (for all four subject areas) were determined to provide the specific kind of quantified correlation data necessary for the epidemiological evaluations of pertinent associations. Appendix K provides the AIPH IPP and USUHS interim findings of the systemic review efforts as of June 2013 which were provided to TRADOC in a July 2013 briefing.



* These numbers include all four subject areas combined

Figure 1. Results* of Systematic Review to Identify Pertinent Studies

8 Identifying Key Warrior Tasks and Battle Drills, May – August 2013

8.1 Scope

During the 3rd QTR FY2013, the AIPH IPP team supported the following initiatives associated with the assessment of physically demanding WTBDs that are required of Soldiers, and design of field events to simulate these WTBDs.

8.2 External SME Panel Discussion on Military Tasks and Fitness Tests

On April 18-19 2013, USAPHC SMEs participated in the national Strength and Condition Associations Blue Ribbon Panel on Military Physical Readiness: Military Performance Testing. The panel members ranked common military tasks and then rated the relevance of each of the health-related fitness components required to perform each task. The panel members then broke into groups to identify and rank a list of field expedient tests that could be used to measure Soldiers' abilities to perform these tasks. A summary of the results of the rankings are provide in Appendix L.

8.3 Deconstruction of WTBDs

In May 2013, USAPHC personnel participated in a workshop with the other study's SME collaborators to deconstruct the most physically demanding WTBD into sub-tasks and then identify the components of physical fitness required to perform these sub-tasks. A presentation (Appendix M) from this workshop provides descriptions of the various tasks of interest.

8.4 Focus Groups to Identify Key Physical Requirements and WTBDs

Focus groups of TRADOC Soldiers were organized by the TRADOC study lead (IMT-CoE) at three locations (Fort Leonard Wood, Fort Benning, and Fort Jackson) in May - July 2013. The purpose was to further support the findings of the May workshop (per Section 8.3) with additional insights from the field about conditions under which WTBDs are conducted and what baseline standards that every Soldier, regardless of gender or MOS, should be able to meet without special skills or training. The sessions were confidential and only basic demographic information about the participants was obtained. Each focus group began with a discussion lead by IMT-CoE staff on problems with the current APFT and the need to connect physical fitness testing with WTBDs. USAPHC provided personnel to facilitate, record answers to questions, and prepare summaries of the sessions. Appendix N provides a summary of the focus groups results and an example of the questions and responses received (from Fort Jackson, July 2013).

8.5 Selection of Field Simulation Events to Represent WTBD

The previous efforts culminated in the selection of field events that simulated the most physical demanding WTBD yet were feasible for testing large numbers of Soldiers in a standardized field setting. TRADOC's August 2013 in progress review (IPR) presentation (Appendix O) describes the basis for recommended field test events. These field simulations were first evaluated during a pilot field site visit at Fort Jackson later that month on 21-30 August 2013. The USAPHC supported this pilot test with a representative from both the Injury Prevention Program and the Ergonomics Program. Based on observations at Fort Jackson, some modifications to the field events were made prior to the official field study planned for Fort Carson, CO.

9 Fort Carson Investigative Field Study - September 16-26, 2013

9.1 Scope

The TRADOC field study at Fort Carson was designed to evaluate the feasibility of conducting the field simulations of the physically demanding WTBDs and common military tasks that were pilot-tested at Fort Jackson. The Army Human Research Protection Office (AHRPO) did an expedited review of, and approved, the study plan (see Appendix P). Relevant for this review, the study was operationally-directed, Soldier participation was voluntary, and personally identifiable information was not used to identify participants. To evaluate Soldier performance on the task simulations, an obstacle-type course was constructed. Stations on the course simulated 4 military tasks that were represented by 11 individual events. Table 3 describes the selected military tasks and the Fort Carson field events used to simulate those tasks. Appendix Q provides a detailed description of the field events and equipment loads.

Table 3. Fort Carson Tasks and Associated Individual Events

Task Name	Basis for Task	Field events to simulate *(see Appendix Q for details)*
Prepare Fighting Position	Common Soldier Task [a]	Bucket Fill Sandbag Stack
Move Over Under (around) and Through ("MOUT")	Elements of Key Warrior tasks ("Move" and "Survive")	Crawl and Ruck Sack move Balance Beam High Walls (wall gauntlet)
Perform Combatives	Elements of Key Warrior tasks [b] ("Move" and Survive"; Elements of Battle Drills (e.g., "react to contact", "react to indirect fire") [c]	Tire Flip Skedko Pull Sandbag Toss Trashcan Spin
Casualty Evacuation	Battle Drills (e.g., "perform combat casualty care") [b]	Extricate Casualty Casualty Drag

[a] DA, 2011
[b] See Appendix O

Two hundred and seventy Soldiers (15% female) volunteered to participate. Volunteers were tested in six groups (three groups each for 2 weeks). All volunteers were given an opportunity to familiarize themselves with individual events on the day prior to the official start of the test study. For the test study, Soldiers times for tasks and events were measured on 3 consecutive days. On test Day 1, Soldiers wore only the basic Army Combat Uniform (ACU), and were first timed for each individual event completed in random order. Time to rest was allowed between events and no overall course time was measured. Next, Soldiers went through the tasks and events in the established sequence of the obstacle course. Time to rest was allowed between events and no overall course time was measured. On Day 2 and Day 3, Soldiers were timed as they executed each event sequentially through the course. On Day 2, they wore the ACU and additional fighting gear ("Fighting Load") to perform the tasks. On Day 3, they also completed a 10-kilometer (km) (6.2 mile) road march wearing their sustainment load, and then completed the series of field events wearing their Fighting Load. Each day as Soldiers finished the course, a study team member asked each Soldier to identify the three most physically demanding events and recorded these responses for later analysis. On Day 3, Soldiers completed a brief survey regarding their experience in performing the simulated WTBDs.

The USAPHC provided on-site personnel to assist with daily data collection and entered all data into databases for analyses. The data collected included gender, body weight, height, and self-reported AFPT scores, daily times for Soldiers to complete each of the events/tasks, overall times to complete the course, Soldiers' daily responses about the most physically demanding events, and the survey responses from Day 3. The data analysis by the AIPH IPP team included a summary of Soldiers rankings of the most physically demanding events and tasks, and an examination of the correlations among the different field events, correlations of Soldier APFT performance and the field events, and correlations of the road march timed performance and the field events.

9.2 Ranked Scoring of Difficult Tasks

After completing the sequential events and tasks each day, Soldiers were asked to rank the three most physically demanding events for that day. Some Soldiers listed only one or two events, rather than three, on a given day. Therefore, the top ranked event for each day was considered most informative. Rankings for all groups over the 2 weeks were tallied together and percentages of ranks for individual events, as well as composite (task) events, were calculated for each of the 3 test days. These percentages provide a basic descriptive assessment of Soldiers' perceptions of these tasks. Anecdotal comments were documented to provide additional insights as to difficulty of performing the various events. Table 4 summarizes results of the composite and individual events and comments. Appendix R includes the detailed daily rankings of perceived most difficult tasks.

- The Perform Combatives task was consistently identified as the most difficult and physically demanding. This task was comprised of four individual events of which the Skedco Pull was consistently identified as the most physically difficult. The next most difficult ranked task was the Casualty Evacuation, which was represented primarily by the Casualty Drag event. The Skedco Pull and Casualty Drag both measured a Soldier's physical capability to drag an injured Soldier some distance, and thus may be considered duplicative test events.

- While trends in ranked scores were similar each day, some notable changes occurred:

  - The Prepare Fighting Position task (specifically the Sandbag Stack event) was ranked as most difficult by 35% of Soldiers on Day 3 after the Road March, as compared to only 15% and 20% on Days 1 and 2.

  - Soldiers reported all events seemed less difficult by Day 3 despite overall fatigue. From day to day, there may have been a task familiarization effect, since many Soldiers specifically stated that previously difficult events such as Skedco Pull, Trashcan Spin, and Casualty Drag actually seemed easier by Day 3 due to their familiarization with the task.

- Across tasks, fatigue was not always the reason given for "difficulty."

  - More problematic were environmental conditions (e.g., on Day 1 wet sand made the sand bags heavier; wet ground made it difficult to get good footing for the Skedco Pull, and Trashcan Spin; and equipment hindrance. Specifically, the body armor and ammo pouch worn on chest was in the way during Sandbag Stack of the Prepare Fighting Position Task, and was also in the way for shorter persons during the High Walls/Wall Gauntlet of the MOUT task. For some Soldiers, the slung weapon was in way especially for certain events such as Trashcan Spin.

  - On the other hand, some of same factors were noted as reasons that certain tasks/events became easier. For example, some Soldiers indicated the Low/HighCrawl, Skedco Pull, and

Trashcan Spin were easier on wet ground. Some Soldiers with shorter stature noted that addition of the fighting load made Skedco Pull seem easier.

- On Day 3, some Soldiers noted that the Road March was difficult due to blisters and discomfort from the boots.

- Finally, while rankings from females were not gathered separately for analyses, anecdotally it appeared that concerns cited by some women were due more to their shorter/smaller stature (height and weight). Some of the same concerns were reported by shorter men. Taller/larger women did not have the same problems. Thus, the equipment issue described above appears to be more of a problem for 'shorter Soldiers' as opposed to being gender-specific. Other specific anecdotal comments are at the end of Table 4.

Table 4. Top Ranked Most Physically Difficult Field Events

Soldier Tasks[a-c] and Associated Events	Day 1 ACU Only	Day 2 Fighting Load	Day 3 Fighting Load, After 6.2 mile Road March
Prepare Fighting Position [a]	**15%**	**20%**	**35%**
Bucket Fill	3%	2%	4%
Sandbag Stack	12%	18%	30%
Move Over–Under- Around- Through (Move O-U-A-T) [b]	**6%**	**19%**	**14%**
Crawl and Rucksack Move	1%	4%	3%
Balance Beam	0%	0%	0%
High walls (wall gauntlet)	5%	15%	11%
Perform Combatives [b, c]	**56%**	**46%**	**51%**
Tire Flip	8%	13%	13%
Skedko Pull	31%	23%	33%
Sandbag Throw	4%	2%	1%
Trash Can Spin	12%	9%	4%
Casualty Evacuation	**23%**	**15%**	**20%**
Casulty Drag (mannequin)	23%	15%	20%
Ruck March*			15%

NOTES: [a-c] are bolded as they represent the tasks, while non-bolded are associated events

[a] Specified as a "Common Soldier Task", Soldier Training Publication (STP) 21-1-SMCT *Soldiers Manual of Common Tasks* (May 2011)

[b] Represent elements of key "Warrior Tasks" [e.g., 'Move'(perform individual movement technique), 'Survive'(react to man-to-man contact)]

[c] Represent elements of "Battle Drills" (e.g., 'react to contact', 'perform combat casualty care', 'react to indirect fire',)

Anecdotal Soldier comments regarding compliant/concerns for various events:

Bucket Fill: Too many buckets to fill (too long of an event); wet sand made it much more difficult; event was very hard on back

Sandbag stack: Too many bags to fill (too long of an event); equipment (ammo pouch) was in way of lifting (especially noted by shorter persons); sand bags much heavier when wet

Ruck sack move: least difficult (physically demanding) event, but crawling on wet ground (grass and dirt) was easier than when ground was dry; event was more difficult with gear, after road march with tired legs; equipment (ammo pouch) got in the way

Balance beam: Not difficult, but some commented that this was NOT the correct technique for carrying the M249 SAW.

Tire flip: Event became easier with improved technique by Day 3; but lower extremity fatigue after the road march was a factor; caused pain in the back for some Soldiers.

Skedco Pull: Majority felt this was most the physically demanding event, but it was easier for many when grass was wet, even though bags inside were heavier when wet; some persons (shorter, lower weight) indicated the event was easier when wearing more gear (Fighting Load) and more so by Day 3 (due to load and technique)
Trash can spin: Can was heavier when wet; many said it was much easier by the last day (sand was drier, but also they had learned 'technique')**;** several felt that trash can rotation event was a strange, poorly designed 'test' and was hard on the back.
Casualty Drag: Many considered this to be more physically demanding than the Skedco Pull , but noted it may seem especially hard because this event was at very end of course; slippery ground made it harder to get footing; many said the event was easier on last day (technique/more practiced)
Road March: Not intended to be a ranked event, as only on Day 3, but some said it was the hardest event that day – not necessarily "physically demanding" but physically difficult e.g., blisters were a common reason (from boots and weight); some stated they thought 10 km was too long distance.

9.3 Correlation Analyses

Obstacle course times were collected individually for each event on the first day and as continuous time stamps on the second and third days of the study. The continuous times were broken into individual event times by taking the difference between consecutive events. All event times were converted into fractions of minutes. Additional Soldier data were collected by study staff (i.e., height, weight, and self-reported most recent APFT results. Body mass index (BMI) was calculated as a Soldier's weight in kilograms divided by the Soldier's height in meters squared. SPSS version 19 (IBM) was used to calculate Pearson correlation coefficients for the variables of interest. Bivariate correlation tables with a two-sided test of statistical significance were constructed. Though it is recognized that various limitations in study design prevent substantial conclusions to be drawn from the data collected, Pearson correlation matrices were prepared for the following three types of data correlations:

- Correlation of the individual events and tasks (measured as "time to complete events/tasks") and physical variables (weight, height, BMI and self-reported APFT scores). Correlation matrices were prepared separately for female and male Soldiers, for each day.

- Correlation within the individual events and tasks (measured as "time to complete event/task"). Matrices were prepared using all available data and not separated by gender.

- Road March (only conducted on Day 3) as correlated to the physical variables and APFT scores, and other field events and tasks

Appendix S includes the correlation matrices of the resulting correlation values. Though limited interpretation of the correlations can be drawn, general observations and conclusions are presented below. To summarize data, statistically significant Pearson correlation (*r*) values greater than 0.4 (for positive correlations) and less than -0.4 (for negative correlations) were considered noteworthy. This criterion was selected due to the expected variation and confounding in these types of associations. Correlation values above 0.4 or below -0.4 were grouped in categories of Very high (≥0.7 or ≤-0.7); High (≥0.5 to < 0.7 or ≤-0.5 ≥-0.7); and Moderate (≥ 0.4 to 0.5 (≥ -0.4 to ≤ – <0.5) for general ranking and discussion purposes.

9.3.1 Task and Event Correlations to Soldiers' Physical Variables

Table 5 provides a summary of the correlations presented in Appendix S, Tables S1-S6.

- For females, height and weight had the strongest correlation to all tasks except for the MOUT. Specific events such as the Sandbag Stack and Skedco Pull were highly correlated with height and weight in a negative relationship: as height and weight decreased, time to complete

these events increased. BMI had lower correlations to both tasks and events. APFT variables had low correlations to all tasks, with some moderate correlation between Sit Ups and the Tire Flip and Casualty Drag events.

- For males, no physical variables (weight, height, BMI, or APFT event/scores) had any noteworthy correlations with any events or Tasks (all r values were Low, <0.4 or >-0.4

Table 5. Summary of Task and Event Correlations to Soldiers' Physical Variables

FEMALES	**Weight**	High correlation with Prepare Fighting Position task time for Day 1 and 2, and Moderate for Day 3 (Fighting Load after Road March). High correlation with Sandbag Stack event (part of the Prepare Fighting Position Task) for Days 2 and 3, and Moderate for Day 1. Moderate correlation of Perform Combatives Task on Day 1 in ACU; Low correlation for this task for Days 2-3 when in Fighting Load. However, there was a High correlation with the Skedko Pull on all 3 days. Moderate correlation with Casualty Evacuation Task on Day 3, Low on Days 2 and 3. Low and non-statistically significant correlation to MOUT task on all days.
	Height	Moderate correlation with Prepare Fighting Position task for all days Within this task, high correlation to Sandbag Stack event for all days High correlation of Perform Combatives Task on Day 1 only, Moderate on Day 3; Low on Day 2. High correlation for Skedko Pull event time on Days 1 and 3, Moderate on Day 2. High correlation to Casualty Evacuation Task on Day 1, Moderate on Days 2 and 3. Moderate correlation due to Extraction event and not Drag.
	BMI	Moderate correlation with time to complete Prepare Fighting Position task. Low correlation with all other Tasks and individual events.
	APFT	Low correlation to all Tasks on all days. Moderate correlation to Tire Flip and Casualty Drag events on Day 3 (Fight Load with Road March); Low correlation to all other individual events, and none of these correlations were statistically significant*
	Sit Ups	Low Correlation to all tasks; none were statistically significant Moderate correlation with Tire Flip and Casualty Drag events on Day 3 (Fight Load with Road March); Low correlation to all other individual events except for a moderate positive correlation between number of sit-up reps and the amount of time it took for a Soldier to reach the vehicle door where the casualty dummy was positioned.
	Push ups	All correlations were Low and not statistically significant, except for a moderate negative correlation between push-up score and balance beam time on Day 2.
	Run	All correlations were Low, except for Moderate negative correlation between APFT Run Time and time to complete the Casualty Drag event on Day 3.

Table 5. Summary of Task and Event Correlations to Soldiers' Physical Variables (continued)

MALES	No noteworthy (all Low <0.4 or >-0.4) correlation between weight, height, BMI, or APFT related variables or associated Tasks, regardless of ACU/Fighting Load, or prior completion of a 10-km Road March.

Notes:

(-) Correlations are negative (e.g., higher weight/height/BMI/ Scores/Reps= less time in Task or event)

* One event included in analyses was referred to as the "vehicle door" as part of Casualty Evacuation; all correlations were Low for this event except with Female sit up reps – which is a moderate positive correlations. Since it is not clear that the same activity was timed for this event for all days it is not considered a key event or finding

9.3.2 Task to Task and Individual Event Correlations

Table 6 provides a summary of the correlations presented in Appendix S, Tables S7-S10.

- On Day 3, the strength of correlation between all Tasks is High to Very High.

- MOUT had no noteworthy correlation to any other tasks on Day 1; however, the highest task-to-task correlations are between MOUT and Performing Combative Tasks on Day 2 and Day 3.

- Of all individual events, the Sandbag Stack, which was part of the Prepare Fight Position task, had the strongest overall correlation to all tasks. This was particularly notable on the day Soldiers complete the obstacle course in their Fighting Load (Day 2): the correlations of this event to other tasks are High or Very High.

- The Skedco Pull was the next most highly correlated individual event (each day) to other tasks, followed by Casualty Drag. These events tend to have High to Very High correlations to each other as well as several other events.

9.3.3 Road March Correlations to Physical Variables, Tasks, and Events

The full correlation matrix is for Road March correlations are presented in Appendix S, Tables S11 and S12.

- Taking into account male and female Soldiers together, time to complete the 10-km Road March was highly correlated with Soldier's height, weight or BMI.

- The only noteworthy correlation was between Road March time and the self-reported 2-mile run time, and this was a positive low correlation. Those with faster 2-mile run times also had faster Road March times.

- Including the entire cohort in the analysis, Road March time had a low correlation only with the Fighting Position task time, in particular, the Sandbag Stack event. Separating the analysis by gender, the correlations between the Road March time and the time to complete these events was low (not noteworthy).

Table 6. Task to Task Correlation Results

Day 1/Soldiers Wearing ACU, Events Performed in Random Order				
	Fight Pos	**MOUT**	**Combat**	**CasEvac**
Fight Pos	1	0.32	**0.60**	**0.50**
MOUT		1	0.39	.31
Combat			1	**0.66**
CasEvac				1
Day 1/Soldiers Wearing ACU, Events Performed in Sequence				
	Fight Pos	**MOUT**	**Combat**	**CasEvac**
Fight Pos	1	0.22	**0.66**	**0.68**
MOUT		1	**0.43**	**0.66**
Combat			1	**0.59**
CasEvac				1
Day 2/Soldiers Wearing Fighting Load, Events Performed in Sequence				
	Fight Pos	**MOUT**	**Combat**	**CasEvac**
Fight Pos	1	**0.72**	**0.73**	**0.68**
MOUT		1	**0.82**	**0.66**
Combat			1	**0.63**
CasEvac				1
Day 3/Soldiers Wearing Fighting Load, Events Performed in Sequence After 10-km Road March				
	Fight Pos	**MOUT**	**Combat**	**CasEvac**
Fight Pos	1	**0.708**	**0.69**	**0.619**
MOUT		1	**0.75**	**0.659**
Combat			1	**.723**
CasEvac				1

Legend:
Fight Pos= Prepare Fighting Position
Combat = Perform Combatives
CasEvac = Casualty Evacuation

NOTE: Correlations greater than 0.4 (for positive correlations) and less than -0.4 (for negative correlations) were considered noteworthy and are bolded. Correlations were grouped in categories of Very high (≥0.7 or ≤-0.7); High (≥0.5 to < 0.7 or ≤-0.5 ≥-0.7); and Moderate (≥ 0.4 to 0.5 (≥ -0.4 to ≤ –<0.5). Darker shading indicated strongest correlations. The changes in strength of these correlations should not be overly interpreted. This data merely demonstrates some consistent correlations between certain tasks over days. The significance in changes in correlation strength may not be significant or could be due to a variety of factors (e.g., learning technique, equipment, fatigue, changes in motivation) that were not measured here.

9.3.4 Conclusions From Correlation Data

Pearson correlation coefficients tell us if there is a linear relationship between two variables; in this study we looked at both 1) the relationship between time to complete events/tasks and Soldier variables such as height, weight, BMI and fitness variables and 2) the relationship between time to complete one event/task with the time to complete all other events/tasks.

The first set of correlations gives us insight on how Soldiers with different body types and fitness levels performed on this obstacle course, and how they potentially would perform, in terms of time to completion, on a future APRT that incorporated some of these events. For men, none of the body or fitness characteristics had notable correlations with time to complete the various events and task, and for women, height and weight had negative correlations events. For the women in this study, those who were shorter and those who were heavier generally took a longer time to complete events and tasks.

The second set of correlations of each task and event with each other task and event provides information about how similar or dissimilar the times were to complete the events. A high correlation indicates that for the Soldiers in the study, the time to complete one event was similar to the time to complete another event. Combining these correlation coefficients with anecdotal evidence (e.g., from the Soldiers rankings and comments described in Section 9.2), it may follow that tasks or events that are highly correlated may have incorporated similar physical skills or exertion. However, it should be noted that if for one event a Soldier was working hard for 4 minutes and another event that Soldier rested for 3 minutes and worked for 1 minute, a high correlation would still be noted. Quantified data was not collected to ascertain this level of individual variation.

We saw changes in the correlations of certain tasks (in particular, the MOUT task) from Day 1, when the Soldier wore only ACUs to Day 2 and 3, in that correlation coefficients were notably higher on Day 2 and 3. While the reason for this change could be related to or influenced by several possible factors (e.g., learning technique, fatigue, motivation, and/or equipment), this correlation analyses cannot be used to provide a reason for this change, as we did not collect data on learning technique, motivation, or effect of the equipment. Fatigue data was collected in the form of asking the Soldier their rated perceived exertion, but these data were not incorporated into the correlation analysis.

10 Discussion and Next Steps

This PHR is intended to serve as a foundation reference for future USAPHC, TRADOC, and Army efforts to establish a new Army physical readiness test. The information provides an understanding that though the existing AFPT is not a validated test, additional work and documentation is necessary to provide clear justification of a new test. Some of initial findings include:

- The current fail points for the APRT events reflect gender-based standards. If the cut-off for failing the APFT pushup and 2-mile run was not adjusted for gender, a much higher percentage of females compared with the percentage of males would fail. The sit ups do not present this gender difference. The gender impact is much lower for some new proposed events (e.g. rower, shuttle and ½-mile run (~800 yards)). This suggests that use of certain events as a fitness standards may be considered ‘unfair’ if they are not made gender specific. Other events, such as sit ups, rower, or short runs (shuttle, ½-mile) may be more “gender-neutral.”

- Review of literature, Focus Groups of Soldiers, and SME recommendations has helped to identify key common Army-required physical task capabilities most critical to military operations. Specific tasks of interest include:

  - Moving short distances quickly, with varying amounts of weight or load, and including over walls and obstacles. Load Weight is a key factor as to ability – focus group responses noted concerns with slower speeds especially while sprinting, marching, crawling, and climbing over obstacles when loads exceeded 35-40 pounds.

  - Lifting, lowering, carrying, dragging items (e.g., lifting, carrying, dragging sand bags and casualties). Digging (e.g. sand or dirt to fill and carry sandbags) pertains to the task "Prepare Fighting Position" which is still considered a reasonably anticipated task. To some extent lifting weights 25-40 pounds was noted at reasonable expectation by focus groups while heavier weights less likely to be 'baseline Soldier' requirements (or could be conducted by more than one Soldier).

- Despite study design limitations during the Fort Carson field study, self-reported perceptions of the events requiring highest physical demands as well as some correlation data provide some useful information regarding these task and associated events or activities:

  - Performance of tasks that require lifting, carry, and dragging (of items and casualties) are highly correlated to each other. Several individual events are also correlated to certain tasks that they are not a component. Therefore, a test of physical capability that is correlated to one task may be used to represent capability of one or more of the other tasks. Key task of greatest interest from activities in this report include the Sandbag Stack of the Prepare Fighting Position task and the Skedco Pull form the Perform Combatives task.

  - Self-reported ranking of perceived physical difficulty with tasks and events did support some correlation findings. The Skedco Pull, along with Casualty Drag, was ranked as the most physical demanding events of those evaluated.

  - For females, height and weight appear to be key differentiating factors to correlations with certain tasks and events. There were no noteworthy correlations to any tasks with APFT scores. For males, no noteworthy correlations were noted for any physical variables, or APFT scores with tasks and individual field events.

  - Though correlations only showed it with females, both shorter men as well as women reported notable difficulties with completing the Sand bag Stack once they were wearing Fighting Load. This was described as due to equipment designs (e.g., the ammo pack) which hindered movement.

- Consideration should be given to how specific tests may increase training injury risk (for example, increasing the 2-mile run to 3 miles, or including a long road march could increase risk of lower extremity injuries).

- Some physical fitness tests result in much higher percentages of males passing if scored against a single standard. This includes the current 2-mile run and push-ups. For other tests (e.g., sit ups or proposed tests such as rowing or sprints) there appears to be less gender bias.

- While fitness tests have been associated with different aspect of fitness (cardio respiratory endurance, muscular strength, muscular endurance), and while certain tasks have been

described as been associated with one or more of these fitness components, the association of the test to the Army's current key physical tasks has not been scientifically documented. Data that specifically evaluates this relationship will be published as a result of the ongoing systematic review.

The USAPHC AIPH Injury Prevention Program is currently continuing efforts to compete and publish supporting reports regarding the results of our systematics reviews.

11 Point of Contact

The Injury Prevention Program is the point of contact for this project, 410-436-4655, DSN 584-4655.

APPENDIX A

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APPENDIX B

History of U.S. Army Physical Fitness Testing

Though the current APFT was established in the 1980s, there were many different tests prior that time, and proposals and review for change since then prior the current 2011-2012 proposed tests. This Appendix documents slides from a presentation prepared by Dr. Whitfield (Chip) East, Department of Physical Education - United States Military Academy (West Point). The Table summarizes the tests identified in his slides.

History of Army Physical Readiness Training & Assessment

World War I – The Princeton Years

- Chairman/Professor of Hygiene and Physical Education
- Introduced mass athletics - sports into training camps
- Mass Physical Training (1919) – approved by Army War Dept

Individual Efficiency Test (IET)

- ✓ Based upon lessons learned from WWI
- ✓ Five-item combat readiness battery
  - 100-yd run
  - Running Broad Jump
  - 8' Wall Climb
  - Hand grenade Throw
  - Obstacle Course Run

Joseph Raycroft

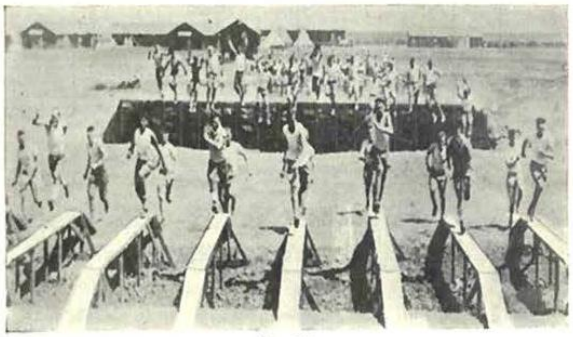


FIG. 120.

Interwar Years (1920 – 1942)

Physical Training, Basic Field Manual - BFM (1936) – Volume I – Chapter 4.

Physical Training, Field Manual - FM 21-20, (1941): recommended a myriad of fitness tests designed to assess combat readiness.

Primary Assessments

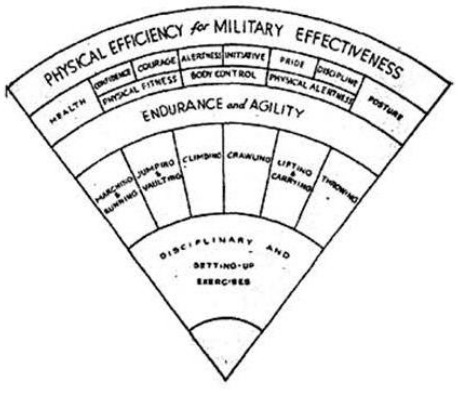
- 100-yd Dash
- Running High Jump
- Running Broad Jump
- Pushups
- OCT – Obstacle Course Test

Individual Efficiency Test (IET)
- 100-yd run
- Running Broad Jump
- 8' Wall Climb
- Hand grenade Throw
- Obstacle Course Run

Secondary Assessments

- Baseball Throw
- Basketball Throw
- Bar Vault
- ¼ mile run
- ½ mile run
- 2 mile walk
- Vertical jump
- Pull-ups
- 20' rope climb
- Stand/Run hop-skip-jump
- Standing backward jump
- Running long dive

FM 21-20 (1941)



Kelton's Outcome Assessments

- scale a 15' wall without instruments
- vault a horse 15 hands high
- leap a ditch 10' wide
- run a mile in 8 min or two miles in 18 min
- walk 4.5 miles in one hour
- walk 3 miles/hour with 20 lb knapsack (arms and equipment)
- swim a mile and repeat
- dive and swim underwater for 45 sec
- dive head foremost from a height of 8 feet
- leap into the water from a height of 20 feet
- demonstrate proficiency in use of the foil, sword, and bayonet

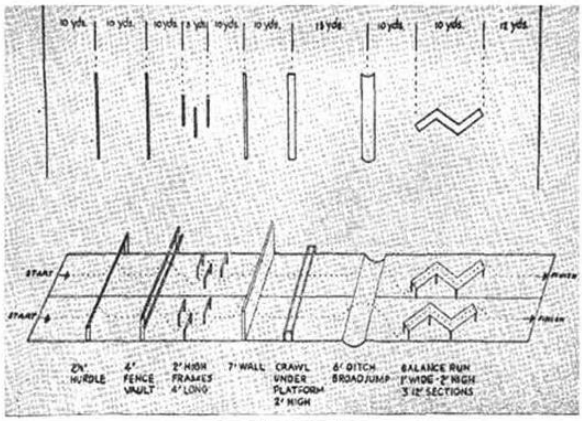


Figure 17.—Obstacle course.

World War II

- **7 December 1941 – Pearl Harbor**
- **1942 – Army Ground Forces Training Directive**
  - ✓ Army Ground Forces (AGF) Test
  - ✓ "highly encouraged"
  - ✓ Contained six (6) events:
    - Pushups
    - 300-yd Shuttle Run
    - 20-sec Burpee Test
    - 70-yd Pig-a-back Run (carrying Soldier of equal weight)
    - 70-yd Zig-zag Run(creep, crawl, jump, run)
    - 4-mile Road March

World War II

Physical Conditioning (DA Pamphlet 21-9, May 1944)

- ✓ Physical Efficiency Test Battery- PETB replaces AGFT
- ✓ First time use of normative scales (0-100)
- ✓ PETB was designed to measure the "man's total score"
- ✓ Contained seven (7) test events:
  - Pull-ups
  - 20-sec Burpee Test
  - Squat Jumps
  - Pushups
  - 100-yd Pig-a-back Run
  - Sit-ups
  - 300-yd Shuttle Run

AGFT
- Pushups
- 300-yd Shuttle Run
- 20-sec Burpee Test
- 70-yd Pig-a-back Run
- 70-yd Zig-zag Run
- 4-mile Road March


COL Theodore Bank

Post World War II to Korea

Physical Training (FM 21-20, 1946 & 1950)

- ✓ Introduced two physical fitness test batteries (PFTB) – "Outdoor" and "Indoor"
- ✓ Terminated AGF Test
- ✓ Revised PETB (eliminated burpee/pig-a-back)

PFTB Outdoor Battery
- Pull-ups
- Squat Jumps
- Push-ups
- Sit-ups
- 300-yd Shuttle Run

PFTB Indoor Battery
- Pull-ups
- Squat Jumps
- Push-ups
- Sit-ups
- Shuttle Run (250 yds) or 60-sec Burpee Test

Post Korean War

Task Force Smith - "As the reports came back from Korea, an alarming number of casualties were attributed to the inability of the U. S. soldiers to physically withstand the rigors of combat over rugged terrain and under unfavorable climatic conditions." (FM 21-20, 1957, p. 10)

FM 21-20, Physical Training and TM 21-200, Physical Conditioning (1957)

- ✓ Retained the Physical Fitness Test Battery (PFTB) - outdoor
- ✓ Introduced the Physical Achievement Test (PAT); which was only administered to "combat type units" and was designed to measure combat readiness.

Physical Fitness Test Battery (PFTB)
- Pull-ups
- Squat Jumps
- Push-ups
- Sit-ups
- 300-yd Shuttle Run

Physical Achievement Test (PAT)
- 5-sec Rope Climb
- 75-yd Dash
- Triple Broad Jump
- 150-yd Man Carry
- 1-mile Run

Pre Vietnam War

Change 1: TM 21-200, Physical Conditioning (1961) introduced the Physical Combat Proficiency Test (PCPT).

- ✓ The PETB and PAT fitness tests were terminated
- ✓ PCPT was designed to assess individual and unit fitness
- ✓ Minimum performance times/scores were provided

Physical Combat Proficiency Test
- 40-yd Low Crawl
- Horizontal Ladder Test (1-min)
- Dodge, Run, and Jump
- Grenade Throw
- 1-mile Run

PFTB
- Pull-ups
- Squat Jumps
- Push-ups
- Sit-ups
- 300-yd Shuttle Run

Vietnam War

Physical Readiness Training (FM21-20, 1969)

Retained the 5-item Physical Combat Proficiency Test (PCPT) and identified three additional specialty tests.

- ✓ PCPT: 40-yd low crawl, horizontal ladder, dodge/run/jump, grenade throw, 1-mile run
- ✓ Army Minimum PFT – Male: squat bender, sit-ups, push-ups, leg over, burpee, stationary run
- ✓ Airborne Trainee PF Qualification Test: chin-ups, bent-leg sit-ups, push-ups, half knee bend, 1-mile run
- ✓ Inclement Weather PFT: push-ups, knee bender, sit-ups, side step (jumping jacks), squat thrust (burpee)

Post Vietnam War

Physical Readiness Training (FM 21-20, 1973)

Introduced the Advanced Physical Fitness Test (APFT), the Staff-Specialist PFT (SSPFT), and the Basic PFT (BPFT).

- ✓ APFT: inverted crawl, bent leg sit-ups, run/dodge/jump, 2-mile run
- ✓ SSPFT: push-ups, bent leg sit-ups, run/dodge/jump, 1-mile run
- ✓ BPFT (for trainees < 40): inverted crawl, bent leg sit-ups, run/dodge/jump, 1-mile run
- ✓ FM 21-20 (1973) also recognized four (4) specialty tests:
  - Inclement Weather PFT
  - Minimum PFT – Male
  - Airborne Trainee PF Qualification Test
  - Ranger/Special Forces PF Qualification Test

Women's Army Corps

FM 35-20, Physical Fitness for Women (1975) approved four physical fitness tests for women.

- ✓ Advanced PFT: 80m shuttle run, modified pushups (knees), run/dodge/jump, modified sit-ups (crunches), 1-mile run
- ✓ Basic PFT (for basic trainees): 80m shuttle run, modified pushups (knees), run/dodge/jump, modified sit-ups (crunches), .5-mile run
- ✓ Staff-Specialist PFT: 80m shuttle run, modified pushups (knees), run/dodge/jump, modified sit-ups (crunches), stationary run
- ✓ Airborne Trainee PF Qualification Test: incline chin-up (approximately 45° angle), modified pushups, modified sit-ups, knee bender, 1-mile run

Unclassified

Cold War PRT

Physical Readiness Training (FM 21-20, 1980)

Introduced the Army Physical Readiness Test (APRT):

- ✓ Supersedes FM 21-20 (1973) and FM 35-20 (1975) establishing the first gender integrated Physical Readiness Training manual
- ✓ Men and women performed same 3-event PRT
- ✓ Stipulations for the APFT were: easy to administer (administer anywhere) and minimal need for equipment
- ✓ Soldiers > 40 years/age were not allowed to test PU or SU:
  - Soldiers (ages 17-39): Push-up, Sit-up and 2-mile Run
  - Soldiers (ages 40-60): 2-mile run or alternate cardio event
- ✓ 1982 – U.S. Army Soldier Physical Fitness Center – FT Ben Harrison
- ✓ 1983 – Master Fitness Trainer Course (6P – ASI)

Breaking the 40 year old Barrier

Physical Fitness Training (Change 1, FM 21-20, 1986)

- ✓ 23 June 1986 Headquarter DA published Change 1.
- ✓ Scoring standards were change to 5-year age increments
- ✓ With 5-year age increments 17-21… a 37-41 age group was established, effectively breaking the 40 year old age barrier
- ✓ Minimum performance scores (60-pt score) for 17-21 year old men and women changed significantly
- ✓ 60-pt scoring standards (17-21):
  - Men PU = 42, SU = 52, 2MR = 15:54
  - Women PU = 18, SU = 50, 2MR = 18:54

Unclassified

Proposed APRT (2002)

The PROPOSED six event APRT consists of the following events:

✓ Long Jump	(2 x 5 second jumps)
✓ Power Squat	(1 minute)
✓ Heel Hook	(1 minute)
✓ Shuttle Run	(6 x 25 yard sprints)
✓ Push-Ups	(1 minute)
✓ 1 Mile Run	(As fast as you can)

Note: There are no exceptions to this sequence.

APPENDIX C

USAPHC Talking Point Paper and White Paper Changes to the Army Physical Fitness Test, 29 February 2012

An initial review of various potential events and effects on physical performance and injuries.

TALKING POINT PAPER

MCHB-IP-DI
29 February 2012

SUBJECT: Changes to the Army Physical Fitness Test

1. Purpose: To provide talking points on the potential effects of proposed changes to the Army Physical Fitness Test on physical performance and injuries.

2. Talking Points:

- The current APFT effectively measures three key components of physical fitness necessary for warrior tasks: aerobic endurance, muscle endurance, and body composition.
- Two-mile run time, the APFT measure of aerobic endurance, is predictive of individual and unit readiness as well as performance on operational tasks.
- Advantages of the current APFT include its ease of administration and the ability to assess Soldier fitness over multiple decades.
- Current physical training doctrine, Army PRT, is built on established scientific principles that improve physical fitness while minimizing overtraining and injuries.
- Training for a 4-mile APFT run event will increase cumulative running mileage, which will increase injuries.
- Training for a 12-mile road march APFT event will result in greater training time requirements and increased injuries.
- Prior studies of physical performance tests should be considered in development of a new APFT.
- Any new tests selected for the APFT should measure recognized components of health and operational fitness, be safe and easy to administer, allow for comparisons to past fitness measures, and should encourage Soldiers to train for the test such that health-related fitness is enhanced and risk of injury is minimized.
- A tiered approach to physical fitness testing that allows for assessment of a base level of fitness and additional assessments according to occupational specialty and common military tasks identified by NATO [24] should be considered.

Drs. Jones and Chervak/MCHB-IP-D1/410-436-1377

APPROVED BY: LTC(P) Cersovsky

WHITE PAPER

MCHB-IP-DI
29 February 2012

SUBJECT: Changes to the Army Physical Fitness Test

1. Purpose: To summarize the potential effects of proposed changes to the Army Physical Fitness Test on physical performance and injuries.

2. Background.

a. GEN Odierno (CSA) will make a decision shortly on proposed changes to the Army Physical Fitness Test (APFT), including possible new events, to be implemented on 1 October 2012. Events that have been considered for the new APFT include the 60-yard shuttle run, one-minute rower, standing long jump, one-minute push-ups, and a 1.5-mile run. In February 2012, the Sergeant Major of the Army suggested that a 4-mile run and 12-mile ruck march with load should be part of the new APFT, rather than a 1.5-mile run. He also suggested replacing push-ups with dead-hang pull-ups and changing the rower event time from one to two minutes.[1]

b. At least 5 changes to the Army's physical performance test have been documented since 1941, when the first Army physical performance test was published.[2] Prior tests have included events considered in the proposed test such as pull-ups and shuttle run. The current 3-event test was established in 1980, and has not been altered except to twice revise the point standards.[2]

3. Physical Fitness, the APFT, and Injury Risk

a. Components of performance-related physical fitness are aerobic endurance, muscle endurance, muscle strength, muscle power, speed, flexibility, agility, balance, reaction time, and body composition.[3] The current APFT measures 3 of these components: aerobic endurance (run event), muscle endurance (push-up and sit-up events), and body composition (body mass index). Aerobic endurance is necessary for warrior tasks such as running or marching under load from one point to another, engaging in man-to-man combat, and evacuating a casualty.[4] Muscle strength and endurance are necessary for nearly all essential warrior tasks such as moving under fire, running or marching with a load, engaging in man-to-man combat, employing hand grenades, and evacuating a casualty.[4]

b. The current APFT measure for aerobic endurance, 2-mile run time, is a validated performance metric. Two-mile run time is highly correlated with maximal oxygen uptake (VO_2max), the gold standard for aerobic fitness,[5] and has been associated with performance on simulated battlefield tasks such as obstacle course completion, a 400-meter run, and a 30-meter rush.[6] In addition, research and field investigations conducted from the early 1980s to the present have demonstrated that low aerobic endurance is consistently associated with injury, a key determinant of individual and unit readiness. Soldiers with the lowest aerobic fitness (slowest run times) experience a 1.4

to 2.8 times greater risk of injury compared to the most aerobically fit.[7-12] While other measures of fitness (e.g., push-ups, sit-ups, and muscle strength) have been shown to be associated with injury risk, the strength of the associations have not been as consistent or strong. Monitoring APFT run time performance can provide commanders with insights into the overall fitness and potential for injury among their Soldiers. Decreased or stagnant fitness levels plus increased injury rates are markers for overtraining.

c. The current APFT measure for body composition, the body mass index (BMI), when gender- and age-adjusted, is considered a reasonable indicator of body fat for population-based assessments.[13] When BMI and fitness levels are examined, Soldiers with high BMIs and high aerobic fitness (e.g., performance on the APFT run event) have lower injury risk. Specifically, during Army basic combat training, aerobically fit male Soldiers with a high BMI (>27.3) had an injury risk of 21% compared to an injury risk of 28% for unfit males with a low BMI (<22.2). Aerobically fit female Soldiers with a high BMI (>25.5) had an injury risk of 38% compared to an injury risk of 61% for unfit females with a low BMI (<21.3).[14]

d. Advantages of the current APFT also include its ease of administration and, given the accumulation of over 20 years of standardized test results, the ability to assess and compare Soldier fitness over time. Given the sit-up, push-up, and run events test different muscle groups and/or fitness components, the events can be conducted on the same day. This could not be accomplished if the APFT included two weight-bearing aerobic events (i.e., a run and a road march). In addition, the current APFT has minimal equipment requirements and can be administered with relatively few staff. Administration of alternative fitness tests such as a shuttle run, standing long jump, or pull-up would require additional staff and equipment such as permanently installed pull-up bars of a standardized circumference, standardized surface for the shuttle run, tape measures, and cones. If testing was conducted outside, the condition of the pull-up bars and ground surface would have to be considered, as the ability to maintain grip or footing while making abrupt changes in direction would be affected by cold and/or wet conditions, which could increase the risk of injury.[2]

e. The current doctrine for physical training, the Army Physical Readiness Training (PRT) Program, was implemented in 2004. It is built on the established principles that injuries can be avoided and desired physical fitness can be obtained by gradually introducing weight-bearing training, limiting total running volume, and including training to enhance agility, mobility, and coordination.[4, 15] Prior studies of both Marine and Army units demonstrated that running distances during training could be reduced without decreasing desired aerobic performance gains.[16, 17] In an evaluation of Army PRT, units conducting traditional Army physical training had a 40% greater injury incidence compared to units conducting Army PRT, yet there were no differences in fitness gains (APFT pass rates) between the units.[18] Surveillance of basic combat training injuries showed a 29% reduction in injury rates during the first 4 years of implementation.[19]

4. Potential Effects of 4-mile Run and a 12-mile Road March APFT Events

a. By increasing the APFT run event to 4 miles, reductions in basic combat training injury rates would likely reverse, as units train for the APFT by running even greater distances. Numerous civilian and military studies have demonstrated that higher cumulative running mileage increases the risk of lower extremity injury. While increasing running mileage can result in enhanced aerobic fitness, there are thresholds at which injury risks increase but fitness levels remain the same or decrease. For example, among runners training 3 days/week at 85-90% maximum heart rate, the group that trained for 45 minutes/day experienced a 54% injury incidence and a 16.9% increase in endurance (as measured by maximal oxygen uptake, or VO_2max).[20] In comparison, the group that trained for 30 minutes/day experienced a much lower injury incidence (24%) with similar gains in endurance (16.1%). In a study of running mileage during Army infantry initial entry training, a unit that ran 130 miles experienced a 29% higher injury incidence with no difference in two-mile run time compared to a unit that ran only 56 miles.[17] Evidence such as this prompted the Joint Services Military Injury Prevention Working Group to rank 'prevention of overtraining' as the top priority for prevention of physical training-related injuries.[21] Such effects have also been seen recently in a 2010 analysis of infantry physical training. In this analysis, Soldiers in units who ran more than 16 miles per week had a 75% greater risk of injury compared to units who ran less than 7 miles per week, with no difference in APFT performance.[22]

b. Similarly, if personnel are being tested on a 12-mile road march with a load, units will train for this event by conducting more and longer road marches. Increased injuries as a result of road marching can be expected.[23-25] As an example, 24% of Soldiers in a light infantry unit were injured during a 20 km (12.4 mile) road march carrying a 46 kg (101 pound) load.[26] The majority (77%) were lower extremity injuries such as blisters, metatarsalgia, and sprains/strains, with back pain/strain making up the remaining 23%. Injuries reported in other studies of military road marches have also included stress fractures, knee pain, and rucksack palsy.[25] Methods to reduce march-related injury risk have been described [25], and regular aerobic and resistance training, as well as routine road marching with load have been recommended to improve road march capabilities.[24, 27] However, adding this training event as well as a 4-mile run would greatly increase training time and injuries resulting from the extensive weight-bearing training Soldiers will be required to perform. Pilot testing and development of appropriate standards would also be required for this test. Such a road march test would be better suited for an operational test battery.

5. Considerations for the Development of a New APFT

a. Prior studies have investigated alternative laboratory and field expedient physical performance tests and the reported relationships to operational tasks in military populations.[6, 28-30] Findings of these studies should be thoroughly reviewed by appropriate organizations and subject matter experts when considering development of new events for the APFT.

b. Regardless of the specific test events selected for the new APFT, the test should measure recognized components of health and operational fitness, be safe and easy to

administer, allow for comparisons to past fitness measures, and should encourage Soldiers to train for the test such that a base level of physical fitness is attained and maintained. As stated in a 1999 consensus statement from the Research Workshop on Physical Fitness Standards and Measurements within the Military Services, required maintenance of a base level of physical fitness "promotes a standard of physical readiness commensurate with the active life style and deployability of the military profession" and serves a "common goal of motivating service members toward good fitness habits, physical training participation, and a healthy life style."[31] However, a number of occupational specialties arguably have additional physical demands for which a "second tier" of operational fitness test measures could be developed to evaluate and test additional job-specific fitness requirements.[31]

6. Conclusions.

a. The current APFT effectively measures three key components of physical fitness necessary for warrior tasks: aerobic endurance, muscle endurance, and body composition.

b. Two-mile run time, the APFT measure of aerobic endurance, is predictive of individual and unit readiness as well as performance on operational tasks.

c. Advantages of the current APFT include its ease of administration and the ability to assess Soldier fitness over multiple decades.

d. Current physical training doctrine, Army PRT, is built on established scientific principles that improve physical fitness while minimizing overtraining and injuries.

e. Training for a 4-mile APFT run event will increase cumulative running mileage, which will increase injuries.

f. Training for a 12-mile road march APFT event will result in greater training time requirements and increased injuries.

g. Prior studies of physical performance tests should be considered in development of a new APFT.

h. Any new tests selected for the APFT should measure recognized components of health and operational fitness, be safe and easy to administer, allow for comparisons to past fitness measures, and should encourage Soldiers to train for the test such that health-related fitness is enhanced and risk of injury is minimized.

i. A tiered approach to physical fitness testing that allows for assessment of a base level of fitness and additional assessments according to occupational specialty and common military tasks identified by NATO [24] should be considered.

Drs. Jones and Chervak/MCHB-IP-DI/410-436-1377

APPROVED BY: LTC(P) Cersovsky

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APPENDIX D

USAPHC-IPP EXSUM - AUG 2012

(Initial TRADOC Tasker VTC)

UNCLASSIFIED
EXECUTIVE SUMMARY
30 Aug 2012

(U) SUMMARY OF VTC REGARDING REVISED APFT TASKER. (U) (MCHB-IP-DI) Drs Jones and Nindl, CPT DeGroot and Mr Hauret and Mr Grier participated in a VTC organized by LTC David DiNenna, HQDA DCS G-3/5/7 in order to clarify issues regarding the revised APFT and other taskers. Also in attendance from HQDA were SGM Wells and SGM Hank McClellan, who lead the discussion. Mr Mike Haith and SGM Taylor from TRADOC and personnel from USARIEM also participated. SGM McClellan stressed that there are multiple taskers regarding fitness testing and physical training and that communication and transparency, especially with HQDA, is important in light of the issues with the now-defunct earlier attempt to revise the APFT. Mr Haith expressed his intention to keep TRADOC senior leaders appraised as the process to develop a new APFT proceeds, as reflected by the Decision Brief dates in the draft EXORD. The meeting was beneficial for AIPH personnel for situational awareness purposes.

CPT DeGroot/MCHB-IP-DI/(
APPROVED BY: Dr Bruce Jones

UNCLASSIFIED

APPENDIX E

Reviews by Subject Matter Experts of the 2012 Proposed Army Physical Readiness Test (APRT)

March - April 2012

DESCRIPTION:

Table E-1. Army Physical Readiness Test (APRT) as a proposed APFT replacement included the following 5 tests:

1. Test	2. Measure
3. 60-yard Shuttle Run	4. (agility)
5. 1 min Rower	6. (muscular endurance)
7. Standing Long Jump	8. (leg power)
9. 1 min Push-up	10. (upper body muscular endurance)
11. 2-mile Run	12. (cardio-respiratory endurance)

Army Combat Readiness Test (ACRT) was conceptualized to be a separate gender/age free test for readiness (e.g. prior deployment):

The Army Combat Readiness Test includes the following and will be completed with the Soldier wearing the Army Combat Uniform, Advanced Combat Helmet and weapon.

- 400-meter run
- hurdles
- a high crawl
- casualty drag
- sprints
- plus several other movement drills

Sample Diagram of how an Army Combat Readiness Test (ACRT) Course may be set up at unit.

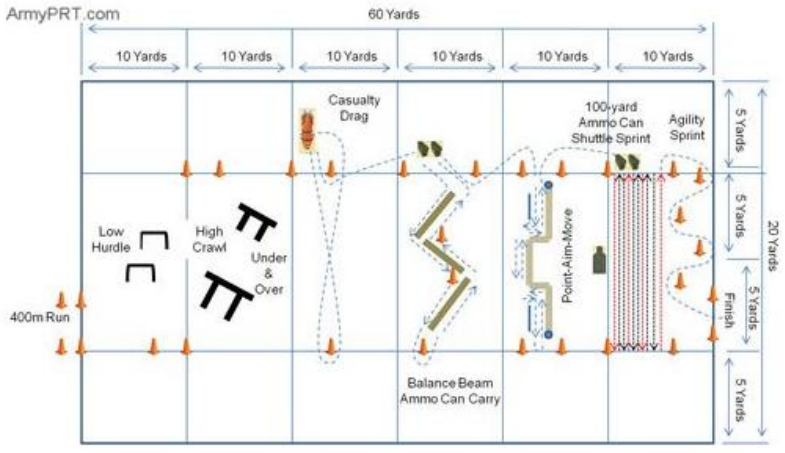


Figure E-1. Concept for ACRT

REVIEW:

In order to advise Army headquarter decision-makers as to whether to implement the new APRT, three groups of subject matter experts (SMEs) were requested by TRADOC to evaluate the APRT by answering the following questions. The responses are provided in the following pages of this Appendix:

1. Is the proposed five-event APRT the right test?
2. Are the five events the right events?
3. Do these five events test what we (the Army) want to test?
4. Is the APRT fair (does height, weight, age affect performance)?
5. What scoring system would best ensure fairness?

Dr. Todd Crowder and Dr. Whitfield East
Department of Physical Education - United States Military Academy (West Point)

Purpose: The purpose of this validation is to provide the CG TRADOC with a level of confidence that confirms that the proposed five-event Army Physical Readiness Test (APRT) is an appropriate replacement for the current Army Physical Fitness Test (APFT).

Question #1: *Is the proposed five-event APRT the right test*?

To determine if the proposed five-event APRT is the "right test", we must first establish a cross-validation criterion. We first reviewed the myriad of tests that have been used by the Army to assess physical readiness. We also reviewed the limited number of studies that have addressed the physiological demands of combat. Further, we considered that ***current*** theater engagements should not dictate the demands of ***future*** full spectrum combat operations in varying terrains, climates, and diverse theaters of operations.

The logical criterion for a physical readiness assessment is the physiological needs of the modern combat Soldier, with a concomitant criterion-referenced measure. Unfortunately there is little or no conclusive research on the physiological demands of combat (i.e., with current uniform, IBA and gear). Therefore, utilizing only a historical perspective with limited physiological combat assessment data, it is problematic to determine if this five-event APRT is the "right test". Without some criterion-referenced basis on which to judge the construct validity of the 5-event battery, our response can only be based upon the intuitive face validity of the five events. In order to improve the basis of our analysis, we will utilize the following three referent criteria to analyze the five events: (1) the attributes of a "good" fitness test items, (2) TRADOC's initial event stipulations, and (3) our philosophy of physical readiness training.

(1) There are five primary attributes of a "good" test event:

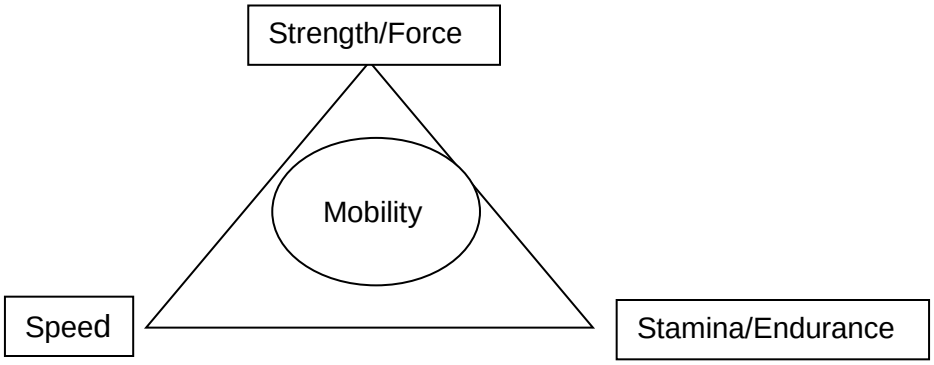
- Validity – events should measure what they purport/intend to measure. Since we have no criterion-referenced standard upon which to conduct a construct validation, the best we can offer is opinions relative to the face validity of each test event.
- Reliability – scores must be replicable over "time".
- Objectivity – scores must be replicable over "raters".
- Discrimination – scores discriminate between levels of performance.
- Authenticity – events should have some functional connection to combat readiness.

(2) As we understand it, these are the current stipulations for the APRT:

- Minimal need for "equipment".
- Event battery should be administrable in 60-120 minutes.
- The rater/Soldier ratio should be relatively low.

- Events should be administrable in a relatively confined area with close proximity between events.

(3) Our underlying physical readiness training (PRT) model is similar to TC 3-22.20. The nexus of our model is “mobility”, which represents the confluence of strength, speed, and stamina:



- Strength/Force: ability to overcome resistance; strength is a high intensity action.
- Stamina/Endurance: ability to do sustainable physical work; stamina is low intensity action.
- Speed: ability to move rapidly over a given distance; speed is a high intensity action.

Question #2: *Are the five events in the proposed PRT (60-yd shuttle run, 1-min rower, standing long jump, 1-min push-up w/no rest and 2-mile run); are these the right events?*

Attribute analysis of the five PRT events:

Event	Assessment	Face Validity	Reliability	Objectivity	Discrimination	Authentic
Shuttle run	Agility	good	good	good	moderate	fair
Push-ups	upper-body endurance	good	moderate	poor	good	fair
Rower	core-body endurance	good	moderate	fair	good	moderate
Long jump	lower body power	good	moderate	moderate	moderate	fair
2-mile Run	C-R endurance	good	good	good	good	moderate

Analysis of the 5-event battery aligned with current APRT stipulations:

Strength/Force: There are many events that can be used to assess muscular strength. Most strength assessments focus on the upper body (shoulder) and lower body (hips/low back). Based upon Stipulations 1 & 4, there are no true strength measures (1RM bench press, 1RM back squat, 1RM dead lift) that would be acceptable to the Army. We, therefore, recommend including two functional strength/power/endurance assessments; as a measure of functional strength/ endurance in the upper body we recommend the Chin-Up and as a measure of functional strength/power in the upper and lower body we recommend the “100-yd Load Carry”.

Chin-ups: Have been used on numerous occasions in Army PR tests.. We recommend some administrative device (like a cadence) to ensure Soldiers come to full extension. We further recommend an "incline chin-up" option for women to score at the 60-65 point level and the awarding of 70 pts for 1 chin-up. Chin-ups score well on virtually every test attribute:

- Chin-ups and chin-up bars are ubiquitous throughout the Army.
- Rater/Soldier ratio is high, but no greater than the current push-up event and is mitigated by the minimal administration time, < 1 minute per Soldier.
- Chin-ups have a relatively high degree of reliability, objectivity, and authenticity.
- Promotes the strengthening of the upper arm/shoulder and posterior-chain muscles to improve shoulder stability and prevent shoulder injuries.

The only issue is the chin-up test is body mass centric; i.e., big, heavy soldiers (fat or muscle) score lower than small, light soldiers. An ancillary benefit to this issue is the chin-up test will serve as a forcing function for lowering body fat.

100-yd Load Carry: Soldiers would "carry" (lift/drag) an 80-pound load 100 yards for time. Soldier may lift this load in any fashion or drag it 100 yards.

- 100-yd Load Carry simulates an event that has been used in three different Army PRTs; the Army Ground Forces Test (1942) – 70-yd "pick-a-back" run, the Physical Efficiency Test Battery (1944) – 100-yd "pick-a-back" run, and the Physical Achievement Test (1957) - 150-yard man carry.
- Rater/Soldier ratio is low.
- Minimal need for equipment (canvas bag, sand, cones, stopwatch).
- Administration time would average < 1 minute per Soldier.
- 100-yd Load Carry has a relatively high degree of reliability, objectivity, authenticity (WTBDs – casualty evac), and discriminates well.
- 100-yd Load Carry provides some equity versus body mass by assessing functional strength/force/power in the lower/upper body.

Stamina/Endurance: The two primary stamina/endurance domains are cardio-respiratory and muscular:

- Cardio-respiratory stamina is the ability to accomplish sustainable, low intensity work. Some of the more common field measures are:
  - Runs for distance (1, 1.5, 2, 3, 4 miles) or time (9-min, 12-min, etc.)
  - Road march for distance (3, 6, 9, 12, 15 miles) – generally with load
  - Stationary or road bike (5, 10, 15 miles)

2-mile Run (2MR): We recommend retaining the 2-mile run in the APRT as a measure of cardio-respiratory endurance.

- 2MR has been used in the Army since 1975.
- Rater/Soldier ratio is low.

- Minimal need for equipment (flat running surface).
- Administration time would average < 20 minutes per Soldier.
- 2MR has a relatively high degree of reliability, objectivity, and discriminates well.

- Muscular endurance – Field measures of muscular endurance generally focus on the shoulder/upper body, hips/lower body and core body. Most field-expedient events have moderate to poor objectivity (due to the subjective performance criteria – i.e., the push-up), making the scores less reliable and therefore less valid. Some of the field measure are:
  - Upper body – pushups, pull-ups, dips
  - Core body – sit-ups, crunches, rower, ankles to the bar, heel hook, plank
  - Lower body - squats/knee bends, squat jumps, burpees/squat thrusts

Push-up: We do not recommend the inclusion of the push-up due to its poor objectivity and isolation/emphasis on anterior-chain muscles, which tends to destabilize the shoulder.

Rower: We recommend retaining the "rower" as a measure of core-body endurance; however we recommend adjusting the administration time to two minutes with no rest to mitigate objectivity issues and potential for soft tissue injuries (TC 3-22.20 uses the "rower" as a warm-up activity and recommends execution at a "slow cadence").

- Rower-like tests have used in the Army since 1946.
- Rater/Soldier ratio is low.
- Minimal need for equipment (flat surface).
- Administration time would average < 2 minutes per Soldier.
- Rower has a relatively high degree of reliability, objectivity, authenticity (more functional than sit-ups, crunches, or plank) and discriminates well.

Mobility: Mobility is generally defined by the six components of skill-related fitness as influenced by a Soldiers strength, speed, and stamina:

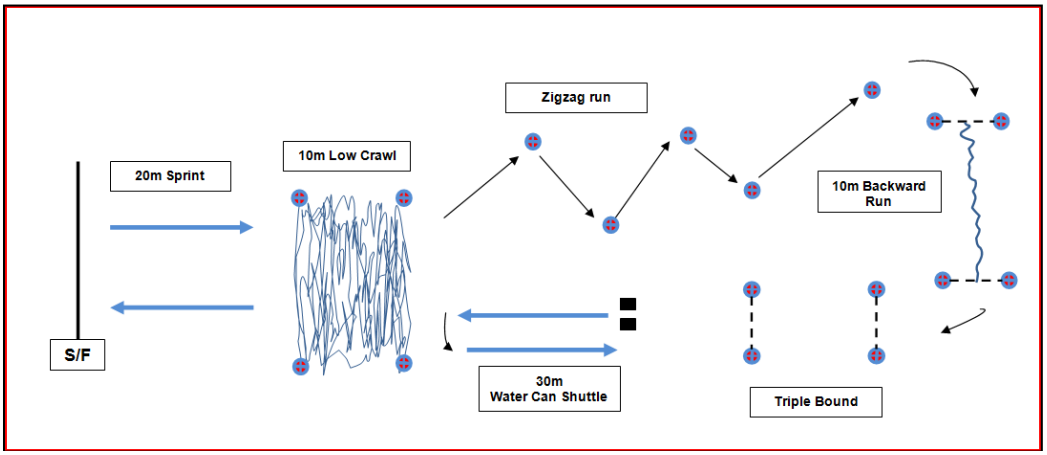
- Agility – shuttle run, 5-10-5 Pro agility test
- Speed – 40, 60, 100 meter sprint
- Balance – stork stand, balance beam walk
- Power – vertical jump, standing long jump, box jumps, Margaria-Kalamen Power test
- Flexibility– sit and reach
- Kinesthesis – spatial awareness of the body during movement

We can either choose to measure the various sub-components of mobility or develop a more authentic, functional test of general mobility. The current APRT proposes two sub-component tests: shuttle run - agility/speed, and standing long jump – explosive power.

Shuttle Run/Long Jump: We believe authenticity is crucial to the APRT. Therefore, we do not recommend including the shuttle run or the long jump based upon their lack of

authenticity, low ability to discriminate, and potential administrative time constraints for the long jump.

Mobility (MOB): We recommend the development of a functional measure of mobility that provides a higher degree of discrimination and authenticity. For over 25 years the Army used a mobility run to assess combat readiness: Army Ground Forces Test (1942) – 70-yd zig-zag run and Physical Combat Proficiency Test (1961) – dodge, run, and jump. Listed below is an example of a functional mobility test (MOB). This test incorporates all of the sub-components of mobility into a functional 1-shot test. The MOB has significantly greater authenticity than the shuttle run and still meets all Army event stipulations; equipment needs and set-up time are minimal and you can test a large number of Soldiers quickly (the test would last < 90 seconds). The MOB also discriminates well among Soldiers.



Summary for Question #2:

We recommend an alternative 5-event battery to test physical readiness that will measure cardio-respiratory stamina, upper-body functional strength, lower-body functional strength, core-body endurance, and mobility. The entire APRT should be completed in ACUs with running shoes. The five test events (in order) are:

1. **MOB** – as a functional measure of mobility (fundamental and motor skills), Soldiers will execute the 90-sec mobility run course
2. **Rower** – as a functional measure of core body endurance, Soldiers will execute the "rower" as described in TC 3-22.20 for a maximum of 2 minutes not to exceed 100 repetitions (100 points). There is no rest position.
3. **100-yd Load Carry** – as a functional test of leg/lower back strength/force, Soldiers will "carry" an 80-pound load 100 yards for time. The load may be lifted to the shoulders as in the "Fireman's carry", carried in front as in the "basket carry", or "dragged".
4. **Chin-ups** – as a functional measure of upper body strength/force. Soldiers will execute the chin-ups until the Soldier reaches momentary muscular failure. There is no rest position. The Soldier may use any of three grips: palms facing out, palms

facing in, or an alternate grip. The Soldier must generally maintain a generally straight body position throughout each repetition. The Soldier may not begin the next repetition until he/she has come to a fully-extended hanging position (or is prompted by the grader – "up" or a cadence).

5. **2-mile Run** – as a functional measure of stamina. Soldiers will run at their best sustainable speed for two miles.

Question #3: *Do these five events test what we (the Army) want to test?*
No - we recommend the five events listed above. To enhance, we further recommend consideration of adding an IBA to each event listed in Question #2 except the chin-ups (APRT-2).

Question #4: *Do these five events test what we (the Army) want to test?*
No, and to a relatively significant degree, neither does the revised 5-event APRT battery we recommended above (although we feel it is more authentic than the currently propose 5-event APRT battery). Without stipulations, we recommend the Army consider the five-event battery listed below. We believe if the Army established the physiological needs of the modern combat Soldier, these events could be tested and would emerge as measures of functional combat readiness.

1. **MOB** – as a functional measure of mobility (fundamental and motor skills), Soldiers will execute the 90-sec mobility run course
2. **Bench Press** (men = 175 lbs, women = 90 lbs.) – as a measure of upper body strength/force. Soldiers will execute repetitions at the specified weight to momentary muscle failure.
3. **100-yd Load Carry** – as a functional test of leg/lower back strength/force, Soldiers will "carry" an 80-pound load 100 yards for time. The load may be lifted to the shoulders as in the "Fireman's carry", carried in front as in the "basket carry", or "dragged".
4. **Chin and Curl** – as a functional measure of upper/core body strength/force, Soldiers will execute alternating repetitions of the "chin-up" and the ankles-to-the-bar (or heel hook) until the Soldier reaches momentary muscular failure. There is no rest position, palms may face out, in or an alternating grip may be used. Soldiers must generally maintain a straight body position throughout the entire repetition. The Soldier may not begin the next repetition until prompted by the grader – "up".
5. **3-mile Run** – as a functional measure of endurance/stamina, Soldiers will run at their best sustainable speed for three miles.

Lastly, we recommend all test events (in Question #4) with the exception of the Bench Press be taken in ACU's with running shoes; in addition we recommend the "MOB" be taken in body armor. The bench press test will be taken on a separate day from the "field" events. The

MOB, 100-yd Load Carry, Chin and Curl, and 3-mile Run will be taken sequentially during a 60-minute testing period.

Question #5: *Is the APRT fair?*

Combat requires a variety of physical skills and abilities and there is no way to predict the full extent to the level of any engagement; i.e., who/what/when/where a Soldier will come into contact with the enemy and/or the physical extent of that contact. Therefore PRT assessments should be sufficiently rigorous to ensure mission success and personal safety/survivability. Combat is pass/fail and the only way to ensure that Soldiers are prepared for combat is to establish combat-focused criterion-referenced standards. Clearly we must account for physiological differences by age and gender; however this accountability should come during the "evaluation" phase, not during the assessment phase. Combat is not fair and when we interject "fairness" into the development of physical readiness assessments we jeopardize the overall mission.

Respectfully submitted; 10 April 2012:
Dr. Whitfield B. East, Professor
Dr. Todd A. Crowder, Associate Professor
Department of Physical Education
United States Military Academy

EXSUM Recommendations:	Current APRT with stipulations	Revised APRT with stipulations	Revised APFT no stipulations
Strength/Power (lower body)	Standing Long Jump	100-yd Load Carry	100-yd Load Carry
Strength (upper body)			Bench Press
Endurance/Strength	Push-up	Chin-up	Chin-Curl
Core Endurance	Rower	Rower	
CR Stamina	2-mile Run	2-mile Run	3-mile Run
Mobility	Shuttle Run	MOB	MOB

Public Health Report No. 12-01-0614

Marilyn A. Sharp, M.S., Barry A. Spiering, Ph.D., Bradley J. Warr, MAJ, SP, Ph.D., MPAS
United States Army Research Institute of Environmental Medicine (USARIEM)

Purpose:

The Director of the Army Physical Readiness Division (PRD) requested input from USARIEM personnel regarding the proposed Army Physical Readiness Test (APRT) as a replacement for the current Army Physical Fitness Test (APFT).

Responses to Specific Questions:

Is the proposed five-event APRT the right test?
[We interpret this as: "Is it better to perform the proposed five-event APRT or the alternatively proposed three-event APRT?"]
Response: Soldiering performance requires multiple physical capabilities, including aerobic endurance, muscle strength, muscle endurance, speed, power, agility, etc. The current APFT is limited to only assessments of aerobic endurance and muscle endurance. An advantage of the five-event APRT is that it captures a more diverse array of physical capabilities (aerobic endurance, muscular endurance, agility, and power), possibly making the five-event APRT a better assessment of soldiering performance. The burden of including two additional tests should be acknowledged, but the burden appears minimal and reasonable.

Are the five events (60-yd shuttle run, 1-min rower, standing long jump, 1-min push-up w/no rest and 2-mile run) the right events?
Response: Retaining the 2-mile run permits a historical assessment of changes in aerobic fitness over time. This is beneficial because Army investigators have large amounts of historical data indicating the utility of the 2-mile run for predicting performance on common soldiering tasks (Myers et al. 1984; Knapik et al. 1990; Harman et al. 2008) as well as predicting future injury risk (Knapik et al. 2001). With regards to the remaining four events, the answer is unknown because the criterion validity has not been established (i.e., no data have been collected to establish the relationship between these APRT tests and performance on common soldiering tasks). These four tests are based on face validity. In other words, in theory these tests seem to be a better indicator of performance on common soldiering tasks, but this theory has not been tested/validated/quantified. Furthermore, there are other field-expedient tests (e.g., pull-ups) that could possibly be better predictors of performance on common soldiering tasks; however, the criterion validity of other field-expedient tests has not been thoroughly investigated. Therefore, at this point it is not possible to determine if these four APRT tests are the "right events", or if other field-expedient tests might be "better tests".

Do these five events test what we (the Army) want to test?
Response: DODI 1308.01 mandates the assessment of aerobic endurance, muscle endurance, and muscle strength. DODI 1308.01 correctly defines strength as the maximal ability of the neuromuscular system to produce force in a single repetition. There is no debate that the current APFT assesses aerobic endurance and muscle endurance. There is also little

debate that the APFT does not adequately assess muscle strength. Therefore, muscle strength is the critical variable not current assessed by the APFT.

The Army PRD has been handcuffed by a requirement mandating that physical performance tests should utilize no equipment. This requirement has forced the Army PRD to rely on field-expedient tests such as the broad jump to assess muscle strength. The broad jump is an adequate assessment of peak power (power = force x velocity). In a small sample of athletic men and women, broad jump is correlated to maximal leg strength (Peterson et al. 2006). However, although the broad jump is correlated with muscle strength, the broad jump is not a commonly accepted assessment of muscle strength.

Regardless of the relationship between APFT/APRT tests and various test constructs (e.g., strength, endurance, agility, etc), a more compelling question is whether performance on the APFT or APRT predicts performance on common soldiering tasks. Previous research has demonstrated that, with the exception of the 2-mile run, the APFT has limitations in predicting performance on common soldiering tasks (Myers et al. 1984; Knapik et al. 1990; Harman et al. 2008). No research has examined this relationship in the APRT events. Based on face validity, it seems that APRT performance would be a better predictor of performance of common soldiering tasks than APFT performance. However, it would be prudent to validate this assumption prior to APRT implementation.

Is the APRT fair?
Response: Vanderburgh (2008) indicates that the APFT is unfair to heavier West Point cadets and ROTC cadets. However, USARIEM investigators did not find this to be true in a large sample of soldiers (Hendrickson et al. 2009). Therefore, whether height and weight bias the APFT results remains equivocal. With respect to age and gender, APFT scores are adjusted to improve “fairness” of the results. Based on the data and analysis provided by Army PRD, it seems that the APRT is no more biased than the APFT. Further analysis of the data might be required to sufficiently answer this question. Importantly, it seems that additional data will need to be collected on 40+ year olds to establish standards.

What scoring system would best ensure fairness?
Response: COA 1 is the “historical approach” to scoring and is acceptable. COA 3 also seems appropriate (everyone judged on the same scale, but required points adjusted by age/gender); this approach has the added benefit of allowing for direct comparisons of performance between age groups and genders. COA 2 (“historical approach” +10%) is arbitrary and therefore difficult to defend. COA 4 (“historical approach” for three-events and “go or no go” for the broad jump and shuttle test) would be advantageous considering the difficulty in scoring the shuttle test accurately without equipment (see comments below). Importantly, it seems that additional data will need to be collected on 40+ year olds to establish requirements.

Gaps and Concerns:

The foundation of the proposed APRT is built on guidance from SMEs and "face validity". This is a necessary first step; however, a critical next step is establishing the criterion validity (i.e., relationship between APRT test performance and common soldiering task performance), test reliability (i.e., the ability of the test to produce consistent scores), impact of environmental conditions on test scores, etc. Further data collection would increase strength of certainty that the five-event APRT is appropriate for Army-wide implementation.

We have concerns regarding the reliability/stability of the shuttle run. The standard error of this test could be relatively large, considering that it will be hand-timed, the likelihood of between-site difference in testing surfaces, the effects of environmental conditions, etc. Relatively large random error in the measurement (likely >0.2 sec) could make meaningful differences in the outcome score, considering that merely a 0.1 sec difference is sufficient to raise/lower a soldier's outcome score.

We have concerns about scoring the rower. Will swinging of the arms generate momentum, thus reducing the force requirements for the abdominal muscles? Could this be overcome by an alternative exercise technique?

Recommendations to Mitigate Gaps and Concerns:

The APFT was not scientifically validated prior to implementation. Instead, the APFT was implemented and subsequent research has challenged is utility and predictive validity. This mistake should not be made again. If a primary objective is to establish the relationship between the APFT/APRT and common soldiering task performance, then additional research must be conducted. Army PRD has an opportunity to further validate the APRT prior to its implementation. This would improve strength of certainty and secure buy-in from the appropriate decision-makers. We recommend that Army PRD collaborates with Army scientists to:

1) Determine the criterion validity of various field-expedient tests (APFT, APRT, and other candidate tests). In other words, assess the ability of various field-expedient tests (e.g., long jump, shuttle run, pull-ups, etc) to predict performance on common soldiering tasks. A large-scale investigation will answer: i) which tests are most appropriate; and ii) the minimal number of tests required to adequately assess performance on common soldiering tasks.
2) Determine the reliability/stability of the field-expedient tests (i.e., how much random error is associated with the measurement, the number of tests required to obtain a stable value, etc)
3) Determine the impact of environmental conditions, surface conditions, etc, on test results
4) Establish appropriate criterion-based and/or normative-based scoring systems

USARIEM Panel:

Marilyn A. Sharp, M.S.
Barry A. Spiering, Ph.D.
Bradley J. Warr, MAJ, SP, Ph.D., MPAS

References:

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Myers DC, Gebhardt DL, Crump CE, Fleishman EA: Validation of the military entrance physical strength capacity test. Alexandria, VA, U.S. Army Research Institute for the Behavioral Sciences, 1984.

Peterson MD, Alvar BA, Rhea MR. The contribution of maximal force production to explosive movement among young collegiate athletes. *Journal of Strength and Conditioning Research* 2006; 20 (4): 867–873.

Vanderburgh PM. Occupational relevance and body mass bias in military physical fitness tests. *Med Sci Sports Exerc* 2008; 40 (8): 1538-45.

Lee E. Brown

I have evaluated all the materials sent to me by Barry A. Spiering regarding the new APRT test. My comments, suggestions and recommendations are below:

COMMENTS
According to DOD 1308.1, section 4.1.1. Physical Fitness. The Military Services shall design physical fitness training and related physical activities consistent with established scientific principles of physical conditioning that enhance fitness and general health essential to combat readiness. Individual Service members must possess the cardio-respiratory endurance, muscular strength and muscular endurance, together with desirable levels of body composition to successfully perform in accordance with their Service-specific mission and military specialty. According to DOD 1308.3, section 6.1.3.1. Military Services shall develop and use physical fitness tests (PFTs) that evaluate aerobic capacity (e.g., timed run, submaximal cycling) and muscular strength and muscular endurance (e.g., push-ups, pull-ups, sit-ups, machine tests). PFTs assess Service-wide baseline generalized fitness levels and are not intended to represent mission or occupationally specific fitness demands. Also, according to section E1.1.7. Muscular Strength. The maximal force that can be exerted in a single voluntary contraction of a skeletal muscle or skeletal muscle group. The simplest measure of strength involves various one-repetition maximum weight-lifting test (the heaviest weight that can be lifted only once). Although tests such as push-ups, pull-ups, and sit-ups measure primarily muscular endurance, there is a physiological continuum where individuals who can perform only a few repetitions of a test are completing a strength test. Thus, the pull-up, for which many individuals can complete only a few repetitions, is closer to a true strength test than push-ups.

The committee was asked to answer the five questions below (per the MEMORANDUM FOR Director, Military Performance Division, U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760-5007):

2. Focus. The CG TRADOC asked that the following five questions be reviewed and answered by an external subject matter expert panel:
a. Is the proposed five-event APRT the right test?
b. Are the five events (60-yd shuttle run, 1-min rower, standing long jump, 1-min push-up w/no rest and 2-mile run) the right events?
c. Do these five events test what we (the Army) want to test?
d. Is the APRT fair?

i. Does height affect performance?
ii. Does weight affect performance?
iii. Does age affect performance?
e. What scoring system would best ensure fairness?

The resultant recommendations by the committee are the five tests below:
1. 60-yard Shuttle Run (agility)
2. 1 min Rower (muscular endurance)
3. Standing Long Jump (leg power)
4. 1 min Push-up (upper body muscular endurance)
5. 2-mile Run (cardio-respiratory endurance)

SUGGESTIONS
1. The DOD documents listed above clearly state strength is a variable of interest. However, the current recommended tests do not measure strength as it is defined by the document. The current recommended tests substitute power for strength.

2. My answers to the five questions asked of the committee below in ALL CAPS.

a. *Is the proposed five-event APRT the right test*?
NO, SINCE THEY DO NOT MEASURE STRENGTH, THEY CANNOT BE RIGHT. IN FACT THIS VIOLATES THE DOD DIRECTIVE BY SUBSTITUTING A POWER TEST (STANDING LONG JUMP) FOR THE STRENGTH TEST. I CAN ONLY ASSUME THIS IS TO SATISFY THE ARMY'S DIRECTIVE TO USE NO EQUIPMENT. HOWEVER, THIS RULE VIOLATES THE DOD DIRECTIVE 1308.1 THAT "THE MILITARY SERVICES SHALL DESIGN PHYSICAL FITNESS TRAINING AND RELATED PHYSICAL ACTIVITIES CONSISTENT WITH ESTABLISHED SCIENTIFIC PRINCIPLES…"

b. *Are the five events (60-yd shuttle run, 1-min rower, standing long jump, 1-min push-up w/no rest and 2-mile run) the right events*? ONCE AGAIN THE ANSWER MUST BE NO AS THEY DO NOT MEASURE STRENGTH, THEY MEASURE MUSCULAR ENDURANCE TWICE (1-MIN ROWER AND 1-MIN PUSH-UP TEST) AND THEY SUBSTITUTE POWER WHICH DOES NOT APPEAR IN THE DOD DIRECTIVE.

f. *Do these five events test what we (the Army) want to test?*
ONCE AGAIN NO FOR THE SAME REASONS MENTIONED ABOVE.

g. *Is the APRT fair?*
i. *Does height affect performance*?

YES, OF COURSE IT DOES AS TALL PEOPLE JUMP FURTHER THAN SHORT PEOPLE. THIS IS FURTHER VALIDATED BY LOOKING AT THE SCORES BY GENDER. MEN OUTPERFORM WOMEN IN ALL PERFORMANCE TESTS (SEE RESULTS IN THE SLIDES 'APRT BRIEF-CONE v6'). THIS IS BASIC HUMAN PHYSIOLOGY AND IS SO ROBUST A FINDING AS TO RENDER IT AXIOMATIC**.**
ii. Does weight affect performance? YES, OF COURSE IT DOES. SAME ANSWER AS ABOVE.
iii. Does age affect performance? YES, OF COURSE IT DOES. THIS IS BASIC HUMAN PHYSIOLOGY AND IS SO ROBUST A FINDING AS TO RENDER IT AXIOMATIC.

h. *What scoring system would best ensure fairness*? WHAT IS MEANT BY FAIRNESS? NORMATIVE OR CRITERION SCALE? THE ARMY MUST HAVE STANDARDS TO PERFORM TASKS. THEREFORE, THERE HAS TO BE CUT-OFF SCORES WHICH WOULD MEAN THE ARMY USES A CRITERION SCALE. THEN WHAT IS FAIRNESS MEAN? THAT WEAK PEOPLE ARE ALLOWED TO PASS THE TEST? IN A RELATIVE SENSE THEN, WOMEN WOULD MOST OFTEN BE CONSIDERED WEAK WHEN COMPARED TO THEIR MALE COUNTERPARTS. IN THIS SCENARIO, STANDARDIZED SCORES SUCH AS Z-SCORES WOULD BE THE BEST SCORING SYSTEM.

RECOMMENDATIONS
Based on my comments and suggestions above, I have three recommendations:
1. Delete either the rower or push-up tests as they are redundant and measure the same thing.
2. Consider deleting the standing long jump test as it measures power (not in the DOD directive) NOT strength. However, it is a useful test and may be added if time permits.
    1. 3. Add at least one strength test (easy and inexpensive). My recommendations are one (upper ***or*** lower body strength)

or two (upper ***and*** lower body strength) of the three tests below:

a. Pull-ups to failure
b. Hand-grip dynamometer
c. Leg dynamometer

APPENDIX F

Physical Fitness as a Predictor of Injury and Analysis of FORSCOM Pilot APRT Data USAPHC- AIPH IPP Briefing, October 2012

Presented at the Baseline Soldier Physical Readiness Study Initial Planning Conference 2-3 OCT 12, Initial Military Training Center of Excellence; Ft Eustis VA

This appendix includes a PowerPoint slide set that was presented by Mr. Keith Hauret from the Injury Prevention Program, USAPHC at the initial meeting for the Baseline Soldier Physical Requirements Study on 2 October 2012. This presentation has two components:

1) The association of the physical fitness tests and injury. Historical data from field studies and program evaluations by the Injury Prevention Program, U.S. Army Public Health Command were presented to illustrate the finding that Soldiers who perform in the lowest quartile (i.e., slowest or least number of repetitions) on the 2-mile run, 300-yard shuttle run, 2-minute push-up test, and 2-minutes sit-up test have higher injury rates compared to those who ran faster or did more push-ups or sit-ups.

2) Summary of the analysis of TRADOC data by the Injury Prevention Program of the pilot evaluation of the proposed Army Physical Readiness Test (APRT) and Army Combat Readiness Test (ACRT) by FORSCOM Soldiers. These tests were to be implemented Army-wide in October 2012. The slides show frequency distributions for the male and female performance on some of the events that comprised the proposed tests. On each slide, the red vertical line represents the cut-point for a 90% pass and 10% fail rate for the event using a gender-neutral standard. (Note: The scores for the current APFT events were established to allow 8% of the males and 8% of the females to fail the events using gender-specific scores (GAO, 1998)). These slides demonstrate differences in the proportion of males and females that would pass the events using a "gender-neutral standard" of the 10% fail rate applied to the overall male and female scores combined. For the existing APFT pushup and 2 mile run events, a much higher percentage of females compared with the percentage of males who would fail. The sit ups, however, do not present a gender difference. Though more substantial gender differences are seen with the pilot APRT long jump and pull up events; the gender impact is much lower for other proposed APRT events (e.g. rower, shuttle and half-mile run (~800 yards)). This suggests that use of certain events as a fitness standards may be considered 'unfair' if they are not made gender specific. Other events, such as sit ups, rower, or short runs (shuttle, ½ mile) may be more "gender-neutral."

If tests are considered a means to assess ability to perform physical military tasks – it is necessary to determine which fitness tests are most associated with military tasks. To date to the association between these fitness tests and military tasks has not been validated.

Physical Fitness As a Predictor of Injury and Analysis of FORSCOM Pilot APRT Data

USAPHC
ARMY INSTITUTE OF PUBLIC HEALTH

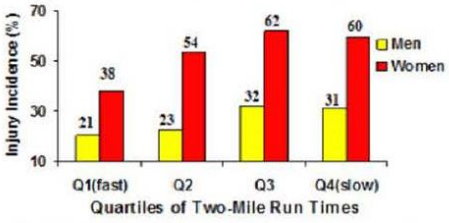
Bruce Jones and Keith Hauret
Army Institute of Public Health

2 October 2012

UNCLASSIFIED

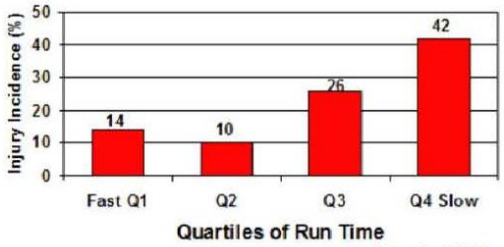
Association of Physical Fitness and Injuries

Association of Two-Mile Run Time With Time-Loss Injuries in Army BCT



N=682 Men, 387 Women; Risk Ratio(Q4/Q1):Men=1.5, Women=1.6
p-value for trend: Men=<0.01, Women=<0.01
Source: Knapik JJ. USACHPPM Tech Report No. 29-HE-8370-98, 1998

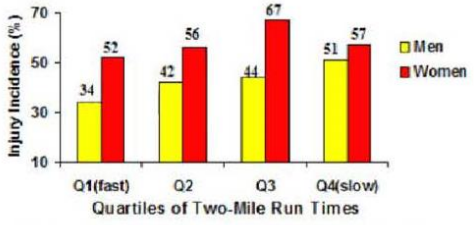
Mile Run Times and Incidence of Injury among Male Army Basic Trainees



Ft. Jackson, 1994; N= 79, 8 weeks BCT
P-value for trend=.02
Median run time (mins) = 7.1

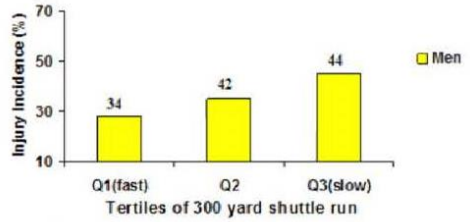
Source: Jones BH. Body Composition & Physical Performance. National Academy Press, pp141-173, 1992.

Association of Two-Mile Run Time and Injuries in the Operational Army

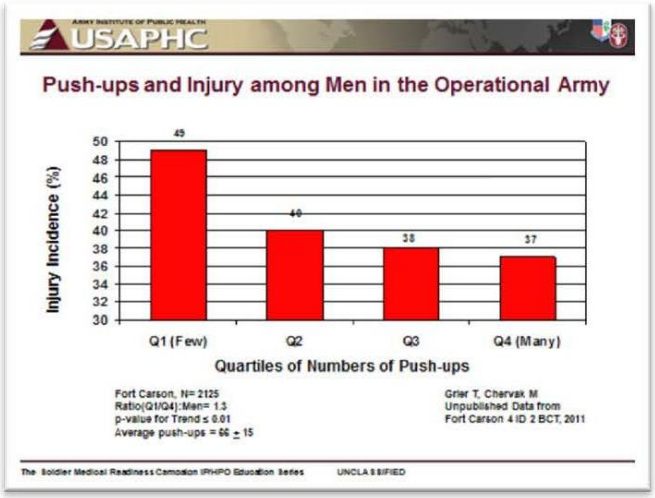


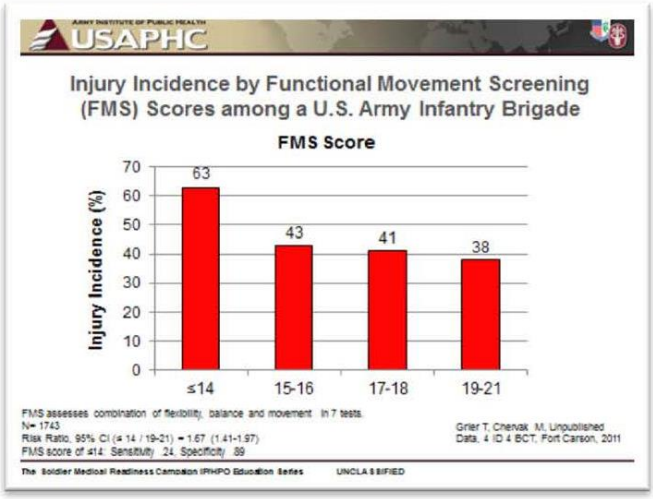
N=1248 Men, 145 Women; Risk Ratio(Q4/Q1):Men=1.5, Women=1.1
p-value for trend: Men ≤ 0.01, Women = 0.06
Source: Grier T, Chervak M, Unpublished Data from the 25 ID 3 BCT

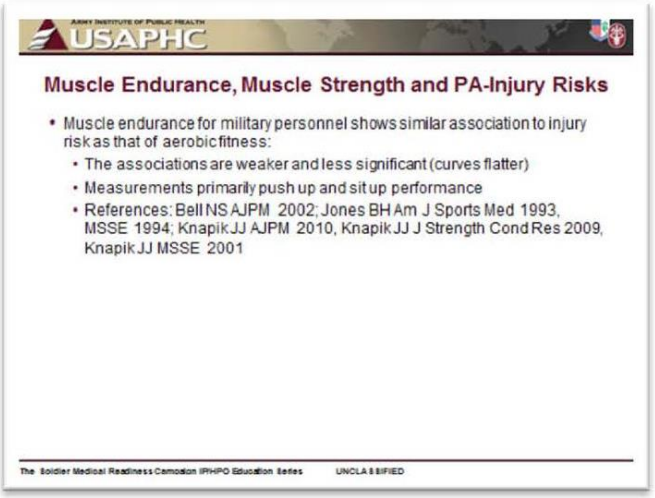
Association of 300 Yard Shuttle Run and Injuries in the Operational Army



N=454 Men, Risk Ratio(Q3/Q1):Men=1.6
p-value = 0.01
Source: Grier T, Chervak M, Unpublished Data from the 4 ID 4 BCT


USAPHC
Push-ups and Injury among Men in the Operational Army
Injury Incidence (%)
50
48
46
44
42
40
38
36
34
32
30
45
40
38
37
Q1 (Few)
Q2
Q3
Q4 (Many)
Quartiles of Numbers of Push-ups
Fort Carson, N= 2125
Ratio(Q1/Q4):Men= 1.3
p-value for Trend ≤ 0.01
Average push-ups = 66 ± 15
Grier T, Chervak M
Unpublished Data from
Fort Carson 4 ID 2 BCT, 2011
The Soldier Medical Readiness Campaign IPHPO Education Series
UNCLASSIFIED


USAPHC
Injury Incidence by Functional Movement Screening (FMS) Scores among a U.S. Army Infantry Brigade
FMS Score
Injury Incidence (%)
70
60
50
40
30
20
10
0
63
43
41
38
≤14
15-16
17-18
19-21
FMS assesses combination of flexibility, balance and movement In 7 tests.
N= 1743
Risk Ratio, 95% CI (4.14 / 19-21) = 1.67 (1.41-1.97)
FMS score of 14: Sensitivity .24, Specificity .89
Grier T, Chervak M, Unpublished Data, 4 ID 4 BCT, Fort Carson, 2011
The Soldier Medical Readiness Campaign IPHPO Education Series
UNCLASSIFIED


USAPHC
Muscle Endurance, Muscle Strength and PA-Injury Risks
• Muscle endurance for military personnel shows similar association to injury risk as that of aerobic fitness:
• The associations are weaker and less significant (curves flatter)
• Measurements primarily push up and sit up performance
• References: Bell NS AJPM 2002; Jones BH Am J Sports Med 1993, MSSE 1994; Knapik JJ AJPM 2010, Knapik JJ J Strength Cond Res 2009, Knapik JJ MSSE 2001
The Soldier Medical Readiness Campaign IPHPO Education Series
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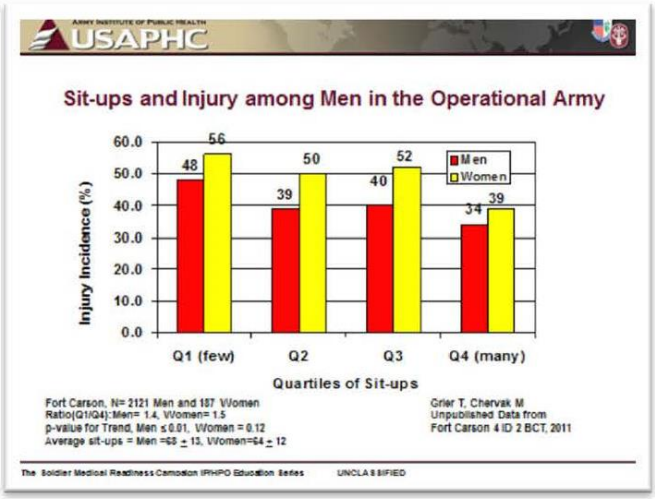
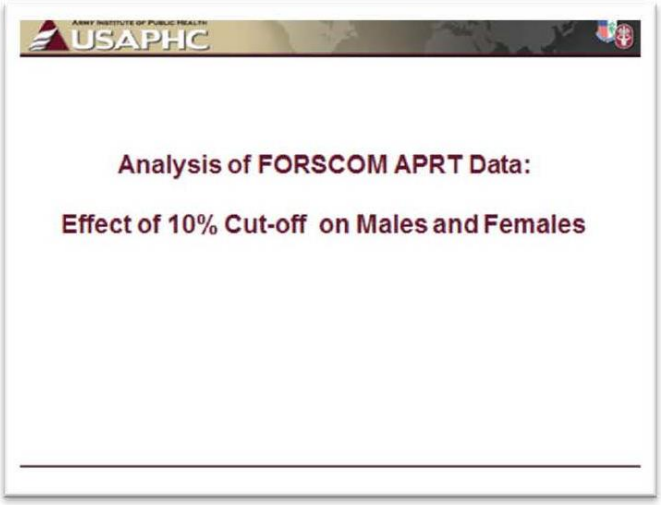
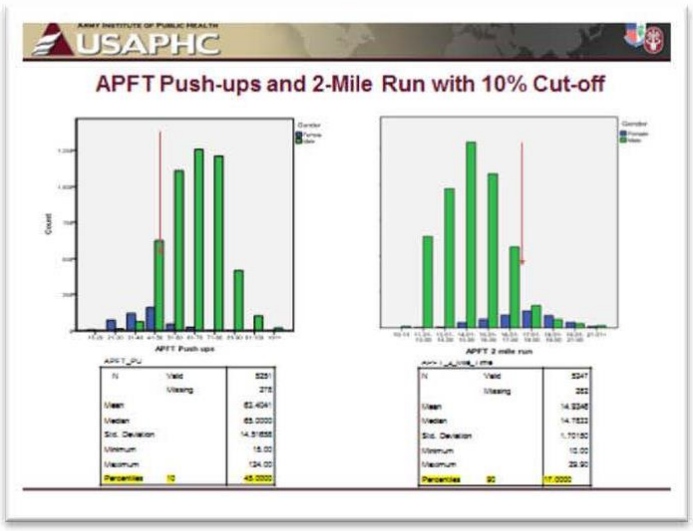
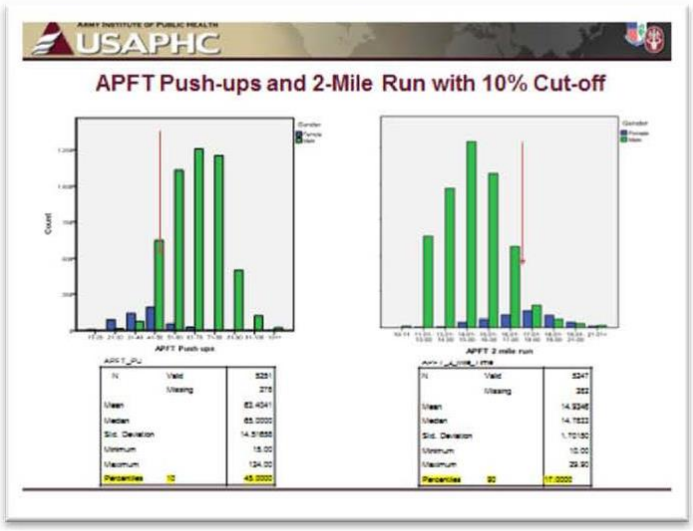
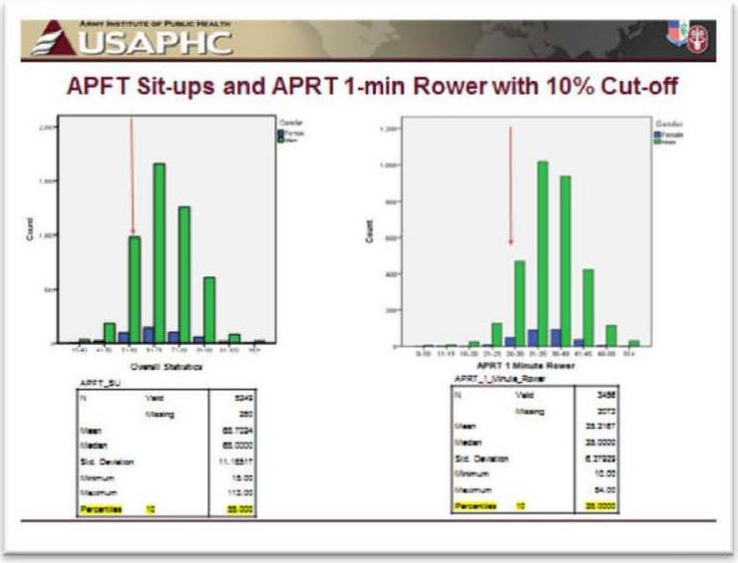
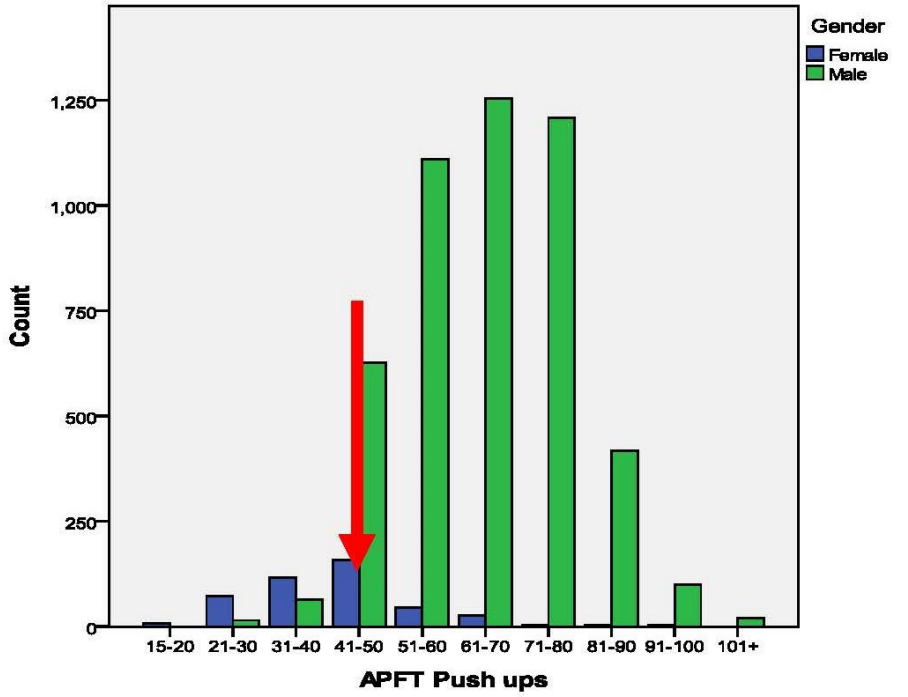

USAPHC
Sit-ups and Injury among Men in the Operational Army
Injury Incidence (%)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
48
56
39
50
40
52
34
39
Men
Women
Q1 (few)
Q2
Q3
Q4 (many)
Quartiles of Sit-ups
Fort Carson, N= 2121 Men and 187 Women
Ratio(Q1/Q4):Men= 1.4, Women= 1.5
p-value for Trend, Men ≤ 0.01, Women = 0.12
Average sit-ups = Men =68 ± 13, Women=54 ± 12
Grier T, Chervak M
Unpublished Data from
Fort Carson 4 ID 2 BCT, 2011
The Soldier Medical Readiness Campaign IPHPO Education Series
UNCLASSIFIED


USAPHC
Analysis of FORSCOM APRT Data:
Effect of 10% Cut-off on Males and Females


USAPHC
APFT Push-ups and 2-Mile Run with 10% Cut-off


USAPHC
APFT Push-ups and 2-Mile Run with 10% Cut-off


USAPHC
APFT Sit-ups and APRT 1-min Rower with 10% Cut-off



Overall Statistics

APFT_PU

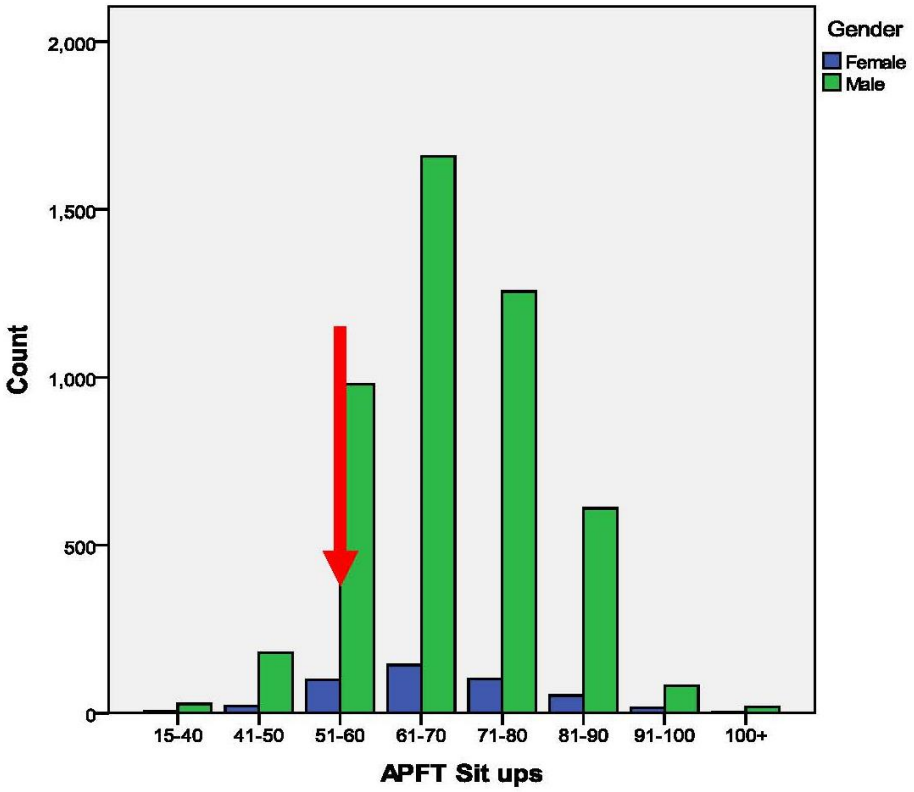
N	Valid	5251
	Missing	278
Mean		63.4041
Median		65.0000
Std. Deviation		14.51658
Minimum		15.00
Maximum		124.00
Percentiles	10	45.0000

Statistics by Gender

APFT_PU

Female	N	Valid	437
		Missing	26
	Mean		42.4050
	Std. Deviation		13.07436
	Minimum		15.00
	Maximum		100.00
Male	N	Valid	4814
		Missing	252
	Mean		65.3103
	Std. Deviation		13.06552
	Minimum		22.00
	Maximum		124.00

Figure F-1. FORSCOM APFT Female and Male Scores – Push Ups ("10%" Point Shown By Arrow)



Overall Statistics

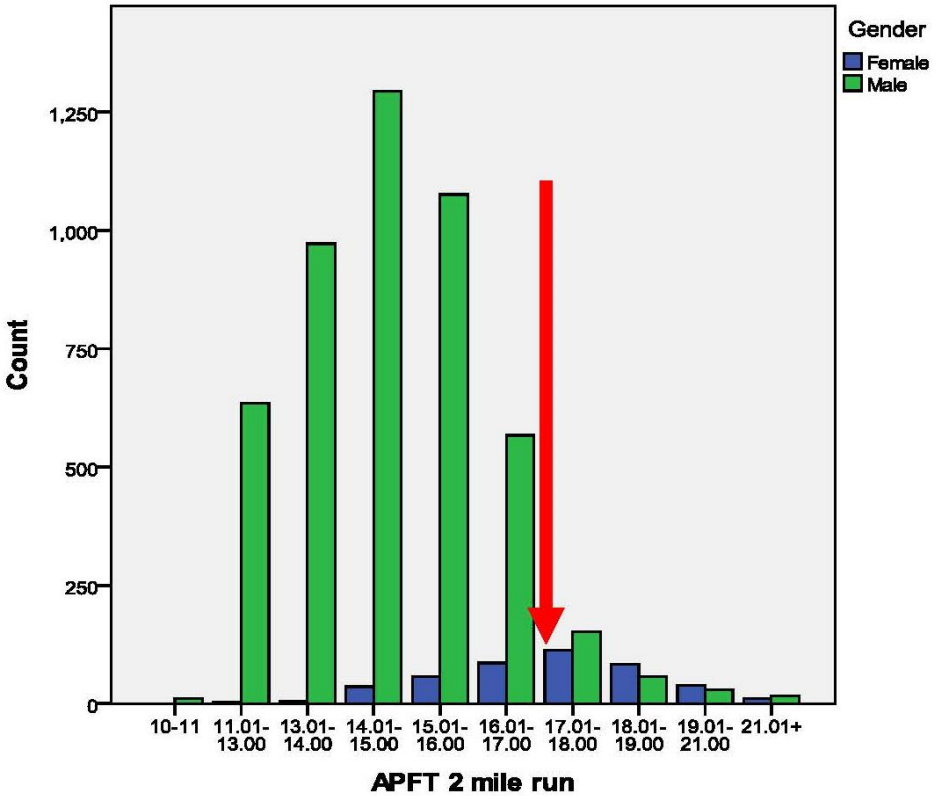
APFT_SU

N	Valid	5249
	Missing	280
Mean		68.7024
Median		68.0000
Std. Deviation		11.18517
Minimum		15.00
Maximum		113.00
Percentiles	10	55.000

APFT_SU Statistics by Gender

Female	N	Valid	437
		Missing	26
	Mean		68.3844
	Std. Deviation		12.28535
	Minimum		32.00
	Maximum		101.00
Male	N	Valid	4812
		Missing	254
	Mean		68.7313
	Std. Deviation		11.08079
	Minimum		15.00
	Maximum		113.00

Figure F-2. FORSCOM APFT Female and Male Scores – Sit Ups ("10%" Point Shown By Arrow)



Overall Statistics

APFT_2_Mile_Time

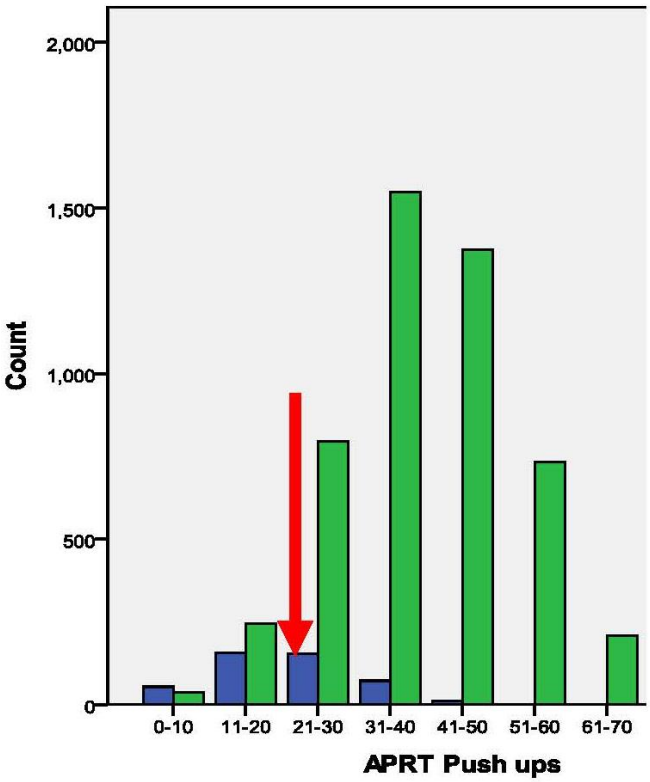
N	Valid	5247
	Missing	282
Mean		14.9246
Median		14.7833
Std. Deviation		1.70150
Minimum		10.00
Maximum		29.90
Percentiles	90	17.0000

Statistics by Gender

APFT_2_Mile_Time

Female	N	Valid	435
		Missing	28
	Mean		17.2350
	Std. Deviation		1.71660
	Minimum		11.83
	Maximum		23.00
Male	N	Valid	4812
		Missing	254
	Mean		14.7158
	Std. Deviation		1.53778
	Minimum		10.00
	Maximum		29.90

Figure F-3. FORSCOM APFT Female and Male Scores – 2Mile Run ("10%" Point Shown By Arrow)



Overall Statistics

APRT_PU

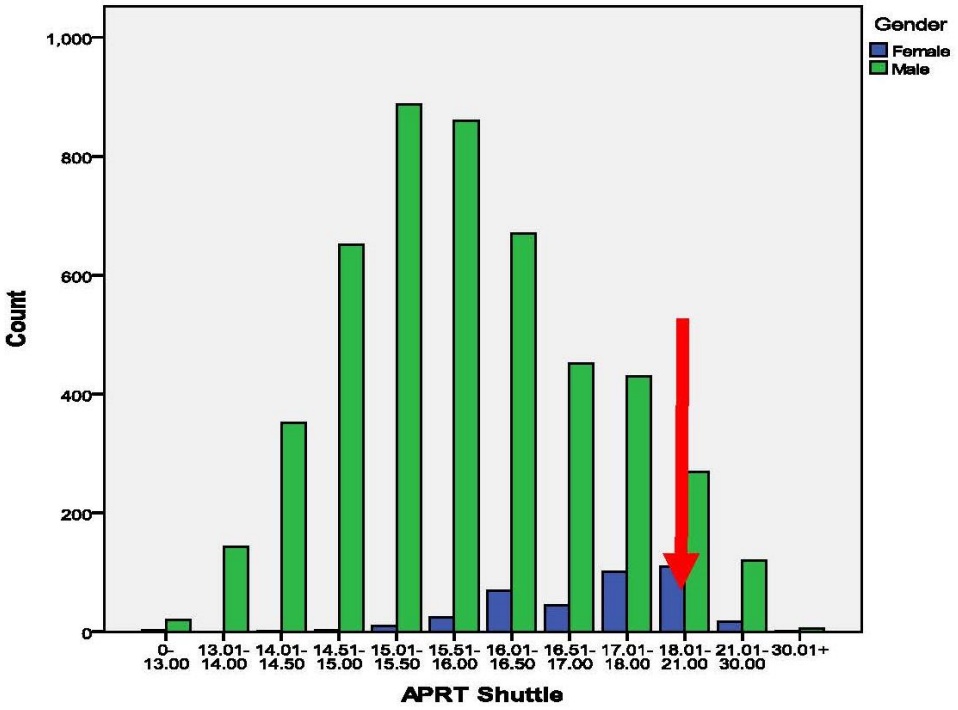
N	Valid	5462
	Missing	67
Mean		38.8495
Median		39.0000
Std. Deviation		13.42676
Minimum		1.00
Maximum		97.00
Percentiles	10	21.0000

Statistics by Gender

APRT_PU

Female	N	Valid	449
		Missing	14
	Mean		21.8129
	Std. Deviation		9.49016
	Minimum		1.00
	Maximum		45.00
Male	N	Valid	5013
		Missing	53
	Mean		40.3754
	Std. Deviation		12.65099
	Minimum		1.00
	Maximum		97.00

Figure F-4. FORSCOM APRT Pilot Event – Push Ups ("10%" Point Shown By Arrow)



Overall Statistics

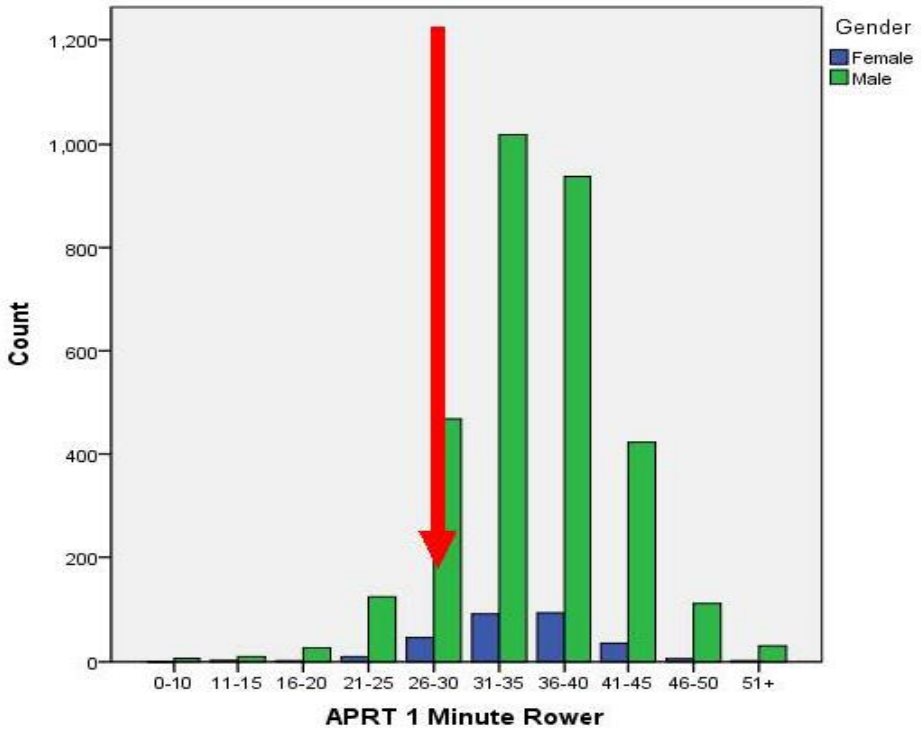
APRT_Shuttle

N	Valid	5238
	Missing	291
Mean		16.1965
Median		15.8800
Std. Deviation		1.90943
Minimum		9.45
Maximum		49.10
Percentiles	10	18.000

APRT_Shuttle **Statistics by Gender**

Female	N	Valid	381
		Missing	82
	Mean		17.7135
	Std. Deviation		2.10887
	Minimum		10.01
	Maximum		35.90
Male	N	Valid	4857
		Missing	209
	Mean		16.0775
	Std. Deviation		1.84099
	Minimum		9.45
	Maximum		49.10

Figure F-5. FORSCOM APRT Pilot Event - Shuttle ("10%" Point Shown By Arrow)



Overall Statistics

APRT_1_Minute_Rower

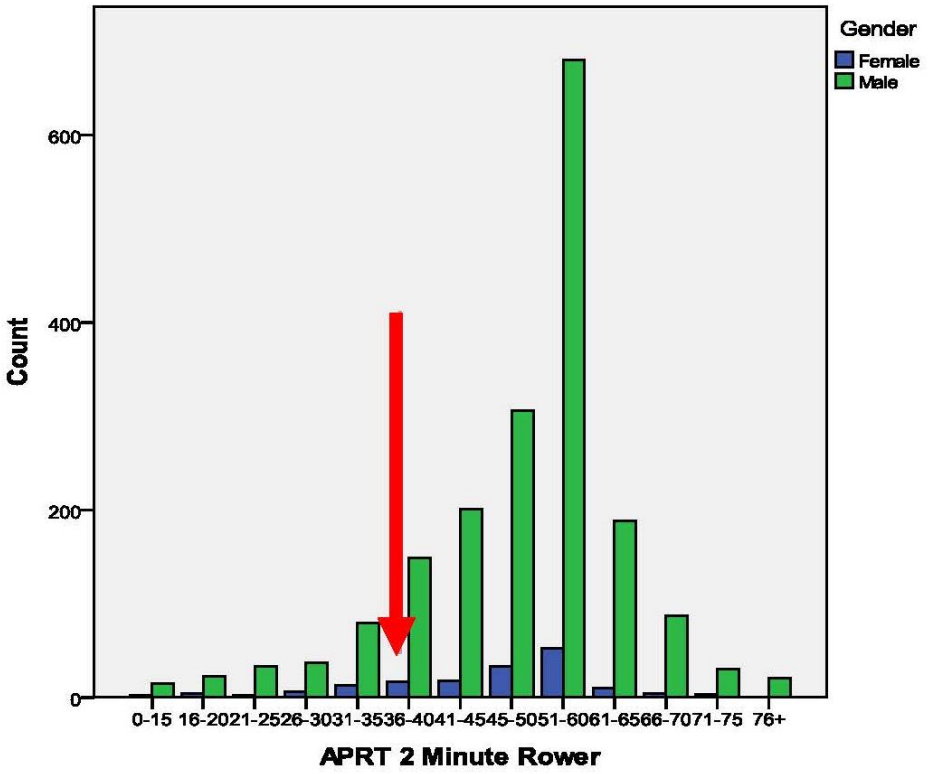
N	Valid	3456
	Missing	2073
Mean		35.2167
Median		35.0000
Std. Deviation		6.27929
Minimum		10.00
Maximum		84.00
Percentiles	10	28.0000

Statistics by Gender

APRT_1_Minute_Rower

Female	N	Valid	294
		Missing	169
	Mean		34.8265
	Std. Deviation		6.03860
	Minimum		15.00
	Maximum		58.00
Male	N	Valid	3162
		Missing	1904
	Mean		35.2530
	Std. Deviation		6.30089
	Minimum		10.00
	Maximum		84.00

Figure F-6. FORSCOM APRT Pilot Event – 1 Minute Rower ("10%" Point Shown By Arrow)



Overall Statistics

APRT_2_Minutes_Rower

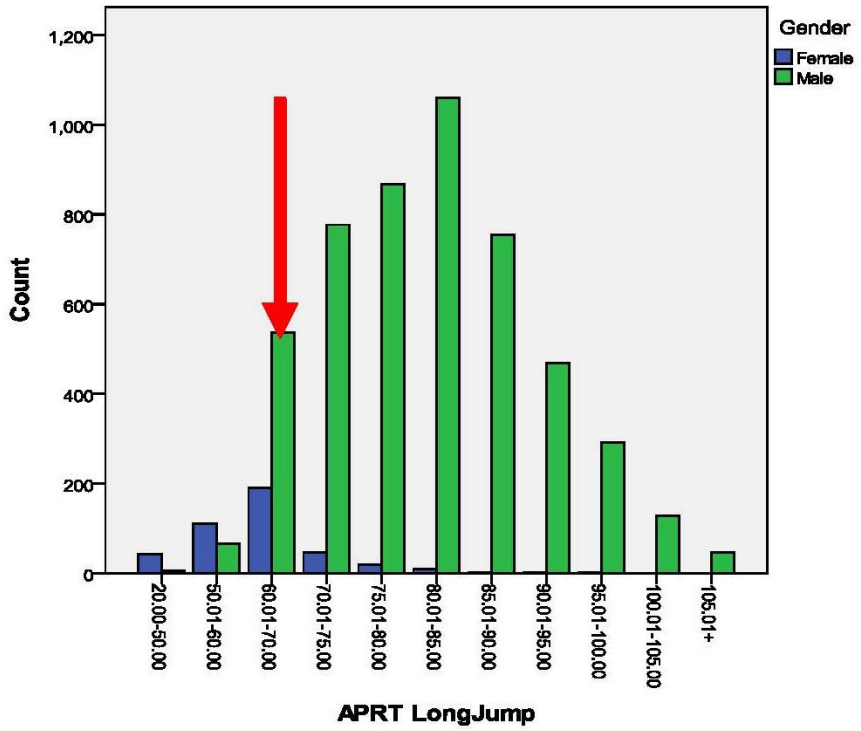
N	Valid	2013
	Missing	3516
Mean		50.2802
Median		52.0000
Std. Deviation		11.92409
Minimum		2.00
Maximum		93.00
Percentiles	10	35.0000

Statistics by Gender

APRT_2_Minutes_Rower

Female	N	Valid	164
		Missing	299
	Mean		47.5915
	Std. Deviation		12.10122
	Minimum		10.00
	Maximum		72.00
Male	N	Valid	1849
		Missing	3217
	Mean		50.5187
	Std. Deviation		11.88221
	Minimum		2.00
	Maximum		93.00

Figure F-7. FORSCOM APRT Pilot Event– 2 Minute Rower ("10%" Point Shown By Arrow)



Overall Statistics

APRT Long Jump

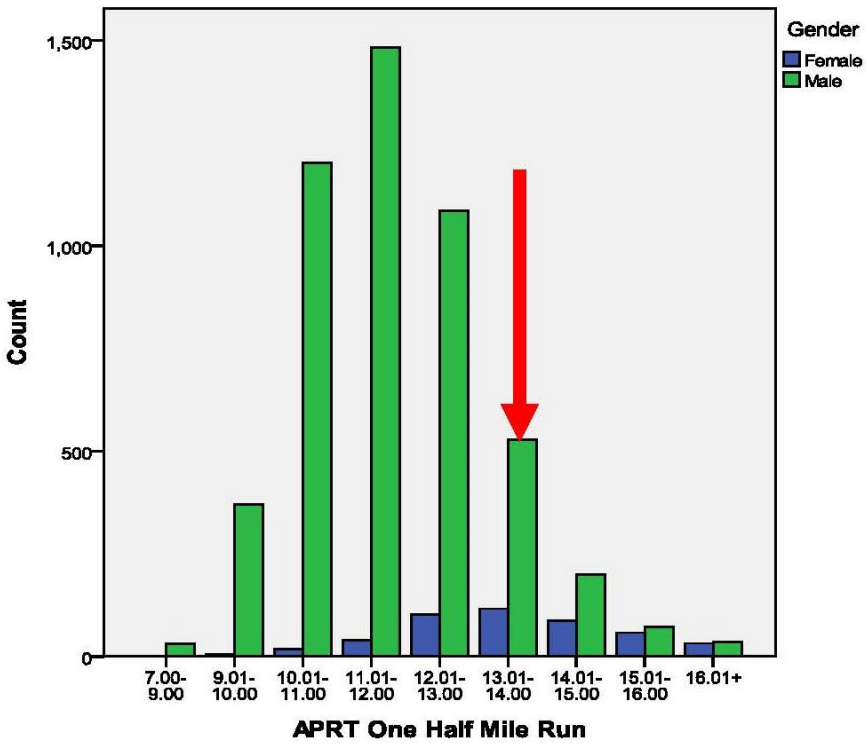
N	Valid	5426
	Missing	103
Mean		80.1758
Median		80.5000
Std. Deviation		15.21225
Minimum		10.39
Maximum		830.00
Percentiles	10	65.7500

Statistics by Gender

APRT Long Jump

Female	N	Valid	422
		Missing	41
	Mean		62.5078
	Std. Deviation		9.38106
	Minimum		24.75
	Maximum		97.00
Male	N	Valid	5004
		Missing	62
	Mean		81.6658
	Std. Deviation		14.66205
	Minimum		10.39
	Maximum		830.00

Figure F-8. FORSCOM APRT Pilot Event – Long Jump ("10%" Point Shown By Arrow)



Overall Statistics

APRT OneHalf Mile Time (min)

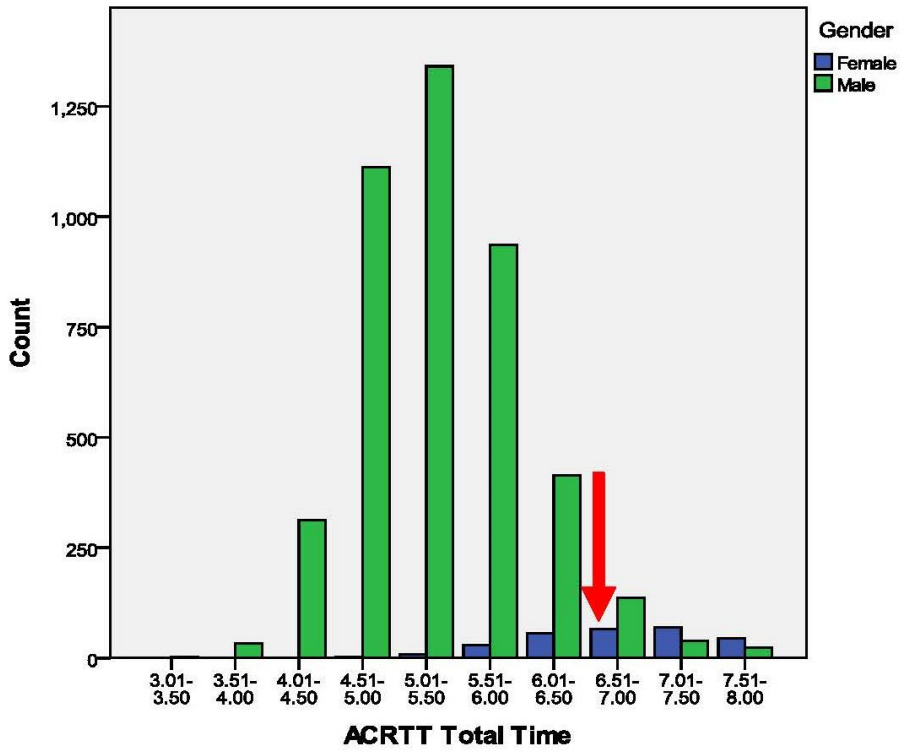
N	Valid	5464
	Missing	65
Mean		11.9189
Median		11.7167
Std. Deviation		1.51650
Minimum		7.38
Maximum		21.60
Percentiles	90	13.8667

Statistics by Gender

APRT OneHalf Mile Time (min)

Female	N	Valid	457
		Missing	6
	Mean		13.6932
	Std. Deviation		1.64989
	Minimum		9.22
	Maximum		20.20
Male	N	Valid	5007
		Missing	59
	Mean		11.7570
	Std. Deviation		1.39575
	Minimum		7.38
	Maximum		21.60

Figure F-9. FORSCOM APRT Pilot Event – ½ Mile Run ("10%" Point Shown By Arrow)



Overall Statistics

ACRT Total Time

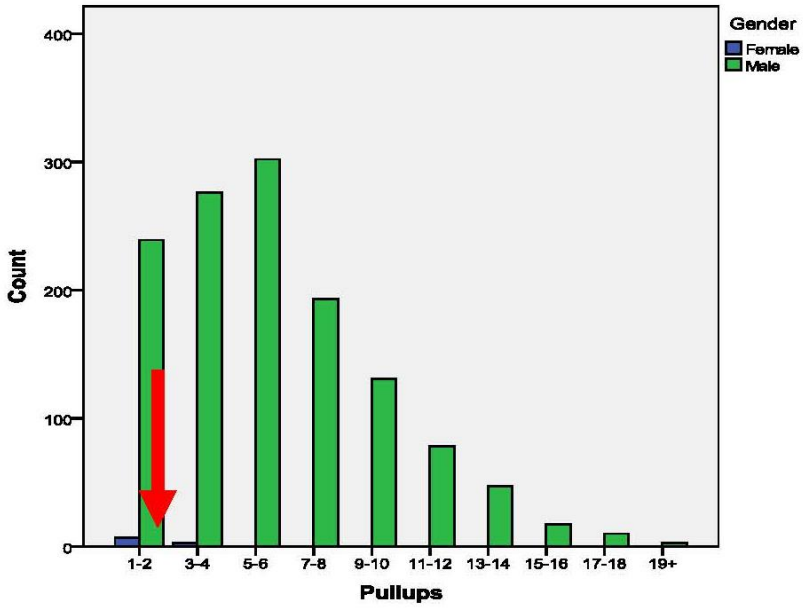
N	Valid	4703
	Missing	826
Mean		5.4788
Median		5.3333
Std. Deviation		.89775
Minimum		3.27
Maximum		17.28
Percentiles	90	6.5000

Statistics by Gender

ACRT Total Time

Female	N	Valid	343
		Missing	120
	Mean		7.1829
	Std. Deviation		1.07040
	Minimum		4.75
	Maximum		11.55
Male	N	Valid	4360
		Missing	706
	Mean		5.3447
	Std. Deviation		.73006
	Minimum		3.27
	Maximum		17.28

Figure F-10. FORSCOM Pilot ACRT- Total Time ("10%" Point Shown By Arrow)



Overall Statistics		
	Valid	1306
	Missing	4223
Mean		5.9043
Median		5.0000
Std. Deviation		3.68210
Minimum		1.00
Maximum		22.00
Percentiles	90	2

Pullups **Statistics by Gender**

Female	N	Valid	10
		Missing	453
	Mean		2.0000
	Std. Deviation		1.05409
	Minimum		1.00
	Maximum		4.00
Male	N	Valid	1296
		Missing	3770
	Mean		5.9344
	Std. Deviation		3.67916
	Minimum		1.00
	Maximum		22.00

Figure F-11. FORSCOM APRT Pilot Event – Push Ups ("10%" Point Shown By Arrow)

Male & Female Combined All FORSCOM APRT ACRT

		BMI	Body fat	APFT Push Ups	APFT Sit Ups	APFT 2 Mile run Time	APRT Push Ups	APRT Shuttle	APRT1Minute Rower	APRT 2 Minutes Rower	APRT Long Jump	APRT One and a Half Mile Run Time	ACRT Total Time	Pullups
BMI	Pearson Correlation	1	.760	-.029	-.151	.252	-.030	.076	-.087	-.135	-.045	.297	-.011	-.167
	Sig. (2-tailed)		.000	.038	.000	.000	.025	.000	.000	.000	.001	.000	.435	.000
	N	5493	5493	5219	5218	5215	5428	5205	3437	1999	5392	5430	4675	1296
Body fat	Pearson Correlation	.760	1	-.286	-.153	.494	-.250	.209	-.108	-.185	-.243	.483	.320	-.180
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	5493	5493	5219	5218	5215	5428	5205	3437	1999	5392	5430	4675	1296
APFT Push Ups	Pearson Correlation	-.029	-.286	1	.507	-.507	.602	-.239	.196	.192	.300	-.406	-.397	.435
	Sig. (2-tailed)	.038	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	5219	5219	5251	5248	5242	5207	4998	3234	1979	5181	5208	4540	1278
APFT Sit Ups	Pearson Correlation	-.151	-.153	.507	1	-.404	.309	-.129	.266	.265	.128	-.315	-.204	.298
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	5218	5218	5248	5249	5240	5205	4997	3233	1978	5180	5206	4538	1277
APFT 2 Mile run Time	Pearson Correlation	.252	.494	-.507	-.404	1	-.403	.233	-.191	-.231	-.281	.697	.520	-.277
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	5215	5215	5242	5240	5247	5203	4995	3236	1973	5177	5204	4538	1276
APRT Push Ups	Pearson Correlation	-.030	-.250	.602	.309	-.403	1	-.251	.337	.313	.324	-.378	-.332	.494
	Sig. (2-tailed)	.025	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	5428	5428	5207	5205	5203	5462	5228	3456	1998	5411	5450	4642	1266
APRT Shuttle	Pearson Correlation	.076	.209	-.239	-.129	.233	-.251	1	-.170	-.205	-.256	.257	.285	-.133
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	5205	5205	4998	4997	4995	5228	5238	3419	1813	5223	5226	4521	1181
APRT 1 Minute Rower	Pearson Correlation	-.087	-.108	.196	.266	-.191	.337	-.170	1	.a	.127	-.257	-.180	.a
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.	.000	.000	.000	.
	N	3437	3437	3234	3233	3236	3456	3419	3456	0	3411	3456	2995	0
APRT 2 Minutes Rower	Pearson Correlation	-.135	-.185	.192	.265	-.231	.313	-.205	.a	1	.167	-.287	-.183	.223
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.		.000	.000	.000	.000
	N	1999	1999	1979	1978	1973	1998	1813	0	2013	2009	2000	1650	1263
APRT Long Jump	Pearson Correlation	-.045	-.243	.300	.128	-.281	.324	-.256	.127	.167	1	-.255	-.469	.261
	Sig. (2-tailed)	.001	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	5392	5392	5181	5180	5177	5411	5223	3411	2009	5426	5413	4638	1266
APRT One and a Half Mile Run Time	Pearson Correlation	.297	.483	-.406	-.315	.697	-.378	.257	-.257	-.287	-.255	1	.516	-.262
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	5430	5430	5208	5206	5204	5450	5226	3456	2000	5413	5464	4641	1261
ACRT Total Time	Pearson Correlation	-.011	.320	-.397	-.204	.520	-.332	.285	-.180	-.183	-.469	.516	1	-.144
	Sig. (2-tailed)	.435	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	4675	4675	4540	4538	4538	4642	4521	2995	1650	4638	4641	4703	1297
Pullups	Pearson Correlation	-.167	-.180	.435	.298	-.277	.494	-.133	.a	.223	.261	-.262	-.144	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	
	N	1296	1296	1278	1277	1276	1266	1181	0	1263	1266	1261	1297	1306

Strength of relationship		
	Strong	(-1.0 to -0.5 or 1.0 to 0.5)
	Moderate	(-0.5 to -0.3 or 0.3 to 0.5)
Blank	Weak or none	(-0.3 ro -0.1 or 0.1 to 0.3)

Male All FORSCOM APRT ACRT

		BMI	Body fat	APFT Push Ups	APFT Sit Ups	APFT 2 Mile run Time	APRT Push Ups	APRT Shuttle	APRT1Minute Rower	APRT 2 Minutes Rower	APRT Long Jump	APRT One and a Half Mile Run Time	ACRT Total Time	Pullups
BMI	Pearson Correlation	1	.958	-.103	-.156	.348	-.087	.116	-.086	-.150	-.100	.383	.103	-.172
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	5030	5030	4782	4781	4780	4979	4824	3143	1835	4970	4973	4332	1286
Body fat	Pearson Correlation	.958	1	-.096	-.175	.381	-.079	.128	-.109	-.179	-.106	.391	.132	-.167
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	5030	5030	4782	4781	4780	4979	4824	3143	1835	4970	4973	4332	1286
APFT Push Ups	Pearson Correlation	-.103	-.096	1	.572	-.405	.536	-.165	.204	.178	.185	-.293	-.235	.430
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	4782	4782	4814	4811	4807	4781	4628	2960	1818	4771	4774	4205	1268
APFT Sit Ups	Pearson Correlation	-.156	-.175	.572	1	-.435	.334	-.136	.257	.267	.136	-.324	-.240	.300
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	4781	4781	4811	4812	4805	4779	4627	2959	1817	4770	4772	4203	1267
APFT 2 Mile run Time	Pearson Correlation	.348	.381	-.405	-.435	1	-.296	.161	-.187	-.222	-.171	.641	.401	-.267
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	4780	4780	4807	4805	4812	4779	4627	2963	1813	4769	4772	4205	1266
APRT Push Ups	Pearson Correlation	-.087	-.079	.536	.334	-.296	1	-.192	.360	.318	.230	-.284	-.191	.489
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	4979	4979	4781	4779	4779	5013	4852	3162	1843	4998	5002	4308	1256
APRT Shuttle	Pearson Correlation	.116	.128	-.165	-.136	.161	-.192	1	-.175	-.205	-.194	.203	.206	-.128
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	4824	4824	4628	4627	4627	4852	4857	3159	1692	4844	4846	4214	1173
APRT 1 Minute Rower	Pearson Correlation	-.086	-.109	.204	.257	-.187	.360	-.175	1	.a	.127	-.255	-.216	.a
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.	.000	.000	.000	.
	N	3143	3143	2960	2959	2963	3162	3159	3162	0	3153	3162	2775	0
APRT 2 Minutes Rower	Pearson Correlation	-.150	-.179	.178	.267	-.222	.318	-.205	.a	1	.150	-.264	-.166	.222
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.		.000	.000	.000	.000
	N	1835	1835	1818	1817	1813	1843	1692	0	1849	1845	1837	1532	1253
APRT Long Jump	Pearson Correlation	-.100	-.106	.185	.136	-.171	.230	-.194	.127	.150	1	-.161	-.317	.252
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	4970	4970	4771	4770	4769	4998	4844	3153	1845	5004	4992	4301	1256
APRT One and a Half Mile Run Time	Pearson Correlation	.383	.391	-.293	-.324	.641	-.284	.203	-.255	-.264	-.161	1	.418	-.252
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	4973	4973	4774	4772	4772	5002	4846	3162	1837	4992	5007	4303	1251
ACRT Total Time	Pearson Correlation	.103	.132	-.235	-.240	.401	-.191	.206	-.216	-.166	-.317	.418	1	-.132
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	4332	4332	4205	4203	4205	4308	4214	2775	1532	4301	4303	4360	1287
Pullups	Pearson Correlation	-.172	-.167	.430	.300	-.267	.489	-.128	.a	.222	.252	-.252	-.132	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.000	.000	.000	.000	
	N	1286	1286	1268	1267	1266	1256	1173	0	1253	1256	1251	1287	1296

Strength of relationship		
	Strong	(-1.0 to -0.5 or 1.0 to 0.5)
	Moderate	(-0.5 to -0.3 or 0.3 to 0.5)
Blank	Weak or none	(-0.3 ro -0.1 or 0.1 to 0.3)

Female All FORSCOM APRT ACRT

		BMI	Bodfat	APFT Push Ups	APFT Sit Ups	APFT 2 Mile Run Time	APRT Push Ups	APRT Shuttle	APRT 1 Minute Rower	APRT 2 Minutes Rower	APRT Long Jump	APRT One and a Half Mile Run Time	ACRT Total Time	Pullups
BMI	Pearson Correlation	1	.946	-.058	-.132	.258	-.131	.038	-.139	-.100	-.077	.275	-.114	-.056
	Sig. (2-tailed)		.000	.229	.006	.000	.005	.454	.017	.202	.115	.000	.036	.878
	N	463	463	437	437	435	449	381	294	164	422	457	343	10
Body fat	Pearson Correlation	.946	1	-.045	-.132	.251	-.107	.082	-.171	-.108	-.066	.271	-.095	-.117
	Sig. (2-tailed)	.000		.348	.006	.000	.023	.109	.003	.169	.174	.000	.079	.747
	N	463	463	437	437	435	449	381	294	164	422	457	343	10
APFT Push Ups	Pearson Correlation	-.058	-.045	1	.439	-.352	.400	-.150	.266	.240	.181	-.359	-.180	.448
	Sig. (2-tailed)	.229	.348		.000	.000	.000	.004	.000	.002	.000	.000	.001	.194
	N	437	437	437	437	435	426	370	274	161	410	434	335	10
APFT Sit Ups	Pearson Correlation	-.132	-.132	.439	1	-.470	.314	-.104	.357	.245	.147	-.418	-.235	.360
	Sig. (2-tailed)	.006	.006	.000		.000	.000	.046	.000	.002	.003	.000	.000	.306
	N	437	437	437	437	435	426	370	274	161	410	434	335	10
APFT 2 Mile run Time	Pearson Correlation	.258	.251	-.352	-.470	1	-.337	.172	-.326	-.282	-.194	.697	.403	-.251
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.001	.000	.000	.000	.000	.000	.484
	N	435	435	435	435	435	424	368	273	160	408	432	333	10
APRT Push Ups	Pearson Correlation	-.131	-.107	.400	.314	-.337	1	-.175	.340	.315	.242	-.304	-.124	.800
	Sig. (2-tailed)	.005	.023	.000	.000	.000		.001	.000	.000	.000	.000	.023	.005
	N	449	449	426	426	424	449	376	294	155	413	448	334	10
APRT Shuttle	Pearson Correlation	.038	.082	-.150	-.104	.172	-.175	1	-.149	-.181	-.352	.176	.263	-.362
	Sig. (2-tailed)	.454	.109	.004	.046	.001	.001		.016	.047	.000	.001	.000	.378
	N	381	381	370	370	368	376	381	260	121	379	380	307	8
APRT 1 Minute Rower	Pearson Correlation	-.139	-.171	.266	.357	-.326	.340	-.149	1	.a	.236	-.390	-.273	.a
	Sig. (2-tailed)	.017	.003	.000	.000	.000	.000	.016		.	.000	.000	.000	
	N	294	294	274	274	273	294	260	294	0	258	294	220	0
APRT 2 Minutes Rower	Pearson Correlation	-.100	-.108	.240	.245	-.282	.315	-.181	.a	1	.193	-.464	-.324	.303
	Sig. (2-tailed)	.202	.169	.002	.002	.000	.000	.047			.014	.000	.000	.394
	N	164	164	161	161	160	155	121	0	164	164	163	118	10
APRT Long Jump	Pearson Correlation	-.077	-.066	.181	.147	-.194	.242	-.352	.236	.193	1	-.179	-.281	-.255
	Sig. (2-tailed)	.115	.174	.000	.003	.000	.000	.000	.000	.014		.000	.000	.478
	N	422	422	410	410	408	413	379	258	164	422	421	337	10
APRT One and a Half Mile Run Time	Pearson Correlation	.275	.271	-.359	-.418	.697	-.304	.176	-.390	-.464	-.179	1	.473	-.324
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.001	.000	.000	.000		.000	.361
	N	457	457	434	434	432	448	380	294	163	421	457	338	10
ACRT Total Time	Pearson Correlation	-.114	-.095	-.180	-.235	.403	-.124	.263	-.273	-.324	-.281	.473	1	-.072
	Sig. (2-tailed)	.036	.079	.001	.000	.000	.023	.000	.000	.000	.000	.000		.844
	N	343	343	335	335	333	334	307	220	118	337	338	343	10
Pullups	Pearson Correlation	-.056	-.117	.448	.360	-.251	.800	-.362	.a	.303	-.255	-.324	-.072	1
	Sig. (2-tailed)	.878	.747	.194	.306	.484	.005	.378	.	.394	.478	.361	.844	
	N	10	10	10	10	10	10	8	0	10	10	10	10	10

Strength of relationship		
	Strong	(-1.0 to -0.5 or 1.0 to 0.5)
	Moderate	(-0.5 to -0.3 or 0.3 to 0.5)
Blank	Weak or none	(-0.3 ro -0.1 or 0.1 to 0.3)

APPENDIX G

Analyses of Existing APFT Data from 2nd Brigade Combat Team, 4th Infantry Division

USAPHC- AIPH IPP preliminary background analyses: comparison of male and female APFT data

If the current APFT were to be gender neutral (e.g., just have one scale for both men and women with an 8%* fail rate), we would want to know how this would affect men and women of different age groups. To determine the percentage of men and women who would fail within these specific age groups, charts were plotted showing the total population compared to either men or women in their specific age group. Tables of injury risk are also included showing that men who perform poorly on the 2-mile run and push-up test were at a higher risk of injury. There were no difference in injury risk for women and the number of push-ups performed. The women in the fastest 2-mile run time group tended to have a lower injury risk compared to the other groups.

Table G-1. Summary of Men and Women Compared to the Total Population who would Fail using an 8% Cut-off Point

Age	% Failed 2-mile run	% Failed 2-mile run	% Failed Push-ups	% Failed Push-ups
	Women	**Men**	**Women**	**Men**
≤ 25	51%	3%	60%	2%
26-35	55%	5%	60%	3%
36+	44%	11%	62%	7%

**** 8 % is used since that is the current cut-point applied to gender-specific APFT results (GAO, 1998)***

All Analyses are of Existing survey data obtained from the 4 ID 2BCT

Table G-2. Averages for Men and Women from existing 4 ID 2BCT Initial Survey Data

	Men	Women	Difference
Age	26.8± 6.0	25.8± 5.6	4%
2 Mile Run Time	14.9± 1.7	17.8± 2.2	19%
Push-Ups	66.2± 14.7	38.5± 13.9	72%
Sit-Ups	68.0± 12.8	64.1± 12.2	6%

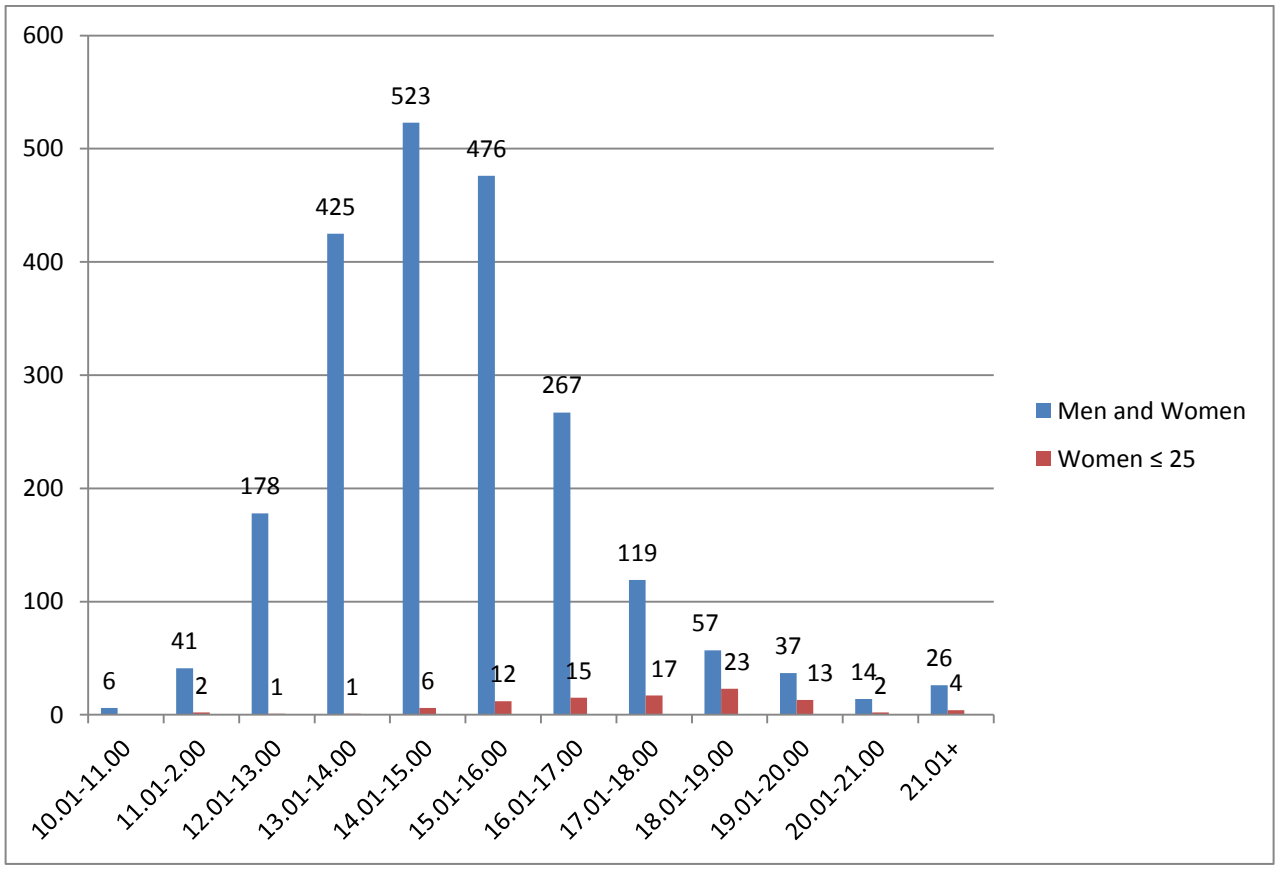


Figure G-1. Two Mile Run Times for Men and Women (n=2169) and Women ≤ 25 years old (n=96)

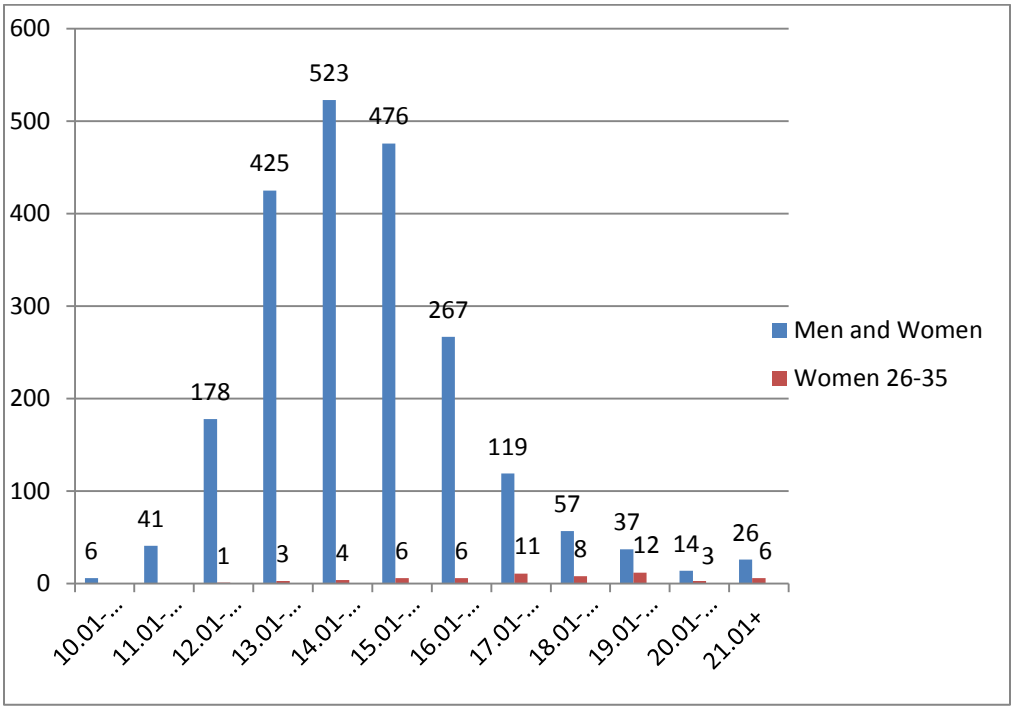


Figure G-2. Two Mile Run Times for Men and Women (n=2169) and Women 26-35 years old (n=60)

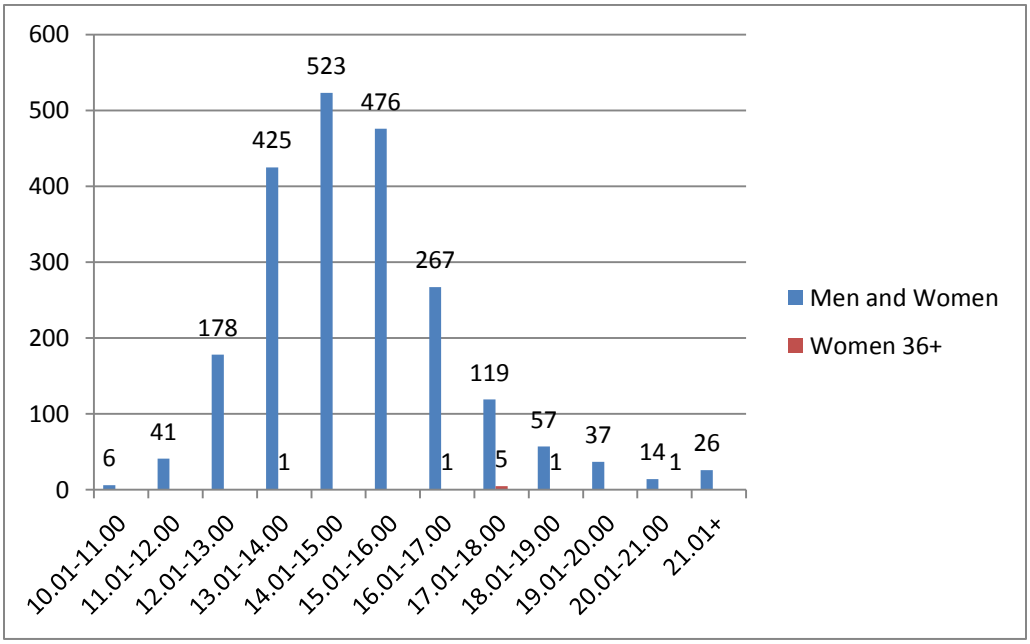


Figure G-3. Two Mile Run Times for Men and Women (n=2169) and Women 36+ years old (n=9)

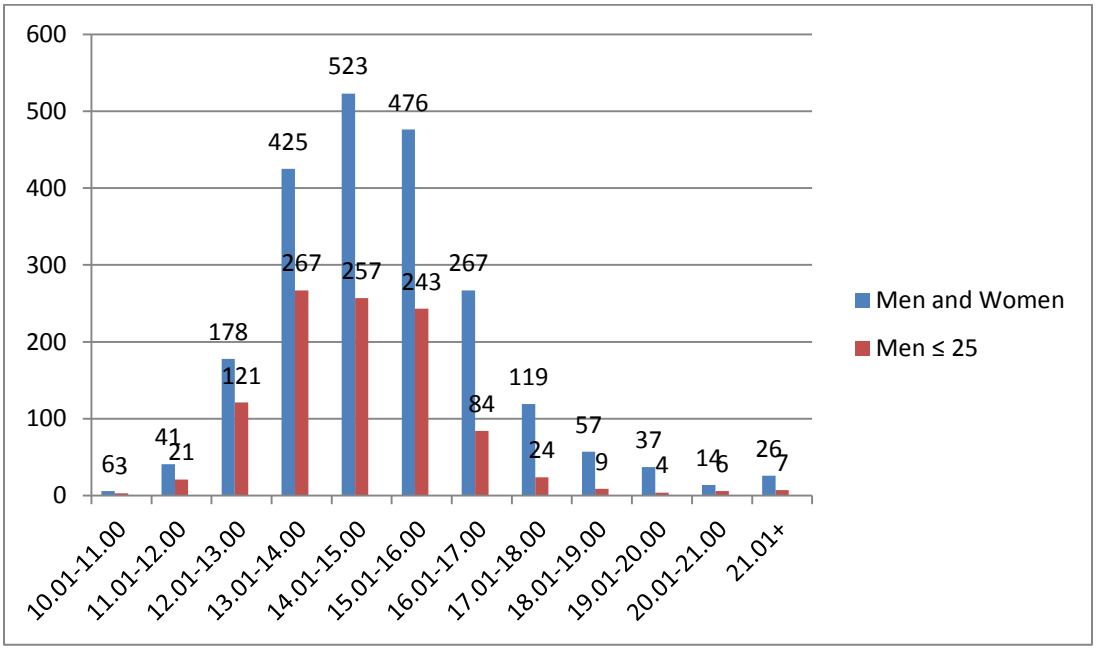


Figure G-4. Two Mile Run Times for Men and Women (n=2169) and Men ≤ 25 years (n=1046)

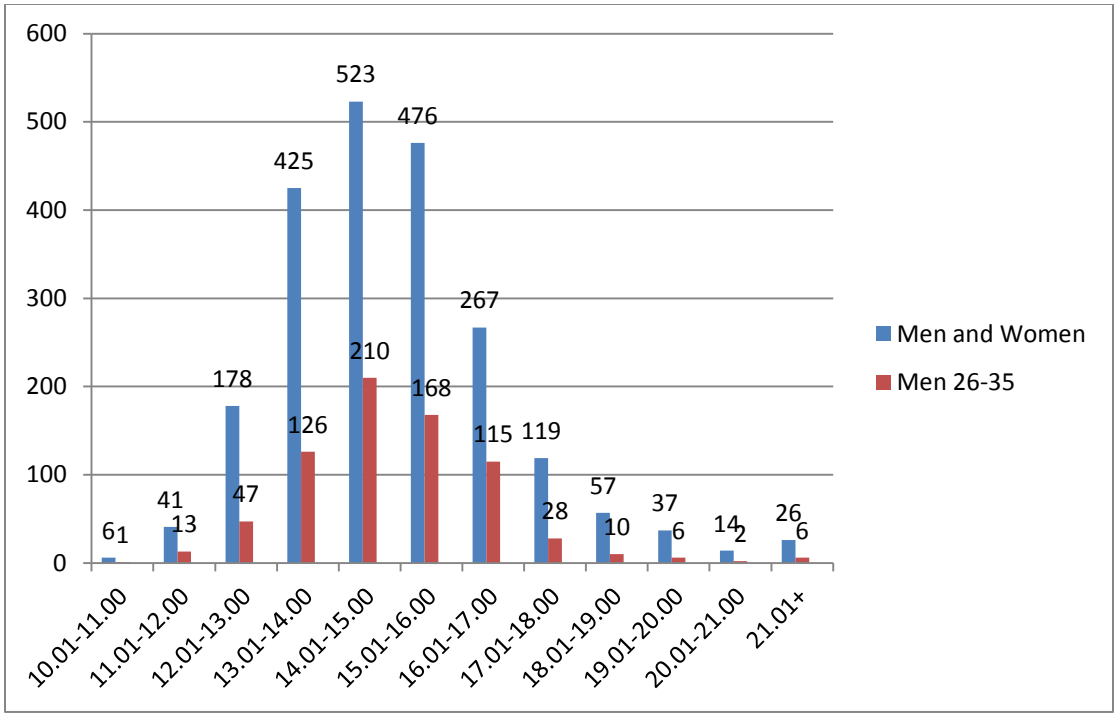


Figure G-5. Two Mile Run Times for Men and Women (n=2169) and Men 26-35 years (n=732)

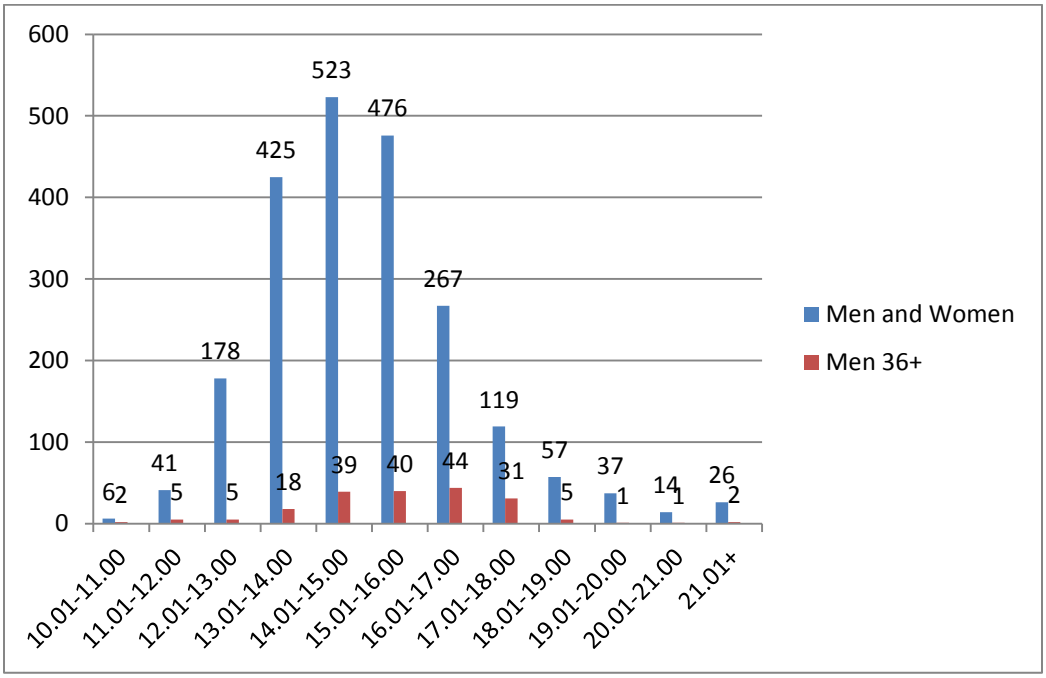


Figure G-6. Two Mile Run Times for Men and Women (n=2169) and Men 36+ years (n=193)

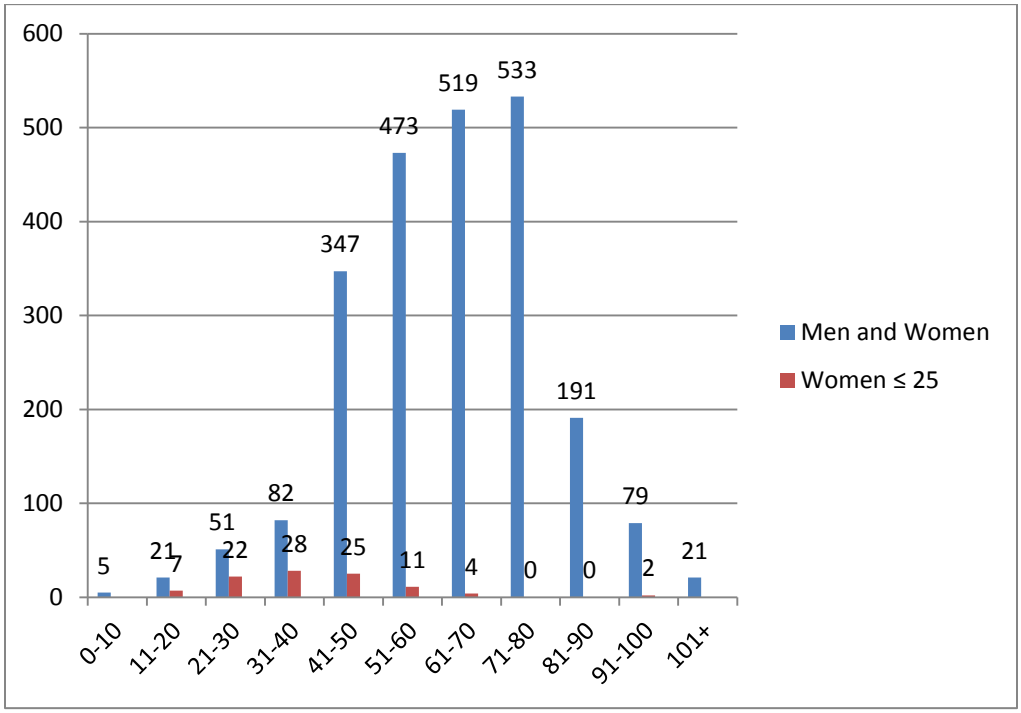


Figure G-7. Push-Ups for Men and Women (n=2322) and Women ≤ 25 years old (n=99)

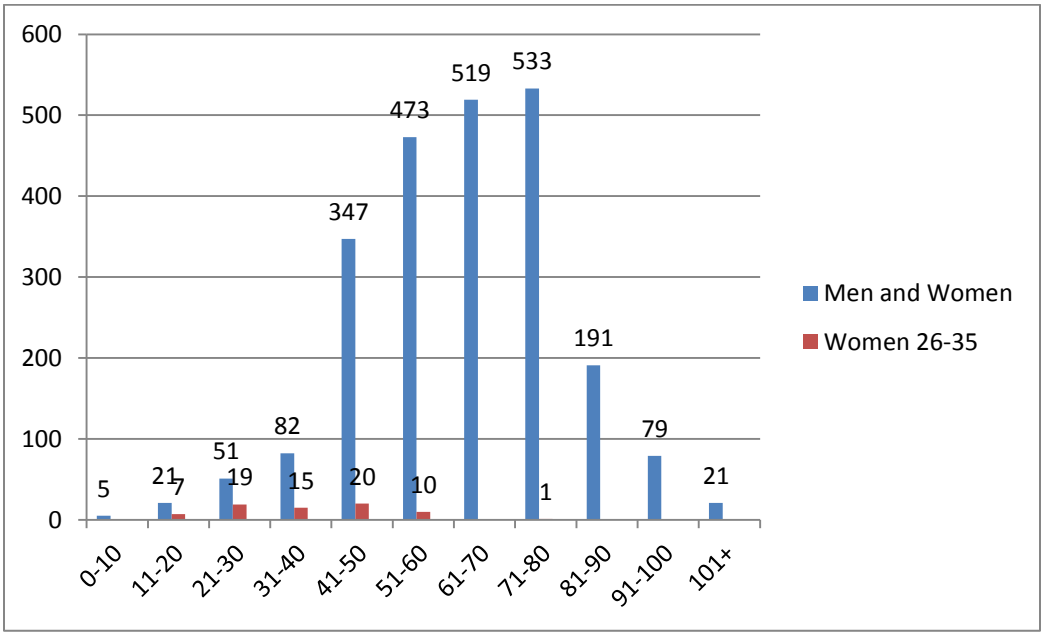


Figure G-8. Push-Ups for Men and Women (n=2322) and Women 26-35 years (n=72)

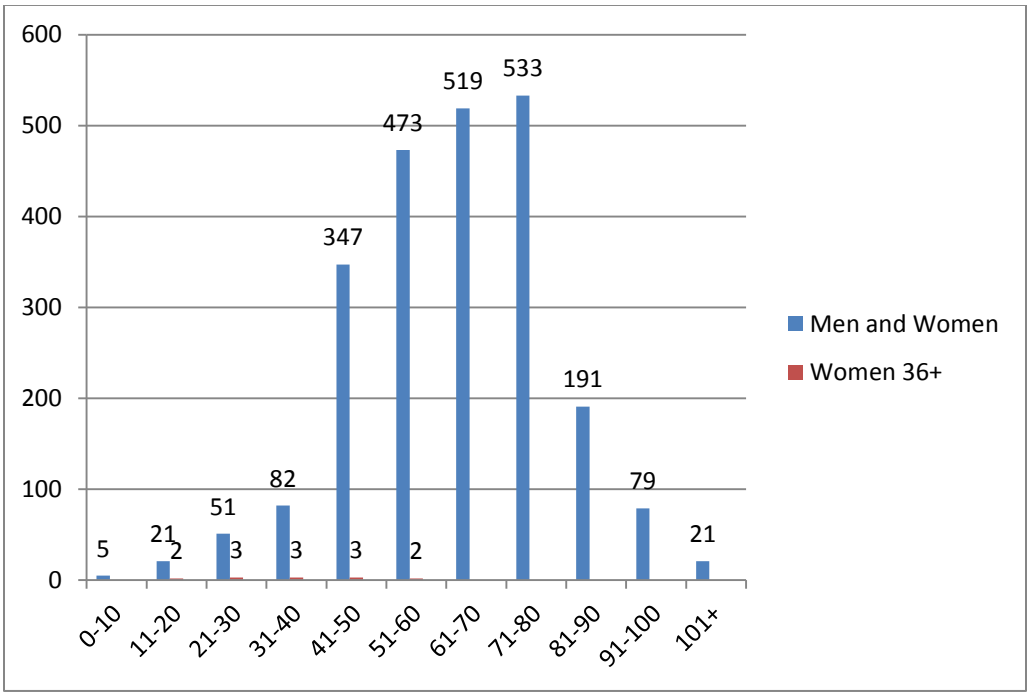


Figure G-9. Push-Ups for Men and Women (n=2322) and Women 36+ years old (n=13)

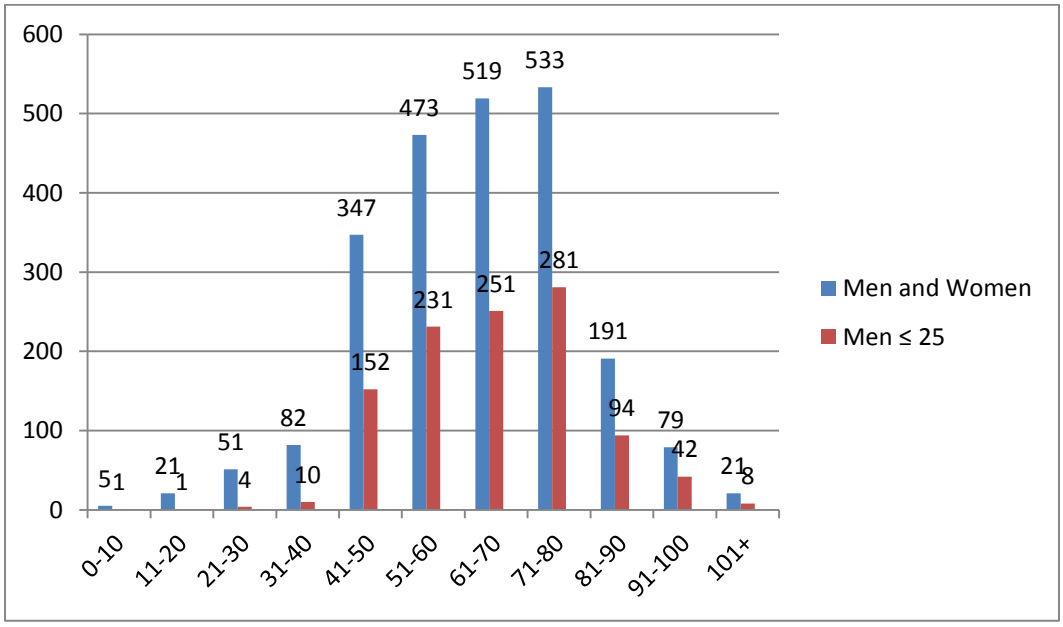


Figure G-10. Push-Ups for Men and Women (n=2322) and Men ≤ 25 years old (n=1075)

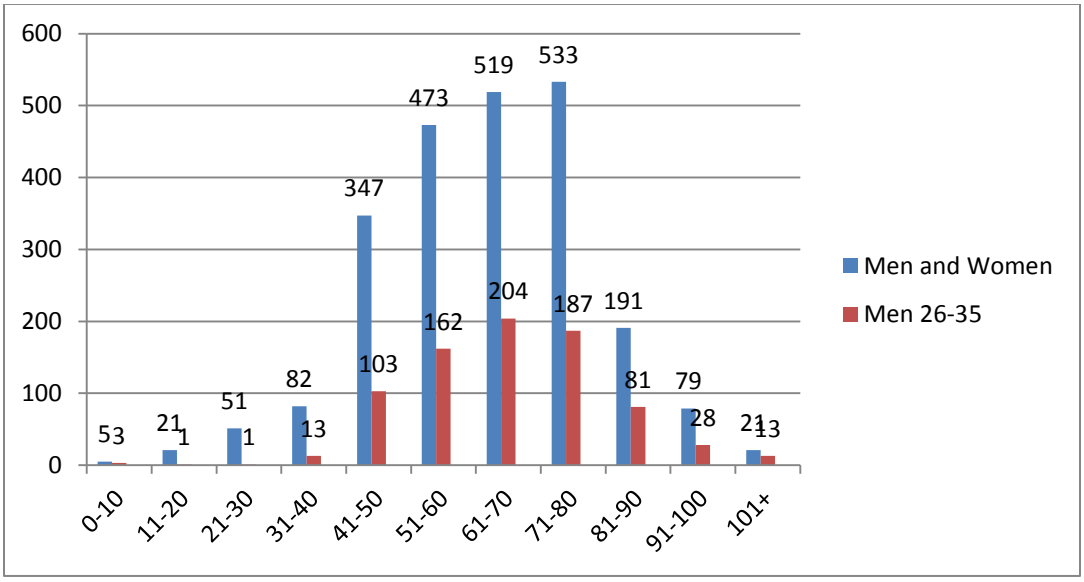


Figure G-11. Push-Ups for Men and Women (n=2322) and Men 26-35 years old (n=796)

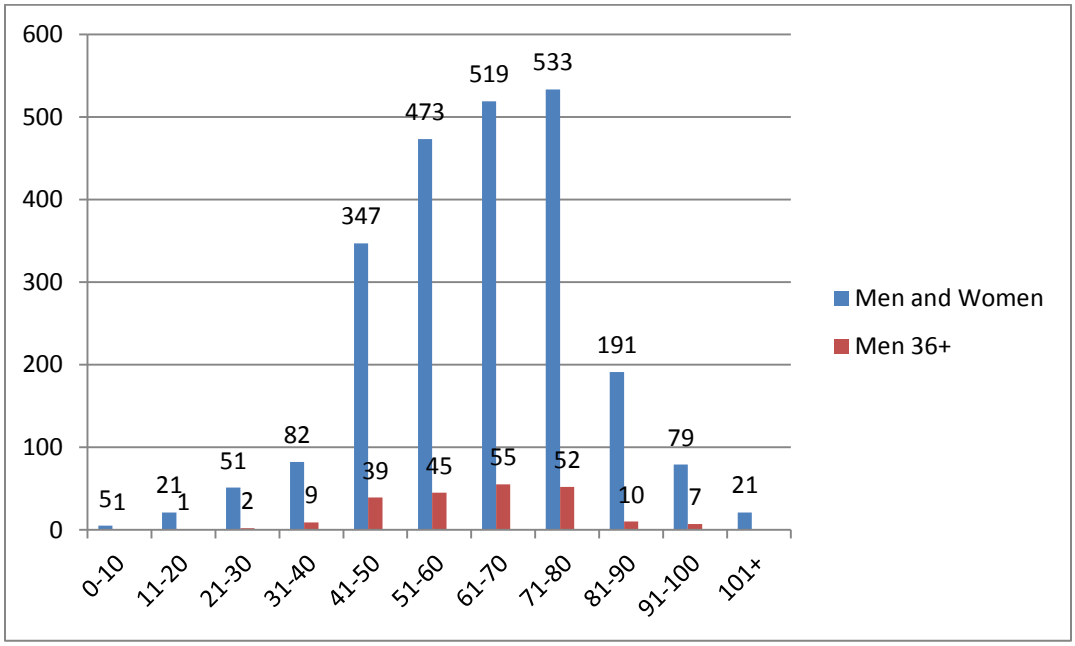


Figure G-12. Push-Ups for Men and Women (n=2322) and Men 36+ years old (n=221)*

Table G-3. Injury Risk and 2 Mile Run Times for Men

Run Time (Minutes and Fraction of a Minute)	n	% Injured	Risk Ratio and 95% CI	p-value
≤ 13.75 min	520	35%	1.00	
13.76-14.67 min	489	36%	1.04 (0.89-1.23)	0.65
14.68-15.75 min	496	41%	1.19 (1.01-1.39)	0.03
15.76+ min	497	44%	1.28 (1.10-1.49)	<0.01

Table G-4. Injury Risk and 2 Mile Run Times for Women

Run Time (Minutes and Fraction of a Minute)	n	% Injured	Risk Ratio and 95% CI	p-value
≤ 16.13 min	42	33%	1.00	
16.14-17.83 min	43	49%	1.47 (0.87-2.48)	0.15
17.84-19.00 min	44	64%	1.91 (1.18-3.09)	<0.01
19.01+ min	42	50%	1.50 (0.89-2.53)	0.12

Table G-5. Injury Risk and Push-Ups for Men

Push-Ups (reps)	n	% Injured	Risk Ratio and 95% CI	p-value
≤ 55	542	49%	1.32 (1.14-1.52)	<0.01
56-66	541	40%	1.10 (0.94-1.28)	0.24
67-76	539	38%	1.02 (0.87-1.19)	0.82
77+	503	37%	1.00	

Table G-6. Injury Risk and Push-Ups for Women

Push-Ups (reps)	n	% Injured	Risk Ratio and 95% CI	p-value
≤ 28	50	58%	1.41 (0.88-2.24)	0.13
29-39	24	55%	1.33 (0.82-2.15)	0.24
40-50	29	46%	1.12 (0.69-1.81)	0.64
51+	14	41%	1.00	

APPENDIX H

Baseline Soldier Physical Readiness Study Initial Planning Conference
Initial Military Training Center of Excellence; Ft Eustis VA
2-3 October 2012

USAPHC EXSUM
and
TRADOC Briefing
presented by Mike Haith, TRADOC IMT-CoE

Public Health Report No. 12-01-0614

TRADOC SOLDIER PHYSICAL READINESS STUDY PLANNING MEETING

(UNCLASSIFIED)

EXECUTIVE SUMMARY

4 October 2012

(U) SUMMARY OF PHYSICAL READINESS STUDY PLANNING MEETING. (U) (MCHB-IP-DI) On October 2-3, Dr Nindl, CPT DeGroot and Mr Hauret of the Army Institute of Public Health (AIPH) along with CSM Ecker participated in a meeting at Ft Eustis hosted by the TRADOC DCG for IMT. The purpose of the meeting was to develop possible courses of action (COA) for creating a new physical readiness test to replace the current Army Physical Fitness Test. In addition to TRADOC IMT personnel, subject matter experts from USARIEM, West Point and USUHS participated in the planning meeting. Four possible COAs were developed, each of which includes a survey of appropriate stakeholders and a systematic review of the literature; AIPH was identified as the lead for those tasks. In the coming months the COAs will be refined into discreet phases, with subtasks, milestones and phase leads. The TRADOC CG will be briefed in mid-December at which time we expect a COA to be chosen. We anticipate a 2-year timeline until study completion and recommendations for the test. AIPH/APHC personnel will be playing a significant role throughout this important, high-visibility project.

CPT DeGroot/MCHB-IP-DI

APPROVED BY: Dr Bruce Jones

Baseline Soldier Physical Readiness Study Initial Planning Conference

2-3 OCT 12
Initial Military Training Center of Excellence
Ft Eustis VA

Conference Outcome

- Finalize Study Plan Team
- Develop NMT 3 Study Plan Courses Of Action for presentation to CG TRADOC for approval NLT 15 DEC 12
- APRT and/or ACRT?
- Develop Literature Review Assignments for Presentation at initial CG TRADOC Decision Brief

Conference Agenda

OCT 2		
Registration and Refreshments	0730-0800	Mr. Haith
Welcome and Introductions	0800-0830	Mr. Haith
Study Overview-Mr Haith	0830-0900	Mr. Haith
WTBD overview	0900-0930	Mr. Haith
MG May Welcome Remarks	0930-0945	MG May
Study Plan Proposals	0945-1300	
Historical Review of Army PRT	0945-1015	Dr. East
USMA	1015-1100	Dr. East
USARIEM	1100-1145	Dr. Zambraski
IPH	1145-1200	Mr. Haith
CHAMP	1200-1315	Mr. Haith
Working Lunch	1200-1300	Breakout Group Leaders
Study Plan Refinement	1315-1700	Breakout Group Leader
OCT 3		
Study Plan Refinement	0800-1100	Breakout Group Leaders
Literature review assignments-Determining what we know and don't know	1100-1200	Mr. Haith
Conference Wrap Up	1200-1230	Mr. Haith

3

Attendees

Name	Position	Organization
Mr. Michael E. Haith	HQE	Initial Military Training Center of Excellence
Dr. Whitfield East	Professor/Title 10	United States Military Academy Department of Physical Education
Dr. Todd Crowder	Associate Professor/Title 10	
Mrs. Marilyn A Sharp	Research Exercise Scientist	US Army Research Institute of Environmental Medicine Military Performance Division
Dr. Barry Spiering	Research Physiologist	
Dr Edward Zambraski	Chief, Military Performance Division	
Mr Keith Hauret	Epidemiologist	Army Public Health Command (PHC)
Dr Bradley Nindl	Scientific Advisor	
CPT David DeGroot	Field Invest. Team Leader	
CSM Gerald Ecker	PHC CSM	
Dr. Dianna Purvis	Director, Strategic Operations and Special Programs	Uniformed Services University Consortium for Health and Military Performance (CHAMP)
SGM Jerry Taylor	TRADOC G3 SGM	TRADOC G3
MAJ Nelson Wahab	TRADOC G3 Institutional Training	TRADOC G3

Baseline Soldier Physical Readiness Study

- Purpose
- Study Participants
- Study Concept
- Study Phase Tasks
- Current Status

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Baseline Soldier Physical Readiness Study

STUDY PURPOSE

- Identify *baseline* soldier physical readiness *requirements* to *perform Warrior Tasks and Battle Drills* (WTBD)
- Develop *physical readiness test(s)* that *evaluates baseline fitness* against *valid performance standards* for *all soldiers*
  - Test assesses all 3 components of PRT Doctrine- endurance, strength, and mobility
  - Standards of performance for all Soldiers, independent of age or gender
  - Standards and Testing aligned with TC 3-22.20, Army Physical Readiness Training (PRT)

WAY AHEAD

- Study duration-1 OCT 12 to 30 SEP 14
- Study Plan-5 Phases:
  - Phase I-Study Plan Development 15 DEC 12
  - Phase II-WTBD Physical Demands Analysis 14 APR 13
  - Phase III-Test Development 31 JUL 13
  - Phase IV-Test Validation 13 DEC 13
  - Phase V-Establish Test Standards 6 JUN 14
- Phases conclude w/ decision brief to CG, TRADOC
- Study concludes w/ Decision Brief to CSA/SMA NLT 11 JUL 14

STUDY PARTICIPANTS

- IMT CoE (Co-lead)
- USMA (Co-lead)
- US Army Research Institute of Environmental Medicine (USARIEM)
- US Army Institute of Public Health (IPH)
- Uniformed Services University (USU)
- University of North Texas-Dr. James R. Morrow

CURRENT STATUS

- Phase 1 Start-Initial Planning Conference 2-3 OCT at Ft Eustis
- HQDA TASKORD and UFR ($200K) with TRADOC for final staffing
- DA G3 Institutional Training (DAMO-TRI) is DA Sponsor
- All participants agreed to take part in study
- Study coordinated w/ the TRADOC KSAO Review

DRAFT

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Study Purpose

Employing a team of Army and Civilian SME:

- Identify *baseline* soldier physical readiness *requirements* to *perform Warrior Tasks and Battle Drills* (WTBD) that are *criterion based* and focused on principles of *functional fitness* in order to *perform baseline military tasks* required of *all soldiers* in combat
- Develop baseline physical readiness *assessment tool* (test) for commanders that *accurately evaluates baseline fitness* levels against *valid performance standards* required for all Soldiers to perform baseline military tasks (WTBD)

Study Participants

- IMT CoE-Mr. Michael Haith, Study lead
- Department of Physical Education, USMA-Dr. Chip East, Co-lead
- US Army Research Institute of Environmental Medicine (USARIEM)-Dr. Ed Zambraski, USARIEM Lead
- US Army Institute of Public Health (IPH)- Dr. Bruce Jones, IPH Lead
- Uniformed Services University (USU)- Dr. Patricia Deuster, USU lead
- Comprehensive Soldier Family and Fitness-LTC Dan Johnston, MC
- Academic SME-Dr. James R. Morrow, Regents Professor Kinesiology, Health Promotion & Recreational Studies, University of North Texas

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Study Concept

This study will address and/or determine as a minimum:

- The requirement for Fundamental and Functions Fitness tests
- The component physical demands of combat/WTBD
- Field-expedient events that replicate the physical demands on soldiers in combat and baseline soldier skills required to perform WTBDs
- Field-expedient events that accurately predict ability to execute relevant combat tasks in WTBDs
- Are certain events more predictive of WTBD physical performance than others

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Revised CG TRADOC Decisions

- ❑ COA 1 -Modified APFT (3 events)
  - ➢1 min Push-up
  - ➢1 min Rower
  - ➢2-mile Run

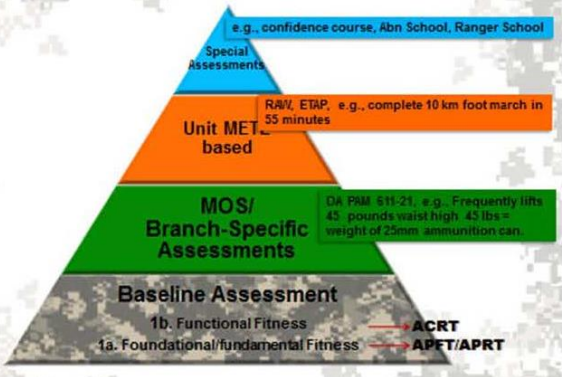
DP

- ❑ COA 2-APRT+ (Retain 2-mile Run)
  - ➢60-yard Shuttle Run
  - ➢1 min Rower
  - ➢Standing Long Jump
  - ➢1 min Push-up
  - ➢2-mile Run
- ❑ COA 3-2 yr (transition from 3 to 5 events)
  - ➢1 min Push-up
  - ➢1 min Rower
  - ➢2-mile Run

  Phase 1
  - ➢Standing Long Jump
  - ➢60-yard Shuttle Run

  Phase 2

Physical Fitness Test Taxonomy



Commander's Intent

Success of this study effort is defined as:

- Transparent study responsive to TRADOC CSM direction
- Identification of baseline soldier physical readiness requirements to perform WTBD that are criterion based and incorporate principles of functional fitness
- Development of valid authentic field-expedient assessment tools for commanders that predict Soldier ability to execute WTBD as a *baseline* level of physical preparedness
- A test(s) that assesses all 3 components of Army Physical Readiness- *Endurance (muscular and cardio-respiratory), strength, and mobility.*
- Selection of test events that have high correlation to physical demands of combat and WTBD
- Determination of the threshold of success (standards of performance) for *all Soldiers*, independent of age or gender.
- Standards and Testing aligned with TC 3-22.20, *Army Physical Readiness Training (PRT).*
- Results that inform KSAO review of fitness requirements for specific branch/MOS/job/unit performance.

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Study Plan

IMT CoE will conduct the Baseline Soldier Physical Readiness Study in 5 Phases:

	Suspense
– Phase I-Study Plan Development	15 DEC 12
– Phase II-WTBD Physical Demands Analysis	14 APR 13
– Phase III-Test Development	31 JUL 13
– Phase IV-Test Validation	13 DEC 13
– Phase V-Establish Test Standards	6 JUN 14

- Each Phase concludes w/ decision brief to CG, TRADOC
- Study duration-1 OCT 12 to 30 SEP 14
- Study concludes with Decision Brief to CSA/SMA NLT 11 JUL 14

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Phase I Tasks
Study Plan Development

- Organize research team
- Research Design Planning
- Survey the force for lessons learned after a decade+ of war
- Review of literature
- Review existing policies and procedures
- Analyze trends and indicators of individual (pre & post accession) and unit fitness
- Determine process to analyze physical demands of WTBDs
- Decision brief to CG, TRADOC NLT 15 DEC

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Phase II Tasks
WTBD Physical Demands Analysis

- Determine and analyze physical requirements of WTBDs
- Report literature review
- Review criterion based assessments
- Review field expedient measures of combat readiness
- Decision brief to CG TRADOC NLT 30 APR 13

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Phase III Tasks
Test Development

- Develop criterion based measures of WTBD
- Develop acceptable Test events and test constructs
- Analysis of alternatives
- Determine limitations on recommended test battery – events, levels
- Decision Brief to CG TRADOC NLT 31 JUL 13

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Phase IV Tasks
Test Validation

- Collect empirical data for criterion and field expedient test events
- Collect performance data
- Utilize the qualitative and quantitative empirical data to develop battery of field expedient measures to best predict criterion measure
- Decision Brief to CG TRADOC NLT 13 DEC 13

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Phase V Tasks
Establish Test Standards

- Collect referent data for various demographic populations in order to establish performance scales
- Collect data for the final test events in order to establish preliminary scoring scales and standards.
- Decision Brief to CG TRADOC NLT 6 JUN 14.
- Decision Brief to CSA and SMA for approval of Physical Readiness test with Standards NLT 11 JUL 14.

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Current Status

- Established by invitation milSuite site to share documents and status

  https://www.milsuite.mil/book/groups/soldierbaselinephysicalreadiness
- Phase 1 start 1-4 OCT 12 Ft Eustis-Bldg 210 IMT CoE
- HQDA TASKORD and UFR with TRADOC Staff for final staffing S: 28 SEP 12
- DA G3 Institutional Training (DAMO-TRI) is DA Sponsor
- All participants have agreed to participate
- Coordinated Study TASKORD with TRADOC LNO to FORSCOM (Colonel
- Coordinating study with the TRADOC KSAO Review

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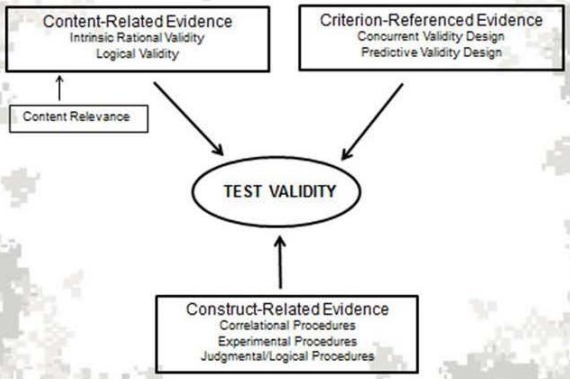
USMA-Testing Outcomes

- To provide an accurate representation of performance

1. Validity – the appropriateness, meaningfulness, and usefulness of specific inferences made from test scores
2. Reliability – consistency of outcomes over time (intra-rater reliability)
3. Objectivity – consistency of outcomes over raters (inter-rater reliability)

Establishing Test Validity



Developing a Functional Fitness Test

1. Identify the physiological aspects of WTBD
2. Review input for the field
3. Collect empirical data as needed
4. Formulate assessment(s)
5. Validate against a known criterion

Content-Related Evidence - APRT

APRT
Bench Press
Sumo Squat
Pull-ups
1.5 MR
Rower
Burpee Pushup
400m sprint

FIELD-EXPEDIENT ASSESSMENTS			
Bench 1rm	military press	Bench press	DB fly
Sumo squat	DB squat	Dead lift	Back squat
pullups	bar chin	rope climb	horiz ladder
ATB	heel hook	hanging crunch	Hanging raise
load carry	load drag	long jump	Sled push
1.5 MR	2MR	3MR	4MR
situps	crunches	plank	rower
burpee pushup	push-up	push-lift	dips
400m sprint	300m shuttle	200m sprint	300m shuttle

BOGSAT

Criterion-Referenced Evidence - APRT

APRT
Back Squat
Load Carry
ATB
2MR
Rower
Burpee Pushup
400m sprint

FIELD-EXPEDIENT ASSESSMENTS			
Bench 1rm	military press	Bench press	DB fly
Sumo squat	DB squat	Dead lift	Back squat
pullups	bar chin	rope climb	horiz ladder
ATB	heel hook	hanging crunch	Hanging raise
load carry	load drag	long jump	sled push
1.5 MR	2MR	3MR	4MR
situps	crunches	plank	rower
burpee pushup	push-up	push-lift	dips
400m sprint	300m shuttle	200m sprint	300m shuttle

Concurrent/Predictive Validity

Combat Skills/WTBDs

Construct-related Evidence - APRT

APRT
50m Sled Push
Military Pre
400 m sprint
3MR
Planks

FIELD-EXPEDIENT ASSESSMENTS			
Bench 1rm	military press	Bench press	DB fly
Sumo squat	DB squat	Dead lift	Back squat
pullups	bar chin	rope climb	horiz ladder
ATB	heel hook	hanging crunch	Hanging raise
load carry	load drag	long jump	sled push
1.5 MR	2MR	3MR	4MR
situps	crunches	plank	rower
burpee pushup	push-up	push-lift	dips
400m sprint	300m shuttle	200m sprint	300m shuttle

Construct #1	Construct #2	Construct #3	Construct #4	Construct #5
load carry	back squat	400m sprint	5 mile run	rower
Pull-ups	dead lift	300m spring	2 mile run	orunches
Pushups	sumo squat	300 yd shuttle	1.5 mile run	situps
Bench press	load drag	200m spring	12 mile ruck	plank
burpee pushup	load carry	5-10-5 Pro	8 mile ruck	leg raises
rope climb	SLJ	burpee pushup		
dips				
horiz ladder				

Consortium for Health and Military Performance (CHAMP

Course of Action for APRT Study

1 October 2012

Dianna Purvis, PhD(c), PMP

Director, Strategic Operations and Special Programs

APRT Study Tasks

PHASE 1: Analysis

- Identify mission essential tasks (MET) associated with Warrior Tasks and Battle Drills (WTBD) required for all Soldiers
- Identify functional movements associated with METs
  - Squat, deadlift, overhead press, trunk rotation, etc.
- Identify energy system contribution to METs
  - Aerobic vs. anaerobic
    - Identify time to perform MET - Short burst, medium effort, or long and sustained activity
- Identify movement qualities associated with MET
  - Mobility - Agility
  - Balance/stability - Accuracy

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APRT Study Tasks (cont.)

PHASE 2: Development

- Develop baseline soldier physical readiness requirements to perform WTBD
  - Based on analysis phase results
  - Incorporate relevant Soldier survey data
    - Information from Soldiers based on their perceived needs to be physically ready for MET
    - Highlights strengths and weaknesses of current PRT and conditioning methods from Soldier's perspective
- Develop physical readiness test (PRT) that assesses required components of WTBD
  - Include endurance, strength, and mobility and any other essential elements as defined by analysis phase

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APRT Study Tasks (cont.)

PHASE 3: Testing

- Pilot test PRT
- Refine PRT test based on pilot data
- Validate PRT test
- Establish age and gender norms
- PHASE 4: Surveillance
- Construct data capture system/use existing systems to assess new PRT standards effect on reduction of musculoskeletal injuries and improved physical readiness
  - Is it working to improve physical readiness and reduce injuries?

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Literature Review Assignments

- Physical Training Test History Overview-USMA
- Female Physical Development and Injuries-IPH
- Injuries and Injury Prevention-IPH
- Selecting physical Performance Standards-USARIEM
- Foreign Army Physical Testing and Test Development-USARIEM
- Army Physical Development and Testing (RAW, ETAP, etc)-IPH
- Sister Service Testing and Test Development-IMT-Mr Haith

COA Development

- Physical Training Test History Overview-USMA
- Female Physical Development and Injuries-IPH
- Injuries and Injury Prevention-IPH
- Selecting physical Performance Standards-USARIEM
- Foreign Army Physical Testing and Test Development-USARIEM
- Army Physical Development and Testing (RAW, ETAP, etc)-IPH
- Sister Service Testing and Test Development-IPH

COA #1

1. Conduct systematic review
2. Conduct focus groups and surveys with Army Leaders
3. Based on the systematic review and focus group results, develop/identify all field-expedient foundation fitness tests to meet physical requirements WTBDs
   - Narrow field-expedient test options
4. Obtain stakeholder and external SME consensus of the foundation fitness test(s)
5. Submit fitness test battery to CG, TRADOC for approval.
6. Conduct field study to determine the criterion-referenced standard (2 months)
7. Submit recommended physical fitness test battery and standards.

COA #2

1. Conduct systematic review (6 months)
2. Conduct focus groups and surveys with Army Leaders (3 months; concurrent with #1)
   - Identify WTBD descriptions and field-expedient tests
3. Based on the systematic review and focus group results, develop/identify all field-expedient foundation fitness tests to meet physical requirements WTBDs (1 month)
   - Narrow field-expedient test options
4. Conduct field study to collect performance data to establish the construct validity the foundation fitness events (6 months)
5. Obtain stakeholder and external SME consensus of the foundation fitness test(s) (1month)
6. Submit fitness test battery to CG, TRADOC for approval
7. Conduct field study to determine the criterion-referenced standard (2 months)
8. Submit recommended physical fitness test battery and standards.

COA #3

1. Systematic review (6 months)
2. Panel/SME meeting (based on results of systematic review) to leverage /refine currently existing scientific protocol (1 month)
   - Define WTBD tests
   - Identify reasonable field-expedient tests (APRT tests)
3. Data collection (6 months)
   - WTBD performance
   - Field-expedient test performance
   - Leader assessment of soldier performance
4. Data analysis (2 months)
   - Establish minimally acceptable WTBD performance
   - Identify most predictive field-expedient tests
5. Submit fitness test battery to CG, TRADOC for approval
6. Conduct field study to determine the criterion-referenced standard (2 months)
7. Submit recommended physical fitness test battery and standards.

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COA #4

1. Systematic review (6 months)
2. Thorough task analysis (6-9 months; concurrent with Step #1)
   1. Survey workforce
   2. Focus groups
   3. WTBD / common soldiering task analysis (instrumented field data collection)
3. Test development (3 months)
   1. WTBD simulations
   2. Field-expedient tests
   3. SME/Army approval
4. Data collection (6 months)
   - WTBD performance
   - Field-expedient test performance
   - Leader assessment of soldier performance
5. Data analysis (2 months)
   - Establish minimally acceptable WTBD performance
   - Identify most predictive field-expedient tests
6. Submit fitness test battery to CG, TRADOC for approval
7. Conduct field study to determine the criterion-referenced standard (2 months)
8. Submit recommended physical fitness test battery and standards.

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APPENDIX I

TRADOC Initial Baseline Soldier Physical Readiness Requirements Study Concept Brief
for the Army Chief of Staff (CSA)
27 November 2012

Presented by Mike Haith, TRADOC IMT-CoE

Baseline Soldier Physical Readiness Requirements Study

Brief to CSA 27Nov12

"It [PRT] may not be the most important thing we do in a day, but it's the most important thing we do everyday"

CPT Nicholas Bilotta
Company Commander, TF Spader, Konar Province, 2011

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Baseline Soldier Physical Readiness Requirements Study

STUDY PURPOSE

- Identify *baseline* Soldier physical readiness *requirements* to *perform Warrior Tasks and Battle Drills* (WTBD)
- Develop *physical readiness assessment* that *evaluates baseline fitness* against *valid performance standards* for *all Soldiers*
  - Assess:
    - 3 components of PRT Doctrine (Endurance, Mobility, Strength)
    - 2 Levels of Fitness (Physical, Functional)
  - Standards of performance for all Soldiers, independent of age or gender
  - Standards and assessment aligned with FM 7-22, Army Physical Readiness Training (PRT)

WAY AHEAD-linked w/ KSAO Review

- Study duration: 23-28 Months
- Study Plan - 5 Phases
  - 1 – Human Use & Systematic Review — 28 JUN 13
  - 2 – Task Identification — 31 OCT 13
  - 3 – Establish Task Parameters — 20 DEC 13
  - 4 – Event Selection/Validation — 15 DEC 14
  - 5 – Final Test and Standards — 30 APR 15
- Phases conclude w/ decision brief to CG, TRADOC
- Study concludes w/ Decision Brief to CSA/SMA NLT 15 May 15

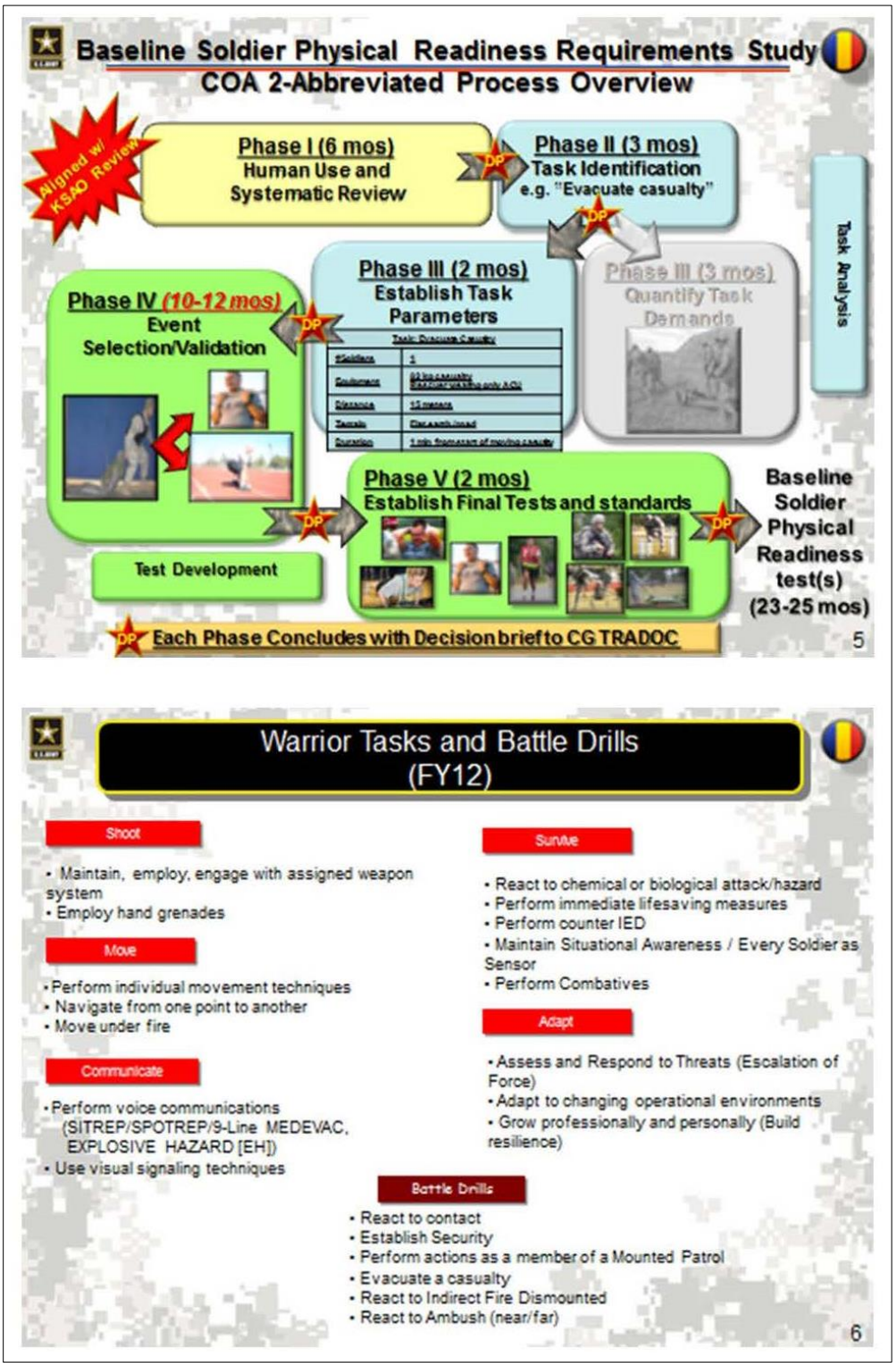
STUDY PARTICIPANTS

- IMT CoE (Co-lead)
- USMA (Co-lead)
- US Army Research Institute of Environmental Medicine (USARIEM)
- US Army Institute of Public Health (IPH)
- Uniformed Services University (USU)
- External SMEs/Consultants-Led by Dr. James R. Morrow, University of North Texas

CURRENT STATUS

- Initial Planning Conference 2-3 OCT at Ft Eustis
- HQDA TASKORD with DA G3 for approval and execution
- CG TRADOC approved study plan-21 NOV 12
- Coordinating study with TRADOC SFTA 2020, MFTC, annual WTBD review
- $276 K UFR approved

2


Baseline Soldier Physical Readiness Requirements Study
COA 2-Abbreviated Process Overview
Aligned w/ KSAO Review
Phase I (6 mos)
Human Use and Systematic Review
Phase II (3 mos)
Task Identification
e.g. "Evacuate casualty"
Phase III (2 mos)
Establish Task Parameters
Phase III (3 mos)
Quantify Task Demands
Task Analysis
Phase IV (10-12 mos)
Event Selection/Validation
Phase V (2 mos)
Establish Final Tests and standards
Baseline Soldier Physical Readiness test(s) (23-25 mos)
Test Development
Each Phase Concludes with Decision brief to CG TRADOC
5
Warrior Tasks and Battle Drills (FY12)
Shoot
• Maintain, employ, engage with assigned weapon system
• Employ hand grenades
Move
• Perform individual movement techniques
• Navigate from one point to another
• Move under fire
Communicate
• Perform voice communications (SITREP/SPOTREP/9-Line MEDEVAC, EXPLOSIVE HAZARD [EH])
• Use visual signaling techniques
Survive
• React to chemical or biological attack/hazard
• Perform immediate lifesaving measures
• Perform counter IED
• Maintain Situational Awareness / Every Soldier as Sensor
• Perform Combatives
Adapt
• Assess and Respond to Threats (Escalation of Force)
• Adapt to changing operational environments
• Grow professionally and personally (Build resilience)
Battle Drills
• React to contact
• Establish Security
• Perform actions as a member of a Mounted Patrol
• Evacuate a casualty
• React to Indirect Fire Dismounted
• React to Ambush (near/far)
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APPENDIX J

USAPHC Preliminary Review –
Military-Relevant Tasks Identified for Systematic Review

Table J-1. Summary of Preliminary Assessment of Military (Army) - Relevant Tasks

MILITARY	Manual tasks Lift, Carry, Push, Pull	Upright Moving Marching, Walking, Running	Other Key Activities	Sources and Notes
CANADA (2009)	▪ Lift (e.g., Ammunition box) ▪ Carry (e.g. Sand bag) ▪ Lift & carry (Jerry can)	Marching -Weight-loaded (~13 km) 3 loads: Fighting/Approach/Emergency	▪ Digging (Entrenchment dig)	NATO 2009 - key source Singh et al, 1991
CANADA (2008-2010)	*Same as above, plus:* ▪ Vehicle extrication (VE) ▪ Casualty Drag (CD) (150-180 lb mannequin 20-25 m) Per observations, drag new method and about one third of 126 observed CE involved VE.	Re-Evaluation of marching: still appears a very relevant task even for non-Combat based on surveys. Almost half of respondents indicated often or more though distance < 13 k and loads heavier	Re-evaluation of digging: appears somewhat relevant task though not definitive data	Reilly 2010 -Canadian 'standards' test for job selection and readiness is separate from physical fitness test (push up, sit up, run) 2010 – Canadian Land Force PT Assessment – evaluation of (7) Predictive Fitness Tests: pushups, grip strength, grip endurance, static squat, static row, wall sit, vertical jump. Evaluation of CD/VE = grip strength and static squat most predictive
UNITED KINGDOM (2009)	▪ Lifting (88%) ◆ ~70% from ground; 57% to waist, 28% to shoulder, 15% to overhead; test via Ammunition box lift of 1.7 m ▪ Carry (48%) ◆ Tet with: sand bag, drum, extinguisher ▪ Push -pull (3%)	▪ March (Road) (2 %)	▪ Digging (Trench Dig) (1%) ▪ Climbing (3%) ▪ Crawling (2%)	NATO 2009 key sources: Bilzon 2002 Rayson, 1998: % are based on 1998 task review
NETHERLANDS	▪ Lifting and carrying	▪ Walking (Loaded)		NATO 2009
UNITED STATES (2009)	▪ Lifting/lowering (41%) ▪ Carry/load bear (30%) ▪ Pull/torque (6%) ▪ Push	▪ Walking/Running/Marching ▪ Infantry -Marching for a long distance, load bearing)	▪ Climb/descend (4%) ▪ Reach 2% ▪ Stoop 2 % ▪ (Dig/Crawl/Throw etc -<1%)	NATO 2009 - % are based on Sharp et al, 1998 a review of 1,999 MOS task requirements (does not address actual measured continuum of activity levels) Also Knapik 2004 (TR)
UNITED STATES (2011, and 2013 Warrior Tasks and Battle tasks (WTBD)) Analysis)	*Above items but more specifically:* ▪ 'Casualty evacuation' [top ranked Battle Drill, 'life saving measures ' top warrior task) ▪ Lift and carry specific weights listed for each MOS (see Notes) based on tasks involving equipment, supplies, ammunition) ▪ Repetitive lifting	▪ Weight-loaded march (move location, security patrol) ▪ Key WTBD: 'Move under fire' & and 'React to ambush.' Includes following: → Weight-loaded run → Run (no load) – (endurance, and sprint) → Stop/start/change direction → Crawl (High & low)	***Key Common Warrior Tasks (CWT)*** ▪ Crawling (low/high) ▪ Traverse pipes ▪ Jump hurdles ▪ Climb walls ▪ Stairs (up/down) ▪ Rushes and sprints ▪ Obstacle/slalom course ▪ Block/strike ▪ Employ/engage weapon ▪ Throw grenade ***Key physical actions for most CWT*** ▪ Squat, Lunge, Jump	▪ 2011 STP 21-1-SMCT: CWT due to increased number of operations in urban settings. ▪ March 2013 WTBD Analysis: Survey response, n = 28, 024) 1. Jump or leap over obstacles 2. Move with agility and coordination 3. Carry heavy loads 4. Drag heavy loads 5. Run long distances (tie) 5. Sprint (tie)

Table J-1. Summary of Preliminary Assessment of Military (Army) - Relevant Tasks (continued)

AUSTRALIA	▪ Lift [*"Strength"*] (via Box lift and place (55 & 66 lbs) ▪ Carry ["*Local muscle endurance* "] (via Jerry can carry: 136 & 300 yds)	▪ March (Loaded) *["Aerobic "]* (via 5 km w 22kg); & 10 km w 38 kg) ▪ Fire and movement simulation *["Anaerobic"]* (via 16 x 6m bounds + leopard crawl)	▪	2012-Australian Defense Science and Technology Organization: Proposed Employment Standards (PES): (1) All Corps Soldier(ASC) and (2) Combat Arms (CA). No age/gender bias; more rigorous tests for required for certain occupations

NOTES

a) One of US Army Common Warrior Task includes donning and basic movement in military gas mask – this is not addressed in this PT assessment
b) Weight estimates: Jerry can weight: 10.5lb empty; ~41lb full (Rayson: ~ 20kg); Ammo box weight: 5lb empty; ~90 full ; (Rayson :35 kg up to 75 kg) ; Sandbags –weights vary (e.g., 40, 60, --150)
c) Loads for marches – military loads vary from 5 to 68 kg over distances 5-20 k (NATO 2009)
d) Current MOS Physical Demand weights (Army , 2007) : Light(LT) = 10-20 lbs, Moderate (MD= 25-50), Moderately heavy(MH)= 40-80, Heavy (HV)= 50-100; and very heavy(VH)=>50->100

Cited Information Sources

- NATO 2009: North Atlantic Treaty Organization (NATO)- Research and Technology Org (RTO) Human Factors and Medicine Panel (HFM) Technical Report (AC/323(TR-HFM-080)TP/200; *Optimizing Operational Physical Fitness*. 2009
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- 2010 – Canadian Land Force PT Assessment : Personal communications with Canadian SMEs, recorded by Mr. Michael S. McGurk Director, Research & Analysis Directorate; Initial Military Training Center of Excellence (IMT-COE), ATTN: ATCG-MTA, 210 Dillon Circle, Fort Eustis, VA
- 2011 STP 21-1-SMCT: Headquarters Department of the Army, Soldier's Manual of Common Tasks Warrior Skills Level 1, May 2011.
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- Knapik, 2004. The Case for Pre-Enlistment Physical Fitness Testing: Research and Recommendations. USACHPPM Report No. 12-HF-01Q9D-04, 2004.

Table J-2. Examples of Military–Relevant Civilian Occupational Physical Performance Tests

Occupation	Manual tasks	Upright and Moving	Other Tasks	Sources and Notes
US Department of Labor industry standards-	▪ Lift and carry (specific weight groups described)	▪ Standing	▪ Sitting	Harbin 2005
Firefighters*	▪ Fire hose carry (upstairs) ▪ Ladder lift/ladder extension ▪ Victim drag or carry or drag downstairs	▪ Continuous walking through all drills ▪ Walk/Run with 'load' (equipment, protective clothing)	▪ Stair climbing ▪ Ladder climbing ▪ Forcible entry ▪ Sledge hammer drive ▪ Rake	Rhea, 2004; Davis, 1982. Tests are sometimes – though not always) performed in fire fighter clothing – including SCBA.

Harbin 2005. Harbin, G and Olson, J. Post-Offer, Pre-Placement Testing in Industry; *American Journal of Industrial Medicine* 47:296–307; 2005.
Rhea, 2004. Rhea, MR Alvar BA, Gray, R. Physical Fitness and Job Performance of Firefighters. *Journal of Strength and Conditioning Research,* 18(2), 348–352; National Strength & Conditioning Association; 2004.
Davis, 1982. Davis, PO et al. Relationship between simulated fire-fighting tasks and physical performance measures; *Medicine and Science in Sports and Exercise* Vol. 14, No. 1, pp. 65-71 1982.

Table J-3. Example Military Tasks As Associated with Components of Fitness

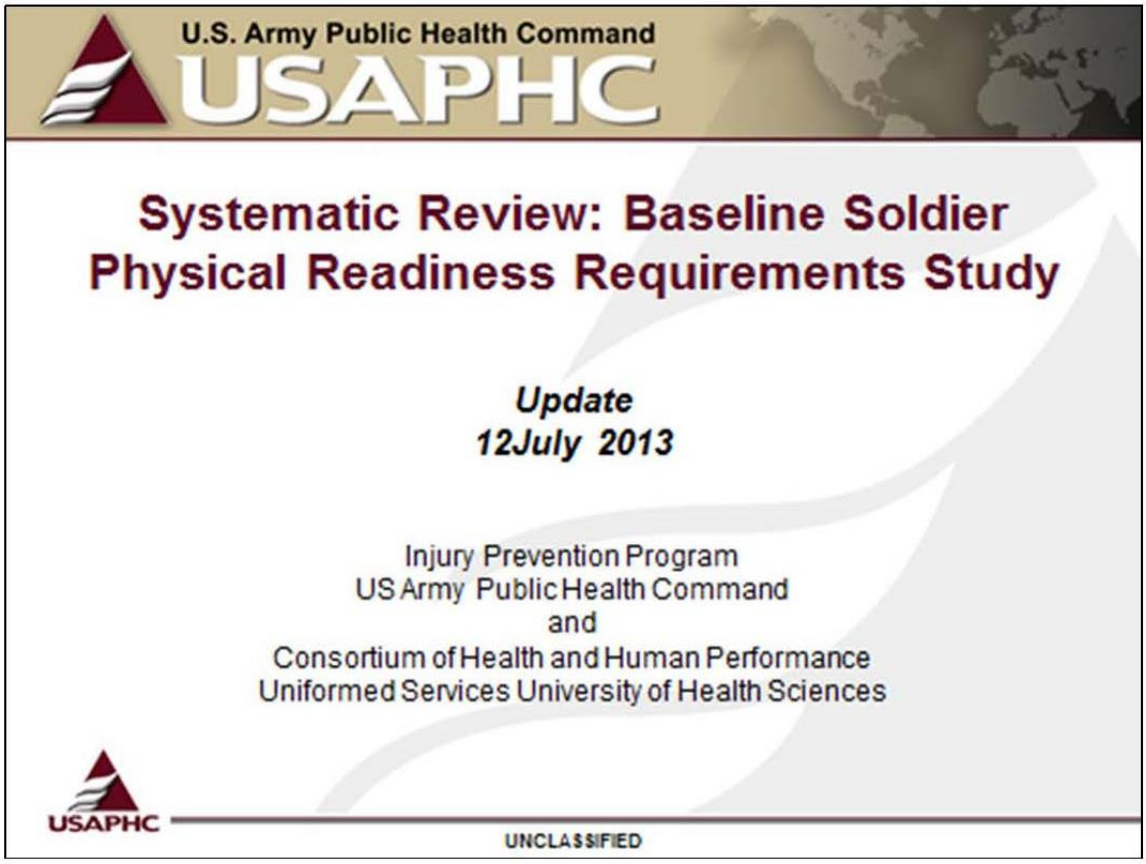
Physical Requirement Areas[1,2]		Fitness Components[3]	Primary Physical Fitness Sub-Components and Definitions[3]		Example Associated Military Tasks/Activities[3]
AEROBIC	ENDURANCE	CARDIO-RESPIRATORY ENDURANCE	➔ **Stamina "Aerobic fitness"**	Ability to sustain high repetition low intensity muscle contractions for long duration	• Patrolling/marching with a ruck • Continuous bouts of high intensity efforts with little or no breaks (e.g., lift, carry, fill, push, pull, drag, sprint/change direction, march) over extended time
ANAEROBIC	ENDURANCE	MUSCULAR ENDURANCE[4]	➔ **Dynamic Strength** "Anaerobic"	Ability to conduct high intensity muscle contractions repeatedly for relatively short periods of time	•Lift & carry equipment/ammunition/supplies •Dig and fill sand bags •Short sprint (e.g., while running for cover)
ANAEROBIC	STRENGTH	MUSCULAR STRENGTH	➔ **Static Strength**	Ability to exert maximal force against a fairly immovable object for a short time	• Lift/push a heavy load • Throw an object (grenade, smoke flare) • Evacuate (drag) casualty
ANAEROBIC	STRENGTH	MUSCULAR STRENGTH	➔ **Explosive Power** "Anaerobic"	Ability to expend a maximum of energy to rapidly project or move an object or the body in one burst or a series of bursts	• Jump/climb (over walls, logs, fences) • Short sprint (e.g., while running for cover)
ANAEROBIC	MOBILITY (and AGILITY)	FLEXIBILITY	➔ **Extent & Dynamic**	Ability to stretch, flex or otherwise lengthen various body parts (Dynamic = quickly) as far as possible	• Stop/change direction (e.g., while running cover to cover) with and without load • March/run/walk/carry ; with and without load • Shoot
ANAEROBIC	MOBILITY (and AGILITY)	COORDINATION	➔ **Gross body coordination**	Ability to synchronize simultaneous movement of a number of body parts.	
ANAEROBIC	MOBILITY (and AGILITY)	BALANCE	➔ **Static & Dynamic**	Ability to maintain body at equilibrium (stable posture) in a fixed position (when static and when moving)	

[1] Does not address Body Composition
[2] Aerobic capacity, strength, endurance (DODI 1308.1) ; anaerobic capacity and mobility and subcomponents such as power/speed, agility, coordination, balance (AR 350-1,611-1; DA Pam611
[3] Key components and definitions reference: (Knapik , 2004) "*The Case for Pre-Enlistment Physical Fitness Testing: Research and Recommendations.*" Technical Report 12-HF-01Q9D-04. USACHPPM 2004.
[4] Key sources describing common tasks include: Knapik , 2004; NATO, 2009; Sharp, 2009; MSCoE, 2011; Haith, 2013 (Personal communications re: 2012 KSO)

APPENDIX K

Physical Readiness Requirements Study
USAPHC IPP Soldier Systematic Review- Final 2013 Update Brief to TRADOC
Interim Findings *
12 July 2013

* As noted in the methods and results section of this document, this presentation represents the findings of the abbreviated system review process in July 2013. This information was considered adequate for the needs of TRADOC, but does not represent a formal or complete Systematic Review. Complete of systematic review is an intended objective of the IPP participants. The systematic review s would provide more quantitative information regarding correlations and limits it data confidence. The general findings identified in this July briefing, however, indicated there are gaps in specific research regarding the physical demands of Army WTBD. This supported TRADOC's decision to conduct field studies to specifically evaluate current Army WTBDs.



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Subject Areas for the Systematic Review

	Subject Areas
1	**Lab vs Field Tests to Assess Physical Fitness** *Tyson Grier, Morgan Anderson, Tim Bushman (USAPHC)*
2	**Comparison of Physical Fitness Tests to Job Task Performance** *CPT(P) DeGroot and Veronique Hauschild (USAPHC)*
3	**Association of Task Performance and Injury** *Keith Hauret and Elizabeth Clearfield (USAPHC)*
4	**Association of Components of Physical Fitness and Injury** *Dr. Dianna Purvis, Dr. Pete Lisman, Dr. Sarah Delamotte, and Ms. Kaitlin Murphy (USUHS)*

3

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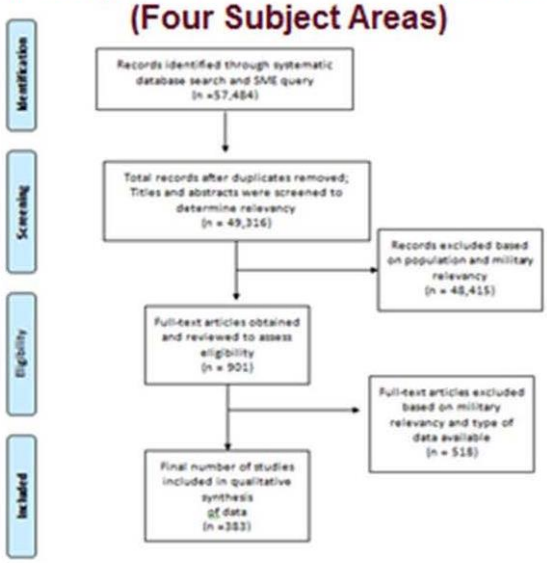
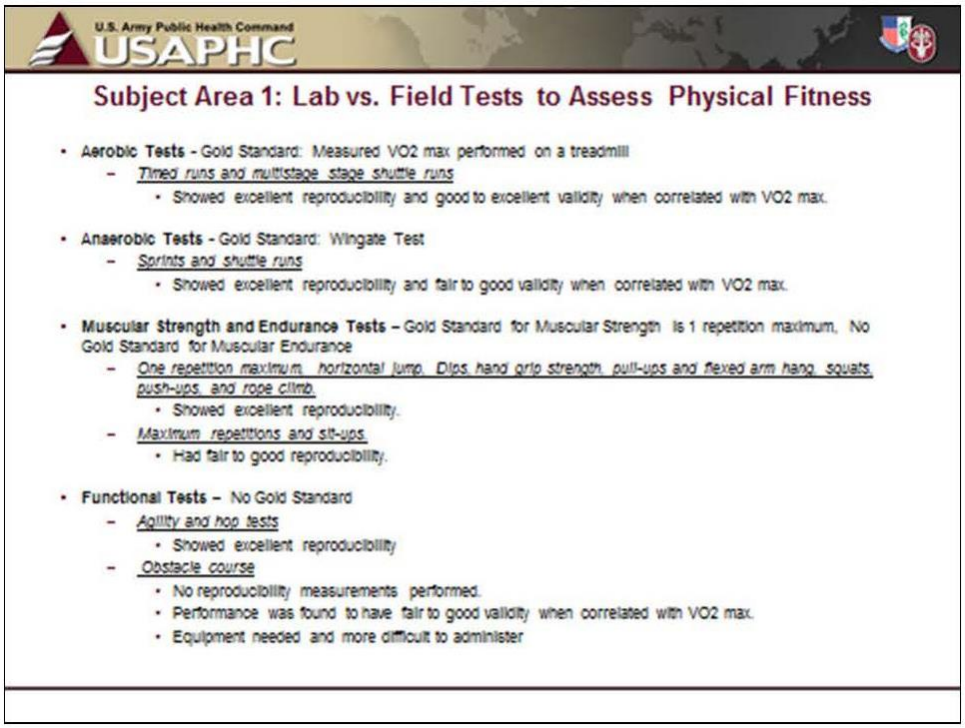
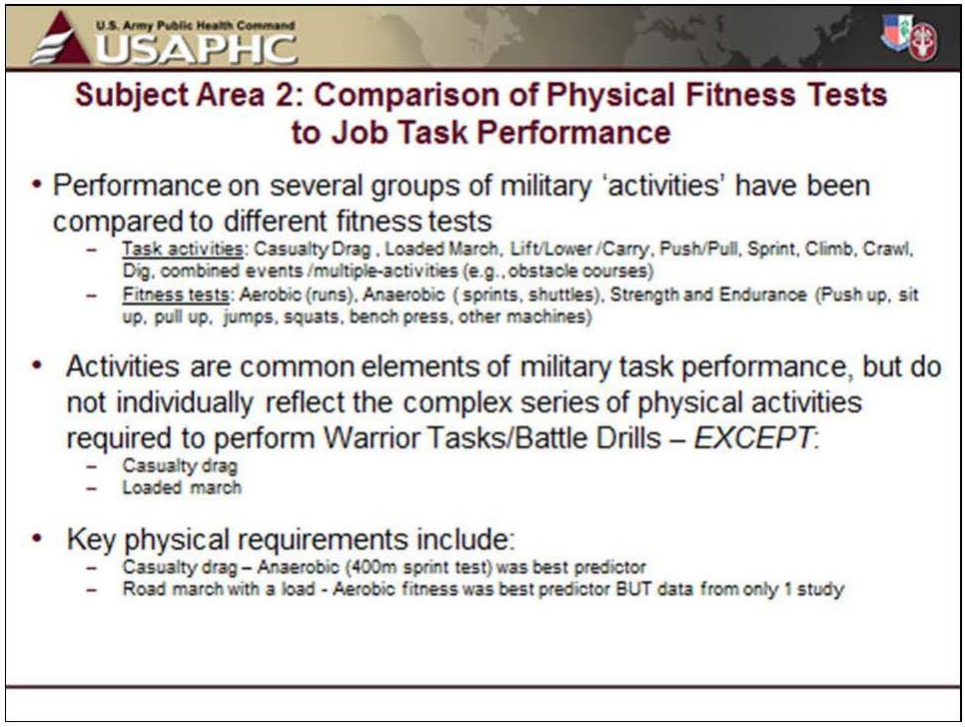
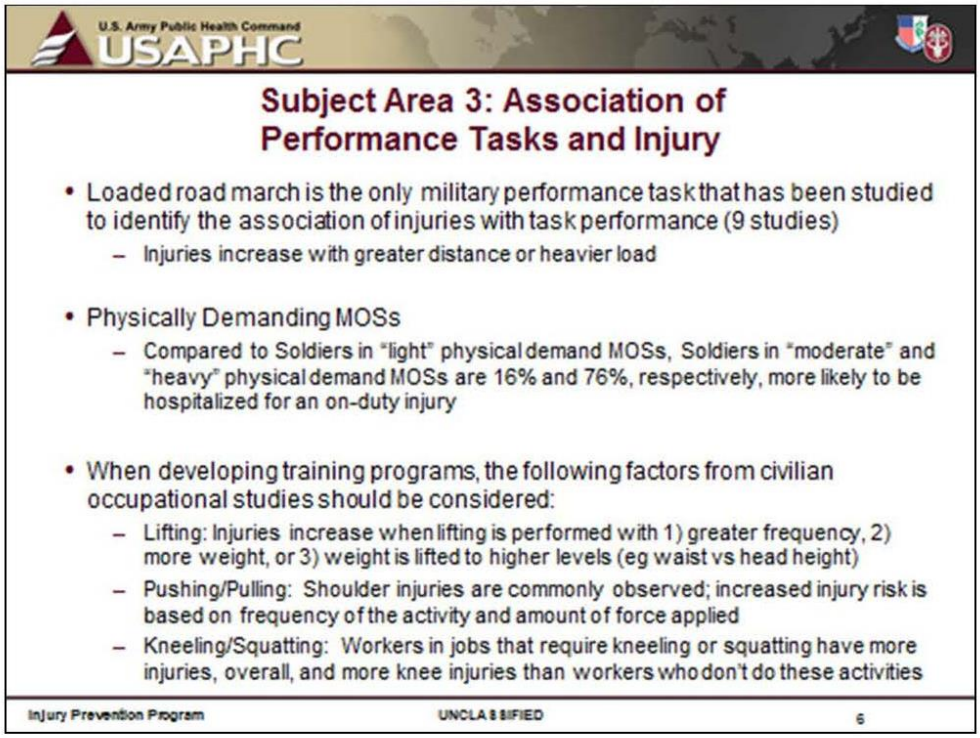
Overall Scope of Work for the Literature Review (Four Subject Areas)



Injury Prevention Program UNCLASSIFIED 2


U.S. Army Public Health Command
USAPHC
Subject Area 1: Lab vs. Field Tests to Assess Physical Fitness
• Aerobic Tests - Gold Standard: Measured VO2 max performed on a treadmill
– Timed runs and multistage stage shuttle runs
• Showed excellent reproducibility and good to excellent validity when correlated with VO2 max.
• Anaerobic Tests - Gold Standard: Wingate Test
– Sprints and shuttle runs
• Showed excellent reproducibility and fair to good validity when correlated with VO2 max.
• Muscular Strength and Endurance Tests – Gold Standard for Muscular Strength is 1 repetition maximum. No Gold Standard for Muscular Endurance
– One repetition maximum horizontal jump. Dips hand grip strength, pull-ups and flexed arm hang, squats, push-ups, and rope climb
• Showed excellent reproducibility.
– Maximum repetitions and sit-ups
• Had fair to good reproducibility.
• Functional Tests – No Gold Standard
– Agility and hop tests
• Showed excellent reproducibility
– Obstacle course
• No reproducibility measurements performed.
• Performance was found to have fair to good validity when correlated with VO2 max.
• Equipment needed and more difficult to administer


U.S. Army Public Health Command
USAPHC
Subject Area 2: Comparison of Physical Fitness Tests to Job Task Performance
• Performance on several groups of military 'activities' have been compared to different fitness tests
– Task activities: Casualty Drag , Loaded March, Lift/Lower /Carry, Push/Pull, Sprint, Climb, Crawl, Dig, combined events /multiple-activities (e.g., obstacle courses)
– Fitness tests: Aerobic (runs), Anaerobic (sprints, shuttles), Strength and Endurance (Push up, sit up, pull up, jumps, squats, bench press, other machines)
• Activities are common elements of military task performance, but do not individually reflect the complex series of physical activities required to perform Warrior Tasks/Battle Drills – EXCEPT:
– Casualty drag
– Loaded march
• Key physical requirements include:
– Casualty drag – Anaerobic (400m sprint test) was best predictor
– Road march with a load - Aerobic fitness was best predictor BUT data from only 1 study


U.S. Army Public Health Command
USAPHC
Subject Area 3: Association of Performance Tasks and Injury
• Loaded road march is the only military performance task that has been studied to identify the association of injuries with task performance (9 studies)
– Injuries increase with greater distance or heavier load
• Physically Demanding MOSs
– Compared to Soldiers in "light" physical demand MOSs, Soldiers in "moderate" and "heavy" physical demand MOSs are 16% and 76%, respectively, more likely to be hospitalized for an on-duty injury
• When developing training programs, the following factors from civilian occupational studies should be considered:
– Lifting: Injuries increase when lifting is performed with 1) greater frequency, 2) more weight, or 3) weight is lifted to higher levels (eg waist vs head height)
– Pushing/Pulling: Shoulder injuries are commonly observed; increased injury risk is based on frequency of the activity and amount of force applied
– Kneeling/Squatting: Workers in jobs that require kneeling or squatting have more injuries, overall, and more knee injuries than workers who don't do these activities
Injury Prevention Program
UNCLASSIFIED
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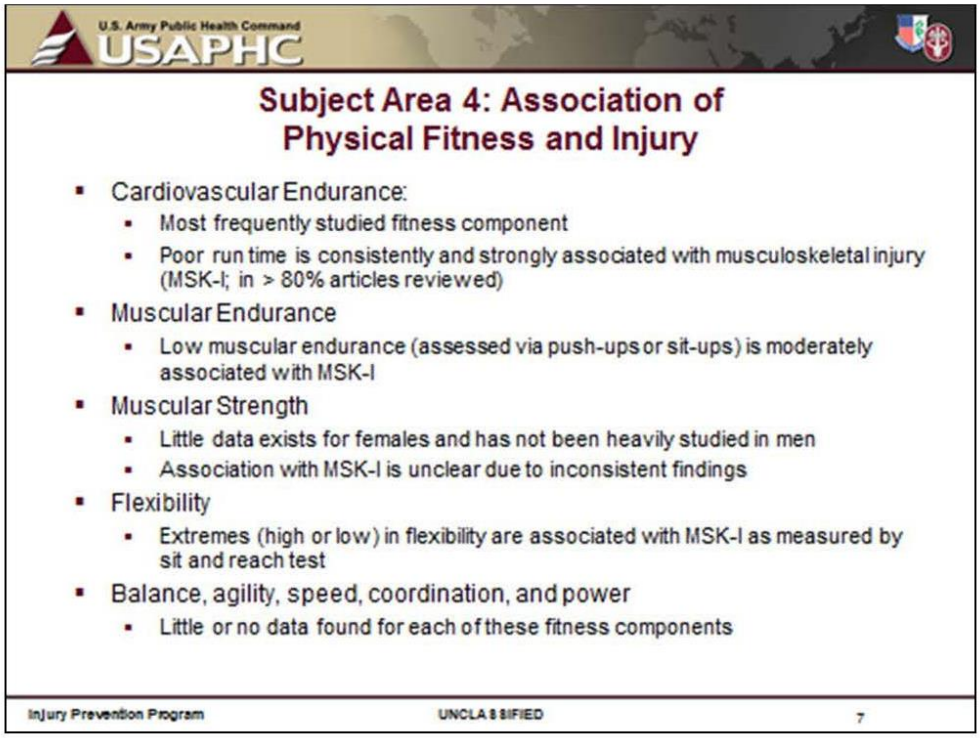
U.S. Army Public Health Command
USAPHC
Subject Area 4: Association of Physical Fitness and Injury
▪ Cardiovascular Endurance:
▪ Most frequently studied fitness component
▪ Poor run time is consistently and strongly associated with musculoskeletal injury (MSK-I; in > 80% articles reviewed)
▪ Muscular Endurance
▪ Low muscular endurance (assessed via push-ups or sit-ups) is moderately associated with MSK-I
▪ Muscular Strength
▪ Little data exists for females and has not been heavily studied in men
▪ Association with MSK-I is unclear due to inconsistent findings
▪ Flexibility
▪ Extremes (high or low) in flexibility are associated with MSK-I as measured by sit and reach test
▪ Balance, agility, speed, coordination, and power
▪ Little or no data found for each of these fitness components
Injury Prevention Program
UNCLASSIFIED
7

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Summary and Conclusions

- Reflecting the current APFT, there is a considerable body of injury and performance literature concerning muscular endurance and cardiovascular fitness
  - Research and injury surveillance will be increasing important when a new fitness test is fielded
- With the exception of casualty drag and road marches, there is a lack of research concerning the physical demands of Warrior Tasks and Battle Drills
  - Data collection planned in support of the Baseline Soldier Physical Readiness study will address this need
- There continues to be a need to strike a balance between training to improve physical performance and avoiding over-training so as not to cause injury
  - More ≠ Better

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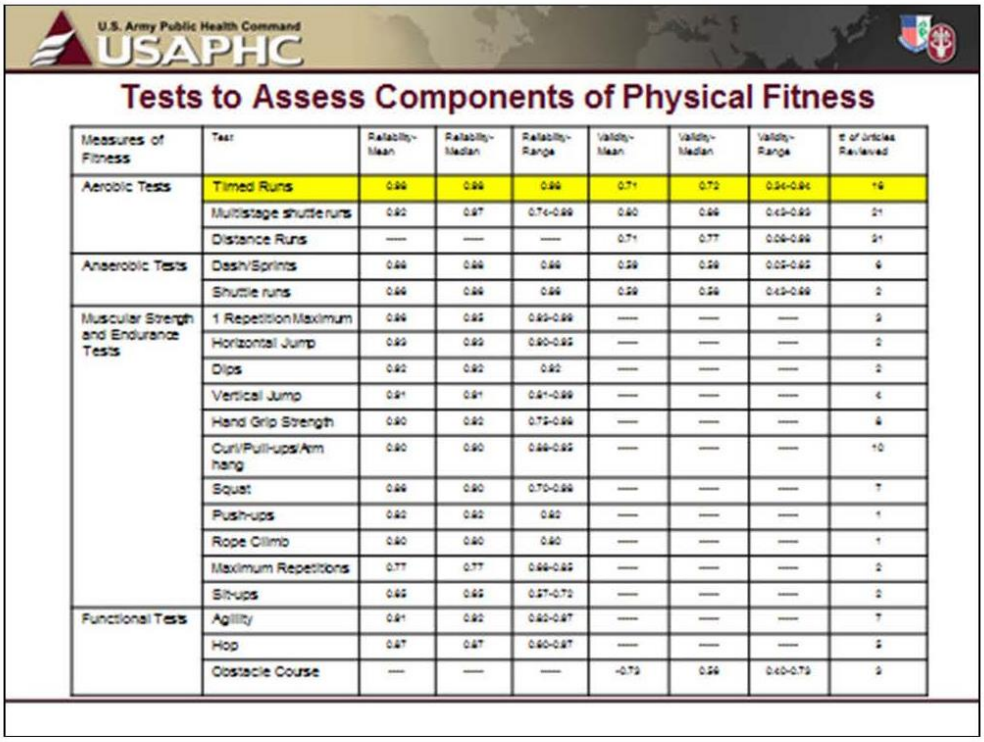
Backup Slides
Subject Area 1:
Lab vs. Field Tests to Assess Physical Fitness



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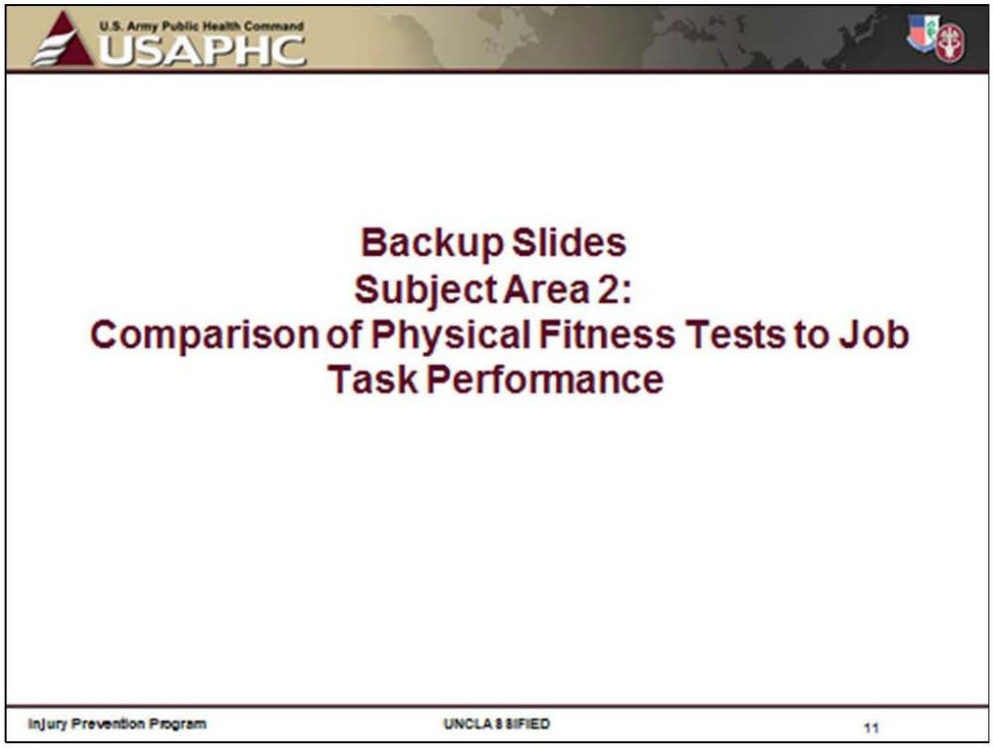
Tests to Assess Components of Physical Fitness

Measures of Fitness	Test	Reliability-Mean	Reliability-Median	Reliability-Range	Validity-Mean	Validity-Median	Validity-Range	# of Articles Reviewed
Aerobic Tests	Timed Runs	0.99	0.99	0.99	0.71	0.72	0.34-0.94	19
	Multistage shuttle runs	0.93	0.97	0.74-0.99	0.80	0.89	0.43-0.93	21
	Distance Runs	——	——	——	0.71	0.77	0.09-0.99	21
Anaerobic Tests	Dash/Sprints	0.99	0.99	0.99	0.29	0.29	0.05-0.93	9
	Shuttle runs	0.99	0.99	0.99	0.29	0.29	0.43-0.99	3
Muscular Strength and Endurance Tests	1 Repetition Maximum	0.99	0.99	0.93-0.99	——	——	——	3
	Horizontal Jump	0.93	0.93	0.90-0.95	——	——	——	3
	Dips	0.93	0.93	0.93	——	——	——	3
	Vertical Jump	0.91	0.91	0.91-0.99	——	——	——	4
	Hand Grip Strength	0.90	0.93	0.79-0.99	——	——	——	6
	Curl/Pull-ups/Arm hang	0.90	0.90	0.89-0.93	——	——	——	10
	Squat	0.99	0.90	0.70-0.99	——	——	——	7
	Push-ups	0.93	0.93	0.93	——	——	——	1
	Rope Climb	0.90	0.90	0.90	——	——	——	1
	Maximum Repetitions	0.77	0.77	0.99-0.93	——	——	——	3
	Sit-ups	0.93	0.93	0.57-0.72	——	——	——	3
Functional Tests	Agility	0.91	0.93	0.93-0.97	——	——	——	7
	Hop	0.97	0.97	0.90-0.97	——	——	——	3
	Obstacle Course	——	——	——	-0.73	0.59	0.43-0.73	3



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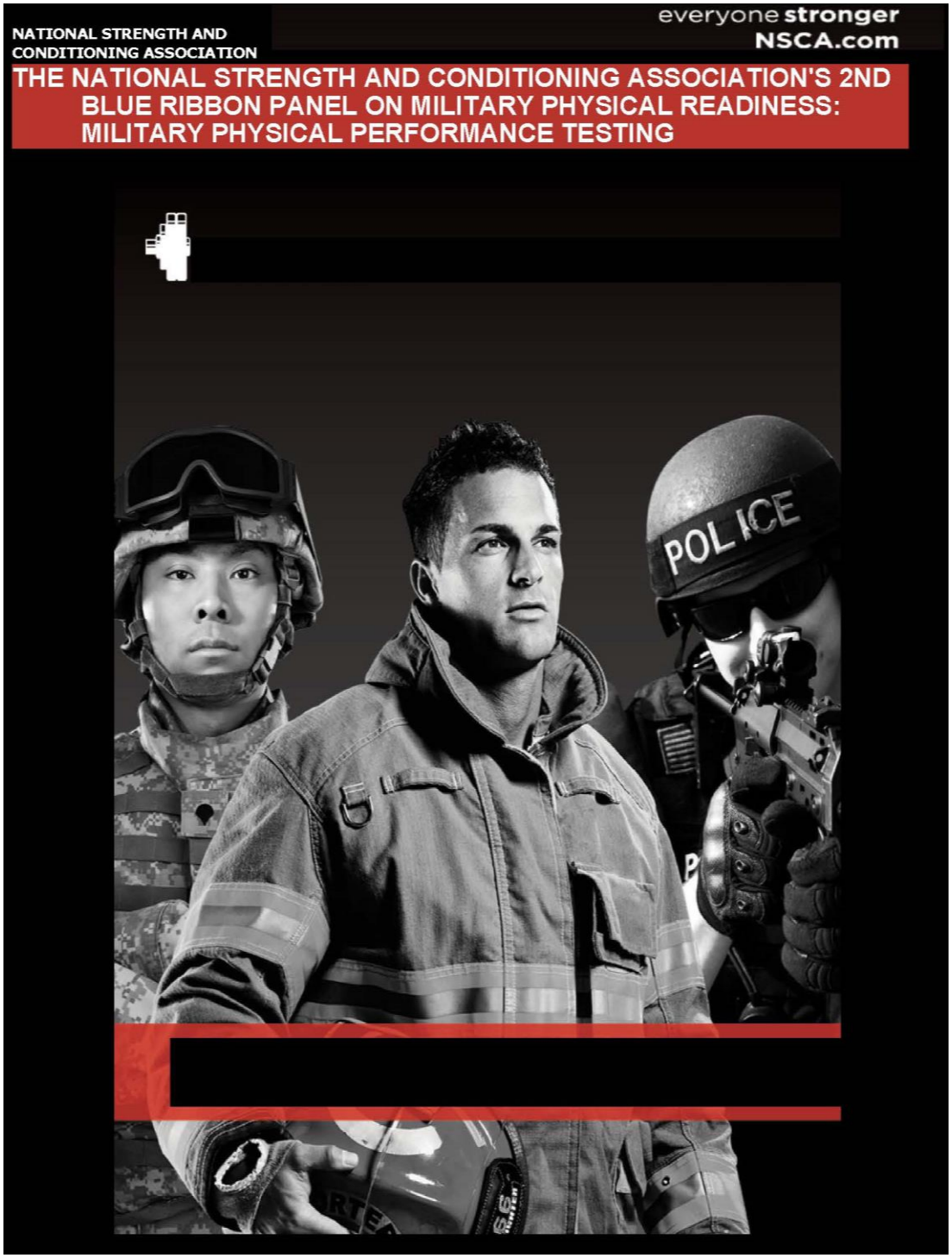
Backup Slides
Subject Area 2:
Comparison of Physical Fitness Tests to Job Task Performance

Injury Prevention Program UNCLASSIFIED 11

APPENDIX L

National Strength and Conditioning Association (NSCA)
Tactical Strength and Conditioning (TSAC) Program
Blue Ribbon Panel for Military Readiness
April 18-19 2013 Norfolk, VA


NATIONAL STRENGTH AND CONDITIONING ASSOCIATION
everyone stronger
NSCA.com
THE NATIONAL STRENGTH AND CONDITIONING ASSOCIATION'S 2ND BLUE RIBBON PANEL ON MILITARY PHYSICAL READINESS: MILITARY PHYSICAL PERFORMANCE TESTING
POLICE

THE NATIONAL STRENGTH AND CONDITIONING ASSOCIATION'S 2ND BLUE RIBBON PANEL ON MILITARY PHYSICAL READINESS: MILITARY PHYSICAL PERFORMANCE TESTING

FORWARD

The National Strength and Conditioning Association (NSCA) was founded in 1978 by 76 strength coaches from across the country with the common desire to network, collaborate, and unify the profession of strength and conditioning. Since its inception, the NSCA has grown to nearly 33,000 Members in 72 countries, and become the leader in the research and education of strength and conditioning professionals. As the worldwide authority on strength and conditioning, the NSCA supports and disseminates research-based knowledge and its practical application to improve athletic performance and fitness.

In 2005, the NSCA founded the Tactical Strength and Conditioning (TSAC) program by working with elite military and law enforcement groups. The TSAC program quickly expanded to include all members of military, law enforcement, and fire & rescue personnel.

The mission of the NSCA's TSAC program is to provide scientifically-sound and safe physical training and educational programs to those who serve and protect our country and communities.

In support of its mission, the NSCA's TSAC program sponsored and hosted the 2nd Blue Ribbon Panel on Military Physical Readiness: Military Physical Performance Testing immediately following the NSCA's 4th annual TSAC Conference on April 18 – 19, 2013 in Norfolk, VA. The 2nd Blue Ribbon Panel was convened to continue the TSAC program's commitment to its mission of providing state-of-the-art physical training and education, and to expand and deliver this information to those who serve and protect our country and communities.

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THE NATIONAL STRENGTH AND CONDITIONING ASSOCIATION'S 2ND BLUE RIBBON PANEL ON MILITARY PHYSICAL READINESS: MILITARY PHYSICAL PERFORMANCE TESTING

EXECUTIVE SUMMARY

This meeting brought together a total of 20 subject matter experts (SME) from the U.S. Air Force Army, Marine Corps, Navy and academia representing practitioners, operators, researchers, and policy advisors to discuss the current state of physical performance testing across the Armed Services. The SME panel initially rated common military tasks (refer to Table 1) by the degree to which health-related fitness components (e.g., aerobic fitness, muscular strength, muscular endurance, flexibility, and body composition) and skill-related fitness components (e.g., muscular power, agility, balance, coordination, speed, and reaction time) were required to accomplish these tasks. Muscular strength, power, and endurance received the highest rating scores.

The Blue Ribbon Panel then broke into SME groups to establish a list of field-expedient tests (refer to Table 2) that could be considered for military physical performance testing for later voting by the entire panel. Table 2 lists the field-expedient tests that received the most votes by the panel.

Panel discussion centered on whether the services should have a common criteria health-based fitness test (82% of panel members concurred) and whether services should consider a Tier II test focused on both health-related and skill-related fitness components based upon occupational, functional, and tactical military performance requirements (95% of panel members concurred).

It was noted that the Marine Corps currently has a combat-oriented, functional fitness test; however, none of the services currently have an occupationally specific physical fitness assessment. The Army and Air Force have study initiatives considering Tier II fitness tests. Subsequently, the panel discussed the need to consider whether Department of Defense Instruction 1308.3 (DOD Physical Fitness and Body Fat Programs Procedures) should be revised to consider inclusion of Tier II tests to assess functional and skill-related fitness components related to occupational tasks.

CONCLUSIONS:

1) Selected fitness components are currently not being assessed by the military.
2) Field-expedient options to measure both health-based and skill-based fitness components are available.
3) Branches of the military may want to consider having common fitness-based tests. Concern for historical perspective and appropriate health-based criterion reference standards should be given to alter military physical performance testing if needed.
4) It seems prudent for each branch of the military to design an occupational, functional, and tactical military performance test for inclusion as part of a fitness testing battery.

RECOMMENDATIONS:

1) The Panel will organize a writing group to publish a peer-reviewed manuscript based on the panel findings and proceedings.
2) The findings and recommendations from the panel should be briefed to the DoDI owners, Office of the Secretary of Defense/Personnel & Readiness/Morale, Welfare and Recreation Policy Division for consideration to revising DODI 1308.3 DOD Physical Fitness and Body Fat Programs Procedures.

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THE NATIONAL STRENGTH AND CONDITIONING ASSOCIATION'S 2ND BLUE RIBBON PANEL ON MILITARY PHYSICAL READINESS: MILITARY PHYSICAL PERFORMANCE TESTING

The opinions expressed at the conference or contained in this paper do not constitute official Department of Defense policy positions or those of the Services.

TABLE 1. COMMON MILITARY TASKS

Military Tasks	Strength	Power	Endurance	Body Composition	Coordination	Balance	Agility	Flexibility	Aerobic Fitness	Speed	Reaction Time
Jump or leap over obstacles	7.5	9	4	6.4	6.9	5.7	6.5	5.9	2.6	5.7	4
Move with agility-coordination	4.7	5.4	5.5	5.8	9.5	8.4	9.8	6.1	4.1	6.5	6.6
Carry heavy loads	8.8	6.2	7.5	5.2	3.7	5	2.9	3.3	5.5	2.2	1.6
Drag heavy loads	9.2	7.4	7.4	5.2	4.5	4.8	3.3	3.8	5.2	2.7	1.6
Run long distances	3.8	3.1	6.9	6.9	3.2	3.2	3	3.2	9.9	4	1.4
Move quickly for short distances	6	7.8	5	6.2	7	6.4	7.8	4.4	4	9.3	6
Climb over obstacles	8.3	6.5	5.7	6.7	7	6.1	6	5.9	3.9	4.1	2.2
Lift heavy objects off ground	9.7	7.7	5.4	5.5	4.8	5.1	2.7	5	3	2.3	1.6
Load/stow/mount hardware	7.7	6	6.3	5	5.7	5.3	3.4	4.9	3.6	2.6	2.2
Overall mean	7.3	6.6	6	5	5.8	5.5	5	4.7	4.6	4.4	3

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TABLE 2. VIABLE PERFORMANCE TESTS

Fitness Component	Field Expedient Options
Aerobic Fitness	Running Test
	Beep Test
Muscular Strength	Isometric Dynamometer
	Pull-Up
	Incremental Dynamic Lift
	Push-Up
Muscular Endurance	Push-Up
	Burpee (Squat Thrust)
	Squat
Flexibility	Functional Movement Screen
	Sit and Reach
	Y-Balance
Body Composition	Circumference Measurements
	Bod Pod
Speed40-Yard Sprint	
Agility	300-Yard Shuttle Run
	T-Test Agility Drill
Power	Standing Broad Jump
	Vertical Jump
	Medicine Ball Throw
Coordination	Sit-Up and Stand w/o using Hands
	Burpees
Balance	Beam Walk
	Y-Balance
Reaction Time	N/A

APPENDIX M

TRADOC May Planning Conference Brief
Deconstruction of WTBDs

Baseline Soldier Physical Readiness Requirements Study Planning Conference

14-16 May 2013

Initial Military Training Center of Excellence
210 Dillon Circle
Fort Eustis, VA 23602

1

Planning Conference Schedule
Tuesday, 14 May 2013

Time		Lead/Facilitator
0800-0815	Registration/Lunch Selection and Payment	COL Cable/SFC Williams
0815-0830	Welcome	Mr. Haith
0830-1130	Calendar Requirements	Mr. Haith
1130-1230	Lunch On-Site	
1230-1600	Calendar Requirements	Mr. Haith
1600-1630	Wrap Up	Mr. Haith

2

Current Status APRT Study

- Completing Phase 1 Systematic Review-Brief Results O/a 28 JUNE to CG TRADOC
  - Completing reviewof exiting scientific research
  - IntegratingWTBD PRT Survey results into the review
- Developing and Synchronizing remaining Phases with Soldier 2020 Initiative
  - Developed Study Protocols for Phases 2 thru 5-Synchronizing execution with MOS Physical Standards Timeline
  - Executing Phase 2 Task Identification
    - Create draft task list 14-16 MAY 13
    - Conduct SME Task Selection/validation Boards 11-13 JUN 13
  - Phase 2 Quantify Task Demands- Observe/measure/analyze physical demands 5-30 AUG 13
  - Phase 3 Establish Task Standards Conduct Focus Group Interviews
    - Validate Physical demand standards with stakeholders 24-28 SEP MAY 13
    - Establish final task physical demand requirements NLT 22 NOV
    - Develop potential test events to simulate WTBD physical demands NLT 28 FEB 14
  - On Track to complete Phase 4 (Event Testing and Validation) NLT JUN 14 and Phase 5 (Determine Final test Events and Validation) NLT APR 15

3

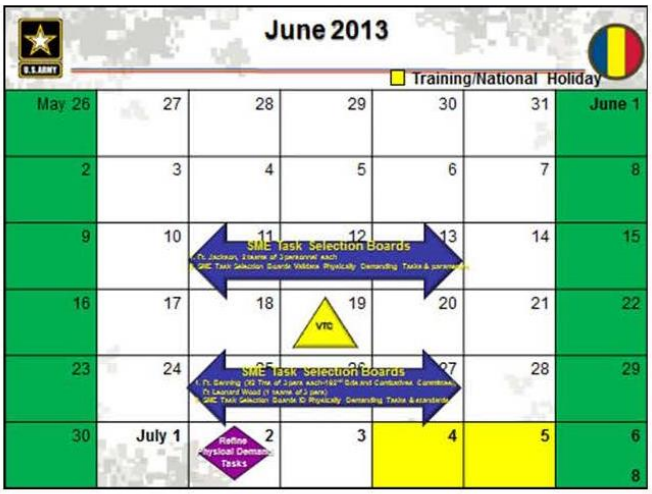
Study Plan Matrix

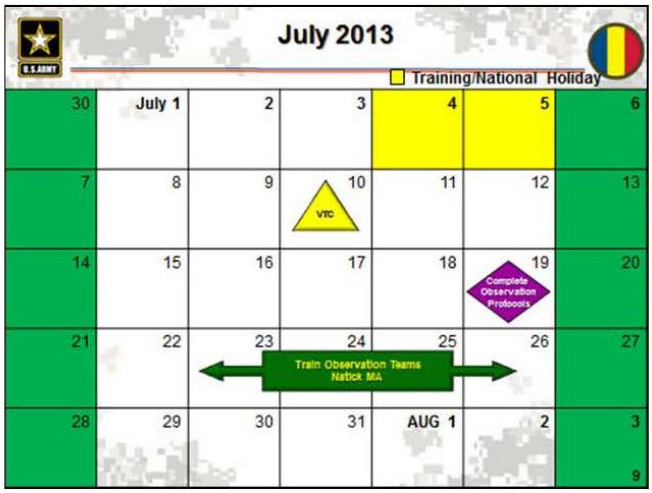
Study Plan Matrix

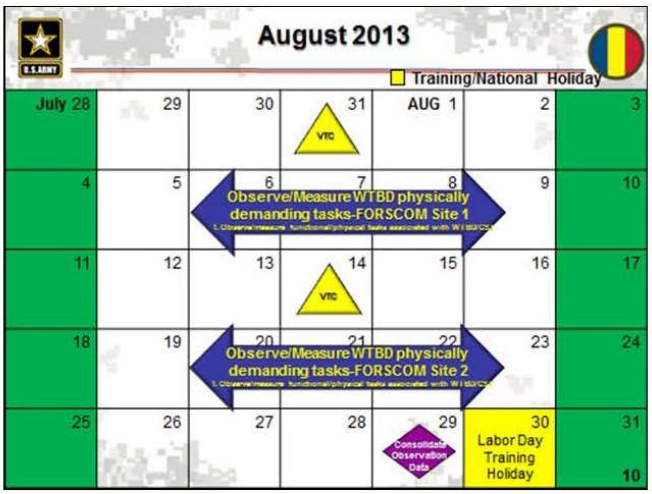
Study Plan Matrix

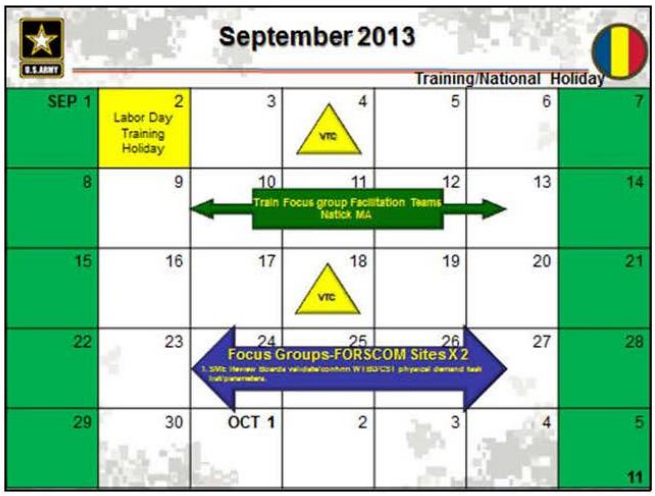
10	Decision Brief - Baseline PRT Study	1. Present/discuss the final functional and physical capacity assessments associated with the physically demanding WTBD/C STs 2. Decision Brief to OEN Cone	1. 18-18 JUL 14 2. 20 JUN 14	1. 2-3 working days 1 day travel	1. FT Eustis	IMT	Baseline SPRT working group
11	Develop Assessment Standards	1. Administer final task simulations to a normative sample of Soldiers 2. Determine criterion and normative scores/scales for functional and physical fitness assessments	1. NLT 27 SEP 14 2. NLT 4 OCT 14		1. to be determined	ALCON	
12	Launch the new Army Baseline Physical Readiness Test		1. 25 OCT 14		In conjunction with the annual AUSA Conference and Army 10-miler	TRADOC	


May 2013
Training/National Holiday
April 28
May 1
Planning VTC
Organize and Train Task Selection Facilitation Teams Ft Eustis
June 1
7


June 2013
Training/National Holiday
May 26
June 1
SME Task Selection Boards
VTC
Refine Physical Demands Tasks
8


July 2013
Training/National Holiday
July 1
VTC
Complete Observation Protocols
Train Observation Teams Natick MA
AUG 1
9


August 2013
Training/National Holiday
July 28
AUG 1
VTC
Observe/Measure WTBD physically demanding tasks-FORSCOM Site 1
Observe/Measure WTBD physically demanding tasks-FORSCOM Site 2
Consolidate Observation Data
30 Labor Day Training Holiday
10


September 2013
Training/National Holiday
SEP 1
2 Labor Day Training Holiday
VTC
Train Focus group Facilitation Teams Natick MA
Focus Groups-FORSCOM Sites X 2
OCT 1
11


Planning Conference Schedule
Wednesday, 15 May 2013
Time
Lead/Facilitator
0800-0830 Welcome Break Out Session Instructions Mr. Haith
0830-1130 Break Out: WTBD Deconstruction
1130-1230 Lunch On-Site
1230-1600 Break Out: WTBD Deconstruction
1600-1630 Wrap Up Mr. Haith
12

Break Out Group Assignments

Break Out Group #1	Break Out Group #2	Break Out Group #3
Mr. Haith (Facilitator)	COL Cable (Facilitator)	Dr. East (Facilitator)
Dr. Zambraski	Ms. Sharp	CPT Henning
CPT DeGroot	CSM Ecker	Dr. Hauret
CPT Soika	Dr. Nindle	1SG Bagwell
Mr. Goddard	Dr. Jones	Mr. Palkoska
SGM Reyes	Dr. Muraca	Mr. Grier
Dr. Purvis	CPT Daniels	
Mr. Fox – lend expertise to all three break outs		

13

WTBDs
Physical Demand, Importance, and Frequency
(n~15,000)

Respondents were asked to indicate how physically demanding/challenging each WTBD is, how important it is for ALL Soldiers to be proficient in each WTBD, and how frequently Soldiers performed each WTBD in a combat environment:

WTBD	Physically Demanding	Importance
Perform Combatives (WT)	1 (most demanding)	16 (last)
Move Under Fire (WT)	2	5
React to Ambush (Near) (BD)	3	7
React to Contact (BD)	4	4
Evacuate a Casualty (WT)	5	3
React to Ambush (Far-BD)	6	8
React to Indirect Fire Dismounted (BD)	7	9
Perform Individual Movement Techniques (WT)	8	12
Perform Immediate Lifesaving Measures (WT)	9	2
Establish Security (BD)	10	6
Employ Hand Grenades (WT)	16 (last)	15 (next to last)

1 – 5: Highest Ranked (most physically demanding, important, or frequently done)

6 – 11: Middle Ranked (moderately physically demanding, moderately important, occurs sometimes)

12 – 16: Lowest Ranked (least physically demanding, important, or least frequently done)

14

Warrior Tasks and Battle Drills (New)

Shoot
- Maintain, employ, and engage targets with assigned weapon system (new or reworded)
- Employ hand grenades

Move
- Perform individual movement techniques
- Navigate from one point to another
- Move under fire

Communicate
- Perform voice communications (SITREP/SPOTREP/9-Line MEDEVAC, EXPLOSIVE HAZARD [EH])
- Use visual signaling techniques

Survive
- React to chemical, biological, radiological, and nuclear (CBRN) attack (new or reworded)
- Perform immediate lifesaving measures
- Perform counter IED
- Maintain Situational Awareness (new or reworded)
- React to Man-to-Man Contact (new or reworded)

Adapt
- Assess and Respond to Threats (Escalation of Force)
- Adapt to changing operational environments
- Grow professionally and personally (Build resilience)

Battle Drills
- React to contact
- Establish Security
- Perform actions as a member of a Mounted Patrol
- Perform Tactical Combat Casualty Care (new or reworded)
- React to Indirect Fire
- React to Ambush (near/far)

TASKS: 15
DRILLS: 6
SUB-Tasks: 81

(Pre-decisional)

15

Potential Common Soldier tasks

- Conduct Dismounted Tactical Movement (move as a member of a team?)*
- Prepare a Fighting Position (Fill and Emplace Sandbags)*
- Others?

Consolidated Task List

- 071-COM-4407 Employ Hand Grenades* (this task was identified as least physically demanding task in the recent WTBD PRT Survey)
- 071-COM-0501 Move as a member of a Team
- 071-COM-0541 Perform Exterior Movement Techniques during an Urban Operation
- 071-COM-0502 Move under Direct Fire*
- 071-COM-0510 React to Indirect Fire dismounted
- 071-COM-0503 Move over, Through, or Around Obstacles (Except Minefields)
- 081-COM-1046 Transport a Casualty-(Infantry task-Drag a Casualty to Immediate Safety-Dismounted)*
- 071-COM-0006 React to Man-to-Man Contact
- 551-001-1043 React to Vehicle Rollover (this was not identified as physically demanding task in the recent WTBD PRT Survey)

* Physically demanding Tasks- 11, 19, 13F MOS

Breakout Group Assignments

Breakout Group 1
- Conduct Dismounted Tactical Movement (move as a member of a team?)*
- Navigate from one point on the ground to another point while dismounted
- 071-COM-0501 Move as a member of a Team
- 071-COM-0541 Perform Exterior Movement Techniques during an Urban Operation
- 071-COM-0510 React to Indirect Fire dismounted
- 071-COM-0502 Move under Direct Fire*
- 071-COM-0503 Move over, Through, or Around Obstacles (Except Minefields)*

Breakout Group 2
- Prepare a Fighting Position (Fill and Emplace Sandbags)*
- 071-COM-4407 Employ Hand Grenades* (this task was identified as least physically demanding task in the recent WTBD PRT Survey)
- 081-COM-1046 Transport a Casualty-(Infantry task-Drag a Casualty to Immediate Safety-Dismounted)*
- 551-001-1043 React to Vehicle Rollover (this was not identified as physically demanding task in the recent WTBD PRT Survey)

Breakout Group 3
- 071-COM-0006 React to Man-to-Man Contact (Combatives)
- 171-COM-0011 Employ Progressive Levels of Individual Force when confronting Civilians

MOS 11B: Infantryman
071-326-3013 Conduct Tactical Movement

Task: Conduct a 24 Kilometer Tactical Movement

Condition: Wearing / Carrying 128 lb Approach March Load

Standard: Complete in 24 hours; Soldiers do not have to complete the entire 24 kilometers at once.

Conduct Tactical Movement

Carry minimum of 128 lbs evenly distributed over entire body and remain able to fight at conclusion of march of 24 kilometers per day.

Weight: 128 lbs-145 lbs Horizontal Distance: 24 km Vertical Distance: 0-2 m Time: 24 hours	- 128 lbs is combined weight of Basic Soldier Uniform (12 lbs), PPE (68 lbs), 24 hour sustainment load (48 lbs) - Weight of specialty equipment varies (e.g., 60 mm mortar base plates weigh 18 lbs) - Patrols remaining in the field overnight or for multiple days increase weight significantly (additional ammunition, food, water, mission essential equipment, etc.) - Army Standard for Tactical Movement is 3-4 km per hour for a total of 24-32 km per day (24 km is approximately 15 miles) - 24 km per day is representative of 1-2 Combat Patrols (6-8 km out and 6-8 km back twice a day) from Combat Outposts and Joint Security Sites in the Afghanistan AOR. - Does not require the Soldier to complete the entire distance at once.

MOS 11B: Infantryman
071-326-5703 Prepare a Fighting Position (Fill and Emplace Sandbags)

Task: Fill Sandbags

Condition: Wearing / Carrying 68 lb Fighting Load(-) (no weapon) and given entrenching tool, 26 empty sandbags, sufficient fill

Standard: 26 sandbags filled 55-60% full in 52 minutes

Fill Sandbags

Dig, lift, and shovel 11 lbs scoops of dirt in bent, stooped or kneeling position into sandbags.

Weight: 11 lbs Horizontal Distance: N/A Vertical Distance: 0.75 m Time: 36-52 minutes	- 11 lbs is combined weight of e-tool and average weight of various soil compositions - 0.75 meters is height of a sandbag, 3-5 scoops of dirt fill one sandbag - One hasty fighting position (without overhead cover) utilizes 18-26 sand bags - 2 minute average to fill a sandbag - 54-130 scoops required to fill 18-26 sandbags

Task: Carry / Emplace Sandbags

Condition: Wearing / Carrying 68 lb Fighting Load(-) (no weapon) and given 26 sandbags (55-60% full)

Standard: Hasty fighting position (without overhead cover) built in 26 minutes 10 meters from the original position of the sandbags

Carry/Emplace Sandbags

Lift 30-40 lbs sandbags waist to shoulder high, carry them 1- 30 m and emplace.

Weight: 30-40 lbs Horizontal Distance: 30 m Vertical Distance: Waist-shoulder high Time: 18-26 minutes (Urban environment requires lifting/heaving sandbags to multiple storied buildings)	- 30-40 lbs is average weight based on soil composition; bags filled 55-60% - Sandbags are typically carried/emplaced waist to shoulder high - 30 meters is farthest distance carried from fill point without a vehicle - 1 minute estimate to carry/emplace sandbags

MOS 11B: Infantryman
071-325-4407 Employ Hand Grenades

Task: Employ Hand Grenades

Condition: Wearing / Carrying 80 lb Fighting Load and given an M69 Practice Hand Grenade

Standard: Throw Hand Grenade 30 meters

Employ Hand Grenades
Throw hand grenade to engage enemy forces.

Weight: 1 lb Horizontal Distance: 30 m Vertical Distance: N/A Time: N/A	- 1 lb equals the weight of an M67 Fragmentation Grenade - IAW Qualification Standards outlined in FM 3-23.30 Soldiers must be able to engage enemy targets at 35 meters with M67 Fragmentation Grenades - Hand grenades are used more frequently when conducting operations in urban environments (ROE Dependent)

MOS 11B: Infantryman
071-COM-0503 Move Over, Through, or Around Obstacles

Task: Move Over, Through, or Around Obstacles; Scale / Climb 2 Meter Vertical Obstacle with Assistance

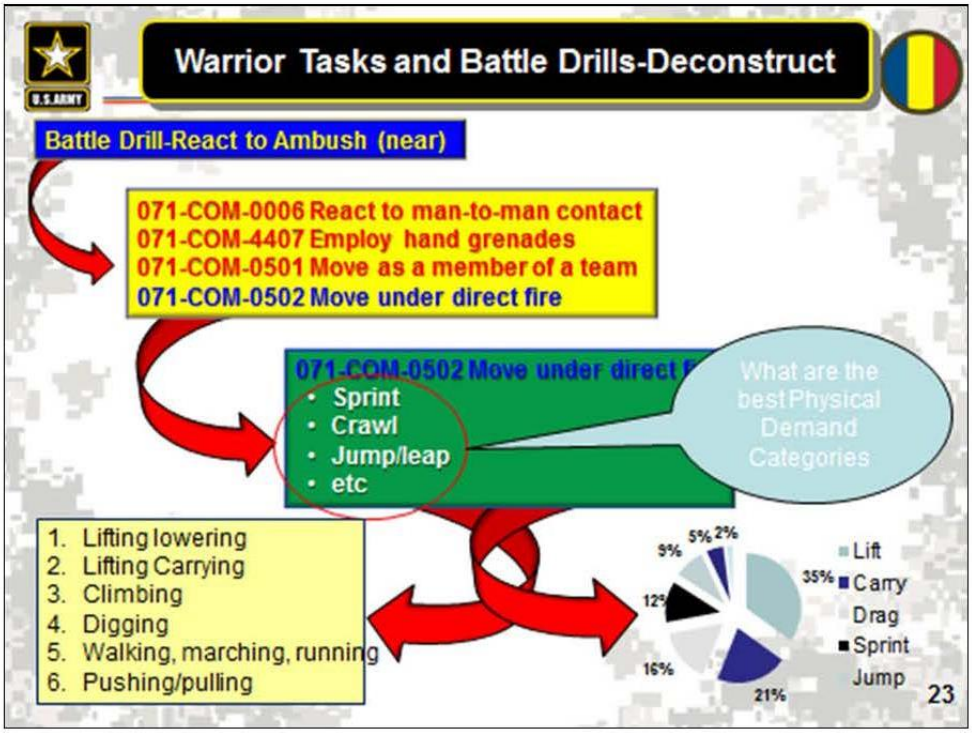
Condition: Wearing / Carrying 80 lb Fighting Load and given a 2 meter vertical obstacle. If necessary, equipment may be removed, but must be worn / carried after obstacle is cleared

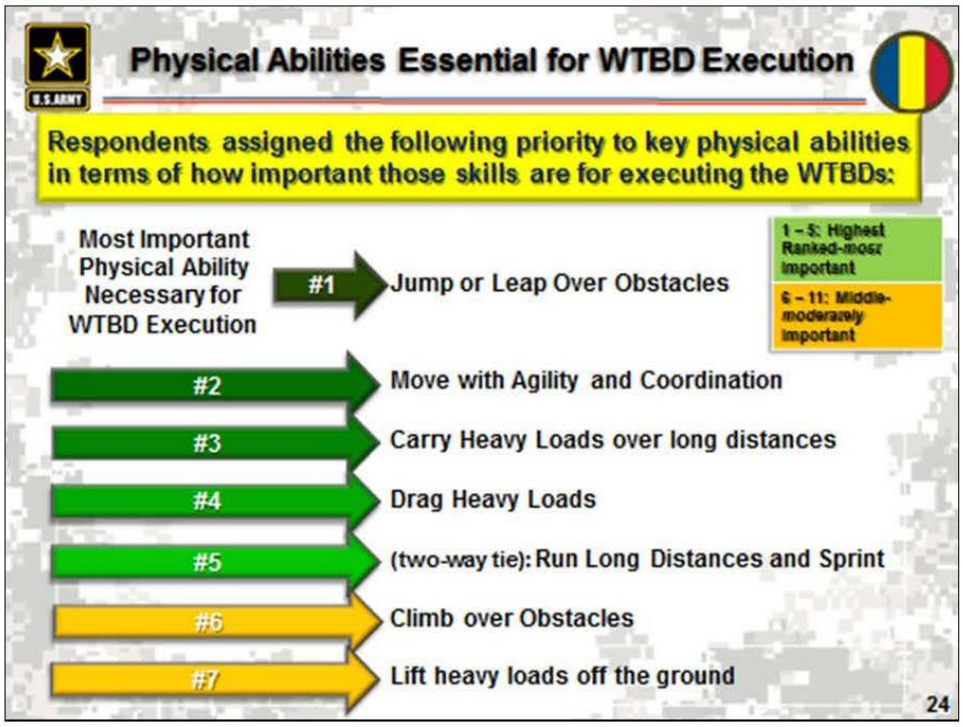
Standard: Obstacle successfully negotiated, with assistance (if needed)

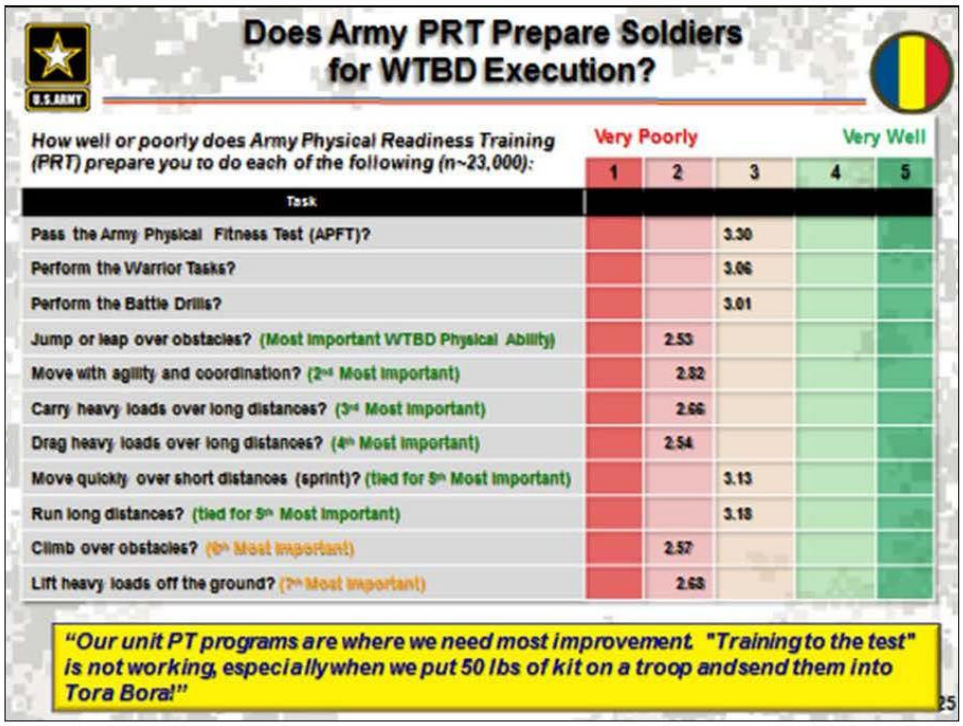
Scale and Climb a 2 Meter Vertical Obstacle
With Assistance

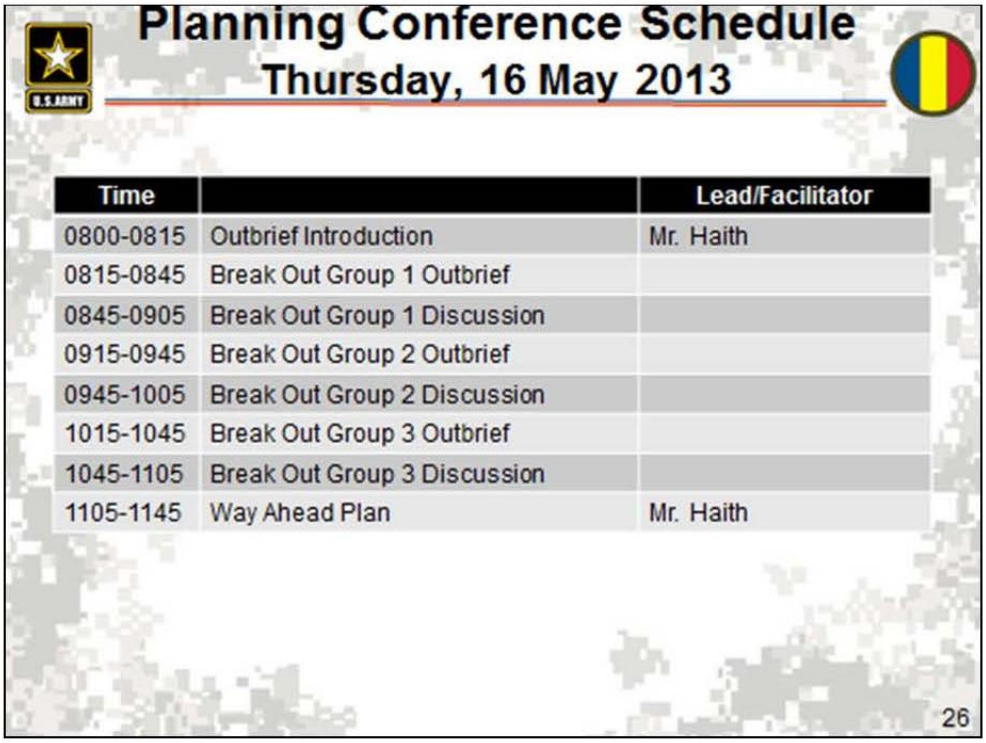
Weight: 80 lbs Horizontal Distance: Varies Vertical Distance: 2 m Time: Varies	Weight: Combat Equipment is 80 lbs Vertical Distance: Common courtyard and compound walls are 2 m; could also be a 2 m vertical obstacle, river bank, or other natural or reinforcing obstacle


MOS 11B: Infantryman
071-COM-0502 Move Under Direct Fire
Task: Move Under Direct Fire (Rise from a Prone, Kneeling, or Crouched Position; Sprint 3 to 5 Seconds; Return to a Prone, Kneeling, or Crouched Position)
Condition: Wearing / Carrying 80 lb Fighting Load
Standard: Sprint 100 meters in 3 to 5 second increments
Rise from a Prone, Kneeling, or Crouched Position; Sprint for 3 to 5 Seconds While Carrying a Minimum of 80 Pounds Evenly Distributed Over Entire Body; Then Return to a Prone, Kneeling, or Crouched Position
Weight: 80 lbs
Horizontal Distance: 100 m or more
Vertical Distance: N/A
Time: Varies
Weight: Combat equipment is 80 lbs Weight does not include Platoon TO&E or mission specific equipment or radios


Warrior Tasks and Battle Drills-Deconstruct
Battle Drill-React to Ambush (near)
071-COM-0006 React to man-to-man contact
071-COM-4407 Employ hand grenades
071-COM-0501 Move as a member of a team
071-COM-0502 Move under direct fire
071-COM-0502 Move under direct
• Sprint
• Crawl
• Jump/leap
• etc
What are the best Physical Demand Categories
1. Lifting lowering
2. Lifting Carrying
3. Climbing
4. Digging
5. Walking, marching, running
6. Pushing/pulling
5%
2%
9%
35%
12%
16%
21%
Lift
Carry
Drag
Sprint
Jump
23


Physical Abilities Essential for WTBD Execution
Respondents assigned the following priority to key physical abilities in terms of how important those skills are for executing the WTBDs:
Most Important Physical Ability Necessary for WTBD Execution
#1 Jump or Leap Over Obstacles
1 – 5: Highest Ranked-most important
6 – 11: Middle-moderately important
#2 Move with Agility and Coordination
#3 Carry Heavy Loads over long distances
#4 Drag Heavy Loads
#5 (two-way tie): Run Long Distances and Sprint
#6 Climb over Obstacles
#7 Lift heavy loads off the ground
24


Does Army PRT Prepare Soldiers for WTBD Execution?
How well or poorly does Army Physical Readiness Training (PRT) prepare you to do each of the following (n~23,000):
Very Poorly
Very Well
1 2 3 4 5
Task
Pass the Army Physical Fitness Test (APFT)? 3.30
Perform the Warrior Tasks? 3.06
Perform the Battle Drills? 3.01
Jump or leap over obstacles? (Most important WTBD Physical Ability) 2.53
Move with agility and coordination? (2nd Most important) 2.82
Carry heavy loads over long distances? (3rd Most important) 2.66
Drag heavy loads over long distances? (4th Most important) 2.54
Move quickly over short distances (sprint)? (tied for 5th Most important) 3.13
Run long distances? (tied for 5th Most important) 3.18
Climb over obstacles? (6th Most important) 2.57
Lift heavy loads off the ground? (7th Most important) 2.68
"Our unit PT programs are where we need most improvement. "Training to the test" is not working, especially when we put 50 lbs of kit on a troop and send them into Tora Bora!"
25



Planning Conference Schedule
Thursday, 16 May 2013

Time		Lead/Facilitator
0800-0815	Outbrief Introduction	Mr. Haith
0815-0845	Break Out Group 1 Outbrief	
0845-0905	Break Out Group 1 Discussion	
0915-0945	Break Out Group 2 Outbrief	
0945-1005	Break Out Group 2 Discussion	
1015-1045	Break Out Group 3 Outbrief	
1045-1105	Break Out Group 3 Discussion	
1105-1145	Way Ahead Plan	Mr. Haith

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APPENDIX N

Summary and Example Results of Focus Group Sessions June 2013

Focus group sessions were sponsored by TRADOC IMT-CoE and organized by COL Sonya Cable and Mr. Mike Haith. The purpose was to gain insight from the field about conditions under which warrior tasks and battle drills (WTBDs) are conducted and establish baseline standards that every Soldier, regardless of gender or MOS, should be able to meet without special skills or training. The sessions were confidential and only basic demographic information about the participants was obtained. Each focus group began with a discussion lead by IMT CoE staff on problems with the current APFT and the need to connect physical fitness testing with WTBDs. A common theme of discussion and participant comments was regarding the weight of clothing and equipment worn and carried during training and combat. The focus groups were beneficial and provided many insights about the validity of selected WTBDs.

The focus groups were conducted at following:

FT Jackson, 12-13 Jun 2013
USAPHC Personnel: Ms. Karen Deaver (group facilitator) and Mr. Tim Bushman
Three focus groups, totaling of 21 men and 7 women of mixed ranks

FT LeonardWood, 18 Jun 2013
USAPHC Personnel: Mr. Joe Houser (facilitator); Ms. Lauren Lynch (transcriptionist)
Two focus groups, totaling 13 men and 7 women of varying ranks

Ft Benning, 25-27JUN13
USAPHC Personnel Ms. Karen Deaver (facilitator), Ms. Elizabeth Clearfield (transcriptionist)
Three focus groups, totaling groups 23 men and 2 women of mixed ranks.

The following is an example of the information transcribed from the focus sessions.

Public Health Report No. 12-01-0614

EXAMPLE SUMMARY OF FOCUS GROUP RESPONSES AND NOTES

12 June 2013
Fort Jackson, SC Day 1
Morning Session-A
Moderator: Karen Deaver-US Army Institute of Public Health
Transcriber: Tim Bushman-US Army Institute of Public Health
Drill Sergeant of the Year: SGT Heilman
Session Start Time: 8:10, Instruction End: 8:20
Session End Time: 10:50
Number of Participants: 10 (7 males, 3 females)

Conduct Tactical Foot March

Q1: Do you think that the average Soldier, male or female, could march 16 km (10 miles)?
Q2: Do you think that the average Soldier, male or female, could march 16 km (10 miles) in 4 hours (a 2.5 mile-per-hour pace)?
Q3: Do you think that the average Soldier, male or female, could march 16 km (10 miles) in 4 hours while carrying a 128-pound load?
Q4: What do you think that an average, baseline Soldier could accomplish in terms of a foot march? If you had to develop the conditions and standards for the average Soldier, what would they be?

1) 16-km is a reasonable distance, general consensus
2) From a baseline perspective, Soldiers that just got in, they start at 12 miles, not 10, and they progressively increase distance and load and this was feasible
3) Distance is usually 20 km or 12 miles
4) They say that 16-km is too low as more conversation transpired
5) Probably ought to be 20-km
6) 4-hour pace for 10 miles is too slow
7) 4-hours for 20-km is good, correct pace
8) Would be easier to make the decision based off of what your actual backpack weighs, not the actual load
9) No Soldier really incorporates what they wear (bag and kit)
    a) Two separate equations you have to account for
10) 35 pounds for the ruck sack
11) 128 pounds and subtract the uniform weight, so roughly a 115-pound load
12) ACH, FLC, weapons, boots has nothing to do with the “load” as far as they think
13) The actual “weight” should be 35 pounds as far as they consider it
14) There is a doctrinal way to think of this: fighting load (FLC) and approach march load (everything) and the middle load is maybe assault load?
15) 128 pounds seems excessive for the approach march load, a more acceptable number is 25-35 pounds
    a) 70-75 pounds for the entire load because the load you’re wearing can vary 20-30 pounds depending on what you’re carrying

   b) 70-75 pounds sounds like a general agreement number as far as what a Soldier should be able to carry
16) For baseline Soldiers, one of the issues is multiple standards for different body sizes
17) It would just be a little easier for the bigger Soldiers and a little harder for the smaller Soldiers
   a) Soldiers can do it, they just have to build up to it but it is totally possible
18) Need to build stamina
19) 1/3 of body weight is a general number as far as load to carry
20) Building up to it is the key for baseline Soldiers, start out at 2-4-6-8-10-12 kilometers
   a) Nothing for 2-km, then continually adding more weight to help train for distance and load simultaneously
21) 4 hours at the 20-km still makes sense with a full load of 70-75 pounds
22) According to Chapter 5 Foot Marches, 21-18 manual, says 72 pounds should be the cap for load
23) Regular Army does that, Ft. Jackson doesn't
24) Fort Jackson bases it on body weight, generally 1/3 of body weight
25) 30-35 pounds average fighting load?
26) 30% of body weight, some units do do that outside of the Army
27) 35-pound ruck is the set standard for Fit to Fight
28) Soldiers need to be able to do this, but there really is no set standard
29) Doesn't make sense to have it MOS specific, because every Soldier is a Soldier first
30) Hard to establish a standard because everyone does something different (MOS)
31) It comes down to enforcement at the end of the day, whatever standard you set forth, you need to enforce that
32) Every unit enforces standards based on MOS, and unless all units enforce the same standards, then anything we establish is "air"
33) Taking APFT in one unit may be different than taking APFT in another unit
34) As a former infantryman, it was "you are going to do this, and it is going to be checked"
35) It comes down to ENFORCEMENT
36) Karen took the conversation away from enforcement, that is another day's conversation, but today's focus is what are you doing TODAY
37) We should expect 20-km in 4 hours with 70-75 pounds in load carriage

Perform Exterior Movement Techniques during an Urban Operation

Q1: In said example, if a Soldier must sprint under load, jump and crouch under load, drop to the prone position under load, and perform balancing acts under load; what different physical components, or physical movements, are involved in this task?
Q2: Considering each physical component described above, how easy or difficult is it to perform? While carrying an 80-pound load? Do you think that the average Soldier, male or female, could perform that physical component with a fighting load? Without a fighting load?
Q3: What do you think an average, baseline Soldier could accomplish in terms of exterior movement during urban operations? If you had to develop the conditions and standards, what would they be?

1. No, not the baseline Soldier (the baseline Soldier wouldn't be doing this?)
2. Just operational, not IET, right after IET though
3. They would never do this in operational anyways

4. What are the physical capabilities that we should expect of the baseline Soldier during unified land operations (Korea, Kuwait to Afghanistan, Northern Africa)
5. Participant thinks this is possible because CTT Training is similar to that above-described scenario, but would never do that on a normal basis
6. If you want to tie these things together, we're not walking, jumping and crawling with the before-stated 70-75 pound load
    a. If that's the standard for walking or marching, it can't be the standard for more operational tasks
    b. 15-25 pounds is a reasonable expectation?
7. If you're under fire, you are dropping your ruck sack and running so allow yourself more maneuverable
8. 210 rounds, weapon, radio
9. Whatever the standard issue is, 35-40 pounds
10. 25-30 pounds sounds like a more appropriate standard as far as consensus
11. What other physical things do we need to do aside from the scenario actions:
    a. Crawl, shoot, pull their own body weight, potentially carry others with this 15-25 pound load
    b. Pull myself up onto a shelf-type obstacle, sprinting, IMT
12. Of the physical components just described, what can you reasonably do with 15-40 pounds?
    a. Crawl, but the less weight the better because of the transition between activities and physical components
    b. If low-crawling with 80 pounds, and then have to get up and sprint, the transition is going to take way too long
    c. Everybody would rather move FASTER
13. Climbing over walls with 25 pounds, reasonable expectation
14. Climbing over walls with 40 pounds, too much
15. 25-30 sounds okay, 40 pounds is too much, you're asking for issues (that's when you are going to run into issues with the baseline Soldier)
16. What about ascending stairs? What weight is reasonable? 25 is always reasonable, 40 is always a huge stretch, seemingly unacceptable
17. 40 pounds you should be able to do a flight of steps, 60-80 pounds is doable but you are going to naturally slow down
18. For sprinting, weight is certainly an issue
    a. Lighter is better, especially if you're getting shot at
    b. Still, 25-35 pounds is okay for the sprint
    c. Any additional weight and you are going to be zigzagging and not sprinting in a straight line anymore, you're just trying to stay out of harm's way
19. 25-40 range seems generally okay for all warrior tasks and battle drills, anything more seems farfetched and seemingly unrealistic/unreasonable

Move Under Direct Fire

Q1: In said example, what are the different physical components, or physical movements, are involved in the task?

Q2: Considering each physical component described above, how easy or difficult is it to perform? While carrying an 80-pound load? Do you think that the average Soldier, male or female, could perform that physical component with a fighting load? Without a fighting load?
Q3: What do you think an average, baseline Soldier could accomplish in terms of moving under direct fire? If you had to develop the conditions and standards, what would they be?

1. Everything on here is legit, except for the weight
2. Is this the right scenario physically under direct fire? YES, it is a reasonable expectation
3. Is there anything missing as far as physical fitness components? Change magazine
    a. Generally would be expected to do low and high crawl
    b. Kneeling behind cover, crouched position depending on cover
4. Reasonable physical components, make sense, but the weight is too much
5. For a reasonable expectation for weight, the weight should be the same
    a. The weight doesn't change, 25-40 pounds as in the scenario above
    b. 15-25 pounds for a 15-meter sprint is a total weight that you're carrying
        i. The distance is okay, but in order to conduct this task 40 pounds is a lot of weight
    c. Last scenario 25-40 was reasonable, but in this scenario you're shedding some weight and looking at a range of 15-25 pounds
    d. With a movement to contact task, you want more speed and less weight
        i. In this particular drill, there is an emphasis of speed and that cannot be achieved with the addition of weight
        ii. YES, GENERAL AGREEEMENT of this opinion
    e. Putting a weight to testing a baseline Soldier is incorrect altogether, because a baseline weight is going to differ
        i. It should be a list of gear that you're wearing
        ii. IBA and rifle all weigh differently from one Soldier compared to another
        iii. The way to describe these scenarios is not defined by weight, it's defined by equipment
    f. Plus or minus 20 pounds is a general range of variation for equipment weights between different Soldiers
6. We want to have as little weight on us as possible
7. Every Soldier should be able to carry weapon, ammunition, water, personal protective equipment
8. Scratch the 80-pounds out and replace with fighting load, and the scenario would be accurate
9. If you don't give a weight requirement, then you better spell-out the equipment you expect me to carry
10. If you don't give us a standard, then what are we doing in the Army?
11. Capabilities
12. Task, condition, standard
13. Standard comes into play
14. Personal protective equipment (PPE) is different between units, which causes loads to fluctuate with PPE

15. Think about the scenario at a couple of different weight limits: low crawl, high crawl, changing the magazine, running and sprinting, transition, lifting your body up and down (depends on terrain)
16. In moving under direct fire, is there really a step called 'climb over something'?
    a. Not generally, you are looking for cover and a concealed position
17. Baseline Soldier cannot crawl with 80 pounds
    a. Could maybe do it for a minute, but you won't be that successful
    b. May be good for 20-30 meters
    c. Not going to do much for anything with 80 pounds
    d. 80 pounds is a show-stopper
    e. 80 pounds is not impossible, but if it's used for standardization then 80 pounds is an issue
18. Is 60 pounds reasonable for 150 meters? NO
19. 15-25 pounds is the very reasonable weight
20. When you raise it to 25-35, you can still perform all those physical components but it becomes DANGEROUSLY slower, which is why that weight needs to come down
21. 35 pounds is a tipping point
22. 51 pounds is what one Soldier would wear, not including his radio and knives but he isn't a baseline Soldier
    a. That's going back to MOS, because it is what he is required to carry
23. 25-40 pounds is our fighting load? Is it a reasonable fighting load? Baseline should be easily 40 pounds, which has a much more general consensus
    a. Can move or is agile with 40 pounds, so the tipping point is 35-40 pounds
    b. But 25 pounds means that you dropped your ACH or some other mission-critical equipment so with the addition of a few more things, you're at 35-40 pounds which is reasonable for these physical components for the baseline Soldier
24. Weapons, ammo, PPE is in the 40-pound range
    a. BASELINE Soldier you stick to 40-pounds
        i. Incorporate the plus or minus 20 pounds
25. You're never going to make everybody happy with this, but 40 pounds is good
26. Another individual is sticking with 15-25 pounds
27. To perform these tasks optimally, the only addition you want to add is 15-25 pounds
    a. But to do these tasks with 40 plus pounds on, it's a "spiritual" task
28. TRADOC is behind, participant thinks that we're going backward, we're still training on things that we have already shown we are proficient at
    a. We already do this, so we need to come up with some newer, different things to forward the training doctrine of the Army
29. Doing these WTBD with 40 pounds you will experience a degree of degradation

<u>React to Vehicle Roll-Over</u>

Q1: In said example, what are the different physical components, or physical movements, are involved in the task?

Q2: Considering each physical component described above, how easy or difficult is it to perform? While carrying an 80-pound load? Do you think that the average Soldier, male or female, could perform that physical component with a fighting load? Without a fighting load?
Q3: What do you think an average, baseline Soldier could accomplish in terms of reacting to vehicle roll-over? If you had to develop the conditions and standards, what would they be?

1. First thing is to take everything you have strapped-on off, keep OTV and whatever else the seat belt will fit around (your "kit")
2. You will not be able to put your chin to your chest, too much stuff
3. 60 pounds would be roughly accurate, not 80
4. If you have your neck guard on, you don't have any room to tuck your chin to your chest
5. Better description is to tuck everything into a ball, "ball-up"
6. Ditching your gear, everything but the helmet because everything you're wearing is going to snag in the vehicle
7. Helmet and weapon
8. You just have to be flexible and agile, IOTV (majority of Army should have these)
    a. Should have pull tabs?
    b. Apparently not everyone has IOTV's
    c. Shouldn't take that much effort to shed that excess equipment and weight
    d. Unit SOP is everyone has to wear your seatbelt at all times
    e. Cut the seatbelt, leave your IBA on because you may have to fight
    f. Others in the convoy will "circle the wagon"
    g. Another thinks you keep your fighting load on you depending on the threat level
    h. If time is of essence, you pull off your excess gear and get out
    i. How smashed up is the vehicle? Is the truck on fire? Is someone on top of you? Are you being engaged?
9. The windows are really small, so trying to get out with all your gear on is rather difficult
10. This is a tough scenario to train on because it varies too much due to the myriad of reasons why a rollover may occur
11. You would have to cover all the scenario to establish SOP's for this type of event
12. What are the physical tasks for getting out of the vehicle?
    a. You would have to establish some strength to try and open and keep the door open (lifting the door, trying to keep it open)
    b. The windows on the humvee, probably going out the windshield because the top is no longer available and the doors are pretty narrow spaces
    c. Look for the quickest way out, which would be the door if it's available
    d. Is ditching your gear and crawling out of the window something a baseline Soldier can do? Everyone should be able to do this. If it's on its side, you would have to pull and lift the door which may take 2-3 Soldiers. If it's on its roof, you would have to go out the sides
    e. Realistic scenario: you have 3 or 4 people that are in rough shape, IF your seatbelt is on you are upside down, someone is unconscious, first thing to do is identify the gunner because he is probably dead

f. This is a realistic expectation for a baseline Soldier, but that's completely different than what will happen in the actual event
    i. One training scenario with gear, one without
    ii. Very realistic to expect a baseline Soldier to recover themselves out of a flipped vehicle
    iii. There isn't a new level of fitness you're asking us to do by executing this task
    iv. If we can do the previous scenarios, we can do this scenario
    v. Physical components are the same or similar than the others
    vi. Don't know what things we're measuring in this task
    vii. This one is almost our easiest one, it's more mental than physical
    viii. "What's going on upstairs", meaning it's more important to think clearly than have the physical capacity to do this
    ix. How are you going to react, can you react?
    x. Too many variables to make this a training exercise, should just be a unit SOP
    xi. Much more mental than physical
    xii. Just rollover, get out, not something you necessarily train on, but you do it in Kuwait before you go to your station
    xiii. Don't have humvees in Afghanistan, different vehicle systems everywhere
    xiv. Not everyone has gunners anymore
    xv. Even State-side, we aren't all driving humvees or tactical vehicles, so don't necessarily have a standard common knowledge

Solder Load

Q1: Considering the Army Combat Uniform (ACU), what does the average baseline Soldier wear every day, and what would he\she be carrying in the pockets? How much do you think this weighs? The uniform plus other pocket and attached items? Do you think the average, baseline Soldier can function effectively while wearing this much weight?

1. Some people shed earplugs, some don't
2. Do not need Chapstik
3. Gloves can shed
4. Underwear can shed
5. Eye protection
6. Everything minus the sports bra I'm taking
7. Left off the multi-tool because not everyone has one, not everyone needs one
8. 11.75, 13, 12.13, 11.0, 12.6, 12.4, 12.3, 13.0, within a pound you're looking at 12 pounds roughly
9. This seems appropriate as far as weight per equipment
10. Most everyone is this room has that much weight right now
11. Is there anything missing that you would have in battle? Some form of communication device
    a. Pound of smart cards
    b. Weapon and a magazine
    c. Looking for equipment in garrison
    d. In garrison you don't need eye pro, ear pro, multi tool, gloves, more comes off the list when 'in garrison' is in effect

    e. Leave the tool or knife
    f. Might want to have your ipro and gloves in garrison
12. Chapstick, earplugs, gloves, maybe multi tool in a battle drill can be left behind
13. Everything except the sports bra, and maybe not underwear
14. You list a notebook, but no pen
15. In a battle drill, you have all of this, but maybe not underwear
16. This is the BASIC UNIFORM, this is how you show up
17. 12-13 pounds sounds good

Q2: Considering the Fighting Load (the ACU plus the gear a Soldier would wear and carry into a situation with potential enemy combatants): what would a Soldier going into a potential combat situation need to wear, carry, and hold in his/her hands? How much do you think this weighs? The uniform plus other items? Do you think the average, baseline Soldier can function effectively while wearing this much weight? What do you think an average, baseline Soldier should be wearing and carrying?

1. 45 pounds after shedding a number of items
2. 50 pounds
3. Kept most of it
4. Took off deltoid protector, lower back, protective side plates, waste pack, etool, compass, visual language translator card, goggles, grenade pouches, grenades, seems to concur all-around (these are all items taking out)
5. The sling was questionable
6. If we're talking about the battles drills vs. just going wherever, we would also take off rhino mount, flashlights, infrared beacon concerning night drills
7. Most people kept on body armor, plates, small arm inserts, em4, ACH, magazines, mag pouch, (all must-haves)
8. Baseline Soldier fighting load should be around 52.81 on the LOW END
9. 52.0 LOW END
10. 52.0, 54.5, 47.0 (middle range), 52.0, 48 (low on the body armor), 64 with side plates, 56, 69 with high end numbers for everything
11. Someone would keep the grenade pouches, but not the grenades
12. Range of 47-69 pounds
13. Assuming 50-55 pounds, can you do the tactical foot march with just this weight? YES (20 km, under 4 hours)
14. Assuming 50-55 pounds, exterior movements for urban operations? YES crawl, transition, climb the wall (yes and no, you are going to have someone there to help you), (you can do this, but it's going to be slow), with this weight UNASSISTED these tasks, 6-foot wall with 60-70 pounds worth of stuff, is not doable
15. At this weight, should the wall be a baseline? NO, because they are not going to be alone and they will have someone there to help me
16. Do not remember having to climb a 6-ft wall
17. Sprinting with this weight: 15-meters yes, but obviously slower
18. Baseline Soldiers should be able to do that, but you haven't given us a standard time? Under double time, yes, absolutely you should be able to d this

19. At 15 meters, the weight doesn't affect the performance as much because it's too short of distance
20. Going up steps, it shouldn't be a problem
21. For moving under fire: not for a baseline Soldier, what can you train them to be able to do after 6 months or so? Yes, after training with the aforementioned fighting loads
22. Should we have our Soldiers saying "this is what you need to do to accomplish the mission?" Is this way too far? Is this realistic? Baseline Soldier in the Army cannot do this, but they should be held to this standard, but it's going to take so much time to get this standard developed that it's "not worth it"
23. Have passed the previously-defined tipping point of 40 pounds?
    a. Individual movement techniques would render 55 pounds as too much weight
    b. It would take a unit a considerable amount of time to get that Soldier to achieve these tasks at said weight of 55 plus pounds
    c. A lot of the Army isn't going to implement this because they have their own mission and agenda
    d. Baseline Soldiers could NOT do this, general agreement
    e. They WON'T DO IT
    f. How many Soldiers get to drill sergeant school and can't perform the tasks and battle drills asked of them
    g. Not a reasonable expectation that is baseline for the entire Army
    h. Assuming that the PPE is mandatory, then it's completely different

Q3: Considering the Approach March Load (the Fighting Load plus the gear a Soldier would wear and carry into a protracted mission in a hostile region): what would a Soldier on a multi-day mission in a hostile region need to wear, carry, and hold in his/her hands? How much do you think this weighs? The uniform plus the other items? Do you think the average, baseline Soldier can function effectively while wearing and carrying this much weight?

1. In addition to your 12-13 pound uniform, roughly 50 pound gear
2. This is enough gear for a 48-hour event, what is the load expectancy?
3. 27, 40, 15, 27.6, 33.4, 47.8,
4. Did not carry: ruck, downgrade to medium ruck, intermediate bag, you need mre's, something to carry it in, molee, less mre's,
5. This tells me what we have been doing, but not that it is optimal
6. Leaving out some sustainment items because this is tactical, so the load goes down by half
7. If you're training for a particular mission, such as 20-km in 5 hours, given our load, then a lot of these things articulated on this matrix would be something to sleep in, keep dry, chow, additional ammunition, radio, map
8. Two-day patrol that is a combat patrol, you aren't taking a sleeping bag because you won't be sleeping (travel light and freeze at night, sucks to be you for two days)
9. No more molee ruck sacks, just three-day packs
10. Molees are stupid, molee rucks
11. Molee rucks suck
12. Three-day pack is close to the old system ruck, more realistic

13. In some circumstances the ruck may be essential to the mission and survival (Alaska), there is a reason to have it in some instances
    a. For baseline Soldier, this is not necessary
14. Two points: fitness as it applies to warrior tasks and battle drills, there are some other avenues that physical fitness gets to: is there a level of fitness to be achieved that helps us with suicide prevention or increases self-esteem? Multiple civilian studies that have found that daughters that are raised with higher levels of fitness have higher levels of self-esteem and don't get into situations where sexual assault becomes an issue? There is another component, not just towards mission, that makes the Army more resilient against suicide, sexual assault, etc.
15. NO ONE agrees that just the PT test and weapons test is good enough to get into the Army
16. With all of this, we have to define what an Army thinks a Soldier should be which always comes down to MOS-specific, which makes us weaker
17. Marines all call themselves Marines, but the Army does not all call themselves Army, they define it by MOS (I'm an infantryman, I'm a mechanic I'm a …)
    a. In the Marines, it's I'm a Marine and I'm a Marine and I'm a Marine
18. We basically train to 2/9 tests to pass BCT (fitness test and arms test), but we need to change this

Mike Haith's Presentation – Key Points

- We need to get back to COMPETITION and allowing squad leaders to gauge their own unit's physical fitness
    - Reinstitute competition
- We need to train "in-kit"
- Where do you draw the line with training and injury risk?
- No tactical training in NCOIS
    - Any school in quartermaster course is the same
    - Not getting the training in school to be able to relay that education and training
- Should be able to have a workout of the day with crossfit, TRX, etc.
- No more "one-size-fits-all" approach
- Need for DIFFERENTIATION AND COMPETITION

APPENDIX O

Baseline Soldier Physical Readiness Requirements Study
TRADOC in Process Review (IPR) Brief
19 August 2013

Presented by Mike Haith, TRADOC IMT-CoE

Soldier Baseline Physical Readiness Requirements Study
IPR
DCG IMT
19 AUG 2013

"It [PRT] may not be the most important thing we do in a day, but it's the most important thing we do everyday"
CPT Nicholas Bilotta
Company Commander, TF Spader, Kunar Province, 2011

1

Event Selection

CRITERIA FOR SELECTING TEST EVENTS.*

a. For military purposes, tests selected should measure the various factors in physical fitness which are essential to military fitness. The most important of these are muscular strength, muscular endurance, cardio-respiratory endurance, agility, and coordination.

b. Test events should be selected which require a minimum of equipment. Necessary equipment must be easy to procure and set up.

c. Test events should be capable of administration with a maximum economy of time.

d. Test events which are dangerous to the unskilled or poorly conditioned men should not be included.

e. Test events used should depend as little as possible upon previously learned skills. The purpose of physical fitness tests is to measure the various components of physical fitness, not to measure acquired skills.

f. Test events should be such as can be scored on a point table. When tests are scored with points, men are strongly motivated to improve their scores.

g. The test in its entirety should be such as to distinguish clearly between the fit and unfit individuals. Test results obtained from fit groups should be consistently better than those obtained from poorer groups.

h. Testing on Mondays or on the day after pay day should be avoided.

*1946 Army Physical Fitness Manual

Agenda

- Review
- Phase 2 Task Identification/Task Demands
  - Ft Jackson physical demand rehearsal testing 21-30 AUG
  - Ft Carson physical demand testing 12-27 SEP
- Way Ahead-FY 14 and beyond

3

Phase 2: Task Identification and Task Demands

May 13
Step 1: SMEs & Stakeholders
- Develop draft list of Physical Demanding WTBD
- Deconstruct Tasks into physical Demands
- Develop Task Narrative
- Develop Draft Soldiers Load

JUN 13
Step 2: Validation Focus Groups
- Validate Task list and task Demands
- Validate Solders Load
- Conducted at 3 TRADOC Installations

SEP 13
Step 3: Observations of WTBD
- ID task physical demands
- Observe FORSCOM Soldier Performance
- Conduct performance AARs
- Complete Questionnaire

OCT 13
Step 4: Stake Holder Focus Groups
- FORSCOM Installations
- Refine Task and demands
- Validate Tasks and Demands

NOV 13
Step 4: Senior Review Panel
- Refine Task List and Demands
- Obtain Panel Approval

DEC 13
Step 4: Brief CG TRADOC for Decision

4

Phase 2 Step 1: ID Physically Demanding Warrior Task and Battle Drills FY 13

Shoot
- Maintain, employ, and engage targets with assigned weapon system (new or reworded)
- Employ hand grenades

Move
- Perform individual movement techniques
- Navigate from one point to another
- Move under fire

Communicate
- Perform voice communications (SITREP/SPOTREP/9-Line MEDEVAC, EXPLOSIVE HAZARD [EH])
- Use visual signaling techniques

Survive
- React to chemical, biological, radiological, and nuclear (CBRN) attack (new or reworded)
- Perform immediate lifesaving measures
- Perform counter IED
- Maintain Situational Awareness (new or reworded)
- React to Man-to-Man Contact (new or reworded)

Adapt
- Assess and Respond to Threats (Escalation of Force)
- Adapt to changing operational environments
- Grow professionally and personally (Build resilience)

Battle Drills
- React to contact
- Establish Security
- Perform actions as a member of a Mounted Patrol
- Perform Tactical Combat Casualty Care (new or reworded)
- React to Indirect Fire
- React to Ambush (near/far)

TASKS: 16
DRILLS: 8
SUB-Tasks: 81

Physically Demanding tasks

(Pre-decisional)

5

Phase 2 Step 1: ID Physically Demanding WTBD

071-COM-4407	Employ Hand Grenades* (identified as least physically demanding task in WTBD PRT Survey)
071-COM-0501	Move as a member of a Team
071-COM-0541	Perform Exterior Movement Techniques during an Urban Operation
071-COM-0502	Move under Direct Fire*
071-COM-0510	React to Indirect Fire dismounted
071-COM-0503	Move over, Through, or Around Obstacles (Except Minefields)
081-COM-1046	Transport a Casualty-(Drag a Casualty to Immediate Safety-Dismounted)*
071-COM-0006	React to Man-to-Man Contact
551-001-1043	React to Vehicle Rollover (not identified as physically demanding task in WTBD PRT Survey)
071-COM-1006	Navigate from one point on the ground to another point while dismounted

Other Physically Demanding Common Soldier Tasks
- Conduct Dismounted Tactical Foot March (Conduct Tactical Movement*)
- Prepare a Fighting Position (Fill and Emplace Sandbags)*
- Drag a Casualty to Immediate Safety-Mounted

* Physically demanding Tasks-11, 19, 12B, 13F MOS

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Phase 2
Step 2: Focus Group Results

Findings:

- Initial Task List and description "about right"
- *To properly assess fitness-WTBD scenarios require task execution in sequence with little rest while under load and fatigued (pre-fatigue)*
- Participants very concerned with Soldier's Load
  - Mission risk vs. protection
  - Loads too heavy
  - Compromises mobility
  - Degrades performance
  - Recommended not less than 25 lbs but no more than 60 lbs (conflicts with list of equipment selected)

Recommendations:

- Create composite task scenarios for Step 3-Observations
- Retain Foot march as physically demanding task
- Modify "Prepare Fighting Position" task to include fill, lift, carry and stack sandbags
- React to man to man contact is situational specific and high injury risk; include capacity tasks of lift, pull, and push
- Omit the following tasks from Step 3-Observations
  - Employ hand grenades *(USMC CFT has hand grenade throw?)*
  - React to vehicle rollover

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Phase 2
Step 3: Observation Phase

Observations Phase

When	AUG-SEP 2013
What	Administer WTBD/Common Soldier Task performance scenarios to Soldiers. • Soldiers execute a tactical foot march and a series of tasks designed to simulate physical dynamics of, and weight carried/moved while performing, WTBDs in a combat environment. • Data collection will include: - Soldier gender, height, weight, combat experience, most recent APFT event scores - Soldier load (actual weight of uniform plus standardized loads) - Time-to-complete tasks under different experimental conditions (given time standard vs. "do until complete") - Perceived physical exertion plus heart rate - Perceived combat relevance/realism of movements executed during task simulations
Where	• Ft Jackson pilot/rehearsal (21-30 AUG 2013) • Ft Carson (12-27 September 2013)
Why	• Validate SME and Focus Group WTBD/Common Task Scenarios-Are the movements/loads in the scenarios consistent with executing WTBDs in combat? • Observe and record physical dynamics of WTBD performance to inform development of Field Expedient Test menu (potential items for new physical fitness test) • Establish WTBD/CST Scenarios as authentic measures to validate the new APRT/ACRT test events

Representative Physically Demanding WTBD

1. **Conduct Tactical Foot March**
2. **Move over/under/around/through**
3. **Prepare a fighting position**
4. **Casualty extraction - drag to safety - dismounted**
5. **Perform combatives**

- **Physically demanding WTBDs included in those above:**
  - Move under direct fire (# 2)
  - React to Indirect Fire (#2)
  - Move as a member of a team (# 1, 2)
  - Navigate Point to Point dismounted (#1, 2)
  - Perform IMTs on Urban Terrain (#1, 2)
  - Drag a casualty to safety – mounted (# 4, 5)
- **WTBDs that do not meet the criteria for physically demanding:**
  - Employ hand grenades
  - React to vehicle rollover

Step 3: Observations of WTBD

- **Ft Jackson Pilot Testing Schedule:**
  - 22-23 AUG – set up WTBD/CST simulations
  - 26 AUG – Brief participants, inspection, practice
  - 27 AUG – test (1) move over/under/around/through and (2) combatives simulation
  - 28 AUG – test (3) casualty evacuation and (4) fighting position
  - 29 AUG – Road March and (1-4) composite simulation
  - 27-29 AUG – AAR and Questionnaire follows each testing session
- **Schedule 26-28 AUG:**
  - 0700 Report to testing site
  - 0710 Equipment inspection
  - 0720 Active Warm-up
  - 0730 Testing
  - 0930 AAR discussion
  - 1000 Dismissed
- **Schedule 29 AUG:**
  - 0600 Report to testing site
  - 0610 Equipment inspection
  - 0620 Active Warm-up
  - 0630-0930 Road March (staggered)
  - 0845 Composite Simulation
  - 1045 AAR
  - 1200 Dismissed

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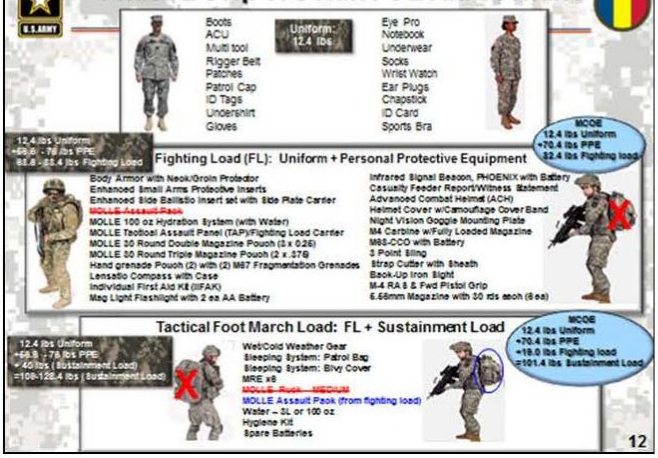
Phase 2 Step 3: Soldier's Load Scenario



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Conduct Tactical Foot March

Task:	Conduct a 10 km tactical foot march
Condition:	Wearing/carrying 80/103-lb Approach March load
Standard:	Complete in 2 hours

Scenario

Soldier conducts a 10 km tactical foot march in 2 hours while carrying a 80/103 pound load. That equates to 6+ miles in 2 hours, or a 3 mph pace.



Move Over, Under, Around, and Through Obstacles



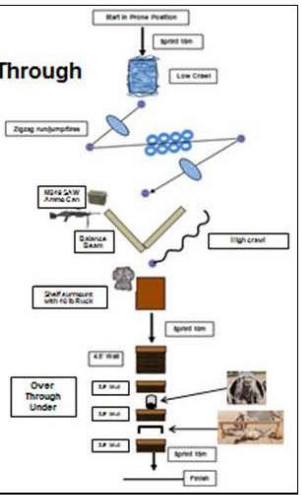
Task:	Move Over, Through, and Around Obstacles
Condition:	Wearing 80 lb Fighting Load; if necessary, equipment may be removed, but must be worn/carried after obstacle is cleared
Standard:	Obstacles successfully negotiated, without assistance

Scenario

Soldier with an 80-pound Fighting Load executes 9 skills: (1) sprints 10m, (2) low crawls 10m, (3) zig/zag run 30 m jumping over 2 low obstacles and negotiating 8 tires, (4) traverses 20' balance beam with load, (5) mounts a 48" platform with load, (6) high crawls 5m, (7) climbs over a 54" barrier (8) negotiates 3-high, 2-low obstacles, (9) and sprints 10m. Time to completion is 3 minutes.


Move Over-Under-Around-Through

- Physical Attributes:
  - Speed
  - Anaerobic endurance/power
  - Muscular strength/power
  - Core stability
  - Dynamic Balance
  - Agility



Prepare a Fighting Position



Task:	Prepare a Fighting Position
Condition:	Wearing/carrying 80 lb Fighting Load, ground-level on sand or soil
Standard:	Dig/fill 2-4gal containers with sand and transfer 5m to 2-55gal containers until they are full. Lift/carry/stack 16 sandbags.

Scenario

Soldier with 80-pound Fighting Load prepares temporary fighting position. Soldier uses E-tool and digs from the bent or stooped position, to fill two transport container weighing 40 lbs when full. Soldier transfers sand to a 55gal container until they are full. Soldier then lifts/carries 16 40lb sand bags and stacks them on a 30" platform to build a 4x4 sandbag wall. Time to completion is 10 minutes.


Prepare a Fighting Position Simulation

- Physical Attributes:
  - Muscular endurance
  - Aerobic endurance
  - Muscular strength
  - Core stability
  - Dynamic Balance



Casualty Extraction – Drag to Safety, Dismounted


Task:	Drag a Casualty to Safety, Dismounted
Condition:	Wearing/carrying 80 lb Fighting Load, unobstructed drag-course, non-responsive casualty
Standard:	Extricate and drag a 220-pound (bodyweight plus Fighting Load) non-responsive casualty 30 meters.

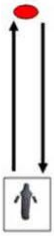
Scenario

Wearing an 80-pound Fighting Load Soldier rises from a pone position of safety and sprints 15m. Soldier moves around a barrier and crouch runs 15m to a disabled HUMVEE with a 220lb casualty belted into the drivers seat. Soldier removes the casualty from the HUMVEE executing a controlled lowering to the ground and grabs pull strap on casualty's pack, rises to crouched position, and uses two hands to drag the casualty 30 meters to safety. Time to completion is 2 minutes.


Casualty Extraction and Drag Simulation

- Physical Attributes
  - Grip Strength
  - Rotational Power
  - Lower Body Speed/Power
  - Upper/lower body strength
  - Pull Power (upper/lower)






Perform Combatives

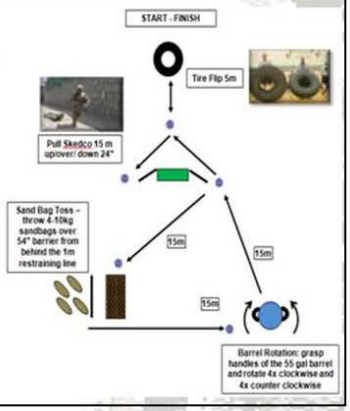
Task:	Perform Combatives
Condition:	Wearing/carrying 35lb load, unobstructed push-course,
Standard:	Execute three basic physical tasks that simulate the strength and power required to perform combatives

Scenario

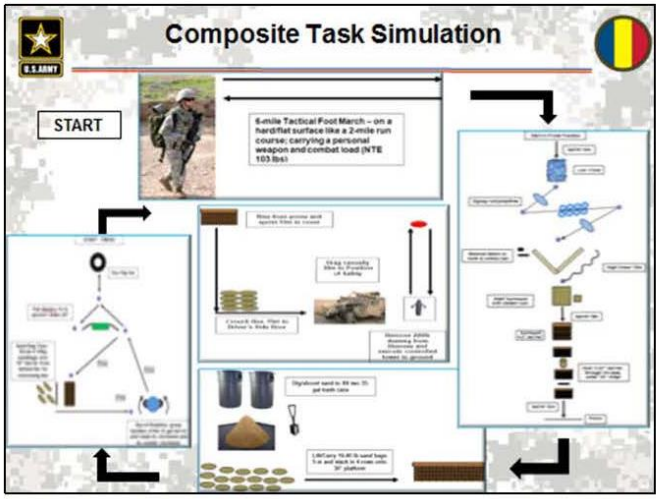
In combat gear Soldier executes the four physical tasks that simulate the strength/power required to perform combatives: 1) push a load of 205lbs, (2) throw four 20lb sandbags over a 54" barrier from behind a 1m retaining wall, (3) control a loaded sled through a zig/zag pattern, 4) rotate a 550lb barrel 360º x 2 clockwise and x2 counter-clockwise by grasping the handles about shoulder height in a crouch position.

Perform Combatives Simulation

- **Physical Attributes**
  - Push Power (upper/lower)
  - Pull Power (upper/lower)
  - Grip Strength
  - Speed
  - Lifting Power
  - Rotational Power



Composite Task Simulation



FY 14 Way Ahead

MONTH	ACTION
OCT/NOV	Conduct Stakeholder Focus Groups (socialize Carson findings, solicit input v. field expedient test of capacity and redundancies in the physical aspects of the WTBDs)
NOV	Conduct Senior Leader Panel (socialize Focus Group findings, solicit input v. feasibility of field expedient test of capacity and redundancies in the physical aspects of the WTBDs)
DEC	IPR Brief to CG TRADOC
JAN	Finalize list of field expedient tests of capacity; finalize field simulation of functional tasks.
FEB – MAR	Determine reliability of field expedient/simulations
APR – JUL	Administer functional field simulations + field expedient capacity tests to Soldiers at four FORSCOM sites (n = 2000)
AUG – SEPT	Develop recommendations for tests of capacity and function
SEPT	Present findings to Senior Leaders

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Discussion

Close-hold / Pre-Decisional For Official Use Only 25

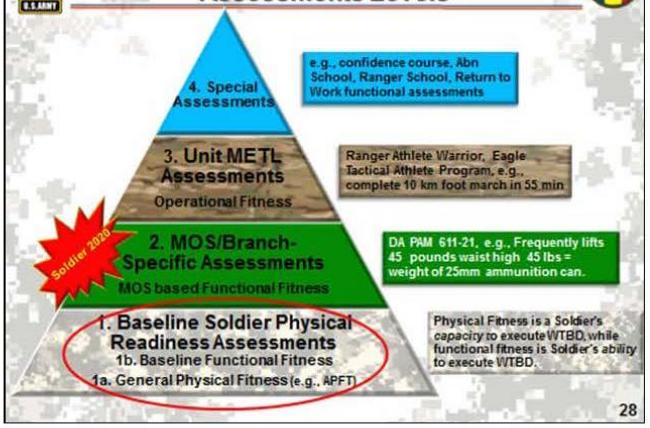
Guidance

Close-hold / Pre-Decisional For Official Use Only 26

Back-Up

Close-hold / Pre-Decisional For Official Use Only 27

Army Physical Readiness Assessments Levels



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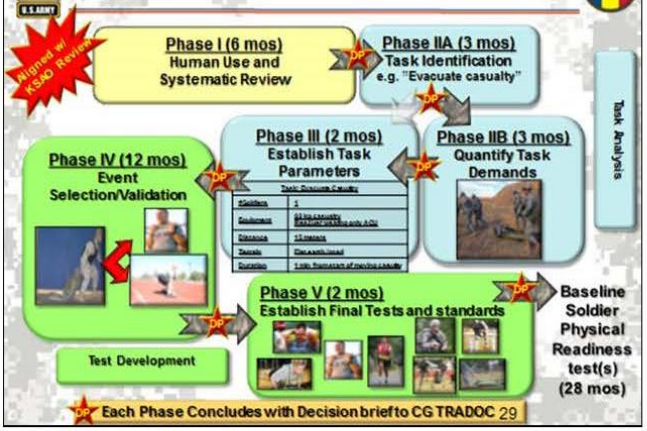
Baseline Soldier Physical Readiness Requirements Study



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Review

Military Problem:

- APFT does not adequately measure both *capacity* and *ability* to perform combat related tasks required of *all* Soldiers (Warrior Tasks and Battle Drills-WTBD)
  - Overemphasizes assessment of individual fitness components-*capacity*
    - Assesses only 1 component of Army Physical Readiness-*Endurance* (muscular and cardio-respiratory)
    - Does not adequately measure *Strength* and *Mobility*
    - Events have *low correlation* to physical demands of WTBD
    - *Does not align* with FM 7-22, *Army Physical Readiness Training* (PRT)
  - *Fails* to measure a Soldier's *ability* to *integrate* fitness components required to perform complex physical or "functional" requirements of *WTBD* or *MOS* physical standards
  - Standards are *normative* (gender/age based) not criterion-referenced (task based)
  - Unit/individual training programs over overemphasize individual components of fitness
    - Fails to prepare Soldiers to perform complex physical requirements
    - Contributes to injuries in training and on deployment, and may lead to overuse injuries

Central Idea: Develop a comprehensive assessment tool that allows commanders to assess general fitness (capacity) and functional fitness (ability) of *all* Soldiers to perform common combat related tasks (WTBD)

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Baseline Soldier Physical Readiness Requirements Study

STUDY PURPOSE

- Identify *baseline* Soldier physical readiness *requirements* to *perform WTBD*
- Develop *physical readiness test(s)* that *evaluates baseline fitness* against *valid performance standards* for *all Soldiers*
  - Test assesses:
    - 3 components of PRT Doctrine -Endurance, Mobility, Strength
    - 2 Levels of Fitness (Physical, Functional)
  - Independent of age or gender, safe and legally defensible
  - Standards and Testing aligned with FM 7-22, *Army Physical Readiness Training* (PRT)

STUDY PLAN

- Study duration: 23-28 Months
- Study Plan - 5 Phases
  - 1 – Human Use & Systematic Review — 15 JUL 13
  - 2 – Task Identification/Task Demands — 20 DEC 13
  - 3 – Establish Task Parameters — 20 DEC 13
  - 4 – Event Selection/Validation — 15 DEC 14
  - 5 – Final Test and Standards — 30 APR 15
- Phases conclude w/ decision brief to CG, TRADOC
- Study concludes w/ Decision Brief to CSA/SMA NLT 15 May 15

STUDY PARTICIPANTS

- IMT CoE (Co-lead)
- USMA (Co-lead)
- US Army Research Institute of Environmental Medicine (USARIEM)
- US Army Institute of Public Health (IPH)
- Uniformed Services University (USU)
- External Review and Validation Panel (TBD)

STATUS REVIEW

- Study Plan briefed:
  - CG TRADOC — 21 NOV 12
  - CSA — 27 NOV 12
- HQ DA EXORD 041-13 — 27 DEC 12
- CSA INFO Papers — 4 JAN 13, 5 JUN 13
- Synchronized with S2020 Campaign
- Ph 1 Complete
- Executing Ph 2
- Detailed Planning of Ph 3-5

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Phase 1-Systematic Review

- **Purpose: Review and analyze body of research related to developing safe, defensible, and effective physical performance standards to inform conduct of the study**
- **Focus Areas**
  - Task identification & standards development process/ methodology
  - Fitness Assessments and task performance
  - Injury and injury prevention
  - Physiological challenges of gender and age
  - Soldiers load and load carriage
  - PRT programs from Multi-national military, US paramilitary, and the Marine Corps
- **Reviewed approximately 383 studies (screened from ~58,000)**
- **WTBD PRT Survey Results**

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Phase 1 Findings (1 of 2)

- Systematic Review validated study plan and methodology
  - Systematic Review validated study plan and methodology
  - Methodology follows widely accepted practices: 1) what are the tasks 2) what are the demands 3) How should we test the demands
- Fitness assessments and task performance
  - Valid and predictive tests exist for aerobic, anaerobic and muscular strength and endurance to assess general physical fitness (capacity)
  - No "gold standard" tests exist to measure Functional fitness (ability)
  - Military tasks and activities (e.g., run, sprint, lift) are common components of WTBD performance but *in isolation do not* reflect complex physical demands required to perform WTBD– *EXCEPTION: Casualty Drag & Loaded Foot March*
- Injury and injury prevention
  - Twice as many deployed Soldiers AIREVAC for non-battle injury (34%) than for battle injury (17%)
  - Physical activity accounts for 58% of non-battle injuries requiring air evacuation:
    1. Physical training and sports -22% (1/2 due to running)
    2. Falls and Jumps -17%
    3. Near-falls (slips and trips)-8%
    4. Lifting, pushing, and pulling-8%
    5. Other Overuse Injuries-3%
  - Fatigue is a major underlying cause of injury
  - Low Aerobic fitness consistently and strongly associated with musculoskeletal injury
  - Threshold exists above which more physical activity increases injury risk but not fitness- *"more is not better"*

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Phase 1 Findings (2 of 2)

- Physiological challenges of gender and age
  - Performance does not appear to decline measurably until 36-40 years old
  - Women face several physiological challenges in performing military tasks compared to men
    - Women at higher risk for Musculoskeletal Injuries
    - Higher Relative work load (exertion) in women leads to exhaustion faster and risk of injury
  - Proper training and nutrition can mitigate challenges but cannot completely overcome gender inequity
- Soldiers load and load carriage
  - Emotional topic amongst soldiers (Phase 2 focus groups)
  - Performance of WTBD is under load and often performed in conjunction with tactical movement
  - Performance of military tasks (WTBD) degraded by load carriage-impaired mobility, effects of pre-fatigue, and higher risk of injury
  - *There is threshold where load carriage leaves soldiers unable to perform military tasks*
  - *Physical and functional fitness training and testing must account for load carriage degradation*
  - Muscle strength *and* aerobic capacity must be trained progressively in addition to frequent (2-4 times per month) loaded foot marches to improve load carriage and reduce injuries

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Comparing Physically Demanding Tasks

	Canada	Dutch	British	Australia	US Army	Marines
Sea Evacuation						X
Land Evacuation						
Low-High Crawl						
Digging	X	X	X		X	
Lifting/Carrying	X	X	X	X	X	X
Road March	X	X	X	X	X	X
Fire & Maneuver	X	X		X	X	X
Kneel-to-stand		X			X	
Climbing				X	X	
Pushing/Pulling					X	X
Evacuate a casualty	X			X	X	X

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WTBD PRT Survey Results
Physical Demand, Importance, and Frequency
(n~28,000)

Respondents were asked to indicate how physically demanding/challenging each WTBD is, how important it is for ALL Soldiers to be proficient in each WTBD, and how frequently Soldiers performed each WTBD in a combat environment:

WTBD	Physically Demanding	Importance
Perform Combatives (WT)	1 (most demanding)	16
Move Under Fire (WT)	2	5
React to Ambush (Near) (BD)	3	7
React to Contact	4	4
Evacuate a Casualty	5	3
React to Ambush (Far)	6	8
React to Indirect Fire Dismounted	7	9
Perform Individual Movement Techniques	8	12
Perform Immediate Lifesaving Measures	9	2
Establish Security	10	6

1 – 5: Highest Ranked (most physically demanding, important, or frequently done)

6 – 11: Middle Ranked (moderately physically demanding, moderately important, occurs sometimes)

12 – 16: Lowest Ranked (least physically demanding, important, or least frequently done)

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Physical Abilities Essential for WTBD Execution

Respondents assigned the following priority to key physical abilities in terms of how important those skills are for executing the WTBDs:

Most Important Physical Ability Necessary for WTBD Execution

- #1 Jump or Leap Over Obstacles
- #2 Move with Agility and Coordination
- #3 Carry Heavy Loads over long distances
- #4 Drag Heavy Loads
- #5 (two-way tie): Run Long Distances and Sprint
- #6 Climb over Obstacles
- #7 Lift heavy loads off the ground

1 – 5: Highest Ranked-most important

6 – 11: Middle-moderately important

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Does Army PRT Prepare Soldiers for WTBD Execution?

How well or poorly does Army Physical Readiness Training (PRT) prepare you to do each of the following (n~23,000):

Task	Very Poorly 1	2	3	4	Very Well 5
Pass the Army Physical Fitness Test (APFT)?			3.30		
Perform the Warrior Tasks?			3.06		
Perform the Battle Drills?			3.01		
Jump or leap over obstacles? (Most important WTBD Physical Ability)		2.53			
Move with agility and coordination? (2nd Most important)		2.82			
Carry heavy loads over long distances? (3rd Most important)		2.66			
Drag heavy loads over long distances? (4th Most important)		2.54			
Move quickly over short distances (sprint)? (tied for 5th Most important)			3.13		
Run long distances? (tied for 5th Most important)			3.13		
Climb over obstacles? (6th Most important)		2.57			
Lift heavy loads off the ground? (7th Most important)		2.68			

"Our unit PT programs are where we need most improvement. "Training to the test" is not working, especially when we put 50 lbs of kit on a troop and send them into Tora Bora!"

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Perform Exterior Movement Techniques during an Urban Operation

Task:	Perform Exterior Movement Techniques during an Urban Operation
Condition:	Wearing/carrying 80-pound Combat Load over uneven terrain with the enemy's strength and location uncertain
Standard:	Move as member of a team within an urban area using proper urban movement techniques while minimizing exposure to enemy fire

Scenario

Dismounted Soldier moves as a member of a team within an urban area. Soldier must minimize exposure to enemy fire. Enemy location and strength are uncertain. Soldier wears/carries an 80 lb Fighting Load (individual weapon with ammunition; individual protective equipment), and travels 100 meters in the following sequence: (1) sprints 15 m across street, (2) moves 15 m along wall, with multiple jumps over street level window and multiple waist level crouches to avoid open window, (3) assumes prone at corner, (4) stands and sprints to base of 2 m wall (1.5m), and (5) crosses 2 m wall unassisted. This sequence may be repeated 3 times.

Considerations

different physical components of this task: Soldier sprints under load, drops to the prone position under load, keeps his or her balance, and a few more things.
What different physical components, or physical movements, are involved in this task?
How easy or difficult are these components? Can the average Soldier execute? Under load?

Conduct Tactical Foot March

Task:	Conduct a 16 km tactical foot march
Condition:	Wearing/carrying 128-pound Approach March load
Standard:	Complete in 4 hours

Scenario

Soldier conducts a 16 km tactical foot march in 4 hours while carrying a 128 pound load. That equates to 10 miles in 4 hours, or a 2.5 miles-per-hour pace, under a 128 pound load.

Considerations

distance: Do you think that the average Soldier, male or female, could march 16 km (or 10 miles)?

pace: Do you think that the average Soldier, male or female, could march 16 km (or 10 miles) in 4 hours – a 2.5 mile-per-hour pace?

load: Do you think that the average Soldier, male or female, could march 16 km (or 10 miles) in 4 hours while carrying a 128-pound load?

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Phase 2 Step 2: Focus Group Validation

We cannot determine if Soldiers are physically fit for battle until we determine what Soldiers do on the battlefield.

Purpose

- Gather information on how WTBD and other Common Soldier Tasks are executed
- Validate WTBD/Common Task scenarios developed by the SME Board 14-16 May

Procedure

- 7 focus groups, 7-to-18 participants each, conducted at Forts Jackson, Leonard Wood and Benning
- Facilitator guided each group through a series of scripted questions about Soldier Load, and WTBD/ Common Task scenarios.
- Key Question: To what extent do scenarios accurately reflect how Soldiers physically execute WTBD in combat?

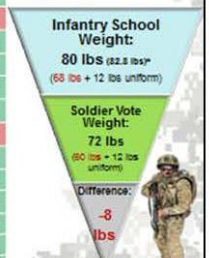
Participants *(n=71)*

Rank	Gender	Time in Service	Branch*	Deployments
• SPC: 1 (1%) • SGT: 5 (7%) • SSG: 18 (25%) • SFC: 13 (18%) • 1SG: 14 (20%) • SGM/CSM: 4 (5.6%) • 1LT: 1 (1%) • CPT: 11 (15%) • LTC: 4 (5.6%)	Male: 56 (79%) Female: 15 (21%)	Range: 3-27 years Average: 14 years 3-5 years: 4% 6-10 years: 28% 11-15 years: 28% 16-20 years: 24% 21-25 years: 14% 25+ years: 1%	AGA: 1 (1.6%) AG: 3 (5%) AR: 5 (8%) CM: 5 (8%) EN: 3 (5%) IN: 29 (48%) MSG: 3 (5%) MI: 1 (1.6%) MP: 1 (1.6%) QMG: 1 (1.6%) SIG: 3 (5%) TRANS: 1 (1.6%)	Range: 0-4 times Average: 2.4 times *96% of Participants deployed at least one time in the past 10 years.* 0 times: 4% 1 time: 20% 2 times: 28% 3 times: 32% 4 times: 15%

Phase 2 Step 2: Soldier Load Results: Fighting Load

Standard Item (Infantry School List)	% of Soldiers indicating they would wear/carry	Standard Item (Infantry School List)	% Wear/ Carry
Body Armor with Neck/Groin Protector	88.10%	Infr Red Signal Beacon, PHOENIX with Battery	66.67%
Deltoid Protector	16.67%	Ballistic Knee/Elbow Pads	42.86%
Lower Back Assembly	23.81%	Combat Glove	76.19%
Enhanced Small Arms Protective Inserts	80.95%	Visual/Language Translator Card	85.71%
Enhanced Side Ballistic Insert set with Side Plate Carrier	57.14%	Casualty Feeder Report/Witness Statement	59.52%
MOLLE Assault Pack	57.14%	Advanced Combat Helmet (ACH)	80.48%
MOLLE 100 oz Hydration System (with Water)	95.24%	Helmet Cover w/Camouflage Cover Band	83.33%
MOLLE Taotical Assault Panel (TAP)/Fighting Load Carrier	83.33%	Night Vision Goggle Mounting Plate	83.33%
MOLLE 50 Round Double Magazine Pouch (3 x 0.26)	85.71%	Military Combat Eye Protection (MCEP) Goggles	45.24%
MOLLE 50 Round Triple Magazine Pouch (2 x .576)	69.05%	M4 Carbine w/Fully Loaded Magazine	92.86%
MOLLE Waist Pack	23.81%	M68-COD with Battery	80.95%
Hand grenade Pouch (2) with (2) M67 Fragmentation Grenades	73.81%	3 Point Sling	78.57%
Entrenching Tool with Carrier	21.43%	Strap Cutter with Sheath	64.29%
Lensatic Compass with Case	69.05%	Back-Up Iron Sight	78.57%
Individual First Aid Kit (IFAK)	95.24%	M-4 RAS & Fwd Pistol Grip	52.38%
Mag Light Flashlight with 2 ea AA Battery	85.71%	5.56mm Magazine with 30 rds each (8 ea)	95.24%

FG Participants were asked to indicate if they routinely did (or would) wear/carry the common Fighting Load items in a combat environment.



*Infantry School modified load weight estimates after Focus Groups were conducted.

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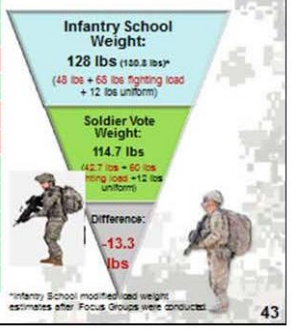
Phase 2 Step 2: Soldier Load Results: Tactical Foot March Load

Standard Item (Infantry School List)	% of Soldiers indicating they would wear/carry
Wet/Cold Weather Gear	61.90
Sleeping System: Patrol Bag	57.14
Sleeping System: Intermediate Bag	28.57
Sleeping System: Bivy Cover	57.14
Sleeping System: Small Stuff Sack	40.48
Sleeping System: Large Stuff Sack	21.43
MRE x8	80.95
MOLLE Ruck – MEDIUM (Includes: Frame, Shoulder Straps, Waist Belt, Sustainment Pouch x2)	78.57
Water – 3L or 100 oz	80.95
Hygiene Kit	73.81
Spare Batteries	71.43

FG Participants were asked to indicate if they routinely did (or would) wear/carry the common Tactical Foot March Load items in a combat environment.



*Infantry School modified load weight estimates after Focus Groups were conducted.

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Defining Fitness Constructs

Muscular Endurance	High repetition, long duration, low intensity muscular work (e.g., loading sand bags)
Aerobic Endurance	High repetition, long duration, low intensity cardio-respiratory work (e.g., ruck march)
Muscular Strength	Low repetition, short duration, high intensity muscular work (e.g., lift/push heavy load)
Anaerobic Power	Short duration, high intensity muscular work (e.g., load carry/evac, sled pull/push)
Speed	Short duration, high intensity muscular work (e.g., sprint)
Agility	Short to moderate duration movements requiring rapid 90-180° change of direction (e.g., 30m sprint from cover to cover)
Coordination	Combining fluid movements of the arms and legs to accomplish movement skills while the body is in motion
Flexibility	Range of motion at a joint or joints (e.g., bending and reaching)
Dynamic Balance	Posture, stability and balance while moving under load (e.g., walk, run, jump, lift, carry)
Balance	Posture, stability and balance while stationary (e.g., bend and reach)

APPENDIX P

Protocol Request for Fort Carson Field Study
September 2013

Public Health Report No. 12-01-0614

-----Original Message-----
From: Hoedebecke, Edward L CIV (US)
Sent: Thursday, September 12, 2013 8:44 AM
To: Jones, Bruce H CIV USARMY MEDCOM PHC (US); DeGroot, David W MAJ USARMY MEDCOM PHC (US)
Cc: Eslinger, Dawn M CIV USARMY MEDCOM PHC (US)
Subject: FW: Request for Review: Baseline Soldier Physical Fitness Study (Protocol Development Phase (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Bruce, Dave,

Nancy Hathaway has reviewed the documents and determined the activity is not research. What I what you to do is review the documents and agree that that is what you are actually doing. If so, we have the answer and can proceed, if not, we have to talk.

Ned

Edward (Ned) Hoedebecke, DVM, MPH, MA, Dipl ACVPM
Chair, Public Health Review Board
Human Protections Administrator
United States Army Public Health Command
Aberdeen Proving Ground, Maryland 21010-5043

-----Original Message-----
From: Hathaway, Nancy L CIV USARMY HQDA OTSG (US)
Sent: Thursday, September 12, 2013 8:41 AM
To: Muraca, Stephanie T CIV (US); Hoedebecke, Edward L CIV (US); Eslinger, Dawn M CIV USARMY MEDCOM PHC (US)
Cc: Myers, Cynthia M CIV USARMY TRADOC (US); Cable, Sonya J COL USARMY (US); East, Whitfield B Dr CIV USA USMA; Whitfield East; Bienvenu, Robert V II CIV USARMY HQDA OTSG (US)
Subject: Request for Review: Baseline Soldier Physical Fitness Study (Protocol Development Phase (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

AHRPO has reviewed the attached documents and determined, based upon the information provided, that the activity does not meet the definition of "research" as defined by 32 CFR 219.

While there is some systematic inquiry (observing individuals perform specific physical tasks and collecting their MOS, height/weight, last PT score, and opinions about the relevance of the tasks), there is no systematic evaluation that could contribute to generalizable knowledge. Rather, the intent of the activity is identify the operational relevance and feasibility of 5 task scenarios. This background information would then be considered in the development of measures for future research activities.

Please note that the data collected from this activity may NOT be used for research purposes.

To the extent that activities fall outside of those specifically described on the attached request, this determination does not apply.
Nancy L. Hathaway, JD, CIP
Acting Deputy Director
Research Ethics and Compliance Officer

Public Health Report No. 12-01-0614

Army Human Research Protections Office
7700 Arlington Blvd, Ste 3SW319
Falls Church, VA 22042-5143
AHRPO Office: 703-681-6565
AHRPO email usarmy.ncr.hqda-otsg.mbx.usarmy-ncr-hqda-otsg-mailbox-otsg--ahrp@mail.mil

-----Original Message-----
From: Muraca, Stephanie T CIV (US)
Sent: Wednesday, September 11, 2013 11:09 AM
To: Hathaway, Nancy L CIV USARMY HQDA OTSG (US)
Cc: Myers, Cynthia M CIV USARMY TRADOC (US); Cable, Sonya J COL USARMY (US);
East, Whitfield B Dr CIV USA USMA; Whitfield East
Subject: Request for Review: Baseline Soldier Physical Fitness Study
(Protocol Development Phase) (UNCLASSIFIED)
Classification: UNCLASSIFIED
Caveats: NONE

Ma'am:

Thank you, very much, for your time and patience regarding this issue. I hope this helps put things in order, but if not, please don't hesitate to contact me at this email address, or via cell [xxxxx].

The attached submission details an "information-gathering" effort to garner the insights and feedback we need to refine potential criterion measures. We are in the process of developing our research protocol, but before we can complete and submit it to AHRPO for consideration, we need to assess the feasibility and operational relevance of a series of Warrior Task and Battle Drill (WTBD) scenarios (our potential criterion measures). WTBDs are common Army tasks on which all Soldiers, regardless of age, gender, or occupational specialty, are required to maintain proficiency. WTBDs are taught in Initial Entry Training, and are consistently trained/reinforced throughout the Army career-cycle.

A team of subject matter experts (SMEs) developed a series of WTBD scenarios that we hope to use as criterion measures in future research efforts. Before we can propose those efforts, or even assess the WTBD scenarios for reliability, we must determine if the scenarios are feasible (given time/space/resource constraints, can they actually be constructed and managed?) and operationally relevant (do experienced Soldiers think the scenarios contain movements actually performed in combat environments?). That is what we hope to glean from this information gathering effort – the insight we need to refine (or scrap) the scenarios so that we can develop a research protocol. This is part of a larger study effort to improve Army Physical Fitness training and assessment by forging a stronger link between the former and the physical demands placed upon Soldiers in combat/hostile environments.

V/r,
Stephanie

Stephanie T. Muraca, Ph.D.
Research Psychologist
IMT-CoE
ATTN: ATCG-MTA
210 Dillon Circle
Fort Eustis, VA 23604-5701

Initial Military Training Center of Excellence (IMTCoE)
Institutional Review Board
Protocol for Human Subjects Research

For Office of Human Protections Use Only:
Protocol Number:_____
Protocol Title:_____
Version:_____
Date Received:_____

- Download this document to your computer prior to entering your information.
- To enter your information, double-click on shaded boxes. This instruction applies to both text and check boxes.

1. Principal Investigator Information

First Name: Whitfield	Middle Initial: B.	Last Name: East
Degree(s): EDD – Measurement, Evaluation, & Statistics		
IMTCoE Human Subjects Training Completed? ☒ Yes ☐ No		Email:
Job Title: Professor	Affiliation: ☐ Student ☒ DoD Employee ☐ Military ☐ Contractor ☐ Other, specify:	
Department/Division: Physical Education	School/College: United States Military Academy	
Company:	Contractor:	
Work Phone:	Fax:	

2. Supervisor Information (Faculty Advisor if PI is a student,) ☒ NA

Supervisor Name: COL Sonya Cable	Title: Director, HDD/IMT-CoE	
Human Subjects Training Completed? ☒ Yes ☐ No		Email:
Department: IMT-CoE	School/University:	
Division: HDD/R&AD	Contractor:	
Work Address:	Zip+4:	
		Cell Phone:

3. Study Contact Information (complete if primary contact is different from PI) ☒ NA

First Name:	Middle Initial:	Last Name:
Degree(s):		
IMTCoE Human Subjects Training Completed? ☐ Yes ☐ No		Email:
Job Title:	Affiliation: ☐ Student ☐ DoD Employee ☐ Military ☐ Contractor ☐ Other, specify:	
Department:	School/University:	
Division:	Contractor:	
Work Address:	Zip+4:	

Work Phone:	Fax:	Pager:	Cell Phone:

4. **Additional Personnel Involved in Study** *(insert additional rows if needed)*
Note: Research personnel include all individuals under IMTCoE IRB jurisdiction responsible for recruitment, consent or data collection.

Name (First, Middle, Last)/Degree	Department/Division or Affiliation	Role In Project	IMT CoE Human Subjects Training Completed	Date Training Complete
Stephanie T. Muraca, Ph.D.	HDD / IMT-CoE	Co-Investigator	☒ Yes ☐ No	08/2011
	/		☐ Yes ☐ No	
	/		☐ Yes ☐ No	
	/		☐ Yes ☐ No	

5. **Study Type Information**

A. Review Requested:

☐ Full Committee -- **Study does not meet Exemption or Expedited Review Requirements**

☐ Expedited -- **Study meets Expedited Review (Research deemed no more than minimal risk AND the only involvement of human subjects is in one or more Federally specified categories.) See Expedited Categories.**

☒ Exempt

B. Has this proposal been previously reviewed by an IMTCoE IRB?

☒ No
☐ Yes *If "Yes," please list IRB #(s):*

6. **Study Abstract**

In 250 words or less, provide a brief abstract of the study in lay language.

***PLEASE NOTE:** The purpose of this effort is to gather the *preliminary information* necessary to develop criterion measures for potential future studies of the extent to which field-expedient physical fitness tests (e.g., push-ups, bench-press, sprint) predict Warrior Task and Battle Drill (WTBD) performance. WTBDs are the Army's "common core" of movements and tactics that all Soldiers, regardless of age, gender, or military occupational specialty, must be able to perform. This effort will provide the insight necessary to develop two research protocols: The first protocol, which will be submitted to AHRPO o/a December 2013, will request approval to assess the reliability (inter-rater and test/re-test) of the yet-to-be-determined criterion measures (WTBD scenarios). The second protocol, which will be submitted to AHRPO in FY2014, will request approval to assess the extent to which different field-expedient physical fitness tests (e.g., push-ups, bench press, sprint) predict performance on the WTBD scenarios.
Before the research protocols can be developed, team members must determine the feasibility of constructing/resourcing the WTBD scenarios, the number of personnel necessary to manage the "obstacle courses," and the extent to which the proposed WTBD scenarios reflect operations in combat/hostile environments. Based on feedback from volunteer observers and/or participants, team members will adjust the WTBD scenarios, and design the final criterion measures.
Team members will be assessing the feasibility/operational relevance of five discrete WTBD performance scenarios developed by Subject Matter Experts (SMEs) to reflect tasks commonly performed by baseline

(entry-level) Soldiers in operational environments. Contributing SMEs included academicians and practitioners in the fields of medicine, human performance, and exercise physiology, Army training developers and instructors, and incumbent Soldiers (Officers and Enlisted, senior and junior, across a range of occupational specialties).
The IMT-CoE team will construct five obstacle-type courses (designed to simulate a tactical march, offensive/defensive movement in a hostile situation, casualty extraction and evacuation, sandbag filling, carrying, and stacking, and combatives), and modify courses on-site to accommodate space, time, and resource constraints. The team will observe volunteers as they execute these tasks, and gather feedback about task relevance, realism, and physical demand.
This proposed observational/protocol development phase is part of a larger study effort to improve Army Physical Fitness training and assessment by forging a stronger link between the former and the physical demands placed upon Soldiers in combat/hostile environments. By observing Soldiers as they execute common task scenarios, study team members will gain a better understanding of the discrete physical movements and physiological processes involved in tactical activities. By assessing the operational relevance and feasibility of the five task scenarios, team members will gather the information they need to develop task-based criterion measures against which to validate potential field expedient test items.

7. **Background Information**
Describe the background information, specific aims, hypothesis or research question, previous experience, and a critical evaluation of existing knowledge (relevant literature) about the research topic. A reference list and copies of pertinent articles can be appended if thought to be of value in the evaluation of the research by the IRB. The IRB needs to understand how this study adds to the knowledge on this topic in order to be able to judge the risks and benefits to the research participants.

The contributions of physical readiness to combat performance are not in disputable. High levels of physical conditioning provide Soldiers with three significant performance advantages: (1) an increased high and low intensity work capacity, resulting in increased functional fitness, (2) an increased mental toughness and perseverance (will to win), and (3) a decreased risk of injury, resulting in increased survivability due to all-cause morbidity and combat-related injuries. Terms, like "pentathelete" and "Soldier athlete", are common place in Army parlance and Army training manuals laud the benefits of high levels of physical conditioning. In addition we clearly know "what right looks like" relative to periodized training and yet the USArmy has never clearly define and operationalize the physiological needs of the modern combat Soldier. This physiological tableau must be scientifically based and sufficiently broad to prepare Soldiers for full spectrum combat operations in varying terrains and climates. Once the Army establishes the requisite physiological needs for combat, it can then develop applicable training programs and criterion-referenced assessments and standards to measure physical readiness and ensure success of our combat mission.[i] These performance assessments and concomitant standards can then serve as the determinant of combat readiness.

> **"Every war in which the US has been involved since 1860 has revealed the physical deficiencies of our soldiers during the initial mobilization…casualties in initial engagements were attributed to the inability of our soldiers to physically withstand the rigors of combat…"[ii]**

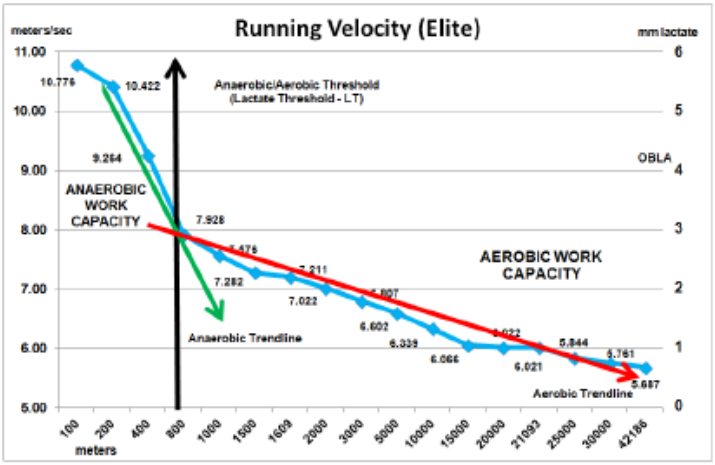
To sharpen our focus on how we think about physical readiness training and assessment in the Army, we can address five embedded issues. Although the U.S. Army Physical Fitness School, the 75th Ranger Regiment (Ranger Athlete Warrior) and to a lesser degree the 101st Airborne Division (Eagle Tactical Warrior Program) and the 4th Infantry Division (Mountain Warrior Program) have made some progress in PRT development over the past six years, the Army has yet to empirically define the baseline physiological needs of the Soldier. We have a myriad of first-person anecdotal reports from Soldiers, commanders, and fitness professionals that describe the physical nature of combat, but we have no

empirical evidence. The closest we came was in 1942-43 when Drs. Esslinger and McCoy worked with COL Ted Bank to develop a "combat focused" PRT program and then tested their program against known measures of endurance, stamina, and coordination and against existing Army PRT programs. These results provided the foundation for TC 87 – *Physical Training* (1942) and DA Pam 21-9 – *Physical Conditioning* (1944).

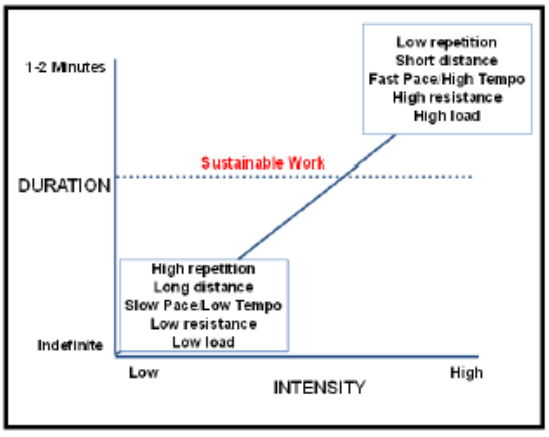
With regard to the physical domain current Warrior Tasks and Battle Drills require significant levels of strength, stamina, and mobility.[iii] Regardless of a Soldier's military occupational specialty there is a common set of physically demanding, commonly occurring Warrior Tasks and Battle Drills[iv] and Common Soldier Tasks[v] that every Soldier must perform. Successful performance of these functional tasks is predicated upon a Soldier's general physical fitness, which is composed of three areas: structural work capacity, metabolic work capacity, and physical work economy.[vi] Structural work capacity is the ability to development and maintain an adequate structural integrity to promote dynamic postural equilibrium and serve as a platform for load carriage. Metabolic work capacity is the ability to generate adequate energy to fuel task performance. Physical work economy is the ability to perform repetitive movement tasks at the lowest metabolic cost. After a short discussion of each of these areas of physical fitness, we will discuss how these areas inform physical readiness training.

Structural work capacity is develop during the general preparation phase (GPP) of fitness development.[vii] In the GPP phase Soldiers work to repair the body from previous physical activity or prepare the body for future physical activity. Physical training should concentrate on light to moderate impact activities to initiate adaptive bone remodeling, refine CNS recruitment of muscle fibers, and soft tissue integrity. Soldiers should concentrate on higher repetition, low load exercises with great attention to body mechanics/posture and precision of movement. After 8-12 weeks these adaptive physical activities prepare the skeletal and soft tissue structures for more vigorous physical activity and load carriage.[viii] The progression curve should be relatively flat as Soldiers work to strengthening the frame and core. An ancillary consideration of this phase is awareness of and attention to body mass, more specifically the absolute amount of fat mass and the ratio of lean to fat mass. Lean mass is metabolically more active and contributes to movement efficiency and effectiveness.

Developing metabolic work capacity primarily occurs in the build (toughening) phase of physical readiness training. Humans are carbon-based aerobes; we are inextricably linked to the production of high quantities of Adenosine Triphosphate (ATP). As Soldiers execute the repetitive movements required in WTBD/CSTs the demand for ATP exceeds what can be supplied via glycolysis and aerobic metabolism supplies the bulk of ATP via oxidative phosphorylation of pyruvate (carbohydrate) and triglyceride (fat). Large quantities of ATP are created via the electron transport chain, which requires a continuous supply of oxygen. Through O2 respiration and transportation to the muscles via hemoglobin, the mitochondria can produce large quantities of ATP. We often measure aerobic work capacity as the maximal level of O2 uptake and is reported in milliliters of O^2 per kilogram of body weight per minute (ml/kg/min) and call this measure predicted VO^2 max. With a continuous supply of O^2 the rate limiter in ATP production for repetitive movements is glucose, which is derived from carbohydrate metabolism. For higher intensity steady-state repetitive movements humans have enough glucose (stored glycogen) to produce requisite levels of ATP for about 2 hours (enough to generate about 2,000 kcals of energy).[ix]



This framework of Army physical readiness training and assessment must be built around the concept of physical work capacity (PWC); i.e., the ability to perform physical work in a functional environment. The standard metric of physical work capacity is work volume, which is defined as the product of work intensity and work duration. Work intensity is a function of resistance (speed) x repetitions (distance) ± rest, which controls work duration. Training frequency (how often we train) is predicated on the status of the Soldier and the training volume (how long/hard we train – duration x intensity). These components must be strictly coordinated with training recovery (i.e., the time required for a Soldier to rest between work bouts). Training recovery is in turn regulated by two factors: the physiologic characteristics of the individual Soldier and their current physiologic status. Failure to understand the rate at which a Soldier recovers and his/her current physiologic status and to incorporate that knowledge into the development and execution a periodized training plan will ultimately lead to organic failures. To produce Soldiers who are capable of accomplishing WTBD/CSTs physiologic training must occur throughout the entire intensity spectrum with accommodations for proper rest/recovery. This PRT framework is perhaps easier to visualize graphically:



Physical Work Capacity Continuum[I]

Physical work capacity is primarily influenced by the quantity and efficiency of lean muscle mass and the ratio to total body mass. Musculoskeletal fitness begins to influence work capacity as work load and work duration increases. Lifting heavy objects for long durations requires muscles to generate a greater amount of force, which imparts a greater metabolic demand and eventually leads to muscular fatigue. Muscular fatigue will result from peripheral fatigue (due to depletion of intramuscular energy stores) and central fatigue (impaired brain and nervous system function due to glycogen depletion), which decreases the muscle's ability to generate force resulting in a decrease in performance and work capacity.[xi] During physical training exposure to progressive work overload causes "type II fibers take on many of the properties of type I fibers, with reduced myosin ATPase activity, increased mitochondrial density and oxidative enzyme activities, and a greater capillary density."[xii]

There are many manifestations of a dysfunctional periodized training plan. In some cases Soldiers fail to develop adequate baseline levels of physical fitness. In other cases the lack of specificity results in a failure to acquire appropriate levels of functional fitness. However, one the most revealing symptoms of a dysfunctional PRT plan is a high number of organic failures (injuries), which seems to be the case in the Army.[xiii] For CY2004 Ruscio et al. estimated that Service members (DoD-wide) had over 2 million injury visits for acute and chronic (overuse) injuries affecting approximately 900,000 Service members at a cost of hundreds of millions of dollars and resulting in over 25,000,000 days of limited duty.[xiv] In 2006 the Department of Defense recorded an estimated 743,547 musculoskeletal injuries at a cost of over $2.2 billion.[xv]

For the Army to regain the momentum in PRT there is a need to resource a modern, comprehensive combat-focused fitness research program that will drive physical readiness training and assessment. We have but to compare the secular advances in the science of exercise and human performance over the past 30 years with current Army PRT doctrine to understand the gross disparity. Here are four basic research questions that demonstrate the depth of our lack of understanding: (1) what are the baseline physical attributes that constitute combat readiness; (2) what are the frequency, duration, and intensity of training required to illicit these physical attributes, (3) what fitness measures best assess these physical attributes; and (4) what resources (trainers, facilities, and equipment) are required to facilitate acquisition of these physical attributes in a timely manner while mitigating organic failures. We currently cannot answer even these basic questions to any degree of scientific acceptability. Only PRT doctrine grounded in the science of exercise and human performance can prepare Soldiers, leaders, and units to fight in the full spectrum of operations.

The most precious and irreplaceable resource in the U.S. Army is the individual Soldier. We must do all we can to develop and preserve this resource. Since the early 1900's the Army's physical readiness training program has been universally recognized as a force multiplier that enhances combat effectiveness, resilience, and survivability on the battlefield. We spend billions of dollars each year developing and producing tactical weapons and funding the associated training necessary to deploy them. Although we have the most technologically advanced Army in the world, our commitment to physical readiness training is derisory by comparison. As the Army moves to a smaller, lighter, more mobile force in the fight against the global war on terrorism, a long-term, comprehensive commitment to the highest quality physical readiness training is mandatory to ensure our future success.

[I] Note: a relevant example of how similar organizations accomplish this goal is the Houston, TX Fire Department. The Houston Fire Department uses a job-related physical ability test designed to determine if an applicant has the requisite strength and endurance needed to perform the job duties of a Firefighter. These job duties require balance, coordination, strength, endurance, and cardio-vascular fitness. Applicants are tested over seven (7) timed, pass/fail events while wearing

gloves and an air pack because Firefighters are required to wear Self-Contained Breathing Apparatus (SCBA) and other heavy protective clothing while functioning at emergency incidents. The events include:

- Balance Beam Walk- within 30 seconds, one must walk the entire length of the beam.
- Ladder Extension - within 1 minute, an applicant must fully extend and lower the fly section of a 24' aluminum extension ladder by using the hand-over-hand method.
- Stair Climb - within 3 minutes 30 seconds, an applicant must pick up, shoulder hold, and carry two (2) 50' sections of hose, tied in a "Brown Fold," then climb and descend six (6) flights of stairs.
- Equipment Hoist - within 1 minute, an applicant standing on the 3rd floor of the drill tower, using the hand-over-hand method, must hoist one section of 2 ½" hose (44 lb.) from the ground up to the 3rd floor window, and then lower the hose back to the ground.
- Portable Equipment Carry - within 1 minute, an applicant must pick up an equipment/accessory box (Hurst, or Amkus, extrication tools) (70 lb.) from a 2' stand and carry it 50' in one direction, turn around to carry it back 50' and then place the box on a 3' stand.
- Rescue Attempt - within 30 seconds, an applicant must carry or drag a 150 lb. human dummy, 30 feet.
- 1.5 Mile Run - within 13 minutes 7 seconds, an applicant must run 1.5 miles.

[2] Department of the Army, *Physical Readiness Training - FM 21-20* (Washington, D.C.: U.S. Government Printing Office, 1980), 1-2.
[3] FM 7-22 – "Army Physical Readiness Training", Department of the Army, October, 2012.
[4] Warrior Tasks and Battle Drills, IMTCoE, March 2013.
[5] Soldier's Manual of Common Tasks, IMTCoE, 2013.
[6] TRADOC PAM 257-3-7: *The Army Human Dimension Concept*, Department of the Army, 2013; Sharon L. Plowman and Denise L. Smith. *Exercise Physiology for Health, Fitness, and Exercise*. Baltimore: Lippincott, Williams and Wilkins, 2008; Tudor W. Bompa. *Periodization Training: Theory & Methodology of Training*. Champaign, Ill: Human Kinetics, 1999.
[7] Personal conversation with Dr. William Brechue, FACSM (9 July 2013).
[8] Belinda R. Beck, "Stress Fractures," *ACSM Current Comment* (Indianapolis, IN: American College of Sports Medicine, , 2007), 1 – available at: http://www.acsm.org (accessed 3 May 2011); Note: based upon the American College of Sports Medicine "Current Comment" on stress fractures, we know it take about six weeks of adaptive exercise before bone density and connective tissue improve enough to help prevent stress-reaction injuries; "Bones are most susceptible to stress fracture when weakened by remodeling-related porosity, a primary stage in the adaptive response of bone to changes in patterns of loading." (p. 2)
[9] Andrew M. Jones, "The Physiology of the World Record Holder for the Women's Marathon" *International Journal of Sport Science & Coaching* 1:2 (2006): 101-116; Scott Powers and Edward Howley, *Exercise Physiology: Application to Theory and* Performance. Columbus, OH: McGraw Hill Publishing Co, 2013.
[10] Whitfield B. East, *A Historical Analysis of Army Physical Readiness Training and Assessment,* FT Leavenworth, KS: Combined Arms Institute Press, US Army Combined Arms Center, March 2013.
[11] Paul J. Sharkey and Brian O. Davis. *Hard Work: Defining Physical Work Performance Requirements*. Champaign, Ill: Human Kinetics, 2008; Per-Olof Astrand, Kaare Rodahl; Hans A. Dahl and Sigmund B. Stromme. *Textbook of Work Physiology*. Champaign, Ill: Human Kinetics, 2003.
[12] Jones, "Physiology of the World Record Holder", 112.
[13] Note: based upon the April 2009 Armed Forces Medical Surveillance Monthly Report, there were 7.8 million ambulatory visits for illness and injury during 2008; the largest percentage (> 24%) of visits were caused by musculoskeletal and connective tissue injuries – generally construed to be "overuse" injuries (approximately 1.9 million visits); Larkin, 2010, p. 41-42.
[14] Bruce Ruscio, et al., *DOD Military Injury Prevention Priorities Working Group: Leading Injuries, Causes and Mitigation Recommendations* (Washington, DC: Office of the Assistant Secretary of Defense for Health Affairs, February 2006), 1, 4, 7; *Preventing Injuries in the U.S. Military: The Process, Priorities, and Epidemiologic Evidence* (Aberdeen Proving Ground, MD: Army Center for Health Promotion and Preventive Medicine, December 2008), Section 1-1, A(2), 1-2.
[15] Christopher P. Larkin, "Combat Fitness a Concept Vital to National Security" (Paper - Master of Science, Department of Defense: Joint Forces Staff College, 18 June 2010), 100; Note: MAJ Larkin extrapolated these data, which were derived from the following source: Armed Forces Health Surveillance Center. "Ambulatory Visits among Members of Active Components, U.S. Armed Forces, 2008," *Medical Surveillance Monthly Report* 16:4 (April, 2009): 10.

8. Location of Research

A. Is this a multi-center research project in which IMTCoE will function as the coordinating center/lead institution? (A multi-center study is one where different PIs at different institutions are conducting the same study.)

☒ No

☐ Yes *Note: If "Yes," please indicate the total number of participants to be consented at ALL sites, including military installations, in item 8B.*

B. List all Performance Sites "engaged in research" *(insert additional rows if needed).*
An institution or performance site is "engaged in research" when its employees or agents (i) intervene or interact with living individuals for research purposes; (ii) obtain individually identifiable private information for research purposes; or (iii) if the institution receives a direct federal award to support such research. Please refer to the instructions for examples of what may be considered "engaged in research." *This may apply when an IMTCoE investigator collaborates with a non-IMTCoE investigator or institution, or when IMTCoE serves as a Coordinating Center. Please check all that apply and add additional sites. Each will require a letter of IRB approval. See IMTCoE Policy for Waiver of Informed Consent.*

Check all that apply	Name of Performance Site (list all participating sites below)	FWA Holding Institution	IRB of Record	IRB Approval
☒	FT Carson, CO		☐ IMTCoE ☒ Other	☐ Attached ☐ Pending
☐			☐ IMTCoE ☐ Other	☐ Attached ☐ Pending
☐	Other, specify:		☐ IMTCoE ☐ Other	☐ Attached ☐ Pending
☐			☐ IMTCoE ☐ Other	☐ Attached ☐ Pending
☐			☐ IMTCoE ☐ Other	☐ Attached ☐ Pending

C. List all Performance Site(s) "<u>not</u> engaged in research" *(insert additional rows if needed).*
☒ NA
An institution or performance site is considered "not engaged in research" when its employees or agents **do not** (i) intervene or interact with living individuals for research purposes; or (ii) **does not** obtain individually identifiable private information for research purposes; or (iii) if the institution **does not** receive a direct federal award to support such research. *This applies if an IMTCoE investigator will be conducting research at a non-IMTCoE site or institution (e.g., when collecting data).* Please refer to the instructions for examples of what may be considered "not engaged in research." *See IMTCoE Policy for Waiver of Informed Consent.*

Name of Performance Site	If the Performance Site has an IRB, a copy of the IRB approval letter is required.	If the Performance Site does not have an IRB, a letter of cooperation is required.
	☐ Attached ☐ Pending	☐ Attached ☐ Pending
	☐ Attached ☐ Pending	☐ Attached ☐ Pending
	☐ Attached ☐ Pending	☐ Attached ☐ Pending
	☐ Attached ☐ Pending	☐ Attached ☐ Pending
	☐ Attached ☐ Pending	☐ Attached ☐ Pending
	☐ Attached ☐ Pending	☐ Attached ☐ Pending

9. Subject Population(s)

A. Identify all categories or groups, primary or secondary target, age range, total number to be solicited, total number to be consented, and the number expected to complete the study. Primary targets are those who either give consent or those who can only provide assent (e.g., minors). Secondary targets are those who provide data to supplement the primary target data (e.g., parents completing a questionnaire, teachers who supply information and data).

Category/Group (e.g., parents, children, teachers, adults)	Primary or Secondary Target	Age Range (e.g., 7-12, 13-17, adults)	Number Directly Solicited (applies only to mailed survey studies)	Number to be Consented (including withdrawals or screen failures)	Number Expected to Complete the Study
4th Infantry Division	☒ Primary ☐ Secondary	adults	☒ N/A	300	200
	☐ Primary ☐ Secondary		☐ N/A		
	☐ Primary ☐ Secondary		☐ N/A		
	☐ Primary ☐ Secondary		☐ N/A		

Insert additional rows if needed.

TOTALS Enter totals from columns 4, 5, & 6	☐ N/A	300	200

B. For multi-center research projects, please provide the total number of participants to be consented at ALL sites. *(See item 8B.)*

☒ **Not Applicable**

C. Describe how the selection of participants is equitable in relation to the research purpose and setting *(e.g., no one ethnic group is targeted or excluded, the same group of participants will benefit from the results of the research)*.

4th Infantry Division Commanders will identify Soldiers who are: (1) physically fit (passed their most recent Army Physical Fitness Test); (2) physically well (e.g., not injured, not on an Army "profile," not recently diagnosed with a performance-inhibiting illness or disease, not pregnant); (3) who are at least one year post-completion of Army Initial Entry Training; (4) who have had sufficient time to acclimatize to Fort Carson's altitude; and (5) who are available to attend an information briefing conducted by IMT-CoE personnel (e.g., Soldiers not on leave, pass, or with conflicting duty assignments). IMT-CoE personnel will provide a general description of the Army's effort to study and potentially change physical fitness testing, and a very detailed description/walk-through demonstration of the WTBD scenarios (potential criterion measures). IMT-CoE personnel will also conduct a safety briefing. Upon conclusion of the briefing, 4th ID Soldiers will be invited to complete the WTBD "obstacle course," parts of the course if they would prefer not to complete it in its entirety, or to observe as others complete the course, and then to provide feedback about the operational relevance/realism of course components, and about modifications that can be made to course construction/execution. Volunteers will not be screened in or out on the basis of gender, ethnicity, education, or any other sociodemographic variable.

10. Does this study target one gender or specific social/ethnic group(s)?

☒ No ☐ Yes *If "Yes," please provide a rationale.*

11. Is the population being enrolled in this study at high risk for incarceration?

☒ No
☐ Yes *If "Yes," will the participants be withdrawn from the study once they are incarcerated?*
☐ No
☐ Yes *If "No," describe how recontacting/reconsenting, treatment, and/or follow-up will occur.*

12. How will non-English speaking participants be consented? ☒ ***Not Applicable at this time**
(Federal regulations require the equitable selection of minorities as research subjects to assure that they receive an equal share of the benefits of research and to ensure that they do not bear a disproportionate burden.)

A. Choose one:
☐ A translated written informed consent document in a language understandable to the participant. This should be an accurate translation of the full informed consent document *(consider having a translator present during the consenting process should the participant have any questions).*

☐ Orally, using a qualified translator to translate the English informed consent document to the participant, and a translated short form in a language understandable to the participant (*See* IRB Policy IV.B "Documentation of Informed Consent" for details).

Note: It is acceptable to submit the English informed consent document and the English short form, if there is no current non-English speaking person identified for the study. Once identified, the translated informed consent document or the short form must be submitted to the IRB for expedited review and approval prior to consenting the participant.

B. Identify the name of the individual or translation service that provided the translation.

C. List the qualifications of the individual who provided the translation.

13. Will a waiver or alteration of the consent process or a waiver or alteration of the consent documentation be used?

☒ No
☐ Yes *If "Yes," complete the Request for Waiver of Consent and/or Authorization.*

14. Participant Identification, Inclusion/Exclusion Criteria, and Recruitment

A. Describe the specific steps to be used to identify and/or contact prospective participants. (If applicable, also describe how you have access to lists of potential participants. Scripts and advertisements should be submitted with this application or examples should be provided for any telephone contacts, advertisements, oral contact, etc.)

4th Infantry Division Commanders will identify Soldiers who are: (1) physically fit (passed their most recent Army Physical Fitness Test); (2) physically well (e.g., not injured, not on an Army "profile," not recently diagnosed with a performance-inhibiting illness or disease, not pregnant); (3) who are at least one

year post-completion of Army Initial Entry Training; (4) who have had sufficient time to acclimatize to Fort Carson's altitude; and (5) who are available to attend an information briefing conducted by IMT-CoE personnel (e.g., Soldiers not on leave, pass, or with conflicting duty assignments). IMT-CoE personnel will provide a general description of the Army's effort to study and potentially change physical fitness testing, and a very detailed description/walk-through demonstration of the WTBD scenarios (potential criterion measures). IMT-CoE personnel will also conduct a safety briefing. Upon conclusion of the briefing, 4th ID Soldiers will be invited to complete the WTBD "obstacle course," parts of the course if they would prefer not to complete it in its entirety, or to observe as others complete the course, and then to provide feedback about the operational relevance/realism of course components, and about modifications that can be made to course construction/execution. Volunteers will not be screened in or out on the basis of gender, ethnicity, education, or any other sociodemographic variable.

B. Describe the specific steps for obtaining informed consent (e.g., by whom, his/her credentials, where, when, etc.).

Civilian IMT-CoE personnel (Mr. Michael Haith, Dr. Whitfield East) will provide the informed consent briefing to 4th Infantry Division Soldiers. The briefing will explain the purpose of the effort and what participants will be asked to do. The informed consent briefer will emphasize that participation is completely anonymous (PII will NOT be collected from volunteer participants) and voluntary, that a volunteer can stop participating at any time/refuse to answer questions, and that there will be no penalties/consequences for not participating/not answering questions. The briefer will also emphasize that complete anonymity will be guaranteed at all times throughout the effort, and that volunteers should not write their name or any other PII on feedback documents or materials. Following the brief, Soldiers will have the opportunity to ask questions, and will be told that they can ask questions at any time throughout the effort. They will also be provided with study team contact information should any questions or concerns arise upon completion of the WTBD scenarios. Soldiers who chose to participate will not be asked to sign any forms in order to maintain complete anonymity of participants.

C. Does the person obtaining consent have an existing relationship with the participant?

☒ No
☐ Yes *If "Yes," describe the relationship and how you will protect against undue influence or coercion.*

D. Identify the criteria for inclusion and exclusion and explain the procedures that will be used to determine eligibility. If psychiatric/psychological assessments will be conducted (e.g., depression or suicidal ideation screenings), state who will administer, his/her experience, and how risks will be managed.

No Soldiers who volunteer to participate will be excluded from the study.

E. **Do you plan to actively recruit participants?**
NOTE: Please provide a copy of all advertising materials including ads, letters and telephone scripts with this application; must include graphics. In addition, The IRB must review and approve final copies of all audio/videotapes prior to use.

☒ No
☐ Yes *If "Yes," choose all recruitment/advertisement methods that apply:*

☐ Flyers	☐ Mass E-mail Sollicitation	☐ Radio
☐ Internet	☐ Newspaper	☐ Telephone
☐ Letter	☐ Posters	☐ Television
☐ Departmental Research Boards	☐ Other (describe):	

F. Do you agree to release study information to IMTCoE-approved web sites or publications? Posting research information on research-related websites allows potential participants to search and find studies related to their condition or interest. (*Please be aware that if this research is subject to a contractual agreement, it may be necessary for you to obtain permission from the sponsor prior to authorizing the release of any study information.)*

☒ No, do not release information to research-related web sites.
☐ Yes, this information may be released as described in item #1 of the informed consent document (Purpose of the study).

15. Methods and Procedures Applied to Human Participants (Where appropriate, check all that apply)

A. Please provide a chronological narrative of ALL study procedures. *(For use of multiple assessments, questionnaires, etc., it is suggested that a table is included showing the frequency and duration of each of the study related activities.)*

***Please Note:** This effort will be conducted over the course of two weeks. Weeks one and two will follow the same order of events (described below), but with different groups of volunteer participants. During week one, 150 volunteer participants from the 4th ID will have the opportunity to execute the WTBD scenarios/provide feedback, and during week two, a separate group of 150 volunteer participants from the 4th ID will have the opportunity to do the same.

1. Command-selected Soldiers assigned to FT Carson's 4th ID will attend an operational concept and informed consent briefing. IMT-CoE team members will explain purpose and procedures, provide a step-by-step description of what study participants will be asked to do, provide an active demonstration of WTBD performance components, and will emphasize principles of informed consent/the voluntary nature of participation/participants' right to opt out at any time without consequence or reprisal.

2. Soldiers who volunteer to participate will receive a safety briefing from a certified Army exercise physiologist (Dr. Whitfield East) about the safe and ergonomically/physiologically correct way to execute the physical task components of the "obstacle course," about proper performance fueling, and about the importance of staying properly hydrated while executing the physical task components. Participants will have the opportunity to ask any questions they may have about proper physical form, nourishment, and hydration, and will be informed that they may ask questions at any time throughout the course of the effort.

3. The criterion development effort will span four days, lasting approximately 3 hours per day.

4. On day one, volunteers will have the opportunity to observe, walk-through, and practice different components of the WTBD "obstacle course."

5. On day two, participants will practice the individual WTBD simulations:

a) Move Over/Under/Around Obstacles. Wearing a tactical "load" (approximately 35 lbs including uniform items), Soldiers will complete a 100m obstacle course that requires them to sprint 15m, zigzag run 45m while jumping over two low obstacles (12") and negotiating 8 tires; traverse on a 40' zigzag balance beam under load (beam will be resting on the ground and Soldiers will carry a 40 lb jerry water can in each hand); lift two 30 lb objects onto a 6' platform, climb onto the platform using hand/foot holds, cross the platform, lower themselves and the objects to the ground; surmount a 4.5' wall; complete an over/under obstacles; and sprint 15m. All these obstacles are commonly occurring in Urban Terrain. Soldiers will proceed at their own pace, may stop and rest, may self administer nutrients and water, and may stop the exercise at any time. Soldiers will be allowed to wear a heart-rate monitor (similar to wearing a wristwatch with a chest strap) if they chose to do so. This event will be filmed and Soldiers will be asked about the level of their physical effort at the end of the course.

b) Dig/lift/carry/fill/stack: Wearing a tactical "load" (approximately 35 lbs including uniform items), Soldiers will complete a dig/fill/carry/stack task that will involve filling 4-gal buckets with sand, carrying 5m and emptying into two 55-gal trashcan (approximately 13 repetitions). When the trashcan is full, Soldiers will lift/carry 16-40lb sandbags (generally one sandbag at a time) 5m and stack 4x4 rows on top of a 36" platform. This task contains common Soldier tasks associated with preparing a fighting position. Soldiers will proceed at their own pace, may stop and rest if necessary, may self administer nutrients and water as needed, and may stop the exercise at any time if necessary. Soldiers will be allowed to wear a heart-rate monitor (similar to wearing a wristwatch with a chest strap) if they chose to do so. This event will be filmed and Soldiers will be asked about the level of their physical effort at the end of the event.

c) Casualty Extraction and Drag: Wearing a tactical "load" (approximately 35 lbs including uniform items), Soldiers will complete a sprint for 15m and crouch run for 15m to get to the objective – a HUMVEE. Once at the HUMVEE the Soldier will open the driver's side door and extricate a wounded soldier (220 lb training dummy) from the HUMVEE with a controlled lowering to the ground. Once the casualty is on the ground the Soldier will drag the casualty 20m. This task contains a commonly occurring WTBD associated with a casualty evacuation. Soldiers will proceed at their own pace, may stop and rest, may self administer nutrients and water, and may stop the exercise at any time. Soldiers will be allowed to wear a heart-rate monitor (similar to wearing a wristwatch with a chest strap) if they chose to do so. This event will be filmed and Soldiers will be asked about the level of their physical effort at the end of the event.

d) Combatives Simulation (***this simulation does NOT involve any manner of combat or physical interaction between Soldiers): Wearing a tactical "load" (approximately 35 lbs including uniform items), Soldiers will a tire-flip, SKEDCO pull, 25-pound sandbag throw, and a barrel rotation (rotate a 55 gal barrel on a plywood base). These tasks capture physical movements endemic to hand-to-hand combat (e.g., pushing, pulling, throwing to the ground, twisting) without asking Soldiers to engage in actual combatives. Soldiers will proceed at their own pace, may stop and rest, may self administer nutrients and water, and may stop the exercise at any time. Soldiers will be allowed to wear a heart-rate monitor (similar to wearing a wristwatch with a chest strap) if they chose to do so. This event will be filmed and Soldiers will be asked about the level of their physical effort at the end of the event.

6. On day three, volunteers will execute a "composite course" (run all four WTBD simulations back-to-back). Soldiers will proceed at their own pace, may stop and rest, may self administer nutrients and water, and may stop the exercise at any time. Soldiers will be allowed to wear a heart-rate monitor (similar to wearing a wristwatch with a chest strap) if they chose to do so. This event will be filmed and Soldiers will be asked about the level of their physical effort at the end of the event.

7. On day four:

a) Participants will complete a 6 mile tactical foot march. Wearing a tactical "fighting load" (approximately 80 lbs including uniform items and weapon), Soldiers will march 6 miles (three repetitions of the approved 2-mile run course). Soldiers will proceed at their own pace, may stop and rest, may self administer nutrients and water, and may stop the exercise at any time. Soldiers will be allowed to wear a heart-rate monitor (similar to wearing a wristwatch with a chest strap) if they chose to do so. Portions of this event will be filmed and Soldiers will be asked about the level of their physical effort approximately every ½ mile.

b) If they choose to do so, volunteers will transition directly from the foot march to the composite course, detailed in step 6, above.

B. ☐ **Compensation** *(Specify the method of compensation (e.g., money, gift certificates, prizes, toys, etc.). If payment schedules are complex, it is suggested that a table is included showing the frequency and amount of compensation.)*
N/A

C. ☒ **Behavioral Observation**
Describe the focus, duration, and number of observations and specify how the observations will be recorded. *NOTE: If this information has been described in detail in item 15.A., it is acceptable to check the box and enter "see 15A."*

See 15A

D. ☐ **Randomization**
Describe the randomization process. *NOTE: If this information has been described in detail in item 8.A., it is acceptable to check the box and enter "see 8.A."*
N/A

E. ☐ **Blinding**
Describe who will be blinded. Describe if and when research results or previously blinded treatment assignments will be made available to participants. Describe the provisions for breaking the blind (e.g., emergency situations, participant's request, etc.). *NOTE: If this information has been described in detail in item 15.A., it is acceptable to check the box and enter "see 15A."*
N/A

F. ☐ **Surveys, Interviews, Questionnaires**
If surveys, interviews or questionnaires will be conducted with this study, indicate who will conduct the survey, interview or questionnaire and their qualifications. In addition, describe the setting and mode of administering the instrument (e.g., by telephone, one-on-one, group, etc.) and attach a copy of the instrument. *NOTE: If this information has been described in detail in item 15A, it is acceptable to check the box and enter "see 15A."*
N/A

G. ☐ **Document and Artifact Collection**
Describe any documents or other artifacts (e.g., student written assignments) that are to be collected.
N/A

H. ☐ **Deception, Withholding or Postponing Medications/Treatments, or Imposing other Restrictions**
Describe the methods of deception to be used, the medications being withheld or postponed, the length of time medications will be withheld or postponed, any other restrictions to be imposed on participants (e.g., diet, exercise), and the precautions taken to decrease or eliminate risks to participants.
N/A

I. ☐ **Data Collection, Storage of Data/Specimens and/or Issues of Confidentiality**

i. Describe the storage of research information including data (hard copies and electronic databases, audio/videotapes, etc.). Indicate who will have access to the research information, where it will be stored, and how long it will be kept. In addition, describe the final disposition of research information when the study is concluded (e.g., will information be destroyed or will the PI maintain the information). *NOTE: If this information has been described in detail in item 15.A, it is acceptable to check the box and enter "see 15A."*

All information obtained during this effort will be treated as privileged and confidential, and will be seen only by the identified researchers involved in the study on a need-to-know basis. Participants will not provide any PII to

IMT-CoE team members, and will be asked to remove Army name tags, rank, and other identifying information from their persons prior to participation in the WTBD scenarios/filming. Soldiers who volunteer to participate will be assigned a 5-digit identification number, which will be used to coordinate information gathering throughout the four-day operation. Soldiers who cannot remove Army name/rank etc., from their uniforms (e.g., if tags are sewn on) will be asked to cover PII with small pieces of obscuring tape (provided by the IMT-CoE team). Lessons Learned from WTBD performance observations will be used to refine WTBD criterion measures, and to develop the two study protocols described in Section 6. As this is neither a study nor a research effort, none of the information gathered will be published or reported. Video recordings will be hand-carried, by the principal investigator, from the FT Carson site to the home office, and maintained on a double-password-protected data file stored on a non-networked computer to which only the principal investigator has access. Video recordings will be deleted upon completion of the full study.

ii. Describe how the confidentiality of participants will be assured. Include a description of any issues specific to the study that might increase the risk of breach of confidentiality. For example, video/audiotapes, discovering information about the participant that could be harmful if released such as mental illness, genetic information, sexual preference, drug abuse, etc. Describe how codes will be generated if codes are used to protect identities, and who will have access to such codes. If a certificate of confidentiality will be provided, include the name of the person holding the certificate. NOTE: If this information has been described in detail in item 15A., it is acceptable to check the box and enter "see 15A."

Participants will not provide any PII to IMT-CoE team members, and will be asked to remove Army name tags, rank, and other identifying information from their persons prior to participation in the study/filming. Soldiers who cannot remove Army name/rank etc., from their uniforms (e.g., if tags are sewn on) will be asked to cover PII with small pieces of obscuring tape (provided by the IMT-CoE team). Soldiers who volunteer to participate will be assigned a 5-digit identification number, which will be used to coordinate information gathering throughout the four-day operation. Video recordings will be hand-carried, by the principal investigator, from the FT Carson site to the home office, and maintained on a double-password-protected data file stored on a non-networked computer to which only the principal investigator has access. Video recordings will be deleted upon completion of the full study.

J. ☒ **Audio or Video Taping**

Video recordings will be hand-carried, by the principal investigator, from the FT Carson site to the home office, and maintained on a double-password-protected data file stored on a non-networked computer to which only the principal investigator has access. Video recordings will be deleted upon completion of the full study.

K. Use or Disclosure of Protected Health Information

i. Will Protected Health Information (PHI) be accessed (used) in the course of screening/recruiting for this research? Protected health information (PHI) is individually identifiable health information that is or has been collected or maintained by IMTCoE, including information that is collected for research purposes only, and can be linked back to the individual participant.

☒ No
☐ Yes *If "Yes," the following 3 conditions must be met:*
1. *The use or disclosure of the PHI is sought solely for the purpose of this research protocol.*
2. *The PHI will not be removed from IMTCoE.*
3. *The PHI is necessary for the purpose of this research study.*

ii. Does this research use or disclose Protected Health Information (PHI)?
☒ No

☐ Yes If "Yes," please complete the IMTCoE HIPAA Compliance Form for submission with this Application. It can be accessed at HIPAA Compliance.

16. Financial Liability for Study Participants

Complete the table below, indicating who is responsible for payment of research activities and procedures. *(Limit list to research activities and procedures.)* Table may be modified as necessary to accommodate more items.

Procedure/Activity	Frequency	Responsible for Payment
		☐ Sponsor ☐ Investigator ☐ Department ☐ Patient
		☐ Sponsor ☐ Investigator ☐ Department ☐ Patient
		☐ Sponsor ☐ Investigator ☐ Department ☐ Patient

17. Potential Conflict of Interest

A. Is there a potential conflict of interest for the Principal Investigator or key research personnel? *Assessment should include anyone listed as Principal Investigator, or other research personnel on page 1 of this application. Please note that the thresholds of ownership described below apply to the aggregate ownership of an individual investigator, his/her spouse, domestic partner and dependent children (e.g., if an investigator, his/her spouse, domestic partner and dependent children own together $10,000 or 5% worth of equities in the sponsor, it should be reported below). Do not consider the combined ownership of all investigators.*

☒ No

☐ Yes *If "Yes," the protocol must be reviewed by the IMTCoE IRB.*

NOTE: Although approval may be granted by the IRB, the Investigator may not proceed with the research until a final determination has been rendered by the Deputy CG IMTCoE.

B. *If "Yes," check all that apply*:

☐ Compensation whose value could be affected by the study outcome.

☐ A proprietary interest in the tested product included but not limited to, a patent, trademark, copyright or licensing agreement, or the right to receive royalties from product commercialization.

☐ Any equity interest in the sponsor or product whose value cannot be readily determined through preference to public prices (e.g., ownership interest or stock options).

☐ Any equity interest in the sponsor or product that exceeds $10,000 or 5%.

☐ Significant payments or other sorts with a cumulative value of $10,000 made directly by the sponsor to any of the investigators listed on page 1 of this application as an unrestricted research or educational grant, equipment, consultation or honoraria.

☐ Significant payments or other sorts with a cumulative value of $10,000 made directly by the sponsor to any of the investigators listed on page 1 of this application as an unrestricted research or educational grant, equipment, consultation or honoraria.

PRINCIPAL INVESTIGATOR'S ASSURANCE STATEMENT

I certify that the information provided in this application is complete and accurate.

I understand that as Principal Investigator, I have ultimate responsibility for the conduct of the study, the ethical performance of the project, the protection of the rights and welfare of human participants, and strict adherence to the study protocol and any stipulations imposed by the Initial Military Training Center of Excellence (IMTCoE) Institutional Review Board.

I understand that, should I use the project described in this application as a basis for a proposal for funding (either internal or external), it is my responsibility to ensure that the human participants' involvement as described in the funding proposal(s), is consistent in principle, to that contained in this application. I will submit modifications and/or changes to the IRB as necessary, in the form of an amendment, to ensure these are consistent.

I agree to comply with all IMTCoE policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human participants in research, including, but not limited to:

- Ensuring all investigators and key study personnel have completed the IMTCoE human subjects training program;
- Ensuring the project is conducted by qualified personnel following the approved IRB application and study protocol;
- Implementing no changes in the approved IRB application, study protocol, or informed consent document without prior IRB approval in accordance with IMTCoE IRB policy (except in an emergency, if necessary to safeguard the well-being of a human participant, and will report to the IRB within 5 days of such change);
- Obtaining the legally effective informed consent from human participants or their legally responsible representative, using only the currently approved date-stamped informed consent documents, and providing a copy to the participant, if applicable.
- Promptly report to the IRB, Data Safety and Monitoring Boards, sponsors and appropriate federal agencies any adverse experiences and all unanticipated problems involving risks to human subjects or others that occur in the course of the research in accordance with IMTCoE IRB Policies and Procedures.
- If unavailable to conduct this research personally, as when on sabbatical leave or vacation, I will arrange for another investigator to assume direct responsibility for the study. Either this person is named as another investigator in this application, or I will notify the IRB of such arrangements;
- Promptly providing the IRB with any information requested relative to the project;
- Promptly and completely complying with an IRB decision to suspend or withdraw approval for the project;
- Obtaining Continuing Review approval prior to the date the approval for the study expires. I understand if I fail to apply for continuing review, approval for the study will automatically expire, and all study activity must cease until IRB approval is granted;
- Maintain accurate and complete research records, including, but not limited to, all informed consent documents for 3 years from the date of study completion;
- Maintain any authorization documents to use or disclose PHI for 6 years from the date authorization is obtained; and
- Fully informing the IMTCoE IRB of all locations in which human participants will be recruited for this project and being responsible for obtaining and maintaining current IRB approvals/letters of cooperation when applicable.

Whitfield B East — 11 Sept 2013

Signature Principal Investigator — Date

By my signature, I certify that I have evaluated this research application for soundness of research design and scholarly merit in accordance with departmental policy and the adequacy of facilities and resources.

FACULTY ADVISOR ASSURANCE STATEMENT

(Applicable for Student Data Requests)

***The faculty sponsor must be a member of the University Faculty. The faculty member is considered the responsible party for the legal and ethical performance of the project.**

By my signature as sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human participants and has sufficient training and experience to conduct this particular study in accordance with the approved protocol. In addition,

- I agree to meet with the student investigator on a regular basis to monitor study progress;
- Should problems arise during the course of the study, I agree to be available, personally, to supervise the student investigator in solving them;
- I will ensure that all investigators and key study personnel have completed the IMTCoE human subjects training program;
- I will ensure that the project is performed only by qualified personnel according to the approved IRB application;
- I will ensure that the student investigator does not implement any changes to the approved IRB application or informed consent document without prior IRB approval in accordance with IMTCoE IRB policy (except in an emergency, if necessary to safeguard the well-being of human participants, and will report to the IRB within 5 days of such change);
- I will ensure that the student investigator only obtains legally effective informed consent from human participants or their legally responsible representative, only the currently approved date stamped informed consent documents for human participants are used; and a copy of the informed consent is provided to the participant.
- I will ensure that the study investigator promptly reports any unanticipated problems involving risks to participants or others, or any serious adverse events (whether anticipated or not) to the IRB in accordance with IMTCoE IRB Policies and Procedures;
- I will assume the responsibility for the accurate documentation, investigation and follow-up of all possible study related adverse events and unanticipated problems involving risks to participants.
- If I will be unavailable to supervise this research personally, as when on sabbatical leave or vacation, I will arrange for an alternate Faculty Advisor to assume direct responsibility in my absence and I will advise the IRB by letter in advance of such arrangements;
- I will ensure that the student investigator promptly provides the IRB with any information requested relative to the project;
- I will ensure that the student investigator promptly and completely complies with an IRB Decision to suspend or withdraw approval for the project; and
- I will ensure that the student investigator obtains continuing review approval prior to the date approval for the study expires. Further, I understand that if the student investigator fails to apply for continuing review, approval for the study will automatically expire and I must ensure that all study activity ceases until IRB approval is obtained.

_____ _____

Faculty Sponsor's Signature Date

By my signature, I certify that I have evaluated this research application for soundness of research design and scholarly merit in accordance with departmental policy and the adequacy of facilities and resources.

_____ _____

Department Chair's Signature Date

[i] Note: a relevant example of how similar organizations accomplish this goal is the Houston, TX Fire Department. The Houston Fire Department uses a job-related physical ability test designed to determine if an applicant has the requisite

strength and endurance needed to perform the job duties of a Firefighter. These job duties require balance, coordination, strength, endurance, and cardio-vascular fitness. Applicants are tested over seven (7) timed, pass/fail events while wearing gloves and an air pack because Firefighters are required to wear Self-Contained Breathing Apparatus (SCBA) and other heavy protective clothing while functioning at emergency incidents. The events include:

- Balance Beam Walk- within 30 seconds, one must walk the entire length of the beam.
- Ladder Extension - within 1 minute, an applicant must fully extend and lower the fly section of a 24' aluminum extension ladder by using the hand-over-hand method.
- Stair Climb - within 3 minutes 30 seconds, an applicant must pick up, shoulder hold, and carry two (2) 50' sections of hose, tied in a "Brown Fold," then climb and descend six (6) flights of stairs.
- Equipment Hoist - within 1 minute, an applicant standing on the 3rd floor of the drill tower, using the hand-over-hand method, must hoist one section of 2 ½" hose (44 lb.) from the ground up to the 3rd floor window, and then lower the hose back to the ground.
- Portable Equipment Carry - within 1 minute, an applicant must pick up an equipment/accessory box (Hurst, or Amkus, extrication tools) (70 lb.) from a 2' stand and carry it 50' in one direction, turn around to carry it back 50' and then place the box on a 3' stand.
- Rescue Attempt - within 30 seconds, an applicant must carry or drag a 150 lb. human dummy, 30 feet.
- 1.5 Mile Run - within 13 minutes 7 seconds, an applicant must run 1.5 miles.

[ii] Department of the Army, *Physical Readiness Training - FM 21-20* (Washington, D.C.: U.S. Government Printing Office, 1980), 1-2.

[iii] FM 7-22 – "Army Physical Readiness Training", Department of the Army, October, 2012.

[iv] Warrior Tasks and Battle Drills, IMTCoE, March 2013.

[v] Soldier's Manual of Common Tasks, IMTCoE, 2013.

[vi] TRADOC PAM 257-3-7: *The Army Human Dimension Concept*, Department of the Army, 2013; Sharon L. Plowman and Denise L. Smith. *Exercise Physiology for Health, Fitness, and Exercise*. Baltimore: Lippincott, Williams and Wilkins, 2008; Tudor W. Bompa. *Periodization Training: Theory & Methodology of Training*. Champaign, Ill: Human Kinetics, 1999.

[vii] Personal conversation with Dr. William Brechue, FACSM (9 July 2013).

[viii] Belinda R. Beck, "Stress Fractures," *ACSM Current Comment* (Indianapolis, IN: American College of Sports Medicine, , 2007), 1 – available at: http://www.acsm.org (accessed 3 May 2011); Note: based upon the American College of Sports Medicine "Current Comment" on stress fractures, we know it take about six weeks of adaptive exercise before bone density and connective tissue improve enough to help prevent stress-reaction injuries; "Bones are most susceptible to stress fracture when weakened by remodeling-related porosity, a primary stage in the adaptive response of bone to changes in patterns of loading." (p. 2)

[ix] Andrew M. Jones, "The Physiology of the World Record Holder for the Women's Marathon" *International Journal of Sport Science & Coaching* 1:2 (2006): 101-116; Scott Powers and Edward Howley, *Exercise Physiology: Application to Theory and* Performance. Columbus, OH: McGraw Hill Publishing Co, 2013.

[x] Whitfield B. East, *A Historical Analysis of Army Physical Readiness Training and Assessment*, FT Leavenworth, KS: Combined Arms Institute Press, US Army Combined Arms Center, March 2013.

[xi] Paul J. Sharkey and Brian O. Davis. *Hard Work: Defining Physical Work Performance Requirements*. Champaign, Ill: Human Kinetics, 2008; Per-Olof Astrand, Kaare Rodahl; Hans A. Dahl and Sigmund B. Stromme. *Textbook of Work Physiology*. Champaign, Ill: Human Kinetics, 2003.

[xii] Jones, "Physiology of the World Record Holder", 112.

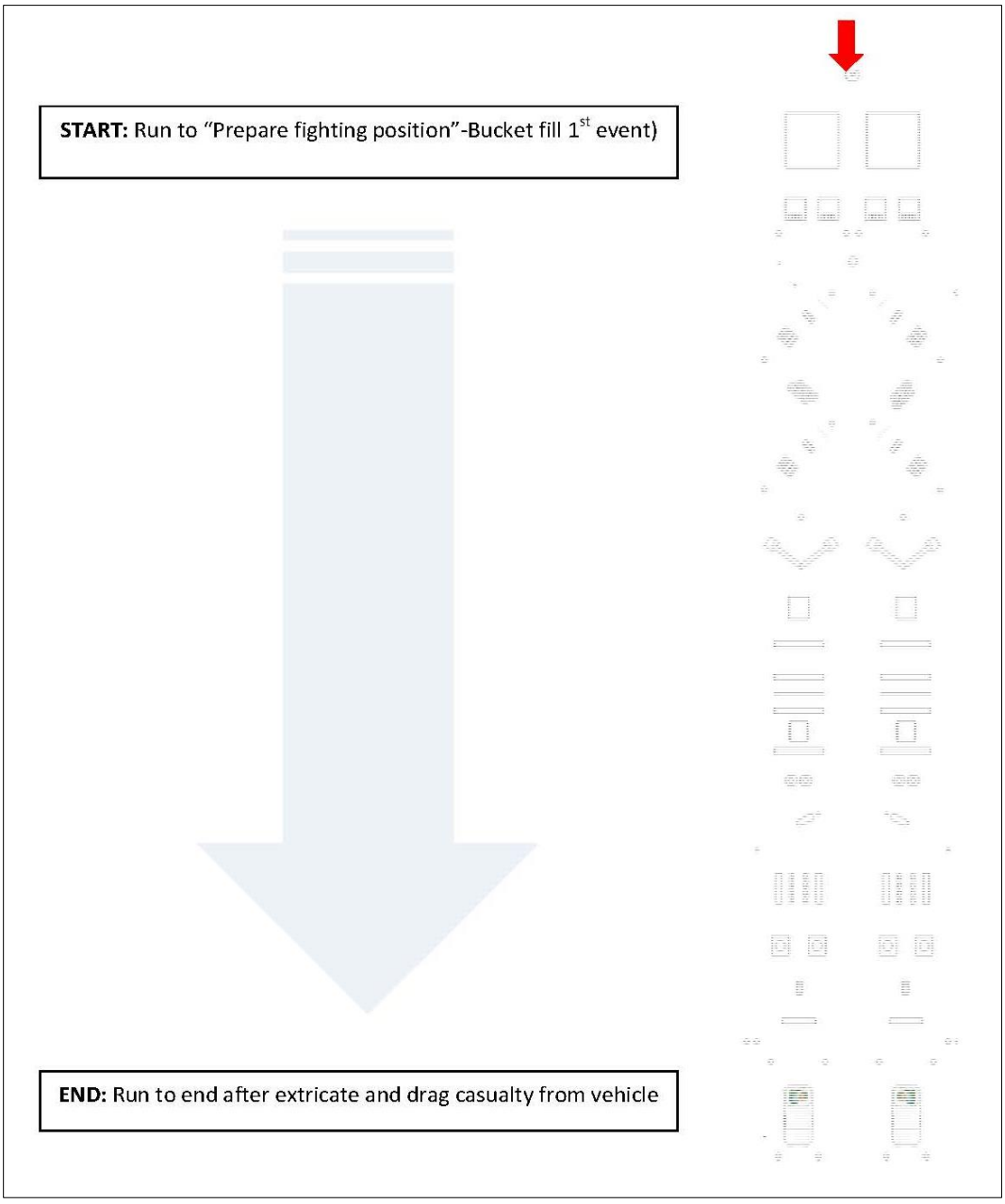
[xiii] Note: based upon the April 2009 Armed Forces Medical Surveillance Monthly Report, there were 7.8 million ambulatory visits for illness and injury during 2008; the largest percentage (> 24%) of visits were caused by musculoskeletal and connective tissue injuries – generally construed to be "overuse" injuries (approximately 1.9 million visits); Larkin, 2010, p. 41-42.

[xiv] Bruce Ruscio, et al., *DOD Military Injury Prevention Priorities Working Group: Leading Injuries, Causes and Mitigation Recommendations* (Washington, DC: Office of the Assistant Secretary of Defense for Health Affairs, February 2006), 1, 4, 7; *Preventing Injuries in the U.S. Military: The Process, Priorities, and Epidemiologic Evidence* (Aberdeen Proving Ground, MD: Army Center for Health Promotion and Preventive Medicine, December 2008), Section 1-1, A(2), 1-2.

[xv] Christopher P. Larkin, "Combat Fitness a Concept Vital to National Security" (Paper - Master of Science, Department of Defense: Joint Forces Staff College, 18 June 2010), 100; Note: MAJ Larkin extrapolated these data, which were derived from the following source: Armed Forces Health Surveillance Center. "Ambulatory Visits among Members of Active Components, U.S. Armed Forces, 2008," *Medical Surveillance Monthly Report* 16:4 (April, 2009): 10.

APPENDIX Q
Fort Carson Field Study, September 2013
Description of Field Events

Diagram and Spreadsheet contributed by Don Goddard, AIPH Ergonomics Program



Day 1 – Army Combat Uniform (ACU)
Day 2 – Fighting Load,
Day 3 – Fighting Load (after 10 K Ruck March w Sustainment Load)

Individual Equipment List

ACU	
Boots	5.00
Jacket & trouser	3.20
Multi tool	0.50
Rigger Belt	0.50
Patches	0.49
Patrol Cap	0.48
ID Tags	0.38
Undershirt	0.35
Gloves	0.25
Eye Pro	0.25
Notebook	0.25
Underwear (shirt/Drawers)	0.55
Socks	0.20
Wrist Watch	0.19
Ear Plugs	0.13
Chapstick	0.01
ID Card	0.01
Sports Bra	0.20

[***Sustainment Load***]		
Poncho	1.05	
Liner Poncho		1.14
Assault Pack w/ waist pack	4.2	
Water – 3L or 100 oz	7.10	
Hygiene Kit		1.0
Undershirt moisture wicking x 1 ea	0.35	
Socks x 1 pr		0.20
Improved Rain suit Top	1.7	
Improved Rain suit Bottom		1.7
Meal Ready To Eat (MRE) 1 ea (1.50/0.68 kg)		1.5
Undershirt moisture wicking x 1 ea	0.35	
Socks x 1 pr	0.20	
Improved Cleaning Kit	1.6	
Chemlight (2per)		0.04
Water purification tablets		0.02

Fighting Load

Body Armor with Neck/Groin Protector	22.5-41.8
Enhanced Small Arms Protective Inserts	
Enhanced Side Ballistic Insert set with Side Plate Carrier	
MOLLE 100 oz Hydration System (with Water)	7.10
MOLLE Tactical Assault Panel (TAP) or Fighting Load Carrier	
MOLLE 30 Round Double Magazine Pouch (3 x 0.25)	
MOLLE 30 Round Triple Magazine Pouch (2 x .375)	
Hand grenade Pouch (2) with (2) M67 Fragmentation Grenades w/o grenades	0.0625
w/ grenades	1.86
Lensatic Compass with Case	0.27
Individual First Aid Kit (IIFAK)	1.08
Mag Light Flashlight with 2 ea AA Battery	0.24
Infrared Signal Beacon, PHOENIX with Battery	0.70
Combat Glove	0.38
Casualty Feeder Report/Witness Statement	0.01
Advanced Combat Helmet (ACH)	2.9-3.8
Helmet Cover w/Camouflage Cover Band	0.28
Night Vision Goggle Mounting Plate	0.20
M16 w/Fully Loaded Magazine (“rubber duck”-issued at Ft Jackson)	8.50
M68-CCO with Battery	0.71
2 Point Sling	0.28
Back-Up Iron Sight	0.32
5.56mm Magazine with 30 rds each (6 ea)	8.25

Fort Carson Field Event Descriptions

Category	Test Item	Movement	Action	Demands
Fighting Position	Start	Move to Bucket Fill	Run	52 ft
	Bucket Fill	Fill Buckets	Shovel	minute, total weight can + bucket, bucket weight)
	Transition	Move bucket fill to sandbag stack	Walk	8 ft
	Sandbag Stack	Stack Sandbags	**Lift**	**40 lb sandbag x 16**
			Carry	(40 lb sandbag 18 ft) x 16
			Lower	40 lb sandbag x 16
	Transition	Move from flag 1 to flag 2 between tables	Run	18 ft
	Transition	Move from flag 2 to flag 3 at high crawl	Run	35 ft
Move O-U-A-T	High Crawl	High Crawl	High Crawl	20 ft
	Transition	Stand		
	Short Run	Run from flag 4 to high wall	Run	25 ft
	High Wall	Jump high wall	Jump	1 ft high sandbag pile
	Short Run	Run from high wall to wide wall	Run	13 ft
	Wide Wall	Jump wide wall	Jump	4.5 wide 4 x 4 sandbag obstruction
	Short Run	Run from wide wall to cone (flag 5)	Run	15 ft
	Short Run	Run from flag 5 to tires	Run	39 ft
	Tire Run	Run through 6 tires	Run	12 ft of tires (6 steps)
	Short Run	Run from tires to cone (flag 6)	Run	38 ft
	Short Run	Run from flag 6 to high wall	Run	15 ft
	High Wall	Jump high wall	Jump	1 ft high sandbag pile
	Short Run	Run from high wall to wide wall	Run	13 ft
	Wide Wall	Jump wide wall	Jump	4.5 wide 4 x 4 sandbag obstruction
	Short Run	Run from wide wall to cone (flag 7)	Run	12 ft
	Short Run	Run from flag 7 to balance beam	Run	15 ft
	Balance Beam	Pick up saw and ammo can	Lift	18.3 lb saw and 29.3 lb ammo can
		Negotiate balance beam	Walk	12' beam length x 2
		Lower saw and ammo can	Lower	18.3 lb saw and 29.3 lb ammo can
	Transition	Run from flag 8 end of balance beam to flag 9 front of rucks	Run	30 ft
	Transition	Run from flag 9 to flag 10 at one end of the rucksack carry ov	Run	15 ft
	Platform Mount	Lift rucksack	Lift	53 lb rucksack from ground and place on 4 ft high platform (4'2" x 4' x 4')
		Climb platform	Climb	Climb on top of 4 ft high platform
		Move over platform	Move	Move over 4'2" long platform
		Jump to ground	Jump	Jump 4 ft from top of platform to ground
		Pull rucksack across platform	Pull	platform
		Lower rucksack	Lower	to ground 4 ft below
	Transition	Run from rucksack platform to high wall	Run	wall
	High Wall	Negotiate high wall	Climb	Climb 4' 6" high wall
	Short Run	Run from high wall low wall	Run	16 ft
	Low Wall	Negotiate low wall	Climb	Climb 3' 6" low wall
	Short Run	Run from low wall to roll under	Run	10 ft
	Roll Under	Roll under obstacle	Roll	under 2 ft high pipe
	Short Run	Run from pipe to low wall	Run	10 ft
	Low Wall	Negotiate low wall	Climb	Climb 3' 6" low wall
	Short Run	Run from low wall to tunnel	Run	10 ft
	Tunnel	Crawl through tunnel	Crawl	4' 6" through tunnel (4'4" x 4'6" x 2'9")
	Short Run	Run from tunnel to low wall	Run	10 ft
	Low Wall	Negotiate low wall	Climb	Climb 3' 6" low wall
	Short Run	Run from low wall to BA Tire	Run	22 ft

Fort Carson Field Event Descriptions, Continued (page 2)

Category	Test Item	Movement	Action	Demands
Perform Combatives	Tire Flip	Lift tire 2 x 2 times	Lift	102 lb tire
		Push tire over 2 x 2 times	Push	___ lb
	Short Run	Run from BA tire to Skedco flag 11	Run	17 ft
	Skedco Pull	**Pull Skedco**	**Pull**	**Pull Skedco using 53.3 force 40 ft x 2**
	Short Run	Run from Skedco cone (flag 11) to flag 12	Run	14 ft
	Short Run	Run from flag 12 to sandbag toss	Run	15 ft
	Sandbag Toss	Throw sandbags over wall	Lift	30 lb sandbag x 4
			Throw	Throw over 4'6" wall x 4
	Short Run	Run from sandbag toss to trashcan	Run	19 ft
	Trashcan Turn	Turn trashcan	Turn	Turn 55 gal trashcan x 4 revolutions using 60 lbs of force
	Short Run	Run from trashcan to low barrier	Run	25 ft
	Short Run	Run from low barrier to high barrier	Run	Run 30 ft
	Short Run	Run from high barrier to HMMWV	Run	31 ft
Casualty Evacuation	Evacuate Casua	Extricate casualty	**Pull**	**Pull casualty out of HMMWV using ___ lb force**
			Lower	**Lower casualty ___ ft to ground**
	Casualty Drag	**Casualty Drag**	**Drag**	**Pull casualty 45 ft using 112 lb force**
	Finish	Run from HMMWV to finish line	Run	67 ft

APPENDIX R
Fort Carson Field Study, Sept 2013-
Rankings of Physically Difficult Tasks

Prepared by USAPHC-IPP,
as discussed in Section 9.2 of this PHR

Table R-1. Analyses of Reported Most Physically Demanding Events, Fort Carson Field Study

Event	Day 1 - TUESDAY Week 1						Day 1- TUESDAY Week 2					
	1st		2nd		3rd		1st		2nd		3rd	
	n	%	n	%	n	%	n	%	n	%	n	%
Ruck March												
Fighting Position	21	18	9	13	15	29	16	12	17	14	29	24
Bucket Fill	3	3	3	4	4	8	5	4	6	5	9	7
Sandbag Stack	18	15	6	9	11	22	11	8	11	9	20	16
Move O-U-A-T	11	9	0	0	0	0	5	4	8	7	3	2
Rucksack Move (crawl & sprint)							2	2	1	1	0	0
Balance Beam[1]							1	1	1	1	2	2
High Walls/Wall Gauntlet	11	9	0	0	0	0	2	2	6	5	1	1
Perform Combatives	62	52	35	51	24	47	79	60	67	56	52	42
Tire Flip	7	6	9	13	1	2	13	10	6	5	5	4
Skedko Pull	38	32	12	17	13	25	41	31	29	24	21	17
Sandbag Throw	7	6	5	7	5	10	4	3	4	3	6	5
Trash Can Spin	10	8	9	13	5	10	21	16	28	23	20	16
Casualty Evacuation	25	21	25	36	12	24	32	24	28	23	39	32
Extricate and Drag	25	21	25	36	12	24	32	24	28	23	39	32
TOTALS	119	100	69	100	51	100	132	100	120	100	123	100

Event	Day 2 - WEDNESDAY Week 1						Day 2 -WEDNESDAY Week 2					
	1st		2nd		3rd		1st		2nd		3rd	
	n	%	n	%	n	%	n	%	n	%	n	%
Ruck March												
Fighting Position	37	30	11	10	9	9	15	11	14	11	14	13
Bucket Fill	3	2	1	1	2	2	2	2	5	4	3	3
Sandbag Stack	34	27	10	10	7	7	13	10	9	7	11	10
Move O-U-A-T	14	11	7	7	2	2	34	26	17	13	9	8
Rucksack Move (crawl & sprint)	0	0	0	0	0	0	10	8	3	2	2	2
Balance Beam[1]	0	0	0	0	0	0	0	0	0	0	0	0
High Walls/Wall Gauntlet	14	11	7	7	2	2	24	18	14	11	7	7
Perform Combatives	58	46	58	55	23	23	60	45	86	65	43	40
Tire Flip	15	12	15	14	6	6	18	14	28	21	5	5
Skedko Pull	28	22	28	27	9	9	31	23	34	26	15	14
Sandbag Throw	1	1	5	5	2	2	3	2	5	4	4	4
Trash Can Spin	14	11	10	10	6	6	8	6	19	14	19	18
Casualty Evacuation	16	13	29	28	19	19	23	17	16	12	41	38
Extricate and Drag	16	13	29	28	19	19	23	17	16	12	41	38
TOTALS	125	100	105	100	53	53	132	100	133	100	107	100

Event	Day 3-THURSDAY Week 1						Day 3- THURSDAY Week 2					
	1st		2nd		3rd [2]		1st		2nd		3rd	
	n	%	n	%	n	%	n	%	n	%	n	%
Ruck March	13	30	3	16			15	11	**1**	1	**0**	0
Fighting Position	43	100	19	100			23	17	16	14	24	24
Bucket Fill	7	16	3	16			1	1	3	3	3	3
Sandbag Stack	36	84	16	84			22	16	13	11	21	21
Move O-U-A-T		0		0			21	16	19	16	11	11
Rucksack Move (crawl & sprint)	5	12	5	26			5	4	3	3	0	0
Balance Beam[1]		0		0			0	0	2	2	1	1
High Walls/Wall Gauntlet		0		0			16	12	14	12	10	10
Perform Combatives		0		0			54	40	62	53	32	32
Tire Flip	9	21	14	74			15	11	12	10	7	7
Skedko Pull	30	70	23	121			33	24	39	33	13	13
Sandbag Throw	1	2	5	26			1	1	3	3	2	2
Trash Can Spin	3	7	8	42			5	4	8	7	10	10
Casualty Evacuation		0		0			22	16	19	16	33	33
Extricate and Drag	16	37	35	184			22	16	19	16	33	33
TOTALS	56	100	22	100			135	100	117	100	100	100

Event	Day 1 - TUESDAY totals								Day 2 -WEDNESDAY Totals							
	1st		2nd		3rd		Top 1-3		1st		2nd		3rd		Top 1-3	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Road March																
Fighting Position	37	**15%**	26	**14%**	44	**25%**	107	**17%**	52	**20%**	25	**11%**	23	**14%**	100	**16%**
Bucket Fill	8	3%	9	5%	13	7%	30	5%	5	2%	6	3%	5	3%	16	3%
Sandbag Stack	29	12%	17	9%	31	18%	77	13%	47	18%	19	8%	18	11%	84	14%
Move O-U-A-T [1]	16	**6%**	8	**4%**	3	**2%**	27	**4%**	48	**19%**	24	**10%**	11	**7%**	83	**14%**
Rucksack Move (crawl & sprint)	2	1%	1	1%	0	0%	3	0%	10	4%	3	1%	2	1%	15	2%
Balance Beam[1]	1	0%	1	1%	2	1%	4	1%	0	0%	0	0%	0	0%	0	0%
High Walls/Wall Gauntlet	13	5%	6	3%	1	1%	20	3%	38	15%	21	9%	9	6%	68	11%
Perform Combatives	141	**56%**	102	54%	76	**44%**	319	**52%**	118	**46%**	144	**61%**	66	41%	328	**53%**
Tire Flip	20	8%	15	8%	6	3%	41	7%	33	13%	43	18%	11	7%	87	14%
Skedko Pull	79	31%	41	22%	34	20%	154	25%	59	23%	62	26%	24	15%	145	24%
Sandbag Throw	11	4%	9	5%	11	6%	31	5%	4	2%	10	4%	6	4%	20	3%
Trash Can Spin	31	12%	37	20%	25	14%	93	15%	22	9%	29	12%	25	16%	76	12%
Casualty Evacuation	57	**23%**	53	**28%**	51	**29%**	161	**26%**	39	**15%**	45	**19%**	60	**38%**	144	**23%**
Extricate and Drag	57	23%	53	28%	51	29%	161	26%	39	15%	45	19%	60	38%	144	23%
TOTALS	251	100%	189	100%	174	100%	614	100%	257	100%	238	100%	160	100%	655	100%

Event	Day 3 - THURSDAY Totals							
	1st		2nd		3rd		Top 1-3	
	n	%	n	%	n	%	n	%
Road March	28	**15%**	4	**3%**	0	**0%**	15	3%
Fighting Position	66	**35%**	35	**25%**	24	**24%**	125	**29%**
Bucket Fill	8	4%	6	4%	3	3%	17	4%
Sandbag Stack	58	30%	29	21%	21	21%	108	25%
Move O-U-A-T	21	**11%**	19	**14%**	11	**11%**	51	**12%**
Rucksack Move (crawl & sprint)	10	5%	8	6%	0	0%	18	4%
Balance Beam[1]	0	0%	2	1%	1	1%	3	1%
High Walls/Wall Gauntlet	16	8%	14	10%	10	10%	40	9%
Perform Combatives	54	**28%**	62	**45%**	32	**32%**	148	**34%**
Tire Flip	24	13%	26	19%	7	7%	57	13%
Skedko Pull	63	33%	62	45%	13	13%	138	32%
Sandbag Throw	2	1%	8	6%	2	2%	12	3%
Trash Can Spin	8	4%	16	12%	10	10%	34	8%
Casualty Evacuation	22	**12%**	19	**14%**	33	**33%**	74	**17%**
Extricate and Drag	38	20%	54	39%	33	33%	125	29%
TOTALS	191	100%	139	100%	100	100%	430	100%

	day 1	day 2	day 3
Fighting Position	**15%**	**20%**	**35%**
Bucket Fill	3%	2%	4%
Sandbag Stack	12%	18%	30%
Move O-U-A-T	**6%**	**19%**	**11%**
Rucksack Move (crawl & sprint)	1%	4%	5%
Balance Beam	0%	0%	0%
High Walls/Wall Gauntlet	5%	15%	8%
Perform Combatives	**56%**	**46%**	**28%**
Tire Flip	8%	13%	13%
Skedko Pull	31%	23%	33%
Sandbag Throw	4%	2%	1%
Trash Can Spin	12%	9%	4%
Casualty Evacuation	**23%**	**15%**	**12%**
Extricate and Drag	23%	15%	20%
Road March			15%
TOTALS	100%	100%	100%

APPENDIX S

Fort Carson Field Study, Sept 2013
Correlation Analyses

This appendix contains the key findings of the correlation analyses conducted on data collected during the Sept 2013 Fort Carson field study described in Section 9 of this report. Due to the expected variation and confounding in these types of associations, statistically-significant Pearson correlation (*r*) values greater than 0.4 were considered noteworthy. However, more specific rankings of the noted correlation values were assessed based on the following scale:

Ranking Scale used to Assess Correlation (r) values

<.4	LOW
≥.4 <.5	MODERATE
≥.5 <.7	HIGH
≥.7	VERY HIGH

Correlation Matrices
Tables S-1 through S-12

Table S-1. FEMALES in ACU: Individual Events and Associated TASK Groups with Weight, Height, and Fitness Variables

		Bucket Fill	Sandbag Stack	**FIGHTING POSITION TASK**	Balance Beam	Over High Wall	**MOUAT TASK**	Tire Flip	Skedco Pull	Sandbag Toss	**COMBAT TASK**	Vehicle Door	Casualty Extraction	Casualty Drag	**CASUALTY EVACUATION TASK**
Weight	correlation	-.369	**-.498**	**-.605**	.062	.148	.138	-.125	**-.526**	-.322	**-.408**	.200	-.132	-.333	-.320
	p-value (N)	*.018 (41)*	*.001 (41)*	*.000 (40)*	*.702 (40)*	*.356 (41)*	*.396 (40)*	*.448 (39)*	*.001 (39)*	*.052 (37)*	*.008 (41)*	*.209 (41)*	*.417 (40)*	*.036 (40)*	*.041 (41)*
Height	correlation	-.244	**-.567**	**-.488**	-.086	-.077	-.101	-.331	**-.580**	-.378	**-.500**	-.020	**-.471**	-.398	**-.535**
	p-value (N)	*.124 (41)*	*.000 (41)*	*.001 (40)*	*.596 (40)*	*.632 (41)*	*.534 (40)*	*.039 (39)*	*.000 (39)*	*.021 (37)*	*.001 (41)*	*.900 (41)*	*.002 (40)*	*.011 (40)*	*.000 (41)*
BMI	correlation	-.298	-.234	**-.436**	.155	.264	.271	.085	-.246	-.152	-.156	.303	.198	-.129	.005
	p-value (N)	*.059 (41)*	*.140 (41)*	*.005 (40)*	*.340 (40)*	*.095 (41)*	*.091 (40)*	*.605 (39)*	*.131 (39)*	*.370 (37)*	*.332 (41)*	*.054 (41)*	*.221 (40)*	*.426 (40)*	*.976 (41)*
Total APFT	correlation	.166	-.103	.222	-.247	-.116	-.252	-.310	.149	-.311	-.100	.053	-.139	-.112	-.079
	p-value (N)	*.407 (27)*	*.609 (27)*	*.277 (26)*	*.223 (26)*	*.565 (27)*	*.213 (26)*	*.123 (26)*	*.468 (26)*	*.131 (25)*	*.620 (27)*	*.791 (27)*	*.497 (26)*	*.585 (26)*	*.697 (27)*
Run Time	correlation	-.347	-.071	-.075	-.344	-.050	-.309	-.112	-.351	-.216	-.260	-.008	-.178	.052	-.013
	p-value (N)	*.065 (29)*	*.715 (29)*	*.704 (28)*	*.073 (28)*	*.796 (29)*	*.110 (28)*	*.570 (28)*	*.067 (28)*	*.279 (27)*	*.173 (29)*	*.969 (29)*	*.364 (28)*	*.794 (28)*	*.946 (29)*
Run Score	correlation	.156	-.101	.173	-.090	-.125	-.134	.008	.326	-.238	.098	.124	.088	-.063	.078
	p-value (N)	*.384 (33)*	*.577 (33)*	*.345 (32)*	*.624 (32)*	*.488 (33)*	*.463 (32)*	*.964 (32)*	*.069 (32)*	*.197 (31)*	*.588 (33)*	*.491 (33)*	*.633 (32)*	*.732 (32)*	*.667 (33)*
Sit-Up Reps	correlation	.163	.103	.310	-.288	-.079	-.259	-.235	.055	-.059	.002	-.162	-.065	-.121	-.247
	p-value (N)	*.406 (28)*	*.603 (28)*	*.115 (27)*	*.146 (27)*	*.688 (28)*	*.192 (27)*	*.237 (27)*	*.785 (27)*	*.775 (26)*	*.992 (28)*	*.410 (28)*	*.746 (27)*	*.549 (27)*	*.206 (28)*
Sit-Up Score	correlation	.029	.001	.192	-.319	.051	-.261	-.279	-.008	-.127	-.086	-.130	-.160	-.078	-.260
	p-value (N)	*.872 (33)*	*.996 (33)*	*.293 (32)*	*.076 (32)*	*.777 (33)*	*.150 (32)*	*.122 (32)*	*.966 (32)*	*.497 (31)*	*.634 (33)*	*.470 (33)*	*.382 (32)*	*.672 (32)*	*.143 (33)*
Push-Up Reps	correlation	-.046	-.070	-.197	.165	.205	.183	-.132	-.033	.081	-.055	.073	.064	-.291	-.156
	p-value (N)	*.814 (29)*	*.719 (29)*	*.315 (28)*	*.400 (28)*	*.287 (29)*	*.352 (28)*	*.503 (28)*	*.869 (28)*	*.687 (27)*	*.776 (29)*	*.705 (29)*	*.746 (28)*	*.132 (28)*	*.418 (29)*
Push-Up Score	correlation	.088	-.210	-.084	.000	-.024	-.055	-.207	-.096	-.232	-.222	.161	-.026	-.132	.010
	p-value (N)	*.627 (33)*	*.242 (33)*	*.649 (32)*	*.998 (32)*	*.896 (33)*	*.764 (32)*	*.255 (32)*	*.600 (32)*	*.209 (31)*	*.214 (33)*	*.371 (33)*	*.889 (32)*	*.473 (32)*	*.957 (33)*

Table S-2. FEMALES Wearing Fighting Load (FL): Individual Events and Associated TASK Groups with Weight, Height, and Fitness Variables

		Bucket Fill	Sandbag Stack	**FIGHTING POSITION TASK**	Balance Beam	Over High Wall	**MOUAT TASK**	Tire Flip	Skedco Pull	Sandbag Toss	**COMBAT TASK**	Vehicle Door	Casualty Extraction	Casualty Drag	**CASUALTY EVACUATION TASK**
Weight	correlation	-.225	**-.599**	**-.580**	-.194	.023	-.141	-.227	**-.518**	-.294	-.267	.057	-.376	-.392	-.341
	p-value (N)	*.163 (40)*	*.000 (40)*	*.000 (40)*	*.230 (36)*	*.893 (40)*	*.386 (36)*	*.182 (36)*	*.001 (39)*	*.069 (40)*	*.095 (40)*	*.726 (40)*	*.017 (39)*	*.014 (40)*	*.031 (40)*
Height	correlation	-.083	**-.552**	**-.499**	-.235	-.237	-.284	-.171	**-.458**	-.393	-.331	-.191	**-.462**	-.343	**-.448**
	p-value (N)	*.611 (40)*	*.000 (40)*	*.001 (40)*	*.145 (40)*	*.165 (36)*	*.076 (40)*	*.318 (36)*	*.005 (36)*	*.013 (39)*	*.037 (40)*	*.238 (40)*	*.003 (40)*	*.032 (40)*	*.004 (40)*
BMI	correlation	-.245	-.390	**-.406**	-.101	.213	.025	-.177	-.342	-.104	-.100	.232	-.137	-.249	-.094
	p-value (N)	*.128 (40)*	*.013 (40)*	*.009 (40)*	*.537 (40)*	*.212 (36)*	*.878 (40)*	*.302 (36)*	*.041 (36)*	*.531 (39)*	*.541 (40)*	*.149 (40)*	*.399 (40)*	*.126 (39)*	*.562 (40)*
Total APFT	correlation	.166	-.041	.012	-.142	-.368	-.211	-.154	.216	-.132	.014	-.207	-.024	.245	-.078
	p-value (N)	*.417 (26)*	*.844 (26)*	*.952 (26)*	*.489 (26)*	*.092 (22)*	*.302 (26)*	*.482 (23)*	*.321 (23)*	*.529 (25)*	*.946 (26)*	*.311 (26)*	*.908 (26)*	*.239 (25)*	*.705 (26)*
Run Time	correlation	-.125	-.309	-.278	-.029	.325	.023	-.217	-.373	-.027	-.338	-.091	-.204	-.182	-.131
	p-value (N)	*.525 (28)*	*.110 (28)*	*.152 (28)*	*.882 (28)*	*.121 (24)*	*.908 (28)*	*.308 (24)*	*.072 (24)*	*.895 (27)*	*.079 (28)*	*.644 (28)*	*.297 (28)*	*.364 (27)*	*.506 (28)*
Run Score	correlation	.010	.066	.033	-.127	-.324	-.024	.085	.127	-.050	.141	-.043	.109	.071	-.045
	p-value (N)	*.955 (32)*	*.721 (32)*	*.858 (32)*	*.489 (32)*	*.092 (28)*	*.898 (32)*	*.669 (28)*	*.520 (28)*	*.788 (31)*	*.440 (32)*	*.816 (32)*	*.553 (32)*	*.702 (31)*	*.805 (32)*
Sit-Up Reps	correlation	.259	-.016	.060	.142	-.265	-.074	-.229	.099	-.097	-.130	-.282	-.081	.130	-.014
	p-value (N)	*.193 (27)*	*.937 (27)*	*.767 (27)*	*.480 (27)*	*.222 (23)*	*.712 (27)*	*.283 (24)*	*.646 (24)*	*.636 (26)*	*.517 (27)*	*.154 (27)*	*.687 (27)*	*.526 (26)*	*.944 (27)*
Sit-Up Score	correlation	.275	-.024	.062	.149	-.160	-.128	-.233	.016	-.034	-.090	-.253	-.027	.145	-.024
	p-value (N)	*.128 (32)*	*.897 (32)*	*.734 (32)*	*.415 (32)*	*.416 (28)*	*.486 (32)*	*.232 (28)*	*.935 (28)*	*.857 (31)*	*.624 (32)*	*.162 (32)*	*.885 (32)*	*.436 (31)*	*.897 (32)*
Push-Up Reps	correlation	.040	-.008	.021	-.210	-.051	-.140	.147	.344	-.227	-.007	.029	-.156	.098	-.081
	p-value (N)	*.838 (28)*	*.966 (28)*	*.915 (28)*	*.285 (28)*	*.813 (24)*	*.477 (28)*	*.483 (25)*	*.092 (25)*	*.255 (27)*	*.973 (28)*	*.882 (28)*	*.427 (28)*	*.628 (27)*	*.684 (28)*
Push-Up Score	correlation	.094	-.178	-.100	**-.404**	-.140	-.236	.119	.312	-.126	.092	-.014	-.233	.047	-.137
	p-value (N)	*.611 (32)*	*.330 (32)*	*.586 (32)*	*.022 (32)*	*.477 (28)*	*.193 (32)*	*.546 (28)*	*.106 (28)*	*.501 (31)*	*.617 (32)*	*.939 (32)*	*.200 (32)*	*.803 (31)*	*.454 (32)*

Table S-3. FEMALES in FL After 6.2 Mile Road March: **Individual Events and Associated TASK Groups with Weight, Height, and Fitness Variables**															
		Bucket Fill	Sandbag Stack	**FIGHTING POSITION TASK**	Balance Beam	Over High Wall	**MOUAT TASK**	Tire Flip	Skedco Pull	Sandbag Toss	**COMBAT TASK**	Vehicle Door	Casualty Extraction	Casualty Drag	**CASUALTY EVACUATION TASK**
Weight	correlation	-.276	**-.432**	-.398	-.030	-.285	-.156	.084	**-.535**	-.322	-.241	-.186	-.057	-.336	**-.424**
	p-value (N)	*.120 (33)*	*.012 (33)*	*.022 (33)*	*.867 (33)*	*.134 (29)*	*.401 (31)*	*.670 (28)*	*.003 (29)*	*.077 (31)*	*.191 (31)*	*.299 (33)*	*.760 (31)*	*.070 (30)*	*.016 (32)*
Height	correlation	-.256	**-.569**	**-.440**	-.227	**-.486**	**-.435**	-.303	**-.578**	-.201	**-.499**	-.070	-.162	-.361	**-.493**
	p-value (N)	*.151 (33)*	*.001 (33)*	*.010 (33)*	*.203 (33)*	*.008 (29)*	*.014 (31)*	*.117 (28)*	*.001 (29)*	*.278 (31)*	*.004 (31)*	*.697 (33)*	*.384 (31)*	*.050 (30)*	*.004 (32)*
BMI	correlation	-.173	-.153	-.201	.120	.009	.121	.319	-.250	-.298	.056	-.208	.068	-.150	-.191
	p-value (N)	*.336 (33)*	*.396 (33)*	*.262 (33)*	*.507 (33)*	*.964 (29)*	*.517 (31)*	*.098 (28)*	*.191 (29)*	*.104 (31)*	*.766 (31)*	*.247 (33)*	*.716 (31)*	*.428 (30)*	*.296 (32)*
Total APFT	correlation	.000	-.124	-.082	-.247	-.345	-.313	**-.404**	.112	.213	-.394	.288	.102	-.035	-.089
	p-value (N)	*1.000 (24)*	*.564 (24)*	*.705 (24)*	*.246 (24)*	*.136 (20)*	*.145 (23)*	*.077 (20)*	*.640 (20)*	*.329 (23)*	*.063 (23)*	*.172 (24)*	*.644 (23)*	*.874 (23)*	*.688 (23)*
Run Time	correlation	.090	-.007	.078	.172	.093	.111	.092	-.170	-.256	.087	-.264	.177	**-.479**	-.075
	p-value (N)	.662 (26)	.972 (26)	.706 (26)	.400 (26)	.680 (22)	.598 (25)	.685 (22)	.450 (22)	.227 (24)	.678 (25)	.192 (26)	.398 (25)	.015 (25)	.723 (25)
Run Score	correlation	-.188	-.024	-.149	-.198	-.117	-.079	-.033	-.064	.208	-.116	.232	-.128	.356	.025
	p-value (N)	*.320 (30)*	*.901 (30)*	*.432 (30)*	*.293 (30)*	*.568 (26)*	*.688 (28)*	*.875 (25)*	*.755 (26)*	*.287 (28)*	*.557 (28)*	*.217 (30)*	*.507 (29)*	*.058 (29)*	*.897 (29)*
Sit-Up Reps	correlation	.266	.036	.177	.084	-.294	-.119	**-.436**	-.058	.375	-.395	**.410**	.038	**-.434**	-.240
	p-value (N)	*.199 (25)*	*.865 (25)*	*.398 (25)*	*.691 (25)*	*.195 (21)*	*.579 (24)*	*.048 (21)*	*.801 (21)*	*.071 (24)*	*.056 (24)*	*.042 (25)*	*.859 (24)*	*.034 (24)*	*.258 (24)*
Sit-Up Score	correlation	.171	-.132	.026	-.025	-.371	-.177	**-.413**	.038	.147	-.302	.184	.199	**-.447**	-.137
	p-value (N)	*.367 (30)*	*.486 (30)*	*.891 (30)*	*.894 (30)*	*.062 (26)*	*.368 (28)*	*.040 (25)*	*.854 (26)*	*.457 (28)*	*.118 (28)*	*.330 (30)*	*.300 (29)*	*.015 (29)*	*.479 (29)*
Push-Up Reps	correlation	-.079	-.090	-.092	-.106	-.281	-.232	-.220	-.060	.081	-.341	.180	-.077	.087	-.094
	p-value (N)	*.702 (26)*	*.661 (26)*	*.655 (26)*	*.605 (26)*	*.206 (22)*	*.264 (25)*	*.325 (22)*	*.790 (22)*	*.699 (25)*	*.096 (25)*	*.378 (26)*	*.716 (25)*	*.678 (25)*	*.656 (25)*
Push-Up Score	correlation	-.021	-.086	-.057	-.131	-.116	-.129	-.139	-.025	.015	-.243	.115	.048	.005	-.083
	p-value (N)	*.914 (30)*	*.652 (30)*	*.764 (30)*	*.491 (30)*	*.572 (26)*	*.512 (28)*	*.506 (25)*	*.905 (26)*	*.940 (28)*	*.212 (28)*	*.544 (30)*	*.807 (29)*	*.980 (29)*	*.669 (29)*

Table S-4. MALES in ACU: Individual Events and Associated TASK Groups with Weight, Height, and Fitness Variables

		Bucket Fill	Sandbag Stack	FIGHTING POSITION TASK	Balance Beam	Over High Wall	MOUAT TASK	Tire Flip	Skedco Pull	Sandbag Toss	COMBAT TASK	Vehicle Door	Casualty Extraction	Casualty Drag	CASUALTY EVACUATION TASK
Weight	correlation	-.110	-.263	-.203	-.006	.019	.048	-.023	-.325	-.145	-.212	-.115	-.144	-.196	-.261
	p-value (N)	*.101 (224)*	*.000 (224)*	*.003 (218)*	*.933 (218)*	*.783 (224)*	*.481 (218)*	*.733 (224)*	*.000 (224)*	*.030 (224)*	*.001 (223)*	*.086 (223)*	*.032 (224)*	*.003 (223)*	*.000 (223)*
Height	correlation	-.135	-.264	-.232	-.131	-.059	-.114	-.119	-.283	-.256	-.246	-.055	-.109	-.253	-.247
	p-value (N)	*.043 (224)*	*.000 (224)*	*.001 (218)*	*.053 (218)*	*.379 (224)*	*.093 (218)*	*.077 (224)*	*.000 (224)*	*.000 (224)*	*.000 (223)*	*.412 (223)*	*.104 (224)*	*.000 (223)*	*.000 (223)*
BMI	correlation	-.042	-.137	-.085	.066	.054	.114	.046	-.198	-.009	-.088	-.099	-.097	-.073	-.149
	p-value (N)	*.536 (224)*	*.040 (224)*	*.210 (218)*	*.334 (218)*	*.425 (224)*	*.094 (218)*	*.491 (224)*	*.003 (224)*	*.895 (224)*	*.188 (223)*	*.139 (223)*	*.147 (224)*	*.279 (223)*	*.026 (223)*
Total APFT	correlation	-.156	-.040	-.125	-.064	-.025	-.120	-.118	-.041	-.146	-.105	-.050	-.056	.059	-.008
	p-value (N)	*.048 (160)*	*.612 (160)*	*.121 (155)*	*.429 (155)*	*.758 (160)*	*.137 (155)*	*.136 (160)*	*.607 (160)*	*.066 (160)*	*.188 (159)*	*.532 (159)*	*.479 (160)*	*.461 (160)*	*.923 (159)*
Run Time	correlation	.168	.265	.238	.169	.069	.223	.198	.124	.227	.164	.102	.104	-.019	.124
	p-value (N)	*.030 (167)*	*.001 (167)*	*.002 (161)*	*.032 (161)*	*.374 (167)*	*.004 (161)*	*.010 (167)*	*.111 (167)*	*.003 (167)*	*.035 (166)*	*.192 (166)*	*.182 (167)*	*.810 (167)*	*.112 (166)*
Run Score	correlation	-.184	-.222	-.265	-.161	-.129	-.242	-.235	-.096	-.266	-.173	-.127	-.125	.019	-.145
	p-value (N)	*.009 (200)*	*.002 (200)*	*.000 (194)*	*.025 (194)*	*.069 (200)*	*.001 (194)*	*.001 (200)*	*.176 (200)*	*.000 (200)*	*.015 (199)*	*.073 (199)*	*.078 (200)*	*.790 (200)*	*.041 (199)*
Sit-Up Reps	correlation	-.143	-.089	-.135	-.131	-.106	-.191	-.090	-.119	-.168	-.214	-.110	-.092	-.124	-.140
	p-value (N)	*.069 (162)*	*.262 (162)*	*.093 (157)*	*.102 (157)*	*.181 (162)*	*.017 (157)*	*.257 (162)*	*.133 (162)*	*.033 (162)*	*.006 (161)*	*.164 (161)*	*.242 (162)*	*.115 (162)*	*.077 (161)*
Sit-Up Score	correlation	-.188	-.099	-.250	-.062	-.107	-.121	-.172	-.096	-.191	-.215	-.136	-.103	-.122	-.172
	p-value (N)	*.008 (201)*	*.161 (201)*	*.000 (195)*	*.389 (195)*	*.130 (201)*	*.093 (195)*	*.015 (201)*	*.176 (201)*	*.007 (201)*	*.002 (200)*	*.054 (200)*	*.145 (201)*	*.085 (201)*	*.015 (200)*
Push-Up Reps	correlation	-.199	-.119	-.205	.029	-.093	-.089	-.225	-.116	-.119	-.188	-.073	-.053	-.044	-.110
	p-value (N)	*.011 (162)*	*.133 (162)*	*.010 (157)*	*.714 (157)*	*.239 (162)*	*.270 (157)*	*.004 (162)*	*.142 (162)*	*.130 (162)*	*.017 (161)*	*.354 (161)*	*.502 (162)*	*.582 (162)*	*.165 (161)*
Push-Up Score	correlation	-.200	-.124	-.261	-.005	-.121	-.135	-.223	-.114	-.110	-.172	-.096	-.078	-.018	-.128
	p-value (N)	*.004 (201)*	*.080 (201)*	*.000 (195)*	*.949 (195)*	*.088 (201)*	*.060 (195)*	*.001 (201)*	*.108 (201)*	*.121 (201)*	*.015 (200)*	*.176 (200)*	*.272 (201)*	*.803 (201)*	*.072 (200)*

Table S-5. MALES in FL: Individual Events and Associated Task Groups with Height, Weight and Fitness Variables

		Bucket Fill	Sandbag Stack	**FIGHTING POSITION TASK**	Balance Beam	Over High Wall	**MOUAT TASK**	Tire Flip	Skedco Pull	Sandbag Toss	**COMBAT TASK**	Vehicle Door	Casualty Extraction	Casualty Drag	**CASUALTY EVACUATION TASK**
Weight	correlation	-.096	-.178	-.201	.075	-.035	.024	-.151	-.328	-.124	-.279	-.173	-.046	-.233	-.261
	p-value (N)	*.155 (219)*	*.008 (219)*	*.003 (213)*	*.279 (212)*	*.606 (219)*	*.724 (211)*	*.027 (215)*	*.000 (217)*	*.068 (219)*	*.000 (214)*	*.011 (215)*	*.497 (219)*	*.001 (219)*	*.000 (216)*
Height	correlation	-.081	-.169	-.118	-.175	-.169	-.272	-.095	-.311	-.219	-.235	-.029	-.046	-.285	-.218
	p-value (N)	*.233 (219)*	*.012 (219)*	*.085 (213)*	*.011 (212)*	*.012 (219)*	*.000 (211)*	*.166 (215)*	*.000 (217)*	*.001 (219)*	*.001 (214)*	*.673 (215)*	*.498 (219)*	*.000 (219)*	*.001 (216)*
BMI	correlation	-.057	-.098	-.152	.182	.063	.185	-.105	-.187	-.004	-.170	-.174	-.016	-.104	-.167
	p-value (N)	*.398 (219)*	*.146 (219)*	*.027 (213)*	*.008 (212)*	*.354 (219)*	*.007 (211)*	*.124 (215)*	*.006 (217)*	*.949 (219)*	*.013 (214)*	*.011 (215)*	*.812 (219)*	*.125 (219)*	*.014 (216)*
Total APFT	correlation	-.083	-.077	-.070	-.150	-.026	-.169	-.223	-.028	-.147	-.171	-.017	-.071	-.174	-.197
	p-value (N)	*.306 (156)*	*.341 (156)*	*.392 (153)*	*.064 (152)*	*.743 (156)*	*.037 (152)*	*.006 (153)*	*.732 (154)*	*.067 (156)*	*.034 (154)*	*.837 (155)*	*.376 (156)*	*.030 (156)*	*.014 (155)*
Run Time	correlation	.135	.180	.154	.230	.239	.320	.269	.129	.262	.259	.090	.158	.113	.243
	p-value (N)	*.086 (163)*	*.021 (163)*	*.052 (160)*	*.004 (159)*	*.002 (163)*	*.000 (159)*	*.001 (160)*	*.102 (161)*	*.001 (163)*	*.001 (160)*	*.255 (161)*	*.044 (163)*	*.153 (163)*	*.002 (161)*
Run Score	correlation	-.233	-.234	-.250	-.209	-.215	-.282	-.275	-.159	-.228	-.249	-.087	-.123	-.139	-.235
	p-value (N)	*.001 (196)*	*.001 (196)*	*.000 (192)*	*.004 (191)*	*.002 (196)*	*.000 (190)*	*.000 (192)*	*.026 (194)*	*.001 (196)*	*.001 (191)*	*.232 (192)*	*.085 (196)*	*.052 (196)*	*.001 (193)*
Sit-Up Reps	correlation	.004	-.171	-.039	-.202	-.030	-.257	-.148	-.091	-.153	-.198	-.018	-.070	-.106	-.131
	p-value (N)	*.958 (158)*	*.032 (158)*	*.631 (155)*	*.012 (154)*	*.711 (158)*	*.001 (154)*	*.066 (155)*	*.260 (156)*	*.055 (158)*	*.013 (156)*	*.826 (157)*	*.383 (158)*	*.186 (158)*	*.101 (157)*
Sit-Up Score	correlation	-.059	-.205	-.111	-.153	-.063	-.228	-.170	-.048	-.114	-.178	-.011	.022	-.035	-.067
	p-value (N)	*.412 (197)*	*.004 (197)*	*.124 (193)*	*.034 (192)*	*.383 (197)*	*.002 (191)*	*.018 (193)*	*.501 (195)*	*.111 (197)*	*.014 (192)*	*.878 (193)*	*.755 (197)*	*.629 (197)*	*.352 (194)*
Push-Up Reps	correlation	-.221	-.236	-.270	-.107	-.031	-.163	-.328	-.169	-.195	-.299	-.100	.157	-.172	-.152
	p-value (N)	*.005 (158)*	*.003 (158)*	*.001 (155)*	*.187 (154)*	*.700 (158)*	*.043 (154)*	*.000 (155)*	*.035 (156)*	*.014 (158)*	*.000 (156)*	*.211 (157)*	*.049 (158)*	*.031 (158)*	*.058 (157)*
Push-Up Score	correlation	-.203	-.205	-.231	-.106	-.032	-.159	-.260	-.113	-.146	-.244	-.069	.168	-.024	-.054
	p-value (N)	*.004 (197)*	*.004 (197)*	*.001 (193)*	*.142 (192)*	*.651 (197)*	*.028 (191)*	*.000 (193)*	*.115 (195)*	*.040 (197)*	*.001 (192)*	*.342 (193)*	*.018 (197)*	*.736 (197)*	*.457 (194)*

Table S-6. MALES in FL After 6.2 Mile Road March: Individual Events and Associated TASK Groups with Weight, Height, &Fitness Variables

		Bucket Fill	Sandbag Stack	FIGHTING POSITION TASK	Balance Beam	Over High Wall	MOUAT TASK	Tire Flip	Skedco Pull	Sandbag Toss	COMBAT TASK	Vehicle Door	Casualty Extraction	Casualty Drag	CASUALTY EVACUATION TASK
Weight	correlation	-.106	-.193	-.194	.115	-.077	.040	.017	-.220	.012	-.100	.030	-.007	-.166	-.102
	p-value (N)	*.129 (206)*	*.006 (206)*	*.006 (202)*	*.103 (202)*	*.270 (206)*	*.576 (202)*	*.808 (204)*	*.002 (205)*	*.860 (206)*	*.153 (204)*	*.673 (204)*	*.926 (205)*	*.017 (205)*	*.148 (204)*
Height	correlation	-.162	-.261	-.242	-.079	-.269	-.209	-.118	-.220	-.087	-.193	-.080	.050	-.117	-.123
	p-value (N)	*.020 (206)*	*.000 (206)*	*.001 (202)*	*.266 (202)*	*.000 (206)*	*.003 (202)*	*.092 (204)*	*.002 (205)*	*.216 (206)*	*.006 (204)*	*.256 (204)*	*.479 (205)*	*.095 (205)*	*.080 (204)*
BMI	correlation	-.019	-.060	-.069	.173	.063	.163	.089	-.110	.057	.005	.081	-.038	-.113	-.039
	p-value (N)	*.783 (206)*	*.396 (206)*	*.330 (202)*	*.014 (202)*	*.368 (206)*	*.021 (202)*	*.203 (204)*	*.118 (205)*	*.417 (206)*	*.938 (204)*	*.251 (204)*	*.593 (205)*	*.108 (205)*	*.578 (204)*
Total APFT	correlation	-.096	-.052	-.058	-.204	.017	-.110	-.053	-.018	-.012	-.026	-.036	.041	-.227	-.159
	p-value (N)	*.239 (151)*	*.529 (151)*	*.480 (149)*	*.013 (149)*	*.833 (151)*	*.182 (149)*	*.517 (151)*	*.825 (151)*	*.881 (151)*	*.749 (149)*	*.666 (149)*	*.616 (150)*	*.005 (150)*	*.053 (149)*
Run Time	correlation	.184	.242	.224	.220	.129	.292	.227	.207	.179	.245	.188	-.008	.071	.170
	p-value (N)	*.021 (157)*	*.002 (157)*	*.005 (155)*	*.006 (155)*	*.108 (157)*	*.000 (155)*	*.004 (157)*	*.009 (157)*	*.025 (157)*	*.002 (155)*	*.019 (155)*	*.916 (156)*	*.379 (156)*	*.035 (155)*
Run Score	correlation	-.283	-.234	-.283	-.239	-.161	-.320	-.238	-.170	-.159	-.233	-.204	-.007	-.107	-.202
	p-value (N)	*.000 (188)*	*.001 (188)*	*.000 (184)*	*.001 (184)*	*.027 (188)*	*.000 (184)*	*.001 (187)*	*.020 (188)*	*.030 (188)*	*.001 (186)*	*.005 (186)*	*.928 (187)*	*.145 (187)*	*.006 (186)*
Sit-Up Reps	correlation	-.092	-.149	-.128	-.084	-.072	-.098	-.070	.061	.004	-.001	-.054	.040	-.087	-.060
	p-value (N)	*.259 (153)*	*.067 (153)*	*.119 (151)*	*.302 (151)*	*.379 (153)*	*.232 (151)*	*.390 (153)*	*.455 (153)*	*.961 (153)*	*.987 (151)*	*.509 (151)*	*.625 (152)*	*.284 (152)*	*.464 (151)*
Sit-Up Score	correlation	-.182	-.132	-.169	-.093	-.107	-.133	-.084	.093	-.009	.005	-.100	.050	-.110	-.100
	p-value (N)	*.012 (189)*	*.071 (189)*	*.021 (185)*	*.207 (185)*	*.142 (189)*	*.072 (185)*	*.249 (188)*	*.203 (189)*	*.899 (189)*	*.947 (187)*	*.174 (187)*	*.492 (188)*	*.132 (188)*	*.174 (187)*
Push-Up Reps	correlation	-.151	-.172	-.154	.016	-.155	-.076	-.051	.031	-.075	-.003	-.075	.164	-.108	-.074
	p-value (N)	*.062 (153)*	*.033 (153)*	*.059 (151)*	*.845 (151)*	*.056 (153)*	*.355 (151)*	*.530 (153)*	*.705 (153)*	*.357 (153)*	*.973 (151)*	*.361 (151)*	*.043 (152)*	*.186 (152)*	*.369 (151)*
Push-Up Score	correlation	-.145	-.152	-.156	-.004	-.149	-.090	-.114	.071	-.047	-.022	-.103	.059	-.072	-.092
	p-value (N)	*.047 (189)*	*.037 (189)*	*.033 (185)*	*.961 (185)*	*.041 (189)*	*.224 (185)*	*.120 (188)*	*.330 (189)*	*.518 (189)*	*.768 (187)*	*.159 (187)*	*.424 (188)*	*.324 (188)*	*.208 (187)*

Table S-7. DAY 1, Soldier's In ACU Performed Each Task Separately in Random Order: Correlation of Field Events with Eachother

		Bucket	Stack	FightPosTASK	Beam	HighWall	MOUT-TASK	TireFlip	Skedco	SandbagToss	CombatTASK	Vehicle Door	CasualtyExtract	Casualty Drag	CasualtyEvacTASK
Bucket	Pearson r	1													
	Sig. (2-tailed)														
	N	248													
Stack	Pearson r	**.465**	1												
	Sig. (2-tailed)	.000													
	N	246	246												
FightPosTASK	Pearson r	**.821**	**.874**	1											
	Sig. (2-tailed)	.000	.000												
	N	241	241	241											
Beam	Pearson r	.000	.085	.043	1										
	Sig. (2-tailed)	.999	.186	.507											
	N	246	244	239	261										
HighWall	Pearson r	.316	**.509**	**.487**	.070	1									
	Sig. (2-tailed)	.000	.000	.000	.264										
	N	244	242	237	259	259									
MOUT-TASK	Pearson r	.186	.359	.317	**.830**	**.587**	1								
	Sig. (2-tailed)	.003	.000	.000	.000	.000									
	N	246	244	239	261	259	261								
TireFlip	Pearson r	.317	**.553**	**.435**	.077	**.408**	.298	1							
	Sig. (2-tailed)	.000	.000	.000	.221	.000	.000								
	N	242	240	235	254	252	254	258							
Skedco	Pearson r	.298	**.552**	**.469**	**.079**	**.422**	.290	**.611**	1						
	Sig. (2-tailed)	.000	.000	.000	.208	.000	.000	.000							
	N	241	239	234	254	252	254	257	257						
Sandbag Toss	Pearson r	.247	**.515**	**.440**	.095	.382	.287	**.555**	**.580**	1					
	Sig. (2-tailed)	.000	.000	.000	.136	.000	.000	.000	.000						
	N	238	236	231	250	248	250	251	251	253					
Combat TASK	Pearson r	.347	**.697**	**.598**	.089	**.552**	.386	**.716**	**.887**	**.819**	1				
	Sig. (2-tailed)	.000	.000	.000	.154	.000	.000	.000	.000	.000					
	N	245	243	238	258	256	258	258	257	253	262				
Vehicle Door	Pearson r	.153	.218	.163	.052	.222	.172	**.448**	.285	.372	.308	1			
	Sig. (2-tailed)	.018	.001	.012	.408	.000	.006	.000	.000	.000	.000				
	N	241	240	235	253	251	253	251	250	245	254	257			
Casualty Extract	Pearson r	.172	.298	.264	-.051	.276	.098	.267	.390	.257	.388	-.042	1		
	Sig. (2-tailed)	.008	.000	.000	.422	.000	.123	.000	.000	.000	.000	.508			
	N	240	239	234	252	250	252	250	249	244	253	256	256		
Casualty Drag	Pearson r	.343	**.511**	**.497**	.039	**.530**	.313	**.474**	**.517**	**.415**	**.604**	.182	.359	1	
	Sig. (2-tailed)	.000	.000	.000	.538	.000	.000	.000	.000	.000	.000	.004	.000		
	N	239	238	233	251	249	251	249	248	245	252	255	254	255	
CasualtyEvac TASK	Pearson r	.331	**.545**	**.499**	.035	**.528**	.314	**.551**	**.581**	**.486**	**.656**	.316	**.509**	**.909**	1
	Sig. (2-tailed)	.000	.000	.000	.585	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	240	239	234	252	250	252	250	249	244	253	256	255	254	256

Table S-8. DAY 1, Soldiers In ACU Performed Each Task in Order through Course: Correlation of Field Events with Each Other

		Bucket	Stack	FightPos TASK	Beam	HighWall	MOUT-TASK	TireFlip	Skedco	Sandbag Toss	Combat TASK	Vehicle Door	Casualty Extract	Casualty Drag	Casualty EvacTASK
Bucket	Pearson r	1													
	Sig. (2-tailed)														
	N	265													
Stack	Pearson r	**.448**	1												
	Sig. (2-tailed)	.000													
	N	265	265												
FightPos TASK	Pearson r	**.812**	**.800**	1											
	Sig. (2-tailed)	.000	.000												
	N	258	258	258											
Beam	Pearson r	.238	.179	.061	1										
	Sig. (2-tailed)	.000	.004	.329											
	N	258	258	258	258										
HighWall	Pearson r	.189	**.441**	.311	.093	1									
	Sig. (2-tailed)	.002	.000	.000	.138										
	N	265	265	258	258	265									
MOUT-TASK	Pearson r	.333	.358	.218	**.867**	**.491**	1								
	Sig. (2-tailed)	.000	.000	.000	.000	.000									
	N	258	258	258	258	258	258								
TireFlip	Pearson r	.354	**.621**	**.547**	.319	.329	**.405**	1							
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000								
	N	263	263	256	256	263	256	263							
Skedco	Pearson r	.292	**.677**	**.590**	.128	.394	.307	**.635**	1						
	Sig. (2-tailed)	.000	.000	.000	.041	.000	.000	.000							
	N	263	263	256	256	263	256	263	263						
Sandbag Toss	Pearson r	.310	**.652**	**.526**	.299	.388	**.423**	**.580**	**.614**	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000						
	N	261	261	254	254	261	254	260	260	261					
Combat TASK	Pearson r	.389	**.738**	**.659**	.254	**.426**	**.428**	**.806**	**.892**	**.780**	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000					
	N	264	264	257	257	264	257	262	262	260	264				
Vehicle Door	Pearson r	.048	.130	.111	.006	.086	.008	.132	.098	.019	.030	1			
	Sig. (2-tailed)	.433	.034	.075	.918	.162	.892	.032	.115	.764	.626				
	N	264	264	257	257	264	257	262	262	260	264	264			
Casualty Extract	Pearson r	.203	.273	.250	.320	.162	.352	.318	.276	.308	.325	.059	1		
	Sig. (2-tailed)	.001	.000	.000	.000	.008	.000	.000	.000	.000	.000	.341			
	N	264	264	257	257	264	257	262	262	260	263	263	264		
Casualty Drag	Pearson r	.337	**.519**	**.479**	.161	.303	.271	**.468**	**.653**	**.464**	**.636**	.135	.108	1	
	Sig. (2-tailed)	.000	.000	.000	.010	.000	.000	.000	.000	.000	.000	.029	.081		
	N	263	263	256	256	263	256	261	261	260	262	262	262	263	
Casualty Evac TASK	Pearson r	.345	**.543**	**.512**	.174	.296	.269	**.497**	**.615**	**.446**	**.586**	**.577**	.379	**.783**	1
	Sig. (2-tailed)	.000	.000	.000	.005	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	264	264	257	257	264	257	262	262	260	264	264	263	262	264

Table S-9. DAY 2, Soldiers In Fighting Load (FL) Performed Each Task in Order through Course: Correlation of Field Events with Each Other

		Bucket	Stack	FightPos TASK	Beam	HighWall	MOUT-TASK	TireFlip	Skedco	Sandbag Toss	Combat TASK	Vehicle Door	Casualty Extract	Casualty Drag	Casualty EvacTASK
Bucket	Pearson r	1													
	Sig. (2-tailed)														
	N	259													
Stack	Pearson r	.524	1												
	Sig. (2-tailed)	.000													
	N	259	259												
FightPos TASK	Pearson r	.796	.911	1											
	Sig. (2-tailed)	.000	.000												
	N	253	253	253											
Beam	Pearson r	.396	.508	.455	1										
	Sig. (2-tailed)	.000	.000	.000											
	N	252	252	252	252										
HighWall	Pearson r	.315	.577	.536	.212	1									
	Sig. (2-tailed)	.000	.000	.000	.001										
	N	255	255	249	248	255									
MOUT-TASK	Pearson r	.436	.716	.634	.695	.745	1								
	Sig. (2-tailed)	.000	.000	.000	.000	.000									
	N	251	251	251	250	247	251								
TireFlip	Pearson r	.379	.595	.597	.251	.376	.441	1							
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000								
	N	251	251	245	244	250	245	251							
Skedco	Pearson r	.421	.716	.678	.311	.519	.610	.615	1						
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000							
	N	253	253	247	246	252	245	251	253						
SandbagToss	Pearson r	.327	.706	.630	.381	.464	.506	.492	.550	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000						
	N	258	258	252	251	255	250	251	253	258					
Combat TASK	Pearson r	.469	.756	.726	.360	.568	.553	.824	.855	.793	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000					
	N	254	254	248	247	250	248	248	248	253	254				
VehicleDoor	Pearson r	.269	.266	.305	.155	.266	.196	.311	.321	.225	.357	1			
	Sig. (2-tailed)	.000	.000	.000	.015	.000	.002	.000	.000	.000	.000				
	N	255	255	249	248	251	247	247	249	254	253	255			
CasualtyExtract	Pearson r	.138	.354	.302	.162	.256	.282	.090	.220	.354	.257	.072	1		
	Sig. (2-tailed)	.026	.000	.000	.010	.000	.000	.154	.000	.000	.000	.253			
	N	259	259	253	252	255	251	251	253	258	254	255	259		
CasualtyDrag	Pearson r	.375	.660	.616	.281	.470	.571	.358	.630	.466	.533	.126	.248	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.044	.000		
	N	258	258	252	251	254	250	250	252	257	253	254	258	258	
Casualty Evac TASK	Pearson r	.462	.709	.684	.349	.589	.629	.443	.679	.540	.640	.534	.436	.832	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	256	256	250	249	252	248	248	250	255	254	255	256	255	256

Table S-10. DAY 3, Soldiers In FL Performed Each Task in Order through Course After 6.2 Road March: Correlation of Field Events with Each Other

		Bucket	Stack	FightPos TASK	Beam	HighWall	MOUT-TASK	TireFlip	Skedco	Sandbag Toss	Combat TASK	Vehicle Door	Casualty Extract	Casualty Drag	Casualty EvacTASK
Bucket	Pearson r	1													
	Sig. (2-tailed)														
	N	239													
Stack	Pearson r	.656	1												
	Sig. (2-tailed)	.000													
	N	239	239												
FightPos TASK	Pearson r	.888	.904	1											
	Sig. (2-tailed)	.000	.000												
	N	235	235	235											
Beam	Pearson r	.475	.549	.494	1										
	Sig. (2-tailed)	.000	.000	.000											
	N	235	235	235	238										
HighWall	Pearson r	.477	.608	.596	.263	1									
	Sig. (2-tailed)	.000	.000	.000	.000										
	N	235	235	231	234	239									
MOUT-TASK	Pearson r	.596	.764	.708	.796	.713	1								
	Sig. (2-tailed)	.000	.000	.000	.000	.000									
	N	233	233	233	233	230	233								
TireFlip	Pearson r	.368	.601	.533	.405	.592	.608	1							
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000								
	N	232	232	229	232	234	229	235							
Skedco	Pearson r	.456	.525	.527	.441	.367	.565	.465	1						
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000							
	N	234	234	230	230	233	229	232	234						
Sandbag Toss	Pearson r	.394	.479	.477	.313	.526	.590	.576	.396	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000						
	N	237	237	233	233	234	231	231	233	237					
Combat TASK	Pearson r	.533	.727	.690	.538	.599	.750	.835	.765	.713	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000					
	N	235	235	231	231	232	231	230	231	233	235				
Vehicle Door	Pearson r	.290	.326	.335	.209	.363	.348	.479	.297	.907	.326	1			
	Sig. (2-tailed)	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000				
	N	237	237	233	233	233	231	230	232	235	235	237			
Casualty Extract	Pearson r	.161	.286	.247	.174	.181	.246	.174	.251	.186	.271	.039	1		
	Sig. (2-tailed)	.013	.000	.000	.008	.006	.000	.008	.000	.004	.000	.556			
	N	236	236	232	232	233	231	230	232	234	233	234	236		
Casualty Drag	Pearson r	.384	.481	.467	.378	.407	.494	.519	.635	.398	.593	.200	.200	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.002	.002		
	N	235	235	231	231	232	230	229	231	233	232	233	235	235	
Casualty Evac TASK	Pearson r	.451	.687	.619	.455	.542	.659	.642	.663	.590	.723	.540	.465	.731	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	236	236	232	232	233	231	230	232	234	235	236	234	233	236

Table S-11. 6.2 Mile Road March Time Correlated with Height, Weight, and APFT Variables

		Weight	Height	BMI	APFT Self-Reported	APFT Recalculated	2 Mile Run Time Self-Reported	2 Mile Run Score Recalculated	2 Mile Run Score Combining Self Report + Recalculated	Push Up Reps Self-Reported	Push-Up Score Recalculated	Push-Up Score Combining Self Report + Recalculated	Sit Up Reps Self-Reported	Sit-Up Score Recalculated	Sit-Up Score Combining Self Report + Recalculated
Road March	Pearson r	-.257	-.321	-.101	-.106	-.114	**.405**	-.101	-.100	-.345	-.061	-.070	-.213	-.220	-.165
Time:	Sig. (2-tailed)	.000	.000	.114	.151	.131	.000	.173	.137	.000	.415	.296	.004	.003	.014
ALL	N	246	246	246	184	178	187	185	222	182	180	223	181	179	223

Table S-12. 6.2 Mile Road March Time Correlated with Task and Associated Individual Events (Day 3, after Road March)

		Bucket Fill	Sandbag Stack	**Fighting Position Task**	Balance Beam	Over High Wall	**MOUT Task**	Tire Flip	Skedco Pull	Sandbag Toss	**Combatives Task**	Vehicle Door	Casualty Extraction	Casualty Drag	**Casualty Evacuation Task**
Road March	Pearson r	.351	**.467**	**.467**	.268	.256	.347	.389	.263	.266	.388	.208	.091	.241	.304
Time:	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.169	.000	.000
ALL	N	232	232	228	228	228	226	225	227	230	228	230	230	229	229
Road March	Pearson r	.182	.352	.310	.140	.088	.174	.284	.118	.173	.231	.078	.056	.181	.184
Time:	Sig. (2-tailed)	.010	.000	.000	.050	.217	.015	.000	.096	.014	.001	.276	.435	.010	.009
MALES	N	200	200	196	196	200	196	198	199	200	198	198	200	200	198
Road March	Pearson r	.260	.082	.218	-.013	-.017	-.137	-.006	-.011	.338	-.097	.390	-.338	-.300	-.302
Time:	Sig. (2-tailed)	.150	.656	.231	.944	.930	.470	.978	.955	.068	.611	.027	.068	.114	.098
FEMALES	N	32	32	32	32	28	30	27	28	30	30	32	30	29	31