

# EOD Warrior-Athlete Working Group II: Forging the Future of the EOD Warrior-Athlete Training Program



# NHRC

NAVAL HEALTH RESEARCH CENTER

CDMCM Jeremiah Stump<sup>1</sup>, LCDR Brian Reitter<sup>2</sup>, LTJG Colton Kawamura<sup>3</sup>, EODC Harry Basnight<sup>4</sup>, CWO4 Dirk Palmer<sup>2</sup>, EODCS Charles Yohnke<sup>5</sup>, EODCM William Fancher<sup>6</sup>, EODCM Steve Fellman<sup>7</sup>, CDR Michael Tripp<sup>2</sup>, EODCM Justin Mayo<sup>1</sup>, EODCM Ryan Anderson<sup>2</sup>, CDR Anthony Tucker<sup>5</sup>, HMC Steve Sevier<sup>5</sup>, LT Anna Mansueti<sup>8</sup>, ENS Barry Despot<sup>8</sup>, EODCS Chad Munroe<sup>1</sup>, LT Sarah Anderson<sup>2</sup>, HM1 Shaun Egly<sup>6</sup>


Lisa M. Hernández, MS<sup>9</sup>, Shiloah A. Kviatkovsky, MS<sup>9</sup>, Genie Leah A. Padilla<sup>9</sup>, Matthew R. Schoenherr, MS<sup>9</sup>, Stephanie D. Coffin<sup>9</sup>, Dianna C. Laver<sup>9</sup>, Kathrine A. Haluch<sup>9</sup>, Aaron J. Wolf, MS<sup>9</sup>, Stefania Marzano, MA<sup>9</sup>, Jason M. Bailie, PhD<sup>10</sup>, Jennifer A. Webb-Murphy, PhD<sup>11</sup>, CDR Shawn E. Soutiere<sup>12</sup>, Pinata H. Sessoms, PhD<sup>12</sup>, Marcus K. Taylor, PhD<sup>12</sup>

<sup>1</sup>EODTEU ONE, San Diego, CA; <sup>2</sup>COMEODGRU ONE, San Diego, CA; <sup>3</sup>EODMU THREE, San Diego, CA; <sup>4</sup>EODTEU TWO, Ft. Story, VA; <sup>5</sup>COMEODGRU TWO, Little Creek, VA; <sup>6</sup>EODMU FIVE, Santa Rita, Guam; <sup>7</sup>EODMU TWELVE, Virginia Beach, VA; <sup>8</sup>EODMU ELEVEN, Imperial Beach, CA; <sup>9</sup>Leidos, San Diego, CA; <sup>10</sup>Defense and Veterans Brain Injury Center, Camp Pendleton, CA; <sup>11</sup>Naval Center for Combat and Operational Stress Control, San Diego, CA; <sup>12</sup>Warfighter Performance Department, Naval Health Research Center, San Diego, CA

**Disclaimer:** I am a military service member or employee of the U.S. Government. This work was prepared as part of my official duties. Title 17, U.S.C. §105 provides that copyright protection under this title is not available for any work of the U.S. Government. Title 17, U.S.C. §101 defines a U.S. Government work as work prepared by a military service member or employee of the U.S. Government as part of that person's official duties. Report No. 18-03 was supported by the Congressionally Directed Medical Research Programs, Joint Program Committee-5, under work unit no. N1511. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of the Army, Department of the Air Force, Department of Veterans Affairs, Department of Defense, or the U.S. Government. Approved for public release; distribution unlimited. Human subjects participated in this study after giving their free and informed consent. This research was conducted in compliance with all applicable federal regulations governing the protection of human subjects in research (Protocol NHRC.2015.0013).

**REVIEWED AND APPROVED BY:**

1/4/2018

 **Marshall Monteville**

---

Signed by: MONTEVILLE, MARSHALL RENO: 1179972869

04 JAN 2018

Date

CAPT Marshall M. Monteville, PhD, MSC, USN

Commanding Officer

Naval Health Research Center

140 Sylvester Rd.

San Diego, CA 92106-3521

## **EXECUTIVE SUMMARY**

### **Bottom Line Up Front**

The Explosive Ordnance Disposal (EOD) Warrior-Athlete Working Group II was convened to establish the way forward for Educational Programming and Individualized Training for the EOD Warrior-Athlete Training Program (WATP). This Working Group determined that both Educational Programming and Individualized Training should: (1) be data- and operator-driven (i.e., “for EOD, by EOD”); (2) be a standardized program delivered by contracted subject matter experts (SMEs) at East and West Coast fleet concentration areas; and (3) include on-demand, mobile capabilities.

### **Background**

In 2014, the first EOD Warrior-Athlete Working Group convened to develop the WATP. Three critical elements (exercise physiology/nutrition, injury prevention/rehabilitation, and combat mindset) and three phases of implementation (Assessment, Educational Programming, and Individualized Training) were identified. Subsequently, Naval Health Research Center (NHRC) developed Phase 1 (Assessment), yielding a *comprehensive database* of EOD operator metrics.

### **Problem Statement**

There is a need to envision, develop, and formalize Educational Programming and Individualized Training within the WATP.

### **Process**

Eighteen active duty stakeholders in the EOD community teamed with 14 scientists from NHRC, Naval Center for Combat and Operational Stress Control, and Defense and Veterans Brain Injury Center to establish requirements for Phases 2 (Educational Programming) and 3 (Individualized Training).

### **Phase 2 (Educational Programming) Requirements, Key Components, and Resources**

The Working Group determined that the requirements for Educational Programming must be propelled by data derived from Phase 1 (Assessment); it should also be driven *by* the EOD operator, *for* the EOD operator. Educational Programming must be standardized and delivered by contracted SMEs at East and West Coast fleet concentration areas. Finally, Educational Programming should include on-demand, mobile capabilities to ensure forcewide access.

### **Phase 3 (Individualized Training) Requirements, Key Components, and Resources**

Similar requirements were identified for Individualized Training. Additionally, Phase 3 must blend individualized goals with broader EOD performance requirements.

### **Budget and Phasing Plan**

A proposed budget will be finalized after EOD conducts a manpower and throughput analysis.

### **Program Evaluation**

Educational Programming and Individualized Training will be evaluated by Phase 1 (Assessment) data (e.g., performance improvement, injury prevalence reduction), participant evaluations, participant testing/evaluation, WATP demand signal, and other indicators.

**Table of Contents**

Bottom Line Up Front..... 05

Background..... 05

Recap of Warrior-Athlete Working Group I..... 06

Establishment of Operator Metrics ..... 07

Problem Statement ..... 07

Process ..... 07

Phase 1 (Assessment) Update ..... 08

Phase 2 (Educational Programming): Requirements, Key Components, and Resources ..... 11

    1. Purpose ..... 11

    2. Requirements and Key Components ..... 11

    3. Resources..... 12

Phase 3 (Individualized Training): Requirements, Key Components, and Resources ..... 12

    1. Purpose ..... 12

    2. Requirements and Key Components ..... 12

    3. Resources..... 14

Budget and Phasing Plan ..... 14

Program Evaluation ..... 14

Conclusion ..... 14

References..... 15

Dedication..... 16

Appendix A: Meeting Agenda..... 17

Appendix B: EOD Warrior-Athlete Working Group II Photo..... 20

Appendix C: Scientific Support Team Presentations..... 21

## **BOTTOM LINE UP FRONT**

The U.S. Navy Explosive Ordnance Disposal (EOD) is the world's premier combat force for countering explosive hazards. The modern EOD Warrior-Athlete must maintain superior physical fitness, resistance to musculoskeletal injury, and a strong combat mindset. In 2014, the first EOD Warrior-Athlete Working Group convened to develop the Warrior-Athlete Training Program (WATP; Stump et al., 2014). Three critical elements (exercise physiology/nutrition, injury prevention/rehabilitation, and combat mindset) and three phases of implementation (Assessment, Educational Programming, and Individualized Training) were identified. Subsequently, Naval Health Research Center (NHRC) developed a prototype of Phase 1 (Assessment), yielding a *comprehensive database* of EOD operator metrics.

In January 2017, the EOD Warrior-Athlete Working Group II was convened to establish the way forward for Phase 2 (Educational Programming) and Phase 3 (Individualized Training) of WATP. This Working Group determined that both phases should: (1) be data- and operator-driven (i.e., “for EOD, by EOD”); (2) become an EOD Individual Readiness Requirement; (3) be a standardized program, delivered by contracted subject matter experts (SMEs) at East and West Coast fleet concentration areas; and (4) include on-demand, mobile capabilities to ensure forcewide access. This report summarizes the processes and conclusions of this Working Group.

## **BACKGROUND**

The U.S. Navy EOD is the leading, worldwide combat force for countering explosive hazards, including improvised explosive devices, weapons of mass destruction, underwater mines, and other types of weaponry. EOD operators are highly-trained, skilled Warriors with expertise in explosives, diving, and parachuting. They render safe all types of ordnance, including conventional, improvised, chemical, biological, radiological, and nuclear weapons. Operators specialize in complex, clandestine operations routinely embedded within units of U.S. Special Operations Command, including direct action support of U.S. Navy Sea, Air, and Land teams (SEALs) and Army Special Forces.

As evidenced in recent conflicts, the modern EOD Warrior-Athlete must regularly demonstrate and maintain: (1) superior physical fitness, comprising muscular strength, explosive power (exerting maximal force in the shortest time possible), aerobic endurance, and resilience to environmental extremes; (2) resistance to and/or rapid recovery from musculoskeletal injury and fatigue; and (3) a strong combat mindset, which allows for the preservation of high neurocognitive functioning and tactical awareness, despite exposure to chronic/extreme operational stress.

The aforementioned demands, which are remarkably similar to those placed on elite competitive athletes (Stump et al., 2014), are routinely exacerbated by unpredictable operational requirements, unforgiving extreme environments, life-or-death contexts, and combat trauma. An in-theater study of expeditionary sailors deployed to Afghanistan showed that 9 of 73 EOD operators (12.5%) sustained a head injury during the current deployment, while 37.0% reported high levels of combat exposure as measured by a standardized scale. More than half (51.6%) reported receiving at least 1 hour less sleep per night than that required to feel well rested (Stump et al., 2014).

## RECAP OF WARRIOR-ATHLETE WORKING GROUP I

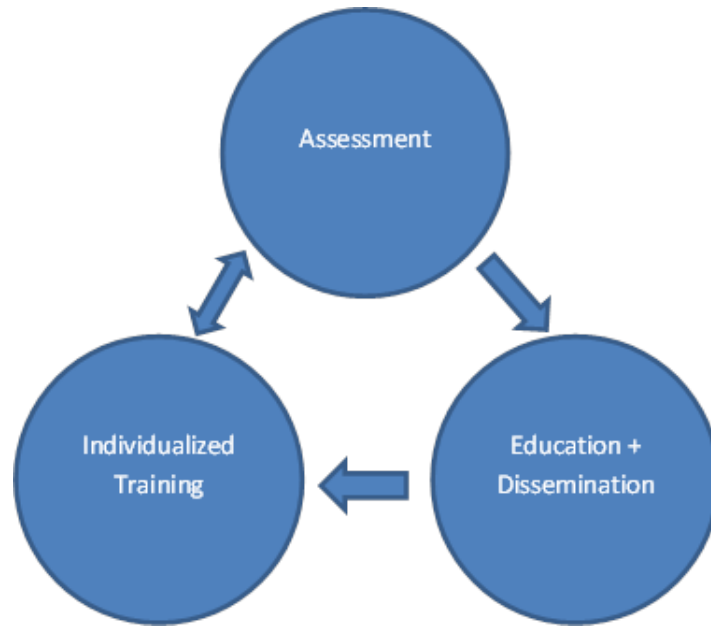
In 2014, EOD leadership articulated a **capability gap**, as there was no established program to promote and sustain health and readiness across the EOD career. Accordingly, there was a need to envision, develop, implement, and institutionalize an EOD WATP. With this in mind, the first EOD Warrior-Athlete Working Group convened to form the WATP. Eleven active duty stakeholders in the EOD community teamed with 15 scientists from NHRC and the San Diego State University Doctor of Physical Therapy Program to outline a comprehensive EOD Warrior-Athlete Training Program (Stump et al., 2014).

First, the Working Group outlined specific physical (e.g., muscular strength, aerobic endurance), mental (e.g., performance under extreme stress), and environmental operational requirements (e.g., extreme temperatures, dehydration) for all EOD Warrior-Athletes. Following this, three critical elements of the EOD WATP were identified: (1) exercise physiology/nutrition, (2) injury prevention/rehabilitation, and (3) combat mindset (Figure 1).



**Figure 1.** Three critical elements of the EOD Warrior-Athlete Training Program.

The Working Group then identified three phases of implementation (Figure 2), including: (1) Assessment (establish baseline markers of readiness to inform targeted educational approaches and individualized training), (2) Educational Programming (disseminate forcewide instructions to optimize physical and mental readiness), and (3) Individualized Training (provide scientifically-derived training programs which meet the needs of each EOD Warrior-Athlete). Scalable cost estimation was provided, and three overlapping funding lines were identified. Finally, it was determined that program efficacy should be measured via longitudinal assessment results, performance on standardized training regimens, injury/attrition rates, and operator evaluations.



**Figure 2.** Three phases of the EOD Warrior-Athlete Training Program.

### ESTABLISHMENT OF OPERATOR METRICS

After the conclusion of Warrior-Athlete Working Group I, NHRC launched a comprehensive study of health and readiness characteristics of EOD Warrior-Athletes (The “EOD Health Study,” Institutional Review Board Protocol NHRC.2015.0013, sponsored by the Office of Naval Research and Congressionally Directed Medical Research Programs). This study yields over 2,000 data points for each participant and serves the following scientific and translational functions for the EOD community:

- Identifies physical and mental determinants of health and readiness in EOD Warrior-Athletes (Fuller, 2017; Hernández & Taylor, 2017)
- Serves as a prototype of Phase 1 (Assessment), yielding a *comprehensive database* of operator metrics representing all three Critical Elements of the WATP
- Establishes a “baseline” of EOD health and readiness, by which WATP efficacy can be evaluated

### PROBLEM STATEMENT

Building upon these recent successes, EOD refined its description of the **capability gap**. Armed with a newly-established prototype of Phase 1 (Assessment), there is now a need to envision, develop, and formalize Phase 2 (Educational Programming) and Phase 3 (Individualized Training) within the WATP.

### PROCESS

Fifteen active duty stakeholders in the EOD community teamed with 14 scientists from NHRC, Naval Center for Combat and Operational Stress Control, and Defense and Veterans Brain Injury

Center to establish the way forward for WATP Phases 2 (Educational Programming) and 3 (Individualized Training). This team was named the EOD Warrior-Athlete Working Group II.

The meeting was held 25–26 JAN 2017 at the Warfighter Performance Department, NHRC, San Diego, California (see Appendix A for full agenda). During those 2 days, the Working Group achieved four milestones:

- Described the status of the force, driven by a summary of Phase 1 (Assessment) data
- Established requirements for:
  - WATP Phase 2 (Educational Programming)
  - WATP Phase 3 (Individualized Training)
- Defined, described, outlined, and planned Phase 2 (Educational Programming)
- Defined, described, outlined, and planned Phase 3 (Individualized Training)

### **PHASE 1 (ASSESSMENT) UPDATE**

As of January 2017, 61 EOD personnel have participated in the EOD Health Study. The majority were male (n=58) and Caucasian (84.4%) with a mean age of  $35.7 \pm 6.8$  years. Forty-eight percent had deployed 4 times in their military career, and 70.5% reported 10 or more years of service. Since September 11, 2001, the total number of years deployed ranged from 1 (n=9) to 7 (n=1) years, and 34.4% had been deployed for a total of 3 years.

#### ***Exercise Physiology and Nutrition (Critical Element #1)***

##### **Strengths**

- All participants met the American College of Sports Medicine/American Heart Association guidelines for aerobic exercise (Pescatello et al., 2014).
- Optimal values were observed in 79.3% of participants for a unique marker of cardiometabolic risk (adipose tissue surrounding the internal organs).
- For measures of muscular strength, 94.6% and 90.7% were able to lift their body weight for the maximum back squat and chest press, respectively.

##### **Vulnerabilities**

- One-third (34.5%) of participants had above normal resting blood pressure (either pre-hypertensive or hypertensive).
- One in three (32.0%) and one in two (46.6%) participants were ranked as “fair” to “very poor” for aerobic fitness and body composition, respectively (Figure 3).

#### ***Injury Prevention and Rehabilitation (Critical Element #2)***

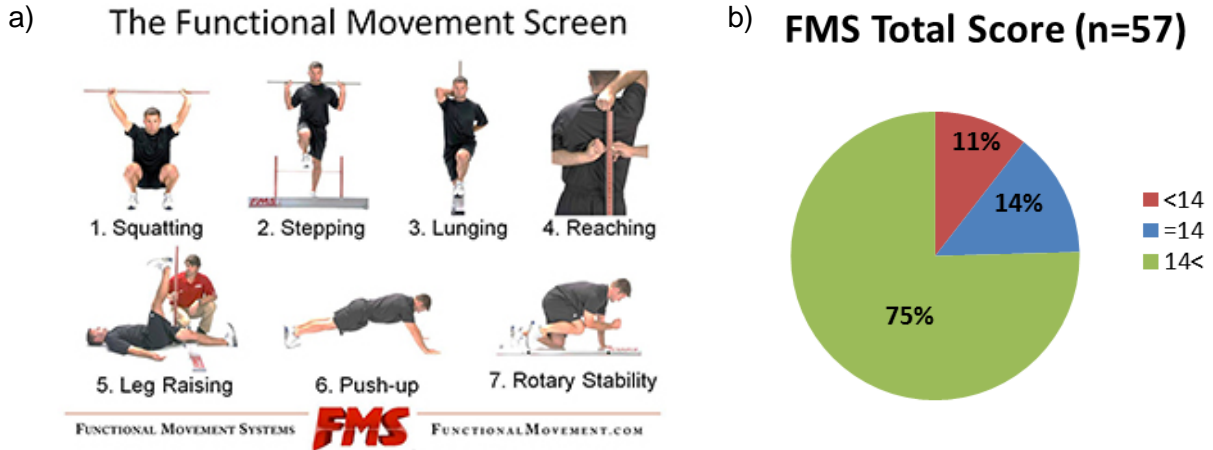
##### **Strengths**

- 75.4% had acceptable functional movement screen (FMS) total scores (Service et al., 2017; Figure 3).
- More than 58% demonstrated no significant limb asymmetry (an injury risk factor).

##### **Vulnerabilities**

- During their military career, 1 in 10 participants (9.8%) reported receiving a positive diagnosis for traumatic brain injury or concussion, 65.6% were within 50 meters of a blast, 26.2% sustained a direct blow to the head, and 21.3% had any type of head injury (Wolf et al., 2016).
- Nearly one half (47.5%) endorsed sustaining both upper and lower body injuries, 13.1% for head/neck and 27.9% for trunk injuries.

**Figure 3.** FMS: (a) movement tests and (b) EOD Health Study total scores.



**Combat Mindset (Critical Element #3)**

**Strengths**

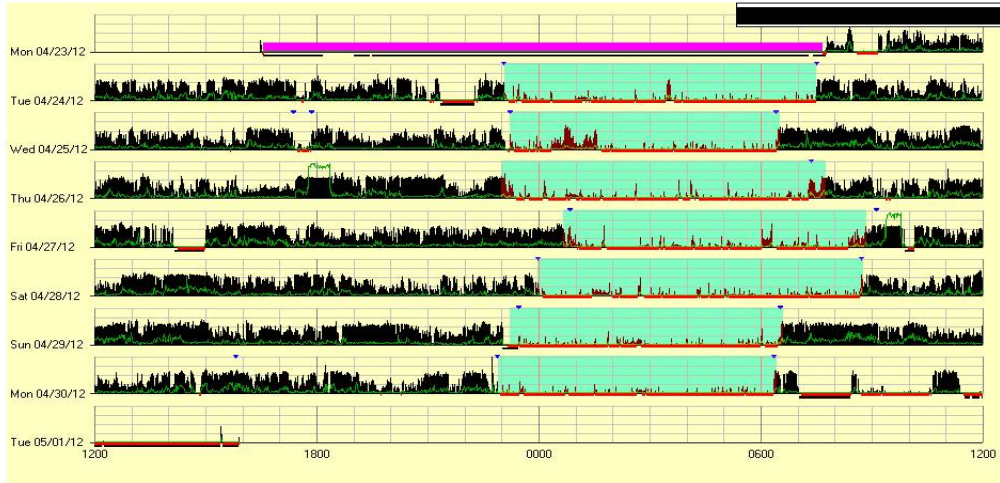
- In neurocognitive assessments (i.e., spatial working memory and visual memory/learning), the majority scored in the 75th–100th percentiles for their age.
- Most participants endorsed relatively frequent use of seven performance strategies (e.g., emotional control, goal setting) in both training and operations (Taylor et al., 2008).
- Anabolic hormones (e.g., testosterone) were similar to comparison groups (SEALs and male athletes; Taylor et al., 2016).

**Vulnerabilities**

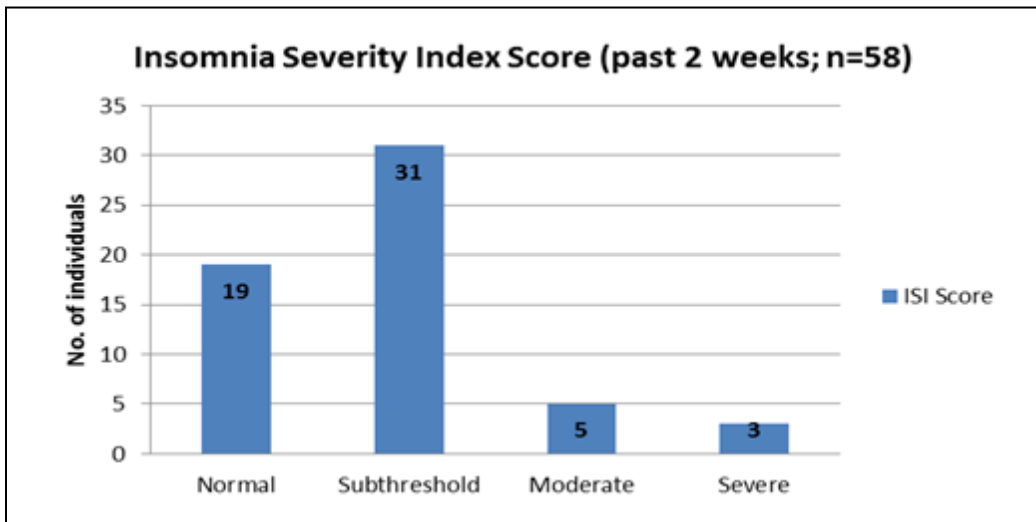
- Two out of three participants (67.2%) reported symptoms that met criteria for subthreshold, moderate, or severe insomnia (Figure 4).
- Two out of three participants (68.0%) did not meet the recommendation for 7+ hours of sleep per night (Watson et al., 2015).
- Underutilization of some performance strategies (e.g., relaxation and mental imagery) was observed in this sample, which can affect mission outcomes. These strategies are relatively simple to integrate into current training.

**Figure 4.** Sleep: (a) example of actigraphy data and (b) EOD Health Study Insomnia Severity Index scores.

a)



b)



### ***Results of the EOD Health Satisfaction Survey***

In response to a follow-up survey request, 26% of personnel that participated in the EOD Health Study (16 of 61) completed an anonymous survey. Five types of assessments (exercise physiology, nutrition, injury prevention, combat mindset, and sleep) were critiqued. With the exception of the sleep portion, the majority enjoyed completing the assessments (88–100%) and felt the staff explained the results well (94–100%). Most agreed (81–94%) the feedback given would help them become better at their job and they learned something new about their body, health, and fitness. The sleep assessment (wearing an actigraphy watch and doing at-home saliva sampling) had the most diverse responses. Between 44% and 56% agreed to enjoying the assessment, the results were well explained, the feedback was helpful, and they learned something new; the rest disagreed, were neutral, or chose “not applicable.”

Participants were also asked the extent to which they could follow the individualized recommendations included in their feedback. For all assessments, many (44–84%) chose either “a lot” or “quite a bit”; about 13–31% responded “some”; and the remaining selected “not at all,” “a little,” or “not applicable.”

## **PHASE 2 (EDUCATIONAL PROGRAMMING): REQUIREMENTS, KEY COMPONENTS, AND RESOURCES**

### **Purpose**

The purpose of this phase is to broadly disseminate an educational curriculum among EOD leaders and operators designed to improve the health and readiness production of the EOD forces. The curriculum will include **operator-driven, operationally-focused, in-person education that is standardized throughout the force** and addresses each of the three critical elements (exercise physiology/nutrition, injury prevention/rehabilitation, and combat mindset). A secondary aim of this phase is to establish a culture of fitness.

### **Requirements and Key Components**

#### Location, space, and personnel

- ✓ All education will be conducted in person by contracted SMEs or SME-trained, uniformed personnel.
- ✓ SMEs will have expertise in the three Critical Elements and only provide education to badge-wearing EOD personnel.
- ✓ Groups 1 (West Coast) and 2 (East Coast) will each have a uniformed Program Manager to oversee education for their respective mobile units (MUs).
- ✓ Education will also be available on demand.
- ✓ It is preferred that Tactical Training Course student education and baseline assessments be held at NHRC. All other education will be available through Groups 1 and 2.
- ✓ SMEs will be centrally located at the educational hubs/human performance centers of Groups 1 and 2, while also mobile around their respective Group MUs.
- ✓ Education will take place in human performance centers, ideally collocated with Phase 1 (Assessment) and Phase 3 (Individualized Training).
- ✓ Preferably, the human performance centers will be established in a preexisting, non-Military Construction facility.

#### Curriculum

- ✓ The educational curriculum will be operationally-focused, relevant, and fully integrated with other EOD specific external programs (e.g., Medical Department, Intrepid Spirit, and Psychological Health Team).
- ✓ The curriculum topics will embody the three Critical Elements.
- ✓ The curriculum will be organized and formalized in an *EOD Warrior-Athlete Guidebook*. This guidebook should be developed by NHRC scientists in collaboration with EOD SMEs.
  - **Exercise and Nutrition**  
Pre-, during, and post-deployment exercise training and nutrition; individualized training and periodization for deployment cycles; and tactical training and operational performance training.
  - **Injury Prevention and Rehabilitation**  
Proper movements and motor recruitment; prehabilitation and recovery techniques for commonly occurring injuries in EOD operators; and individualized rehabilitation education.
  - **Combat Mindset**  
Habits, including targeted nutrition, that support “brain health”; the “Big 4” mental skills (mental imagery, positive self-talk, goal setting, and relaxation); resilience building, mindfulness; sleep hygiene, stress management; and self-monitoring and assessment strategies.

## **Resources**

- ✓ Educational equipment will consist of computers, tables, chairs, projectors, exercise and physical therapy equipment, log books, computer and phone applications, educational reading materials, biofeedback devices, cameras for movement assessments, and office and relevant medical supplies.

## **PHASE 3 (INDIVIDUALIZED TRAINING): REQUIREMENTS, KEY COMPONENTS, AND RESOURCES**

### **Purpose**

The goal of Phase 3 is to develop individualized, in-person training programs driven by data from Phase 1 (Assessment). Thus, training programs will be tailored to meet the unique needs of each EOD Warrior-Athlete.

### **Requirements and Key Components**

#### Location, space, and personnel

- ✓ Individualized training should begin at the unit level, either by appointment, in groups, or in platoons.
- ✓ Training will be conducted in-person by NHRC-trained SMEs.
- ✓ SMEs will have expertise in the three Critical Elements.
- ✓ Groups 1 and 2 will each have a uniformed Program Manager to oversee individualized training for their respective MUs, and each MU will have their own uniformed Phase 3 Individualized Training Coordinator.
- ✓ Individualized training will take place in human performance centers that will ideally be collocated with Phase 1 (Assessment) and Phase 2 (Educational Programming) at NHRC and Joint Expeditionary Base Little Creek.
- ✓ Preferably, the human performance centers will be established in a preexisting, non-Military Construction facility.
- ✓ An internet-based scheduling portal should be established to allow access to on-demand individualized training.

#### Deliverables

- ✓ Comprehensive, in-person individualized training (based on Phase 1) will be delivered by SMEs.
- ✓ Core individualized training program will be standardized per level of EOD operator status: Level 1 (Pipeline), Level 2 (TTC), and Level 3 (Operator).
- ✓ Operator-driven, operationally-focused, and fully integrated with other EOD-specific external programs (e.g., Medical Department, Intrepid Spirit, and Psychological Health Team).
- ✓ Based on EOD population metrics for operator standards, as well as individual operator goals.
- ✓ Available on demand, with virtual capabilities.
- ✓ Cross-functional capacity, as coordinated with medical and other teams.
- ✓ Individualized training topics will map to the three Critical Elements.
  - Exercise and Nutrition
  - Injury Prevention and Rehabilitation
  - Combat Mindset

## Resources

- ✓ Exercise and physical therapy equipment, log books, computer and phone applications, training materials, and biofeedback devices.
- ✓ *EOD Warrior-Athlete Guidebook.*
- ✓ Adequate fitness center equipment, determined by throughput per day, in a 4,999 sq. ft. facility.
- ✓ Sports injury monitoring system.

## BUDGET AND PHASING PLAN

A proposed budget will be finalized after EOD conducts a manpower and throughput analysis.

## PROGRAM EVALUATION

Effectiveness of the EOD WATP will be measured via:

- Operator evaluations
- Operator retention
- Demand signal
- Improvements from baseline and previous assessments
- Comparisons to control groups
- Prevalence of injury and return-to-duty rates
- A standardized *EOD Stress Test*. This assessment tool should be developed by NHRC scientists in collaboration with EOD SMEs.

## CONCLUSION

Remarkable progress has been made toward the realization of the EOD WATP, since its initial inception in 2014. This report provides a roadmap for the EOD community to *develop and institute evidence-based*, Educational Programming as well as Individualized Training for every EOD Warrior-Athlete. Continuous coordination and collaboration among leaders at EOD GROUP ONE, EOD GROUP TWO, Navy Expeditionary Combat Command, and NHRC will bring our shared WATP vision to fruition.

## REFERENCES

- Fuller, S. (2017). Dose dependent increases in electrodermal activity during exercise in military men: Absolute versus relative workloads. *Medicine and Science in Sports and Exercise*, 49(5S), 93.
- Hernández, L. M., & Taylor, M. K. (2017). Diurnal pattern of salivary C-reactive protein and associations with biobehavioral correlates in military men. *Medicine and Science in Sports and Exercise*, 49(5S), 96.
- Pescatello, L. S., Arena, R., Riebe, D., & Thompson, P. D. (Eds.). (2013). *ACSM's guidelines for exercise testing and prescription* (9th ed.). Baltimore, MD: Lippincott Williams & Wilkins.
- Service, K. A., Wolf, A. J., Sessoms, P. H., & Taylor, M. K. (2017). Functional movement characteristics of U.S. Navy Explosive Ordnance Disposal Technicians. *Medicine and Science in Sports and Exercise*, 49(5S), 441–442.
- Stump, J., Haywood, J., Mendenhall, R., Robinson, T., Beville, P., Leppell, R., . . . Taylor, M. K. (2014). *EOD Warrior Athlete Working Group: Recommendations for an evidence-based, forcewide, EOD Warrior Athlete Program* (Report No. 14-35). San Diego, CA: Naval Health Research Center.
- Taylor, M. K., Gould, D., & Rolo, C. (2008). Performance strategies of U.S. Olympians in practice and competition. *High Ability Studies*, 19(1), 15–32.
- Taylor, M. K., Kviatkovsky, S. A., Hernández, L. M., Sargent, P., Segal, S. K., & Granger, D. A. (2016). Anabolic hormone profiles in elite military men. *Steroids*, 110, 41–48.
- Watson, N. F., Badr, M. S., Belenky, G., Bliwise, D. L., Buxton, O. M., Buysse, D., . . . Tasali, E. (2015). Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Sleep*, 38, 843–844.
- Wolf, A., Service, K. A., Sessoms, P. H., Hernández, L. M., Dominguez, J. A., & Taylor, M. K. (2016, August). *Correlations between an objective measurement of concussion and self-reported head injury in Explosive Ordnance Disposal (EOD) Technicians*. Poster session presented at the 24th Annual Military Health System Research Symposium, Kissimmee, FL.

## **DEDICATION**

This report is dedicated to all U.S. Navy EOD Warrior-Athletes who place themselves in harm's way so that others can be safe.

## Appendix A

### Meeting Agenda

# **EOD Warrior Athlete Working Group II: Forging the Future for Education & Training (25-26 JAN 2017)**

## **MISSION**

1. Describe Phase 1 (**Assessment**) aka “Status of the Force”
2. Establish requirements for
  - a. WATP Phase 2 (**Education**)
  - b. WATP Phase 3 (**Individualized Training**)
3. Define, describe, outline, and plan Phase 2 (**Education**)
4. Define, describe, outline, and plan Phase 3 (**Individualized Training**)

## **ATTENDEES**

### **EOD:**

CMDCM Stump, Jeremy (EODTEU 1)  
LCDR Reitter, Brian (EODGRU 1)  
LTJG Kawamura, Colton (EODMU 3)  
EODC Basnight, Harry (TEU2)  
CWO4 Palmer, Dirk (GRU 2)  
EODCS Yohnke, Charles (GRU 2)  
EODCM Fancher, William (EODMU 5)  
EODCM Fellman, Steve (EODMU 12)  
CDR Tripp, Michael (EODGRU 1)  
EODCM Mayo, Justin (EODTEU 1)  
EODCM Anderson, Ryan (EODGRU 1)  
CDR Tucker, Anthony (NECC)  
HMC Sevier, Steve (EODGRU 2)  
LT Mansueti, Anna (EODMU 11)  
ENS Despot, Barry (EODMU 11)  
EODCS Munroe, Chad (EODTEU 1)  
LT Anderson, Sarah (EODGRU 1)  
HM1 Egly, Shaun (EODMU 5)

Scientific Support:

Marcus Taylor, PhD (NHRC)  
Lisa Hernández, MS (NHRC)  
Genieleah Padilla (NHRC)  
Shiloah Kviatkovsky, MS (NHRC)  
Matthew Schoenherr, MS (NHRC)  
Stephanie Coffin (NHRC)  
Christine Laver (NHRC)  
Pinata Sessoms, PhD (NHRC)  
Kathrine Haluch (NHRC)  
Aaron Wolf, MS (NHRC)  
Stefania Marzano, MA (NHRC)  
CDR Shawn Soutiere (NHRC)  
Jason Bailie, PhD (DVBIC)  
Jennifer Webb-Murphy, PhD (NCCOSC)

**SCHEDULE**

**DAY 1 (25 JAN 2017)**

0800 ARRIVE/COFFEE/INFORMAL

0830 WELCOME

- Introductions

- o NHRC: CDR Soutiere, Dept. Head, Warfighter Performance, NHRC
- o EODGRU ONE: LCDR Reitter, CSO, EODGRU ONE

0900 The WATP Vision (CMDRCM Stump)

0945 Overview of Phase 1 Assessments (Taylor)

1000 Status of the Force (Brief: Phase 1 Evidence Base)

- Key Element #1, Exercise Physiology & Nutrition (Hernández/Kviatkovsky)
- Key Element #2, Injury Prevention (Haluch/Sessoms)
- Key Element #3, Combat Mindset (Taylor)

1130 BREAK

1140 Tour, Warfighter Performance Labs (Taylor/Hernández/Wolf)

1215 Lunch (provided)

1250 Team Photo

1300 Whiteboard Workshop/Draft Requirements Document: Part 1 (All)

Phase 2: Education

- Define Requirements
- Outline Key Components & Resources
- Establish Budget & Phasing Plan

Phase 3: Individualized Training

- Define Requirements
- Outline Key Components & Resources
- Establish Budget & Phasing Plan

1550 Summary & Synthesis (Day 2 Goals & Plan; Taylor)

1600 *ADJOURN*

**DAY 2 (26 JAN 2017)**

0800 ARRIVE/COFFEE/INFORMAL

0830 Whiteboard Workshop/Draft Requirements Document, Part 2 (All)

Phase 2: Education

- Define Requirements
- Outline Key Components & Resources
- Establish Budget & Phasing Plan

Phase 3: Individualized Training

- Define Requirements
- Outline Key Components & Resources
- Establish Budget & Phasing Plan

1030 Summary & Synthesis

1100 *ADJOURN*

DELIVERABLE:

DOD TECHNICAL REPORT,

**“EOD WARRIOR-ATHLETE WORKING GROUP II:**

**FORGING THE FUTURE FOR EDUCATION AND TRAINING”**

## Appendix B

### EOD Warrior-Athlete Working Group II Photo



**Top row** (left to right): Aaron Wolf; CDR Anthony Tucker; Jennifer Webb-Murphy; CDR Michael Tripp; Kathrine Haluch; Dianna Laver; Genieleah Padilla

**2nd from Top row** (left to right): EODCM Steve Fellman; EODCM William Fancher; Lisa Hernández; HM1 Shaun Egly; Stefania Marzano; Pinata Sessoms



**2nd from Bottom row** (left to right): Shiloah Kviatkovsky; HMC Steve Sevier; EODCS Chad Munroe; CMDCM Jeremiah Stump; EODCS Charles Yohnke; EODC Harry Basnight; Jason Bailie

**Bottom row** (left to right): ENS Barry Despot; LT Sarah Anderson, CWO4 Dirk Palmer; LT Anna Mansueti; LTJG Colton Kawamura; Marcus Taylor

**Not pictured:** CDR Shawn Soutiere; LCDR Brian Reitter; EODCM Justin Mayo; EODCM Ryan Anderson; Matthew Schoenherr; Stephanie Coffin

## Appendix C

### Scientific Support Team Presentations



# Naval Health Research Center

*Readiness Through Research*

## EOD Warrior Athlete Working Group I (WAWG I): Brief Synopsis

EOD Warrior Athlete Working Group II (WAWG II):  
Forging the Future for Education & Training  
25-26 JAN 2017

1

## EOD WAWG I, Brief Synopsis

### PROBLEM STATEMENT

1. Despite the EOD Warrior's responsibility to maintain superior physical and mental readiness, **there is currently no readiness sustainment program** across the EOD career. Accordingly, an *EOD Warrior Athlete Training Program (WATP)* must be envisioned, developed, implemented, and institutionalized.
2. *EOD WATP* should include assessment, education, and individualized training across an entire EOD career.
3. *EOD WATP* components must be tailored to **EOD job requirements**.



## **Primary EOD Physical Requirements (Per SME input)**

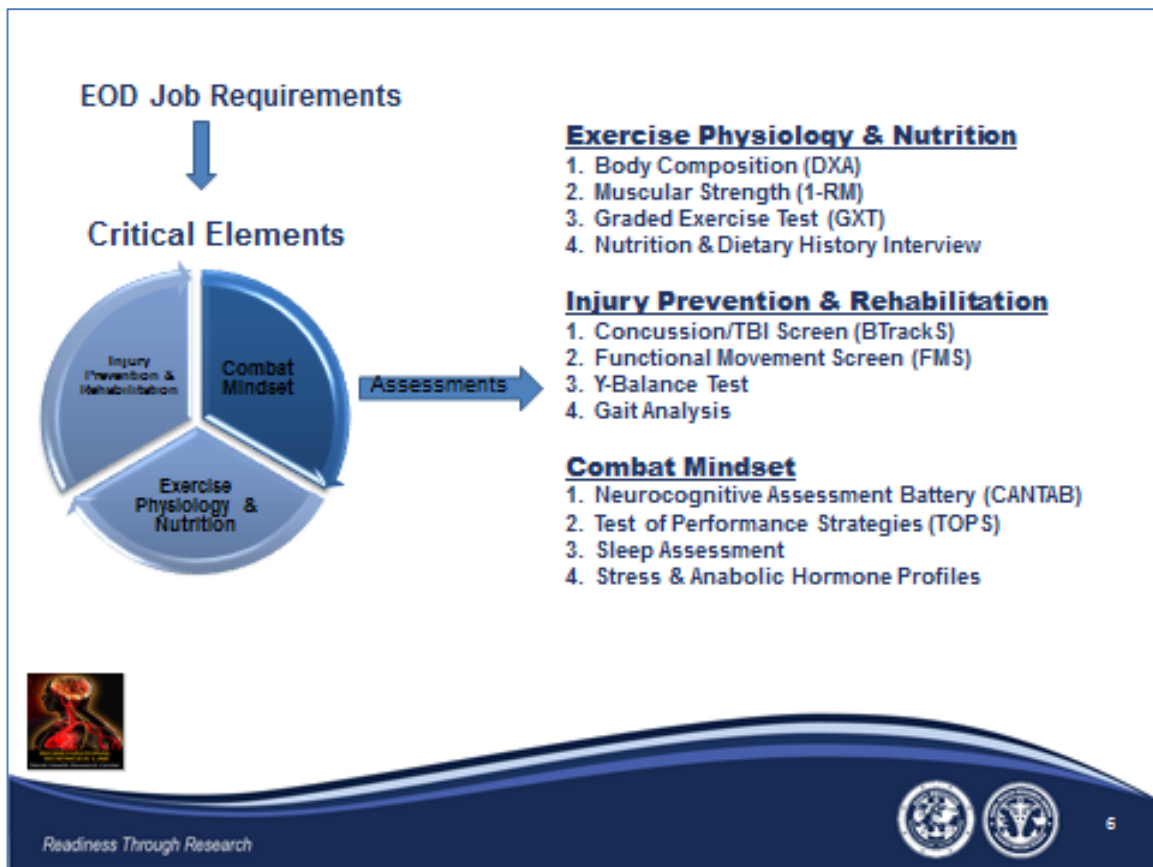
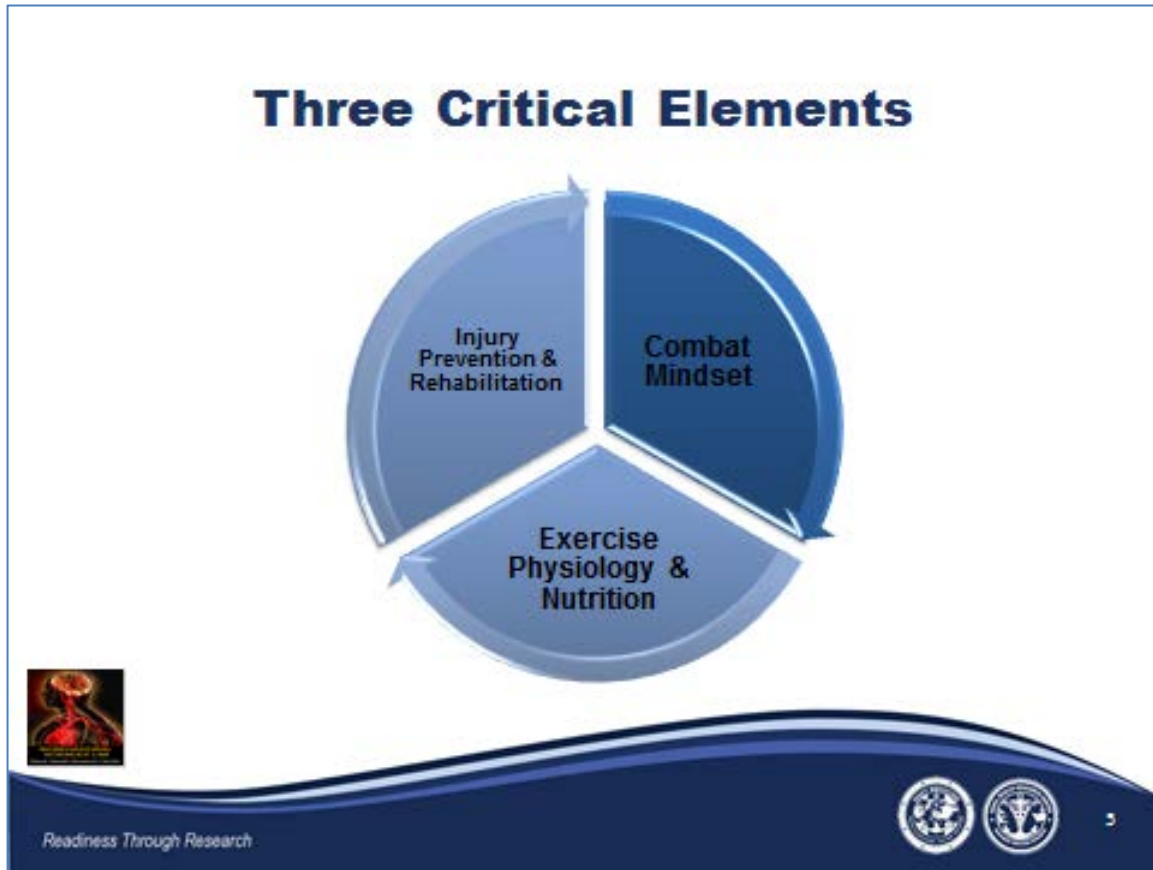
- Aerobic endurance
  - Muscular endurance
  - Muscular strength
  - Explosive power
- Resistance to:
    - fatigue
    - caloric deficits
    - musculoskeletal injury



## **Primary EOD Mental Requirements (Per SME input)**

- Under extreme stress, maintain:
    - mental clarity
    - superior neurocognitive function
    - fine motor skills
- Resistance to:
    - sleep disruption
    - sleep deprivation
    - chronic operational stress





## The Way Forward

*Today, we focus on*  
Baseline Assessments  
(EOD Health Study)

- Exercise Physiology & Nutrition
- Injury Prevention & Rehabilitation
- Combat Mindset



*Tomorrow, we discuss*  
Long-Term Vision



## WAWG II Mission

1. Describe Phase 1 (Assessment) aka "Status of the Force"
2. Establish requirements for
  - a. WATP Phase 2 (Education)
  - b. WATP Phase 3 (Individualized Training)
3. Define, describe, outline, and plan Phase 2 (Education)
4. Define, describe, outline, and plan Phase 3 (Individualized Training)





# Naval Health Research Center

*Readiness Through Research*

## Status of the Force: Phase I (Assessment) Evidence Base

EOD Warrior Athlete Working Group II:  
Forging the Future for Education & Training  
25-26 JAN 2017




9

## Disclaimer

I am a military service member (or employee of the U.S. Government). This work was prepared as part of my official duties. Title 17, U.S.C. §105 provides the "Copyright protection under this title is not available for any work of the United States Government." Title 17, USC, §101 defines a U.S. Government work as work prepared by a military service member or employee of the U.S. Government as part of that person's official duties.



This work is supported by Office of Naval Research (ILIR Program) under Work Unit No. N1522. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of the Army, Department of the Air Force, Department of Veterans Affairs, Department of Defense, or the U.S. Government. Approved for public release; distribution unlimited.

Human subjects participated in this study after giving their free and informed consent. This research has been conducted in compliance with all applicable federal regulations governing the protection of human subjects in research (NHRC.2015.0013)



Readiness Through Research

10



# Naval Health Research Center

*Readiness Through Research*



## EOD Health Study: Exercise Physiology & Nutrition

Lisa M. Hernández, MS, TSAC-F®  
Shiloah A. Kviatkovsky, MS, TSAC-F®



11

## Key Element #1: Exercise Physiology & Nutrition

- Demographics
- Service History
- Physical Health
- Nutrition




Readiness Through Research




12

# DEMOGRAPHICS & SERVICE HISTORY

Self-report Survey Data




Readiness Through Research



13

## Demographics (N=61)



**Age**

40+	33%
25-29	24%
30-39	43%

**Ethnicity**

White	84%
Non-White	16%

**Paygrade/Rank**

O4 or higher	7%
E5-E6	13%
O1-O3	28%
E7-E9	52%

**Gender**

Female	5%
Male	95%


**Marital Status**

Never Married	21%
Divorced	13%
Married/Cohab	66%

**Years of Service**

1 to 2 years	2%
3-5 years	11%
6-9 years	16%
10+ years	71%

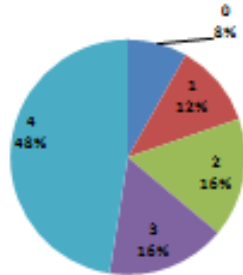
Readiness Through Research



14

## Deployment History (n=58)

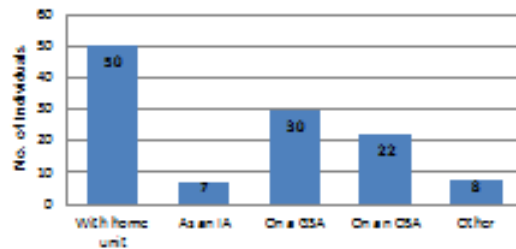
Total # of deployments in military career



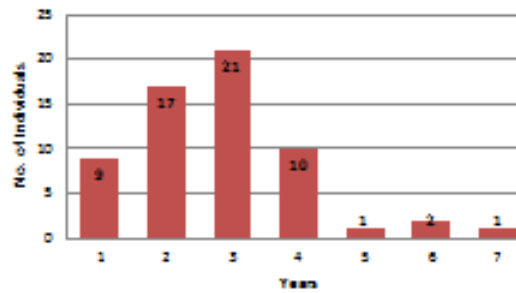
- Averages
  - Total deployments ~ 3
  - Total deployed time ~ 2 yrs



### Deployment History



### Total deployed years since 9/11



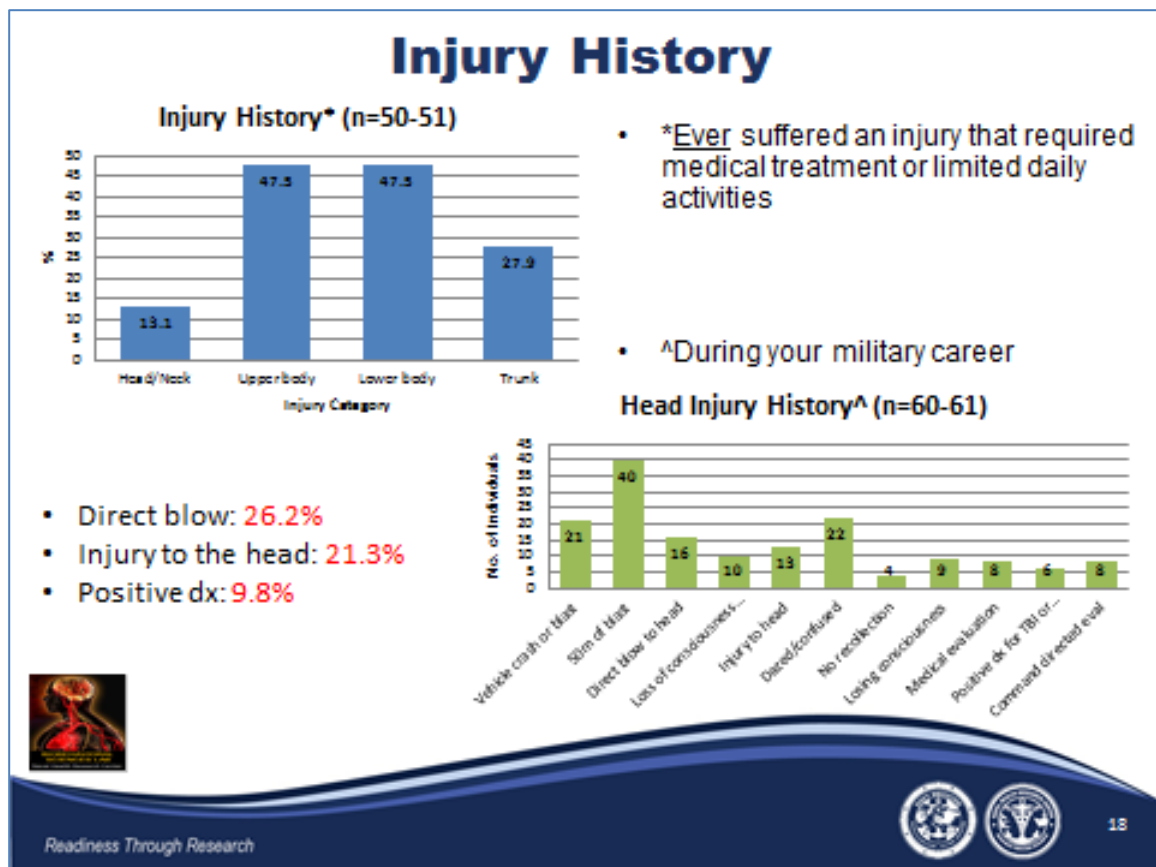
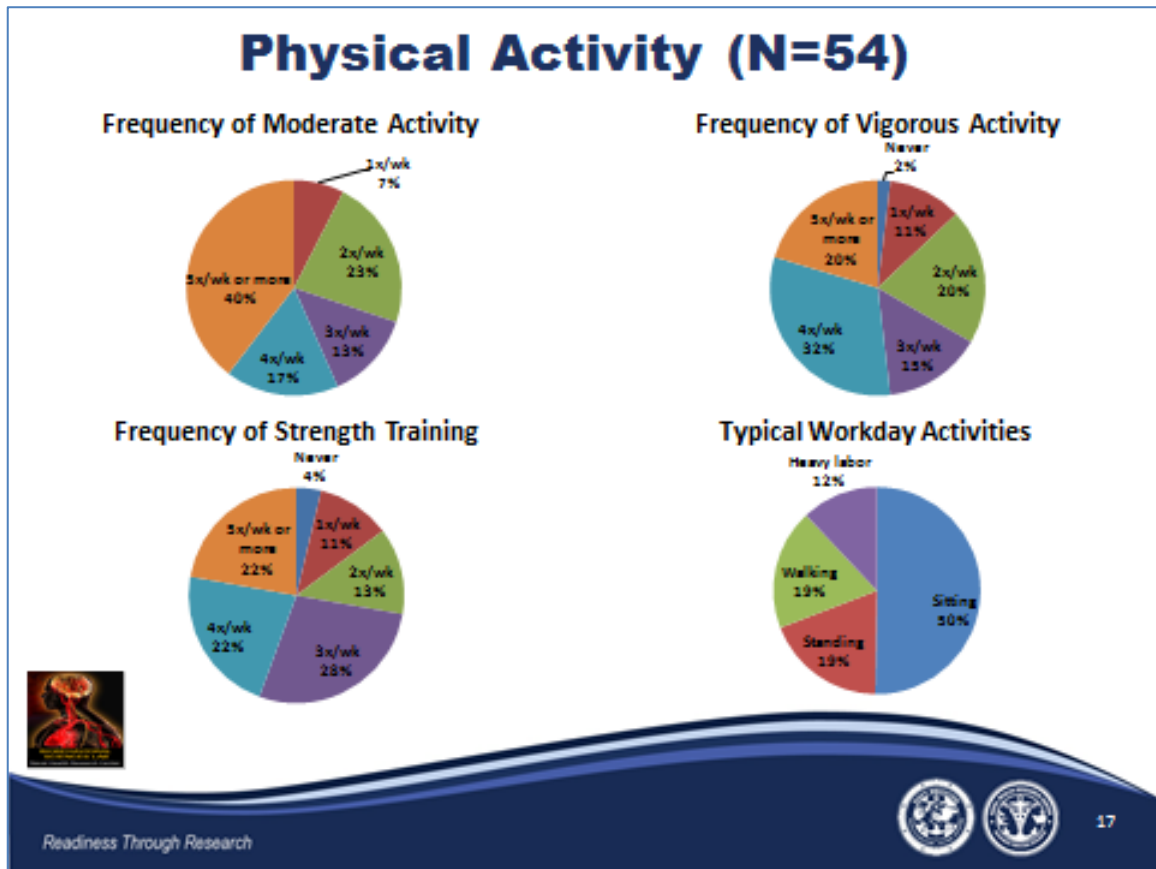
# PHYSICAL HEALTH

(Dataset includes male participants only)

Self-report Survey Data

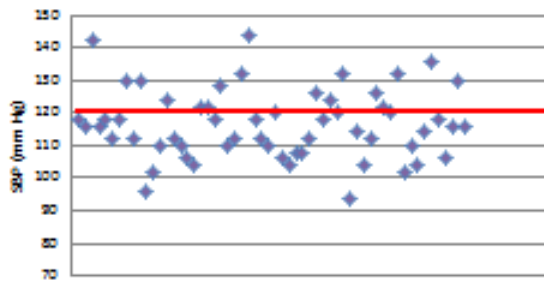
Physiological Measures



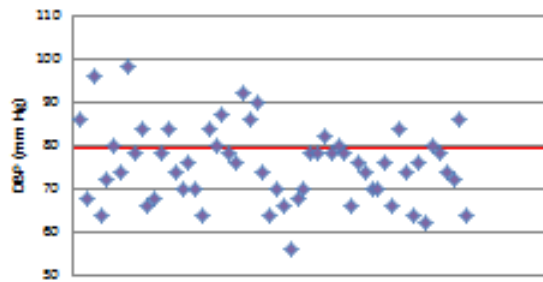


## Resting Blood Pressure (n=58)

Resting Systolic BP



Resting Diastolic BP



- Average  $\pm$  SD SBP:  $116 \pm 11$  mm Hg
- 34.5% are above normal

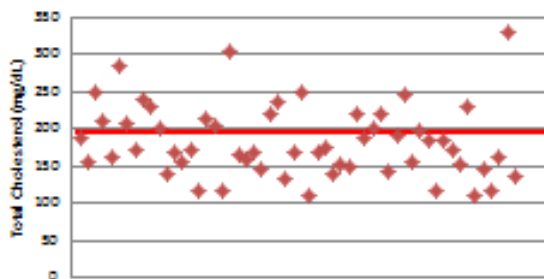
- Average  $\pm$  SD DBP:  $76 \pm 9$  mm Hg
- 29.3% are above normal

	Hypertension			
	Normal	Pre-Hypertension	Stage I	Stage II
Systolic BP (mm Hg)	<120	120-139	140-159	$\geq 160$
Diastolic BP (mm Hg)	<80	80-89	90-99	$\geq 100$

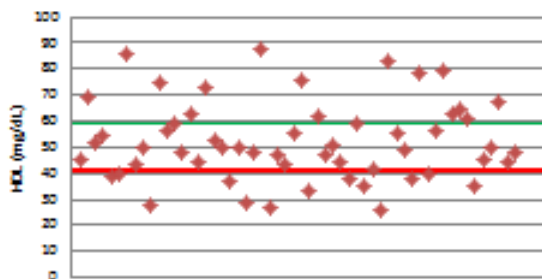


## Blood Lipids (n=55-56)

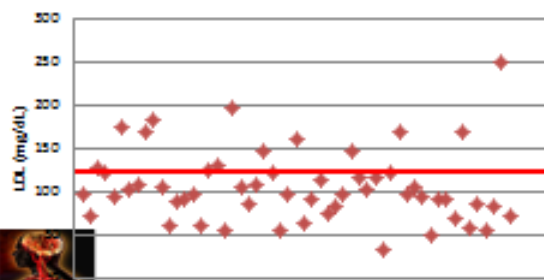
Total Cholesterol



HDL ("Good" cholesterol)



LDL ("Bad" cholesterol)



- TC: 33.9% are above normal
- HDL: 23.2% below normal
- LDL: 20.0% are above normal

	Normal	Borderline	High
TC (mg/dL)	<200	200-239	>240
HDL (mg/dL)	>40	N/A	$\geq 60$
LDL (mg/dL)	100-129	130-159	>160



## Dual X-Ray Absorptiometry (DXA)

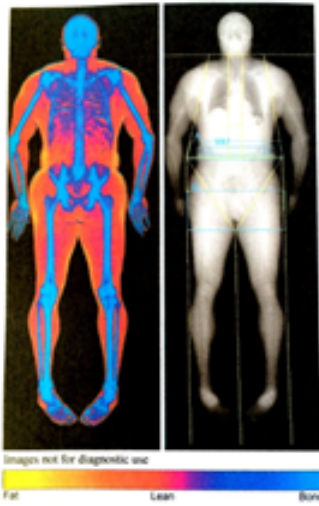


Photo courtesy of NHRC

- Gold standard of body composition measurement
- Also measures bone mineral density
  - Hip
  - Spine
- Calculates Visceral Adipose Tissue (VAT)
  - Fat that surrounds the abdominal organs

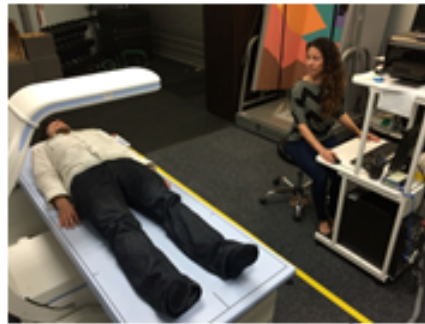
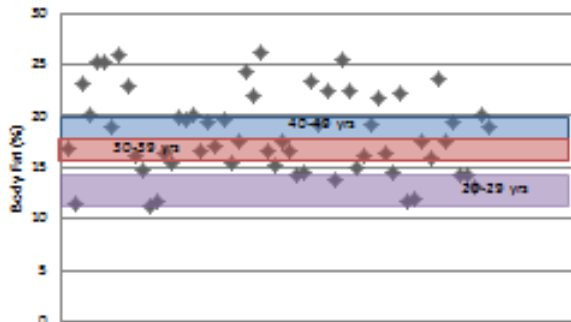


Photo courtesy of NHRC

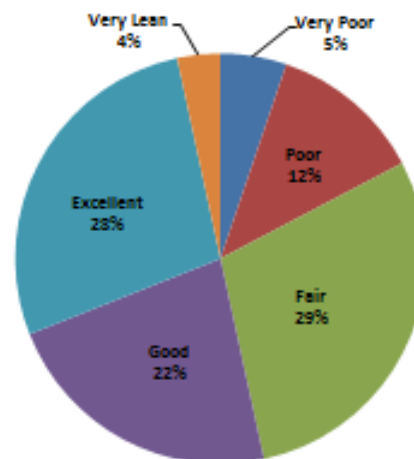


## DXA Measures: Body Composition (n=58)

### Total Body Fat %



### Body Composition Percentile Ranking



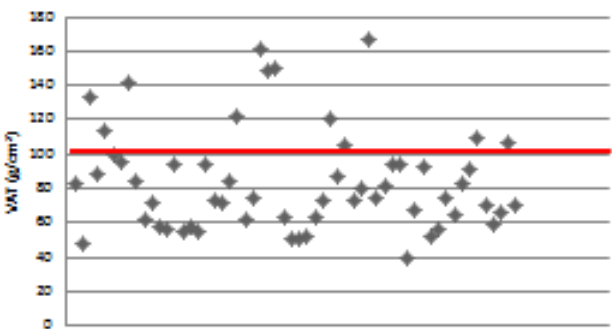
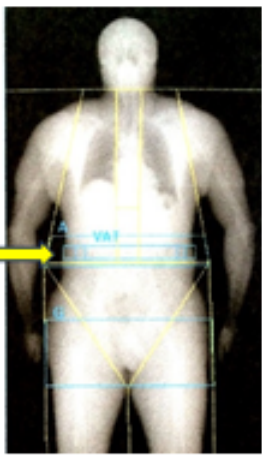
- Body Fat Percentage (BF%)
  - Average  $\pm$  SD:  $18.2 \pm 4.1\%$
  - 47% are ranked fair to very poor
  - Impact of BF% on operational performance depends on the task




## DXA Measures: VAT (n=58)

Photo courtesy of NHRC



### Visceral Adipose Tissue

- Visceral Adipose Tissue (VAT)
  - VAT is the fat that surrounds the abdominal organs
    - VAT values >100 g/cm<sup>2</sup> are associated with increased risk for cardiometabolic disease
    - Values >160 g/cm<sup>2</sup> are considered at high risk
  - Average ± SD: 83.9 ± 29.6 g/cm<sup>2</sup>
  - **20.7%** are at increased risk, 2 of which are at high risk

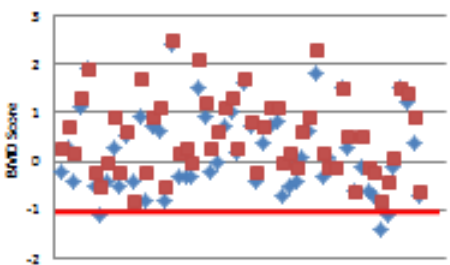


Readiness Through Research

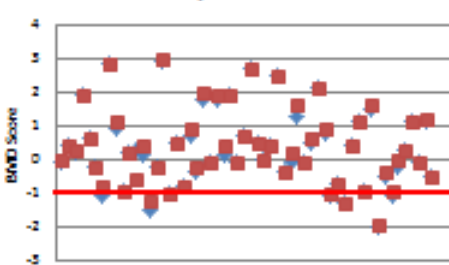


23


## DXA Measures: BMD (n=56)

### Left Hip BMD Scores




### AP Spine BMD Scores







- T-score: Individual vs. young men
- Z-score: Individual vs. age-matched cohorts (NHANES reference data)
- Score ranges
  - Normal: ≥ -1.0
  - At risk for osteoporosis (osteopenia): -1.1 to -2.4
  - Osteoporosis: ≤ -2.5

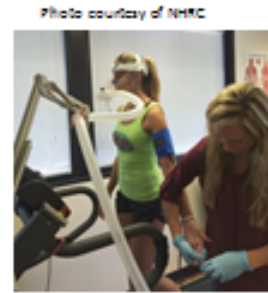
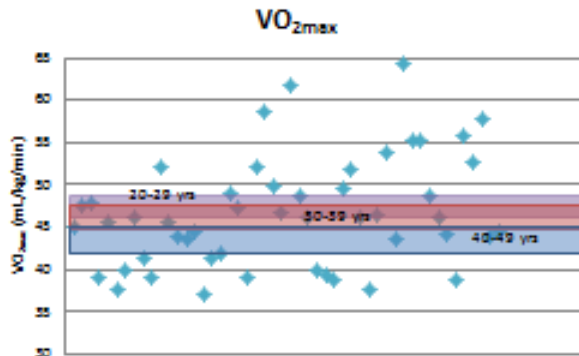


Photos courtesy of NHRC

Readiness Through Research



24

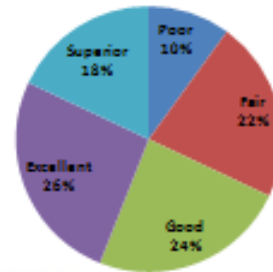
## GXT: Cardiorespiratory Fitness (n=50)



- VO<sub>2max</sub>: 32.0% are ranked fair to poor
- Time on treadmill = 12.2 ± 1.5 min
  - Equivalent to 15 METs
- Ventilatory Threshold (VT) = onset of fatigue
  - VT% of VO<sub>2max</sub> = 58.6 ± 6.8%



### VO<sub>2max</sub> Percentile Ranking



## One-Repetition Maximum (1-RM)

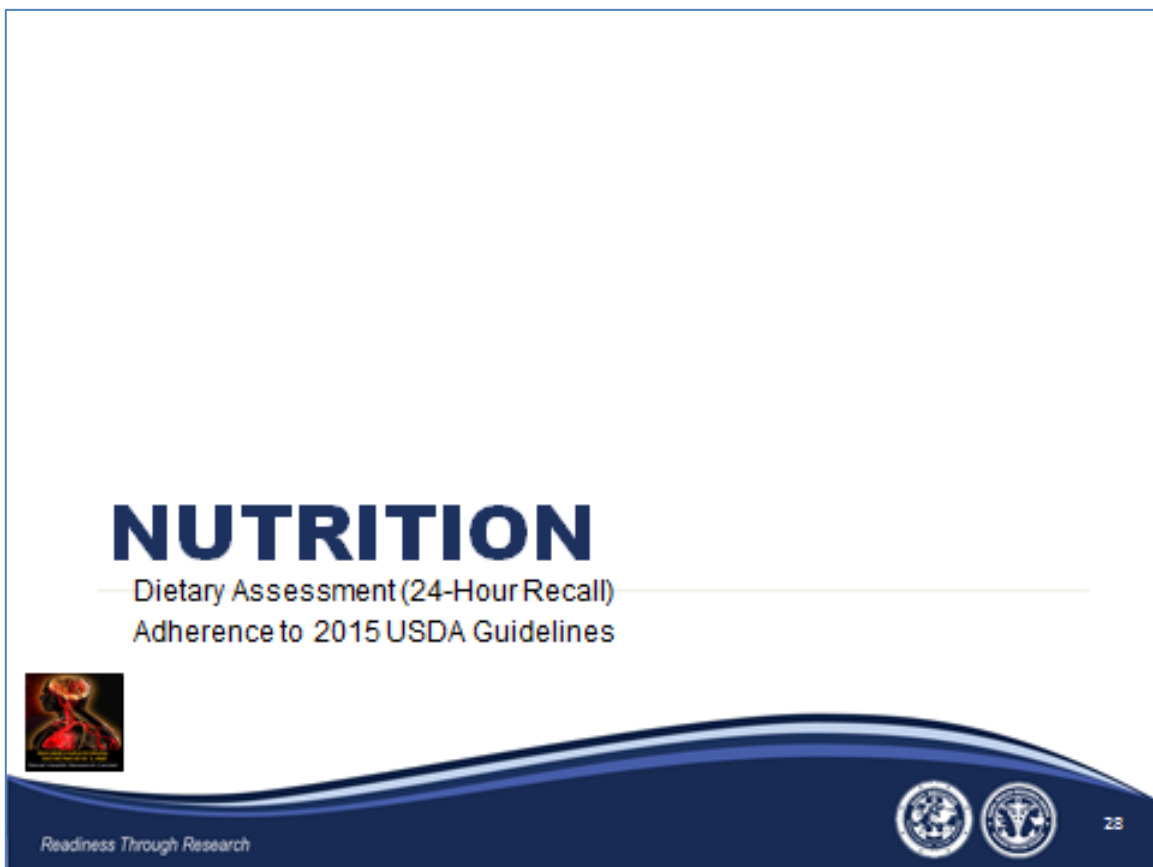
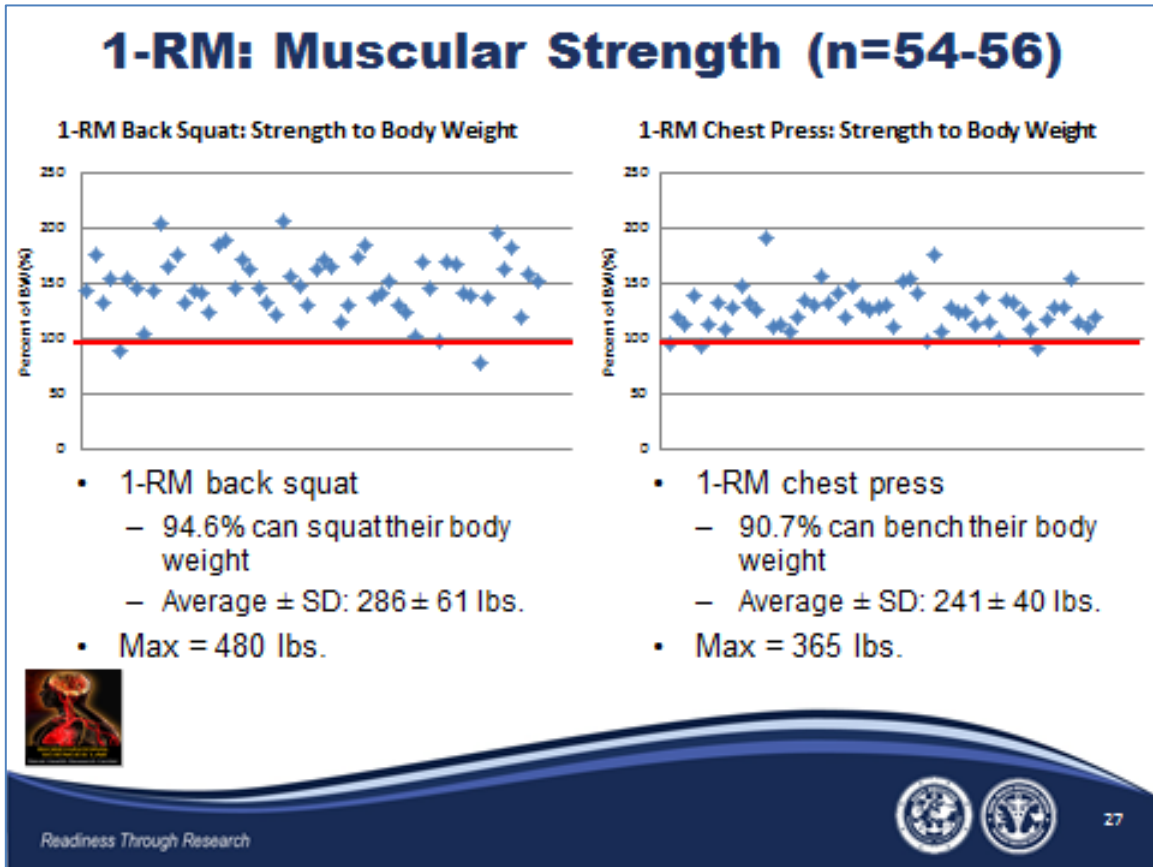
Back Squat: Lower Body Strength

Chest Press: Upper Body Strength



Photo courtesy of NHRC





## Dietary Assessment: 24-Hour Recall

Was yesterday a normal eating day?						
Breakfast Time:	AM Snack Time:	Lunch Time:	Snack Time:	Dinner Time:	PM Snack Time:	Total Servings
Fruits:	Fruits:	Fruits:	Fruits:	Fruits:	Fruits:	
Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:	Vegetables:	
Grains:	Grains:	Grains:	Grains:	Grains:	Grains:	
Whole Grains:	Whole Grains:	Whole Grains:	Whole Grains:	Whole Grains:	Whole Grains:	
Protein:	Protein:	Protein:	Protein:	Protein:	Protein:	
Dairy:	Dairy:	Dairy:	Dairy:	Dairy:	Dairy:	
Fluids:	Fluids:	Fluids:	Fluids:	Fluids:	Fluids:	
Typical Breakfast:	Typical AM Snacks:	Typical Lunches:	Typical PM Snacks:	Typical Dinners:	Typical Evening Snacks:	



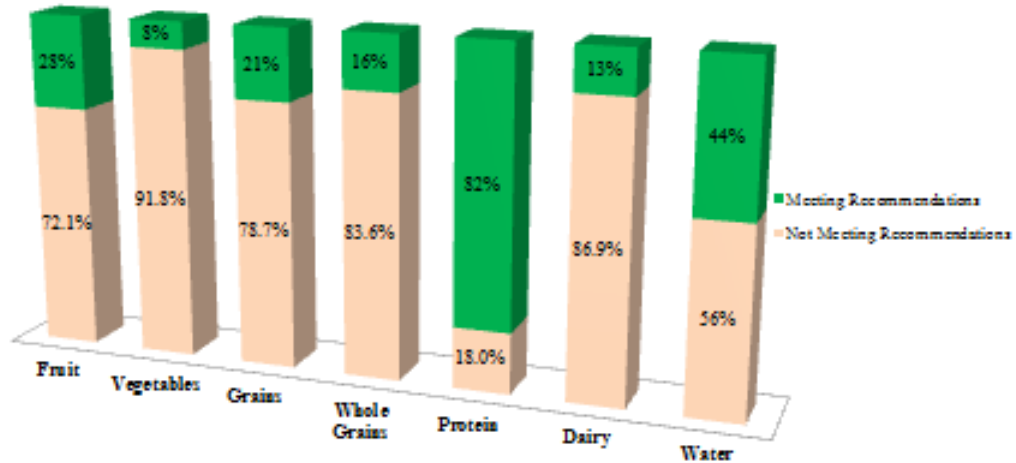
## 2015 USDA Guidelines for Americans\*

Calorie Level	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
<b>Food Group</b>									
<b>Fruits</b>	1 ½ c	1 ½ c	2 c	2 c	2 c	2 c	2 ½ c	2 ½ c	2 ½ c
<b>Vegetables</b>	2 c	2 ½ c	2 ½ c	3 c	3 c	3 ½ c	3 ½ c	4 c	4 c
<b>Grains</b>	5 oz.	6 oz.	6 oz.	7 oz.	8 oz.	9 oz.	10 oz.	10 oz.	10 oz.
<b>Whole Grains</b>	3 oz.	3 oz.	3 oz.	3 ½ oz.	4 oz.	4 ½ oz.	5 oz.	5 oz.	5 oz.
<b>Protein</b>	5 oz.	5 oz.	5 ½ oz.	6 oz.	6 ½ oz.	6 ½ oz.	7 oz.	7 oz.	7 oz.
<b>Dairy</b>	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c	3 c

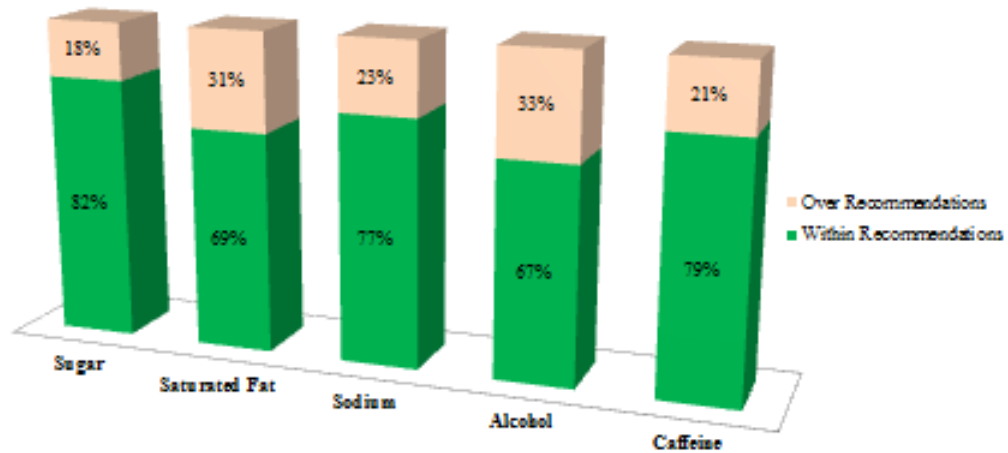
\*U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at <http://health.gov/dietaryguidelines/2015/guidelines/>



## Adherence to the USDA Dietary Guidelines (Meeting vs. Not Meeting; N=61)



## Adherence to the USDA Guidelines (Staying Within or Over-Consuming; N=61)



## Selected Key Nutrients Associated with Each Food Group and Their Functions

Food Group	Not Meeting USDA Guidelines	Key Nutrients	Functions	Dysfunctions
<b>Fruit/ Vegetables</b>	<b>72/92%</b>	<ul style="list-style-type: none"> <li>• Potassium</li> <li>• Fiber</li> <li>• Vitamins A and C</li> </ul>	<ul style="list-style-type: none"> <li>• Healthy BP, Blood Lipids, and Body Weight</li> <li>• Decreased CVD Risk</li> <li>• Wound Healing</li> </ul>	<ul style="list-style-type: none"> <li>• Hypertension</li> <li>• Muscle Weakness</li> <li>• Impaired Immunity and Wound Healing</li> </ul>
<b>Grains</b>	<b>79%</b>	<ul style="list-style-type: none"> <li>• B Vitamins</li> <li>• Fiber</li> <li>• Iron</li> <li>• Magnesium</li> </ul>	<ul style="list-style-type: none"> <li>• Energy Production</li> <li>• Nerve Function</li> <li>• Protein Synthesis</li> </ul>	<ul style="list-style-type: none"> <li>• Muscle Weakness</li> <li>• Decreased Neurological Function</li> <li>• Increased CVD Risk</li> </ul>
<b>Protein</b>	<b>18%</b>	<ul style="list-style-type: none"> <li>• Vitamin E</li> <li>• Iron</li> <li>• Magnesium</li> <li>• Zinc</li> </ul>	<ul style="list-style-type: none"> <li>• Muscle Strength and Integrity</li> <li>• Bone Health</li> <li>• Immunity and Wound Healing</li> </ul>	<ul style="list-style-type: none"> <li>• Muscle Weakness</li> <li>• Osteoporosis</li> <li>• Impaired Immunity and Wound Healing</li> </ul>
<b>Dairy</b>	<b>87%</b>	<ul style="list-style-type: none"> <li>• Calcium</li> <li>• Potassium</li> <li>• Vitamin D</li> </ul>	<ul style="list-style-type: none"> <li>• Bone Health</li> <li>• Muscular Strength and Integrity</li> <li>• Nerve Function</li> </ul>	<ul style="list-style-type: none"> <li>• Osteoporosis</li> <li>• Muscle Weakness</li> <li>• Muscle Spasms</li> </ul>



Readiness Through Research



33



# Naval Health Research Center

*Readiness Through Research*

## PhyCORE Measures of Functional Movement

Kathrine Service, Aaron Wolf, Stefania Marzano, Pinata Sessoms

34

## Key Element #2:

### Injury Prevention & Rehabilitation



### PhyCORE Functional Movement Assessments

- Purpose: To examine functional movement by assessing patterns of mobility and stability during performance of basic exercises
- Objective: Prevention of musculoskeletal injury by tracking functional movement performance over time to identify areas for improvement
- Test battery:
  - Postural sway analysis (BTracks)
  - Mobility (FMS)
  - Mobility and stability (Y-Balance)
  - Gait (PKMAS)
  - Jump height (Vertical Jump Test)

## Demographics

- Population = U.S. Navy EOD technicians
- Current N = 61
- Data reported on N = 57
- Sex = males
- Age =  $35.4 \pm 7.0$  years
- Height =  $68.9 \pm 2.8$  inches
- Weight =  $187.6 \pm 27.8$  lbs

\*Note: Three female participants and one male participant, who was unable to complete testing, were excluded from analyses (57/61).



## Balance Tracking System (BTrackS)

**Use:** Measures displacement in center of pressure during quiet stance

**Implications:** Evaluation of postural stability

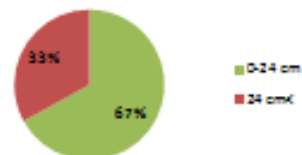


Figure 1. Subject performing a test on the BTrackS board.

Table 1. Mean values of BTrackS scores for EOD Health participants with comparative means.

Group:	EOD (age 25-49)	Gen Pop* (age 18-29)	Gen Pop* (age 30-50)	Male Athlete** (age 19-25)
Mean (cm):	$23.1 \pm 10.3$	22	24	23
Range (cm):	11 - 85	10 - 98	11 - 118	10 - 57

BTrackS Score % Rankings



- \*Gen Pop: Values based on 1260 males and females within the general population of the U.S.; values shown are ranked at the 50<sup>th</sup> percentile (Balance Tracking Systems reference data).
- \*\*Male athlete: Values are based on a sample of 2851 healthy male athletes across the US; values shown are ranked at the 50<sup>th</sup> percentile (Balance Tracking Systems reference data).



## Functional Movement Screen (FMS)

**Use:** Assessment of joint mobility and stability during full body functional movement patterns

**Implications:** Mobility and stability limitations observed within functional movement patterns may suggest an increased risk of musculoskeletal injury



Figure 2. Example of the seven FMS exercises

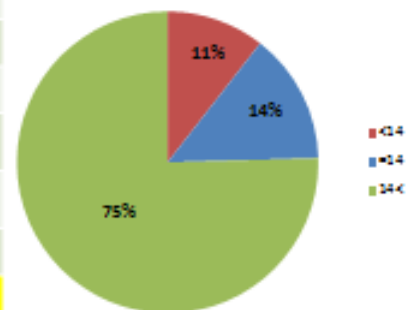


## FMS: EOD Results

Table 2. Mean values of FMS scores for EOD Health participants. Scores range from 0 to 3.

Movement	Left	Right	Final	Pain
1. Deep Squat	n/a	n/a	2.3 ± 0.6	n/a
2. Hurdle Step	2.2 ± 0.5	2.2 ± 0.5	2.1 ± 0.5	n/a
3. Inline Lunge	2.2 ± 0.6	2.1 ± 0.6	2.1 ± 0.6	n/a
4. Shoulder mobility	2.2 ± 0.8	2.3 ± 0.8	2.1 ± 0.9	0
5. Active Straight Leg Raise	2.5 ± 0.6	2.5 ± 0.6	2.4 ± 0.6	n/a
6. Trunk Stability Push-up	n/a	n/a	2.6 ± 0.6	0.1 ± 0.2 N = 4
7. Rotary Stability	2.0 ± 0.4	2.1 ± 0.2	2.0 ± 0.4	0
<b>Total Score*</b>			<b>15.5 ± 2.5</b>	

FMS Total Score % Rankings



- \*Total scores for the EOD group ranged from 11-20; highest possible score is 21.
- Scoring per movement: 0-3 scale; 3=highest score, 1=lowest score, 0=with pain
- Majority of scores of "1" observed during the shoulder mobility assessment
- Total scores of ≤14 are at greater risk for injury (Maligh et al, 2010; Usman et al 2015)
- Individual scores of ≥2 are minimum necessary for adequate mobility patterns and injury avoidance (FMS standard)



## Y-Balance Lower Quarter (YB-LQ)

**Use:** Measure of lower limb stability and mobility during single leg stance

**Implications:** Identification of decreased mobility/stability or asymmetries between limbs may be used to identify increased injury risk

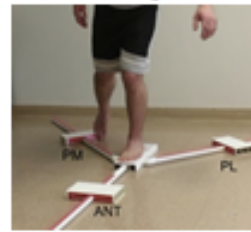
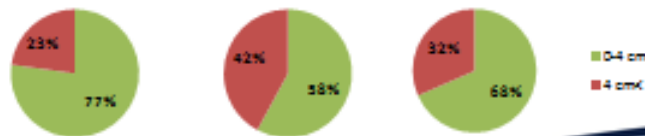


Figure 3. Participant performing the Y-balance lower quarter test and label of three directions.

Table 3. Mean values of Y-balance scores for EOD Health participants.

Anterior Difference (cm)	Posterior-Medial Difference (cm)	Posterior-Lateral Difference (cm)	Left Composite* (% LL)	Right Composite* (% LL)
4.4 ± 8.6	4.3 ± 3.8	3.2 ± 2.5	95.9 ± 18.6	96.0 ± 18.6
Differences of >4cm between right and left legs are considered asymmetrical performance and areas for improvement (Y-balance standard)			Composite Score Comparative Mean (Taylor et al, 2014): 96.9 ± 8.6	

ANT Difference % Rankings    PM Difference % Rankings    PL Difference % Rankings



## Gait Measures

**Use:** Measures spatial and temporal parameters of gait

**Implications:** Identification of asymmetries or extreme footfall patterns may indicate abnormal gait patterns adapted due to lack of functional movement

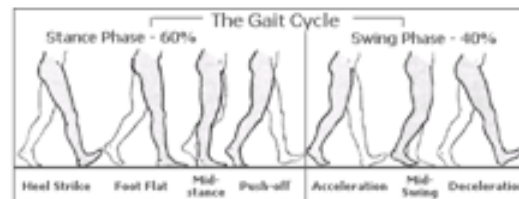


Figure 4. Phases of the gait cycle

Table 4. Mean values of gait measures for EOD Health participants.

Measure:	Velocity (m/s)	Step Length (m)	Stride Width (cm)	Stance%	Swing %
EODH	1.2 ± 0.1	0.6 ± 0.0	9.4 ± 3.6	64.5 ± 1.4	35.5 ± 1.4
Comparative Means*:	1.3 ± 0.2	0.7 ± 0.1	8.0 ± 2.9	64.1 ± 1.5	36.0 ± 1.5

- \*Comparative Means: Measures are taken from a sample of 48 healthy active duty males within an approved NHRC study (NHRC.2009.0018).
- Stride width and step length: related to stability (wider strides and shorter steps allow for a greater base of support and increased contact with the ground while walking)



## Vertical Jump

**Use:** Measures vertical jump height and ground reaction forces during take off and landing during a jump task

**Implications:** Indirect measure of lower limb force production



Figure 5. Image of force plate used to collect vertical jump data.

Table 5. Mean values of vertical jump height for EOD Health participants with comparative means.

Group:	EOD (age 25-49)	Average male (age 18-34)*	Competitive male college athletes*	Recreational male college athletes*
Jump height (cm):	36.6 ± 5.8	41-50**	64	61



- \*NSCA reference values at the 50<sup>th</sup> percentile with variable sample sizes
- \*\*Briggs, M., 2013
- Vertical jump is not a great indicator of power but has been used as an indirect measure of such
- Subjects participating in this study performed the vertical jump with hands placed on hips whereas the comparative means shown were collected from vertical jumps performed with no constraint on arm swing



## References

- Raleigh, M. F., McFadden, D. P., Deuster, P. A., Davis, J., Knapik, J. J., Pappas, C. G., & O'Connor, F. G. (2010). Functional Movement Screening: A novel tool for injury risk stratification of warfighters. In *Proceedings from the Uniformed Services Academy of Family Physicians Annual Meeting*. Retrieved from <http://www.sportsrehabexpert.com/mfposterfinalquant100.pdf>
- Lisman, P., O'Connor, F. G., Deuster, P. A., & Knapik, J. J. (2013). Functional Movement Screen and Aerobic Fitness Predict Injuries in Military Training. *Medicine & Science in Sports & Exercise*, 45(4), 636-643. <http://doi.org/10.1249/MSS.0b013e31827a1c4c>
- Teyhen, D. S., Riebel, M. A., McArthur, D. R., Savini, M., Jones, M. J., Goffar, S. L., ... Pilsky, P. J. (2014). Normative Data and the Influence of Age and Gender on Power, Balance, Flexibility, and Functional Movement in Healthy Service Members. *Military Medicine*, 179(4), 413-420. <http://doi.org/10.7205/MILMED-D-13-00362>
- Marc Briggs. (2013). *Training for Soccer Players*. Marlborough: The Crowood Press Ltd.
- Balance Tracking Systems, 2013. <http://balancetrackingsystems.com/>
- National Strength and Conditioning Association (NSCA) <https://www.nsc.com/>
- NHRC-2009.0018 Development of a database for able-bodied ambulators while using the Computer Assisted Rehabilitation Environment (CAREN)





# Naval Health Research Center

*Readiness Through Research*

## EOD Health Study: Combat Mindset

Marcus K. Taylor, PhD

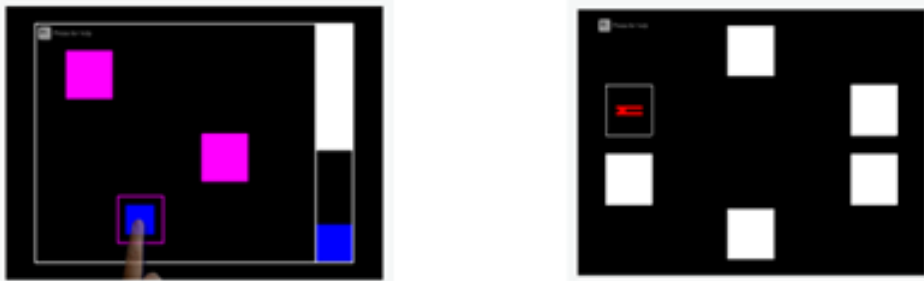
43

### Key Element #3: Combat Mindset



- Cambridge Neuropsychological Test Automated Battery (CANTAB)
- Test of Performance Strategies (TOPS)
- Sleep
- Anabolic Hormones







# CANTAB

Spatial Working Memory (SWM)  
 Paired Associates Learning (PAL)

Photos courtesy of  
 Cambridge Cognition



Readiness Through Research




47


# CANTAB

Test	Min	Measures
Motor Screening Task (MOT)*	2	Following instructions & re-learning
Reaction Time (RT)*	5	Movement time, RT, response accuracy, & impulsivity
Spatial Working Memory (SWM)	8	Retention, strategy, & executive function
Paired Associates Learning (PAL)	10	Visual memory & learning
Attention Switching Task (AST)*	8	Attention switching
Affective Go/No Go (AGN)*	10	Decision making & affective bias

\*Currently acquiring normative data for comparison

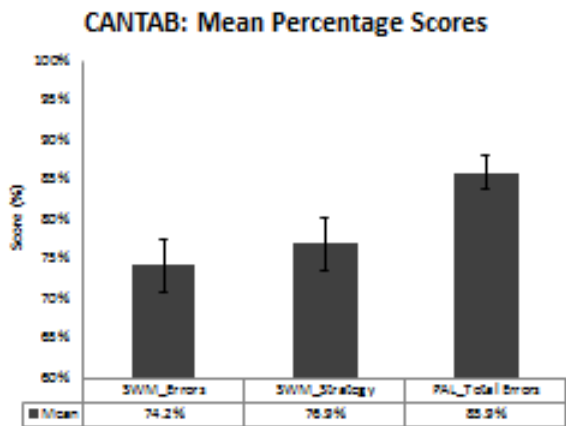


Readiness Through Research



48

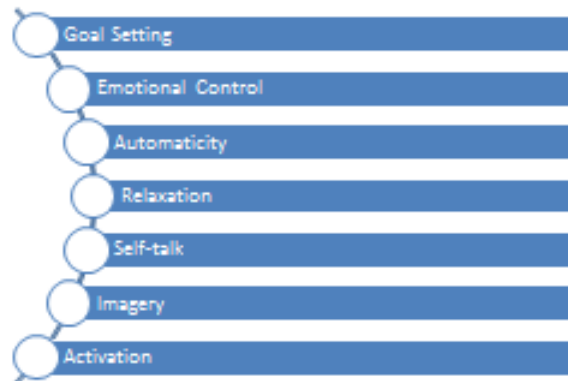
## CANTAB Group Results (n=49)



**Score Distributions for SWM & PAL**

Score Range	SWM Errors	SWM Strategy	PAL Errors
≤25%	4.1%	8.2%	0%
26-50%	10.2%	6.1%	4.1%
51-75%	34.7%	16.3%	14.3%
76-100%	51.0%	69.4%	81.6%

Data reported as mean percentages, where participants scored "As good or better than" their age-matched cohorts.



## TOPS

Strategies Utilized During Training and Operations



# TOPS Survey

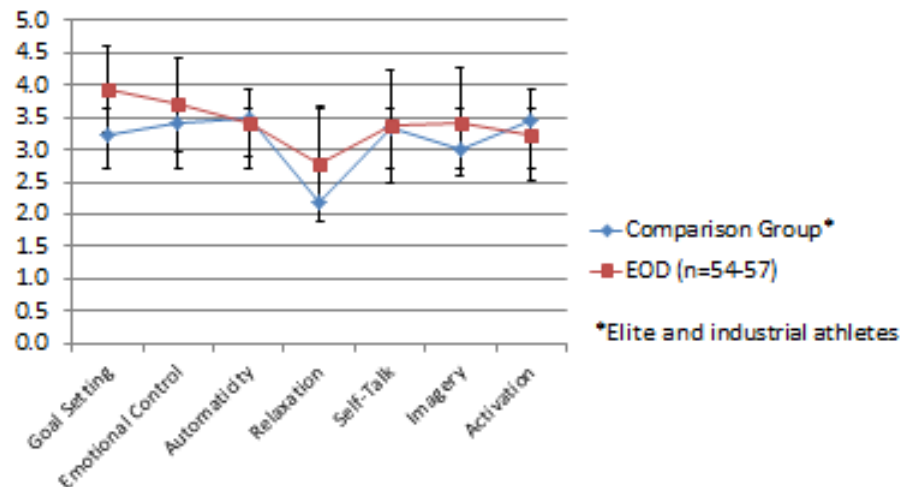
- Goal setting: Establishing and working towards specific targets
- Emotional control: Keeping your emotions steady, regulating, or effectively channeling emotional responses during an event
- Automaticity: Doing things without thinking too much about it or being able to perform a task automatically when prompted
- Relaxation: Maintaining a state of physical and emotional relaxation
- Self-talk: Talking to yourself, either silently or aloud, for encouragement or motivation
- Imagery: Visualizing yourself completing a task in a certain way
- Activation: Getting "psyched up" to perform a task



## 1-5 scoring scale

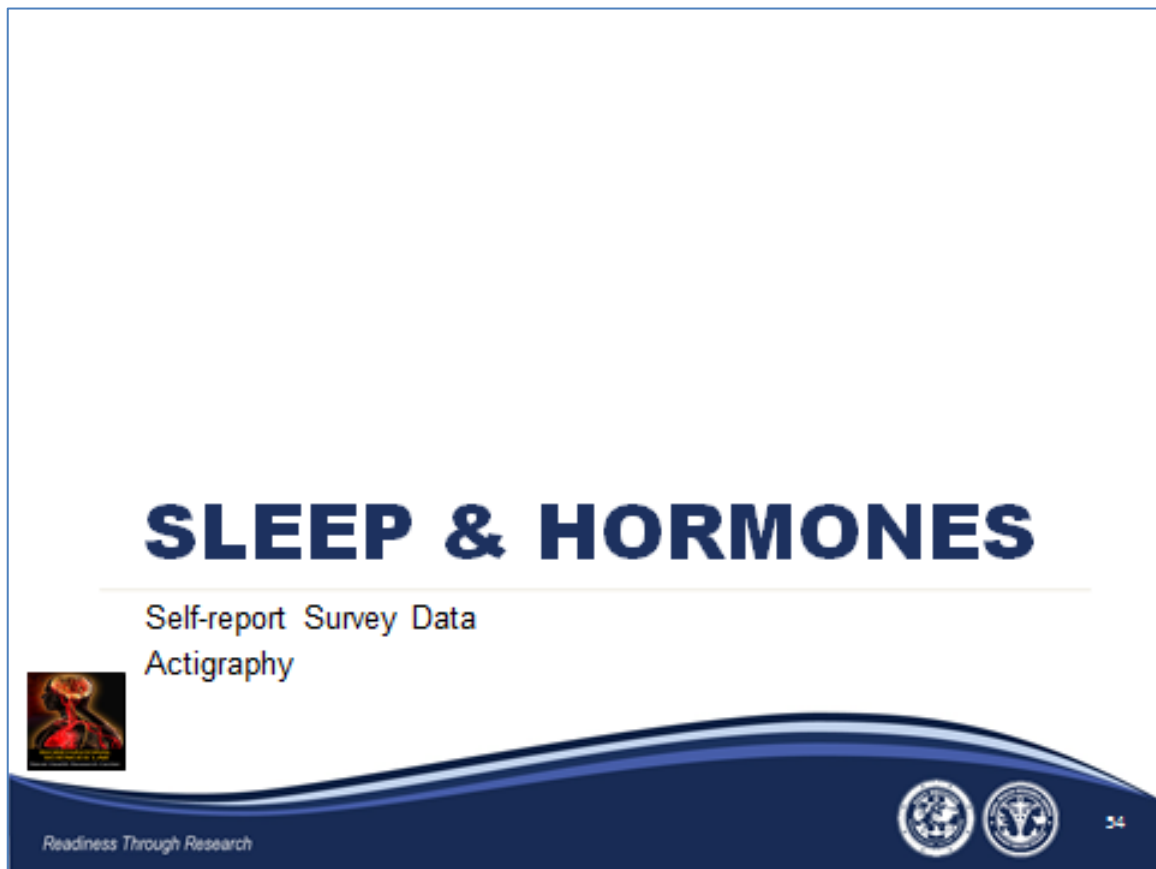
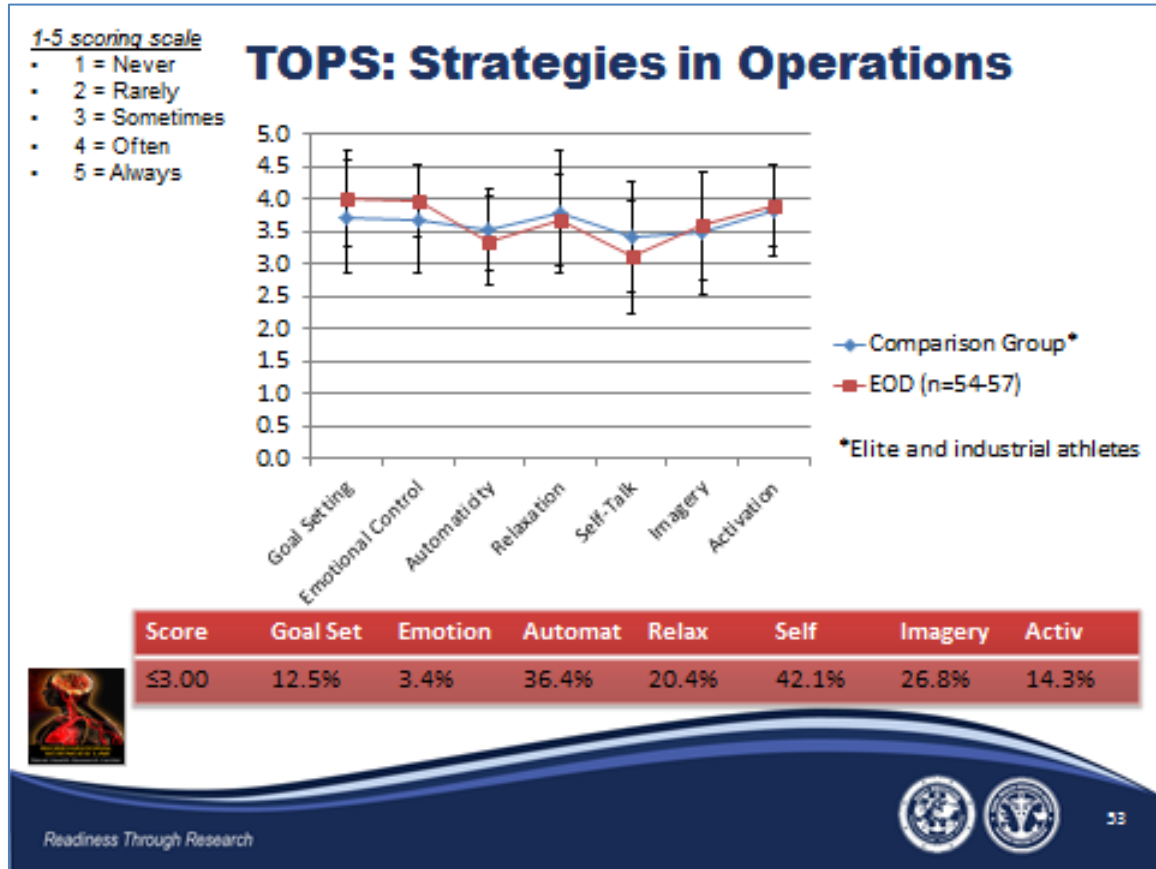
- 1 = Never
- 2 = Rarely
- 3 = Sometimes
- 4 = Often
- 5 = Always

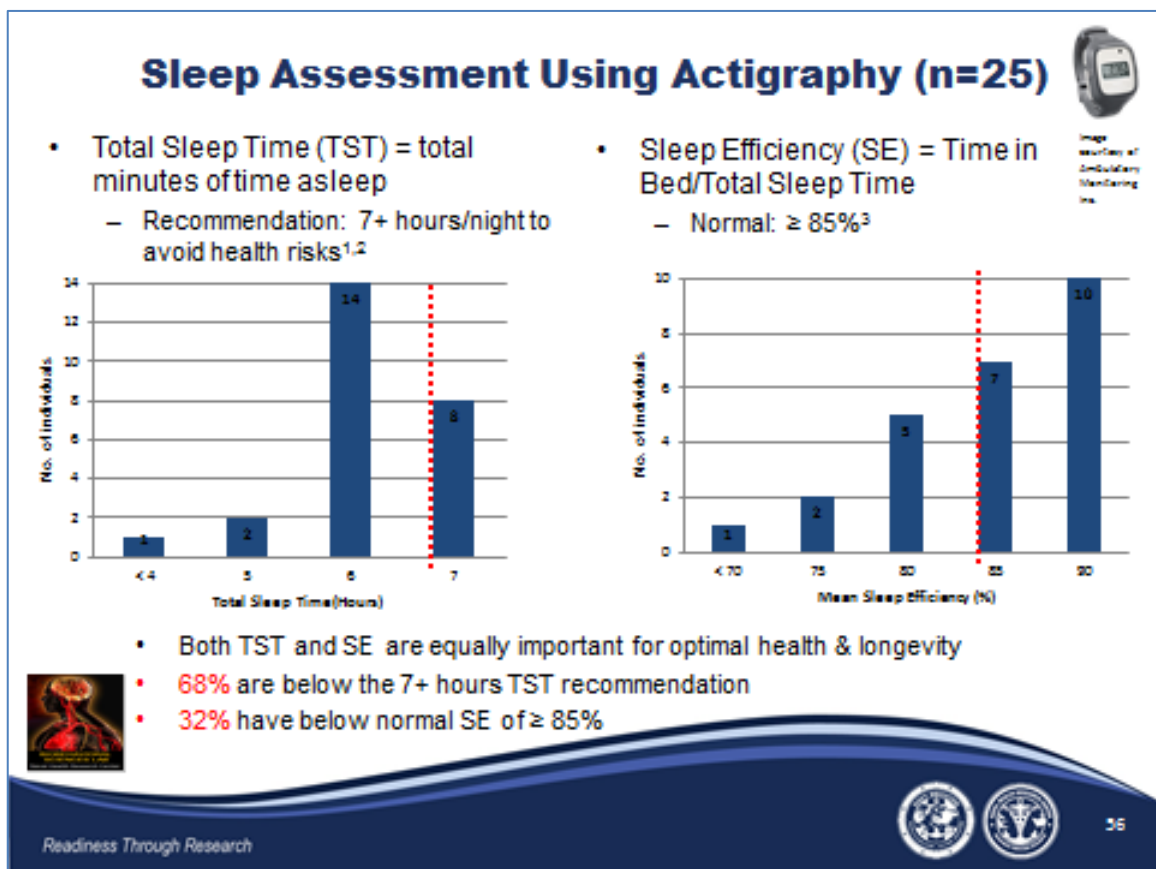
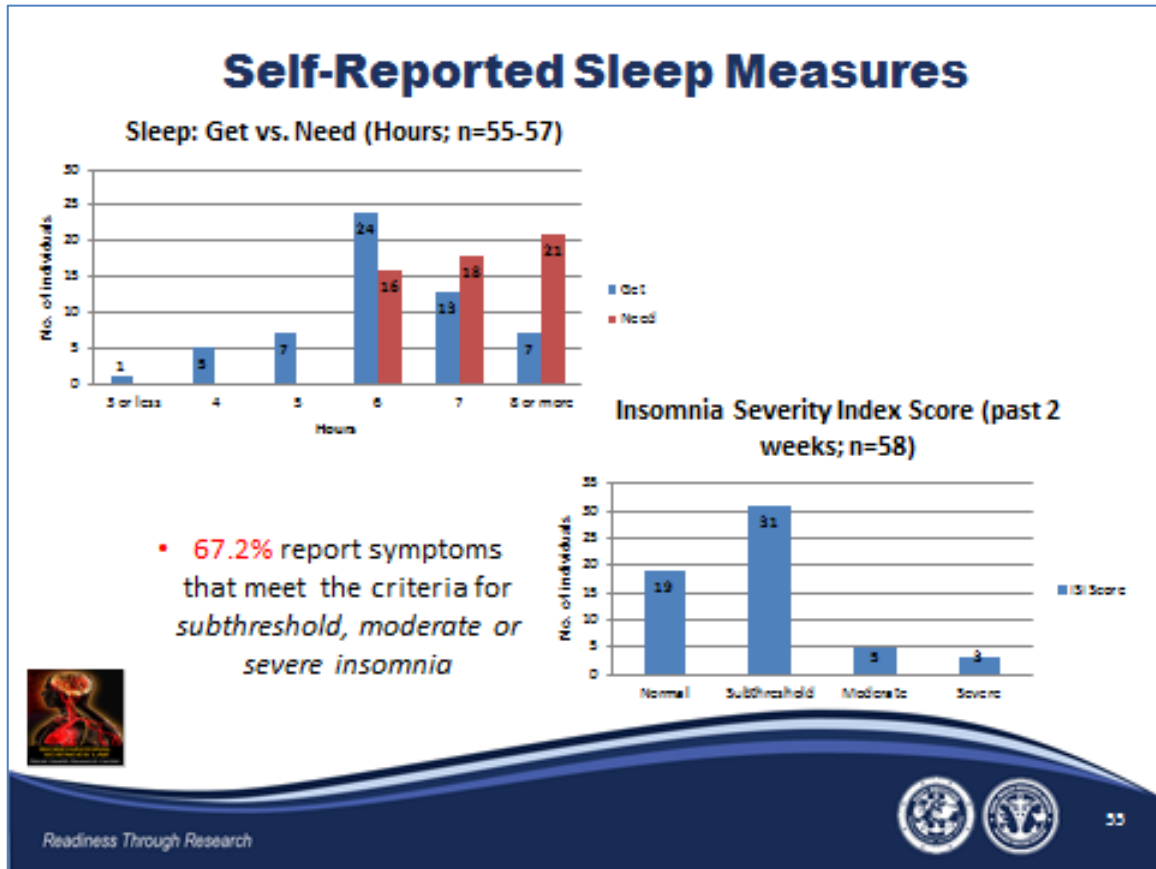
## TOPS: Strategies in Training

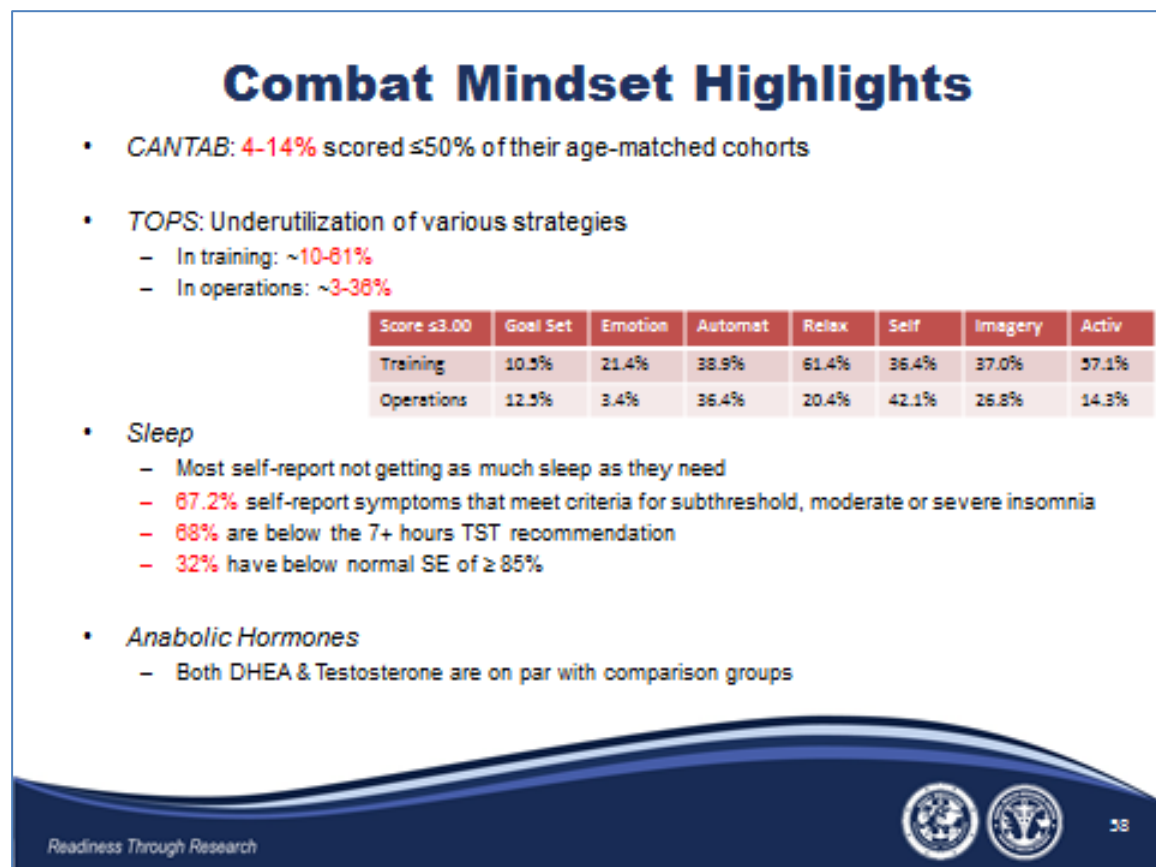
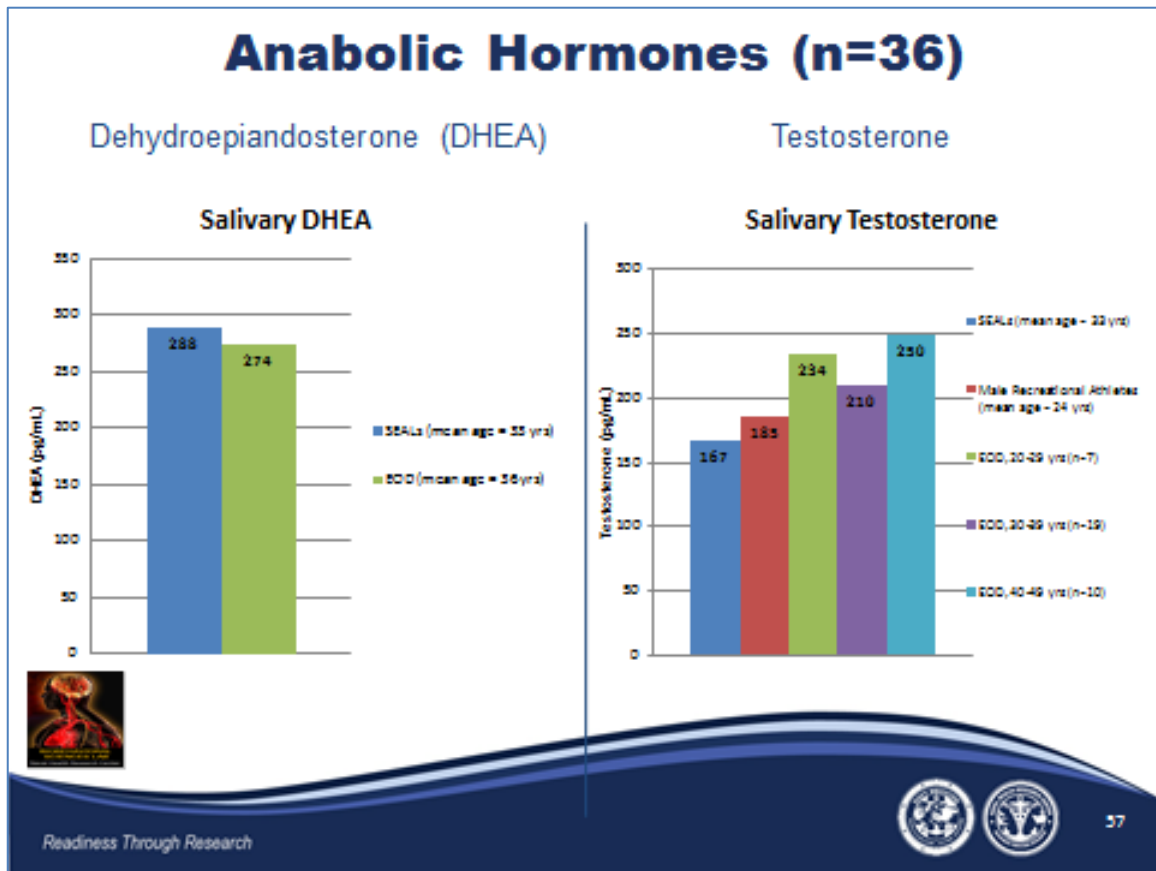


Score	Goal Set	Emotion	Automat	Relax	Self	Imagery	Activ
≤3.00	10.5%	21.4%	38.9%	61.4%	36.4%	37.0%	57.1%









## References

- 1) Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, Dinges DF, Gangwisch J, Grandner MA, Kushida C, Malhotra RK, Martin JL, Patel SR, Quan SF, Tasali E. Recommended amount of sleep for a healthy adult: a joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *SLEEP* 2015;38(8):843–844.
- 2) Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, Hazen N, Herman J, Katz ES, Kheirandish-Gozal L, Neubauer DN, O'Donnell AE, Ohayon M, Peever J, Rawding R, Sachdeva RC, Setters B, Vitiello MV, Ware JC, Adams Hillard, PJ. National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health* 2015;1(1):40-43.
- 3) Zhang, J., Ma, R. C. W., Kong, A. P. S., So, W. Y., Li, A. M., Lam, S. P., ... Wing, Y. K. (2011). Relationship of Sleep Quantity and Quality with 24-Hour Urinary Catecholamines and Salivary Awakening Cortisol in Healthy Middle-Aged Adults. *Sleep*, 34(2), 225–233.
- 4) Taylor et al., 2016 Jun. Anabolic hormone profiles in elite military men. *Steroids*, 110:41-8. pii: S0039-128X(16)30012-5. doi: 10.1016/j.steroids.2016.04.001. [Epub 2016 Apr 13].
- 5) Teo et al., 2011. The effects of circadian rhythmicity of salivary cortisol and testosterone on maximal isometric force, maximal dynamic force, and power output. *Journal of Strength and Conditioning Research*, 25(6), 1538-1545.



Readiness Through Research



39



# Naval Health Research Center

*Readiness Through Research*


## EOD Health Satisfaction Survey


EOD Warrior Athlete Working Group II: Forging the Future for  
Education & Training  
25-26 JAN 2017


60


## Primary Survey Questions


Four questions are asked about the following assessments:

  
ExPhys

  
Nutrition

  
PhyCORE

  
Combat Mindset

  
Sleep

Enjoyed completing the assessment

• Strongly Disagree - Disagree - Neutral - Agree - Strongly Agree - N/A

Staff explained results in a way that was easy to understand


• Strongly Disagree - Disagree - Neutral - Agree - Strongly Agree - N/A



The feedback will help me become better at my job

• Strongly Disagree - Disagree - Neutral - Agree - Strongly Agree - N/A

Learned something new about my body, health & fitness

• Strongly Disagree - Disagree - Neutral - Agree - Strongly Agree - N/A

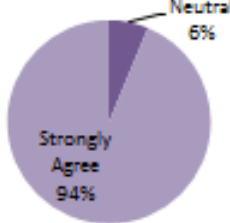




61

Readiness Through Research

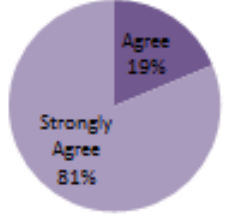
## ExPhys Assessments: DXA, 1-RM & GXT

### Enjoyed assessment



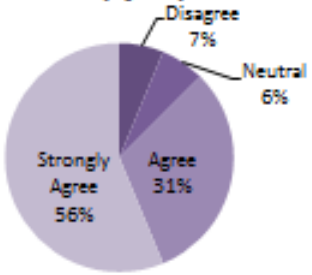
Response	Percentage
Strongly Agree	94%
Neutral	6%

### Results well explained



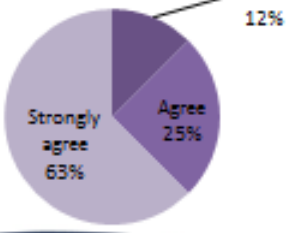
Response	Percentage
Strongly Agree	81%
Agree	19%

### Feedback will help job performance




Response	Percentage
Strongly Agree	56%
Agree	31%
Disagree	7%
Neutral	6%



### Learned something new



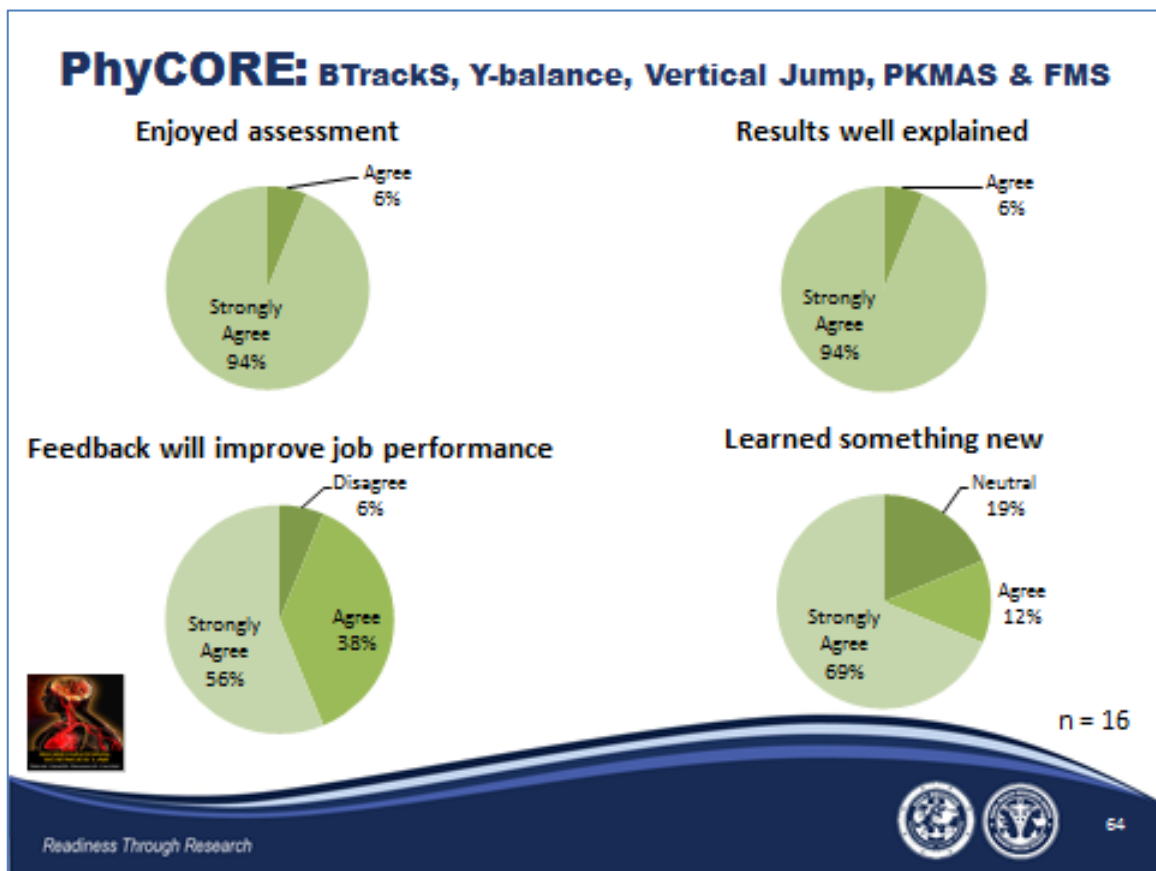
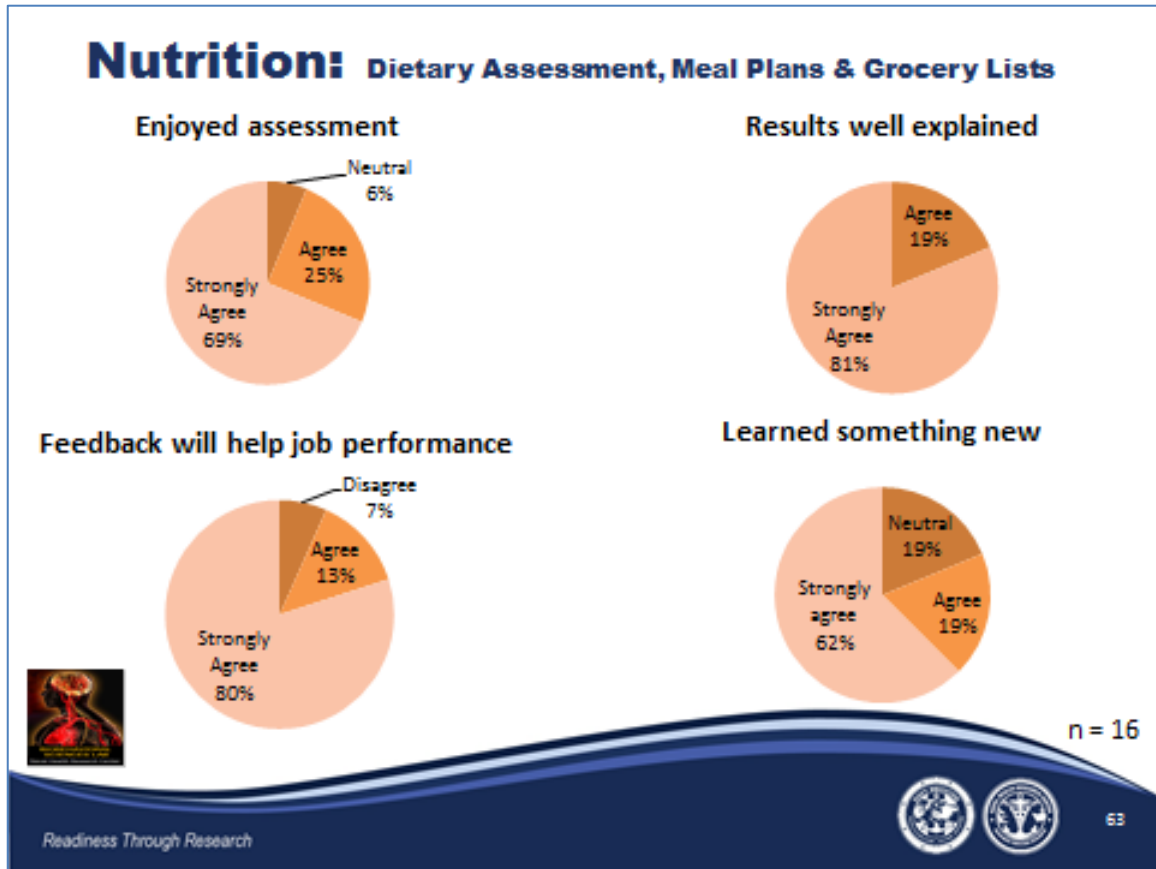
Response	Percentage
Strongly agree	63%
Agree	25%
Neutral	12%

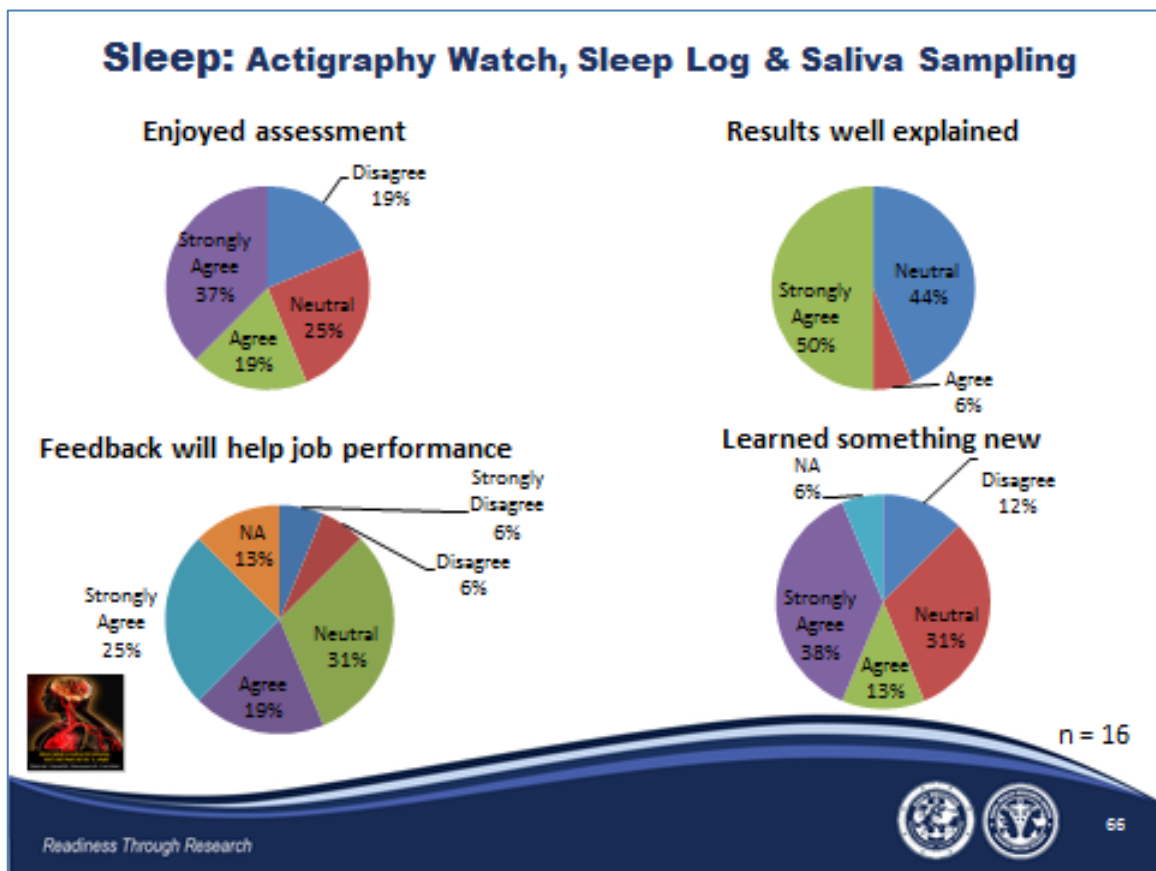
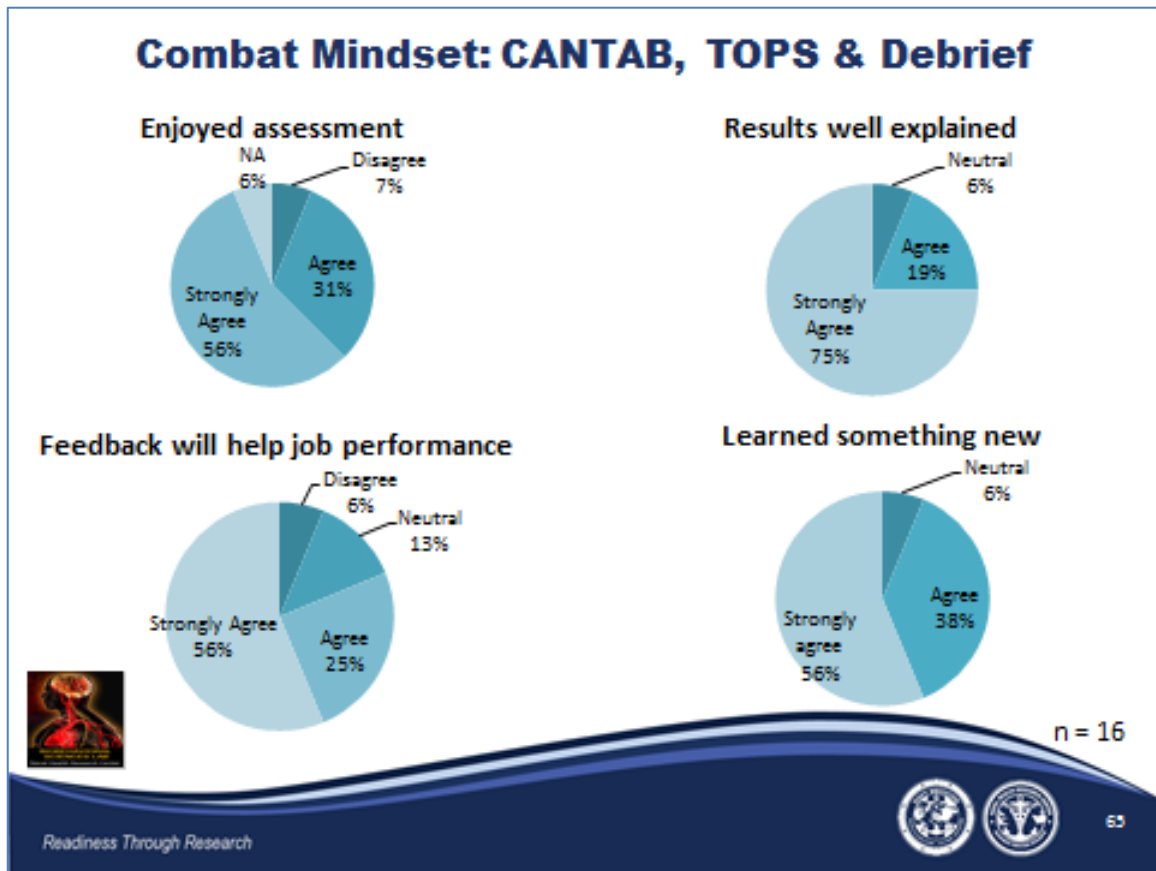
n = 16



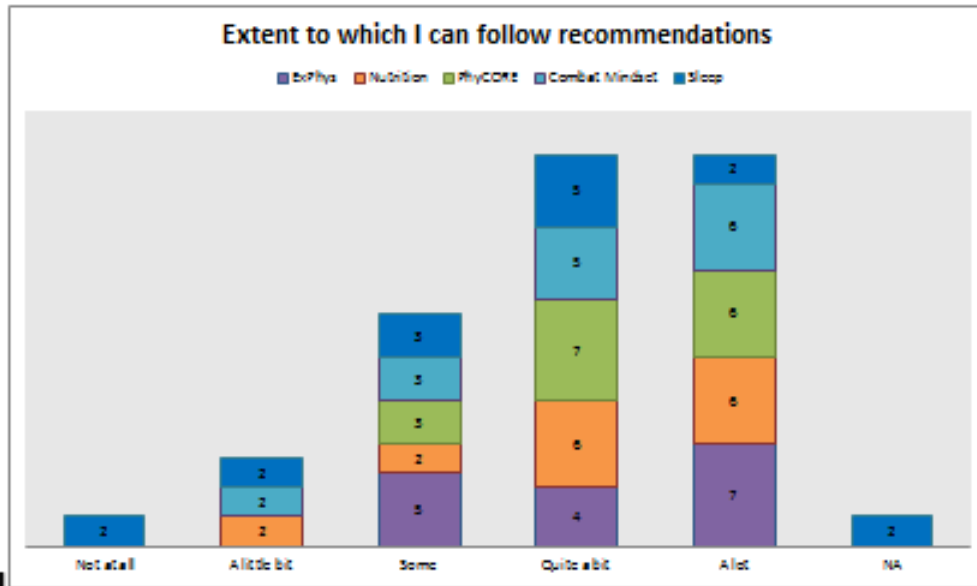


62

Readiness Through Research





### Additional Survey Question



n = 16

