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Total Force Fitness for the 21st Century A New Paradigm



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Guest Editors

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TOTAL FORCE FITNESS FOR THE 21st CENTURY: A NEW PARADIGM

In this special issue of *Military Medicine*, we provide the foundation of a new paradigm for maintaining health, readiness and performance in the Department of Defense (DoD). It is a holistic view to carry us into the 21st Century and be applied to all those who work daily to help preserve the health of those in harm's way.

We are in an age of sustained conflict. Wars and threats to our security are no-longer episodic, but require continuous optimal performance, resilience and recovery. Injury from these conflicts may be physical and mental, social and spiritual. It impacts the service member, their family and community, and the nation. If we are to protect the freedom and security of our nation, we must move beyond simply having a sound body to a holistic view of health and fitness that includes both mind and body. Such a shift is essential, perhaps even for our very survival.

Because of this need the Chairman of the Joint Chiefs of Staff (JCS), ADM Michael Mullen, asked the Consortium for Human and Military Performance (CHAMP) at the Uniformed Services University of the Health Sciences (USU) to develop the concept of Total Force Fitness (TFF). CHAMP coordinated with the Samueli Institute (a non-profit research organization), the Institute of Alternative Futures, and members of the JCS office to organize and host such a workshop. A group of over 70 scientists, health, social, community and spiritual leaders and those from the front lines was convened to help frame, define and tell us how to evaluate and measure what we need to keep our service members resilient and flourishing in the current environment. The workshop was held on December 6-9, 2009 at the (USUHS), Bethesda, Maryland. This special issue is the result of those deliberations and the work of dozens of contributors after the conference.

The front cover of this issue illustrates the framework with which we began. It depicts the mind and body of the service member surrounded by the family, community and environment in which they

live and function. The back cover illustrates the eight domains of Total Force Fitness the group addressed. These include physical, nutritional, medical, environmental, behavioral, psychological, spiritual, and social, with family embedded within multiple domains. Eight working groups were established to define the domain and describe its components, provide a summary of the rationale and evidence for including it in TFF and collect the metrics and measurement approaches that are or could be used to evaluate the success of DoD programs in attaining TFF. All articles were subject to rigorous peer-review and those who passed this process were accepted for publication.

The goal of this issue was not to describe the many programs existing or in development to enhance fitness in the force, as that would be beyond the scope of this effort. We did attempt to provide the foundation for how any fitness program could be evaluated and compared, and a summary of metrics that could be used for monitoring program effectiveness and for improving and comparing those already in existence. In addition, a number of current measurement indexes used both inside and outside the military were reviewed with the potential to integrate these evaluations for the individual, unit commander, community and DoD leadership.

At the end of this issue we have selected articles addressing the challenges to implementing this holistic view. Many lessons from the past have gone unlearned and many current programs are going unevaluated, which dooms us to repeat our failures and lose sight of our successes. In recent years, science has become sub-divided and distanced from the front lines so appropriate and evidence-based information does not always get translated for those who need the information in a timely manner. We hope the readers will find the information in this special issue of *Military Medicine* a major step toward closing the gap so they may deliver more and better value to those they serve.



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TOTAL FORCE FITNESS FOR THE 21st CENTURY A NEW PARADIGM

Guest Editors:

Wayne B. Jonas, Francis G. O'Connor, Patricia Deuster, and Christian Macedonia

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On Total Force Fitness in War and Peace

ADM Michael Mullen, Chairman of the Joint Chiefs of Staff

“Fitness” is a commonly used word in our society today but within the military it has a particularly deep meaning. Conventionally, being fit means being adapted to a particular condition or circumstance. In war, militaries and their individual combatants must adapt to the chaos and complexities of battle. As these militaries return from war, they must maintain a state of vigilance while also peacefully coexisting within the civil society that produced them. Their fitness is not just something that is merely physical; it is holistic.

Fitness for an individual, family, or organization, is a state of adaptation in balance with the conditions at hand. An individual fit for marathon running may be perfectly unfit for mountain climbing. A family adapted to the state of having the soldier-parent gone may suddenly find themselves poorly suited for the sudden return of a battle-hardened warrior. An organization having spent the past decade in counterinsurgency warfare may find the role of conventional armor warfare too restrictive or mundane to perform well on the tank gunnery range.

In a static world, perfect fitness is achievable. However, in the real world being fit is a dynamic state of being. Optimal fitness may be more dependent on our state of mind than on the frequency of trips to the gym. I believe the secret to optimal fitness lies in the constant awareness of the changing environment and the continuous pursuit of flexible adaptation to the inevitable shifts. For the warrior, this necessity for “awareness” is encapsulated in the quotation from Sun Tzu “Know the enemy and know yourself; in a hundred battles you will never be in peril. When you are ignorant of the enemy but know yourself, your chances of winning or losing are equal. If ignorant both of your enemy and yourself, you are certain in every battle to be in peril.”¹ This sounds so simple and yet it is very hard. Hearing about our strengths is easy. Finding out that we are vulnerable requires integrity in our assessments. Nowhere is this more true than in our unit readiness reporting.

Fitness is often used interchangeably with the term “readiness.” Are you fit, are you ready? As I see it, readiness is all about being capable of being able to accomplish something you are called to do. A unit of troops may be ready to load onto airframes and deploy to a distant land. How many troops are leaving behind families that are falling apart? How many are flagged for unresolved drug or alcohol issues. How many are being loaded onto these aircraft while we in leadership remain oblivious to these problems that do not show on a readiness report? I, for one, want to know not only that a unit is ready but also that it is in a state of what I would call “total fitness.”

Total fitness is a state where mind and body are seen as one. It is a state where people, their families, and the organizations

in which they serve are connected and thriving. I see total fitness as a point of balance between readiness and well-being, where each of these two conditions are mutually supporting and in complete balance. A total force that has achieved total fitness is healthy, ready, and resilient; capable of meeting challenges and surviving threats. Achieving that begins with the way we treat our people.

In the discussions of deployment we often talk about “boots on the ground” or “numbers of bodies.” When a soldier is medically evacuated from theater we “requisition” a replacement. Our current language bespeaks the idea that we are moving around an inanimate object. We cannot forget that a mind occupies the body of every person we deploy.

From Aristotle and Plato through Descartes and Kierkegaard, philosophers have debated the mind–body duality. Regardless of one’s beliefs in a mind–body duality, a growing body of scientific evidence, as I read it, certainly links the general health of the body with the state of one’s perceptions of well-being.² Scientists have also gathered ample evidence that one’s attitudes toward wellness influence how one maintains one’s physical health.^{3,4,5} Even if one still believes that success in war is all about boots on the ground, one has to concede that being concerned about the state of a soldier’s mind is just as important as the state of his or her weapons system.

It is also true that what we put into our bodies has just as much importance as how we prepare our minds and bodies. The emerging science behind the positive effects of omega-3 fatty acids on mood indicate that diet is not simply a matter of maintaining ideal body weight. Fitness cannot be separated completely from nutrition.^{6,7} Stress eating may just be compounded by the fact that we present so many “comfort foods” in deployed settings—where the ability to expend calories is ever present; yet upon return, individuals with much lower calorie requirements continue to ingest these high-fat and high-carb diets.

It would be a mistake to fix a discussion on fitness in a military at war only in the negative. It is, in fact, not at all uncommon for people to achieve a higher level of physical and emotional fitness following difficult events like battles and wars. This is what Richard Tedeschi and others have called “post-traumatic growth.” Many of the principles described under the rubric of post-traumatic growth can be found in the Army’s pioneering efforts in comprehensive soldier fitness.^{8,9} The key seems to me to be the ability to maintain a balance both emotionally and physically under a variety of rapidly changing demands.

In this edition of *Military Medicine*, scientists will explore what fitness really means to warriors and their families. I have charged them to think hard, to apply science, and to help me

understand how I can make sure that warriors and their families can lead their lives to the fullest. I have challenged the scientists to think holistically and to provide our 21st century leaders with 21st century definitions of fitness, health, and resilience.

Inevitably in war, some men and women pay the ultimate sacrifice. For those surviving members of their families and those who have served beside them I am obligated to provide opportunities for them to meet whatever challenges they face in the future. For those who continue to serve, I must make sure they stand fit and ready to face whatever missions they are called to execute. For those who move into the civilian world, I believe we owe them our full support for a successful transition toward a life that is as rich and fulfilling as it can possibly be. Most importantly, for the families who have sacrificed so much, I fully embrace my role as a defender of their rights.

Total force fitness is more than a physical fitness. It is the sum total of the many facets of individuals, their families, and the organizations to which they serve. It is not something someone achieves twice a year for a test. It is a state of being.

To the scientists and health care providers who read this issue of *Military Medicine*, I issue this call: Help me help our troops and their families. Give us the tools to know when to intervene. Provide us with scientific measures of total force fitness. Give our people the guidance and support they need. Keep your minds open to creative new concepts and possibilities. Critically evaluate the role of complementary and alternative medicine.^{10,11} Add to our understanding of the connections between physical fitness and aging.^{12,13} And finally, explore the anecdotal evidence regarding total force fitness and then develop scientific protocols to put these observations to objective tests. In return, I will defend your efforts, advocate for your cause, and fight any bureaucratic hurdles that may pass in your way.

REFERENCES

1. Sun Tzu: The Art of War. Translated by Samuel B. Griffith. Oxford University Press, 1971.
2. Ekeland E, Heian F, Hagen KB, Abbott J, Nordheim L: Exercise to improve self-esteem in children and young people. *Cochrane Database Syst Rev* 2004; (1):CD003683.
3. Dutta-Bergman MJ: Primary sources of health information: comparisons in the domain of health attitudes, health cognitions, and health behaviors. *Health Commun* 2004; 16(3): 273–88.
4. Strong KA, Parks SL, Anderson E, Winett R, Davy BM: Weight gain prevention: identifying theory-based targets for health behavior change in young adults. *J Am Diet Assoc* 2008; 108(10): 1708–15.
5. Aarnio M, Winter T, Kujala U, Kaprio J: Associations of health related behaviour, social relationships, and health status with persistent physical activity and inactivity: a study of Finnish adolescent twins. *Br J Sports Med* 2002; 36(5): 360–4.
6. Su KP: Biological mechanism of antidepressant effect of omega-3 fatty acids: how does fish oil act as a ‘mind-body interface’? *Neurosignals* 2009; 17(2): 144–52.
7. Parker G, Gibson NA, Brotchie H, Heruc G, Rees AM, Hadzi-Pavlovic D: Omega-3 fatty acids and mood disorders. *Am J Psychiatry* 2006; 163(6): 969–78.
8. Joseph S: Client-centred therapy, post-traumatic stress disorder and post-traumatic growth: theoretical perspectives and practical implications. *Psychol Psychother* 2004; 77(Pt 1): 101–19.
9. Calhoun LG, Tedeschi RG, Park CL: Posttraumatic growth: positive changes in the aftermath of crisis. Lawrence Erlbaum Associates, 1998.
10. Levin JS, Glass TA, Kushi LH, Schuck JR, Steele L, Jonas WB: Quantitative methods in research on complementary and alternative medicine. A methodological manifesto. *NIH Office of Alternative Medicine. Med Care* 1997; 35(11): 1079–94.
11. Aickin M: The importance of early phase research. *J Altern Complement Med* 2007; 13(4): 447–50.
12. Hardy S, Grogan S: Preventing disability through exercise: investigating older adults’ influences and motivations to engage in physical activity. *J Health Psychol* 2009; 14(7): 1036–46.
13. Colcombe SJ, Kramer AF, McAuley E, Erickson KI, Scalf P: Neurocognitive aging and cardiovascular fitness: recent findings and future directions. *J Mol Neurosci* 2004; 24(1): 9–14.

Current Department of Defense Guidance for Total Force Fitness

COL Beverly C. Land, MC USA

ABSTRACT Fitness and health care have traditionally had a major focus in the military and will continue to be an important focus for the medical community throughout the 21st century. The challenges of meeting comprehensive mental and physical care for service members are many, especially in this era of persistent conflict. We must clearly define what those fitness components will be, how they will be assessed as an individual measure, as well as how it will be applied to the community at large. How will it be “trained” and who determines and what is the “end state” are only some of the tasks ahead. The Department of Defense (DoD) will be an active participant in these discussions as we forge ahead. Effective, well-informed guidance from our senior leaders is paramount to the success of this initiative and ensures that it becomes integrated into the entire life cycle of our service members.

CURRENT DEPARTMENT OF DEFENSE GUIDANCE FOR TOTAL FORCE FITNESS

Fitness and health care have traditionally had a major focus in the military and will continue to be a important focus for the medical community throughout the 21st century. Today, the challenges of meeting comprehensive mental and physical care for our service members are many, especially in this era of persistent conflict. One must ask two questions: What is military fitness? What and who determines what qualities are components of total force fitness? We have focused much of our attention on enhancing physical health and equating that to fitness, but we must look beyond this singular focus for all. Going back to 2006, the Uniformed Services University of the Health Sciences held a conference for more than 80 attendees from several Department of Defense (DoD) and service-level organizations on this subject. Entitled “Human Performance Optimization (HPO) in the Department of Defense,” this conference set out toward a goal of initiating the development of an overall strategic plan for human performance optimization for the military. The finding of this conference was subsequently published in *Military Medicine* in 2007.¹ This conference recognized that there was a capability gap regarding HPO, and even today it continues to be so. One important initiative that evolved from that meeting was the development of a dedicated human performance office within Force Health Protection in the Assistant Secretary of Defense Office (Health Affairs). This office has been an active partner within the DoD on all issues arising in the area of HPO. Other related efforts at the DoD Health Affairs level to highlight fitness and performance can be found in the Military Health System Strategic Plan. A “Healthy, Fit and Protected Force” is one of the four components of the mission of the MHS and “Optimizing Human Performance” is further specified in mission element 2: Fit, Healthy and Protected Force.² The importance of fitness is also recognized in the most current version of the Joint Force Health Protection Concept of Operations dated July 2007, as a Joint Force Health Protection capability.³ Senior leadership further

recognized the need for a more inclusive and comprehensive program for fitness. In December 2009, a “Total Force Fitness for the 21st Century” conference was held at the Uniformed Services University of the Health Sciences to again address health, fitness, and performance optimization, and ultimately, develop a consolidated Chairman, Joint Chiefs of Staff directive on the way ahead for DoD total force fitness, with application to all services. One product from the conference was an identification of eight integral components of fitness: social, behavioral, physical, environmental, medical, spiritual, nutritional, and psychological fitness. Furthermore, this program would be prevention focused, individual centric, and that the family would be recognized as central to the total force fitness equation. This direction is similar to the Comprehensive Soldier Fitness program that was recently launched by the Army, which contains several overlapping areas of emphasis: family–soldier relationships, assessment and training from accession to retirement, and that leadership engagement is a key component in individual growth. The Army’s focus on the comprehensive soldier fitness concept has been an important framework for the Chairman, Joint Chiefs of Staff to engage all the services to adopt a unified overarching product, but gives the services the freedom to address individual differences. The Air Force has forged out in this realm too in a quest to improve human performance. They have moved from a model traditionally founded on force protection to a more holistic doctrine that “incorporates a capabilities-based, total life-cycle approach to managing airmen, a performance-based force projection model that concentrates on human performance.”⁴

Traditionally, attention to fitness within the military has generally been targeted only to the physical domain. Each service has its own unique evaluation tool, such as the Army Physical Fitness Test, to measure an individual’s physical performance with some of the test requirements changing focus over time using measure/metric to evaluate their performance. As the military closes in on the ninth year of persistent conflict in Iraq and Afghanistan, a larger concern is emerging about the total health of the force. Physical injury patterns

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from blast and improvised explosive devices are clearly different from previous conflicts, especially in the area of amputations, which has challenged traditional health care standards, both in how we take care of them and the total numbers seen. Not so easily identified and treated are the so called “hidden” injuries—hearing, vision, and now the more often diagnosed concussions, post-traumatic stress disorder, and anxiety. The personal and professional burden they create for our returning warriors is potentially overwhelming.

Our experience with injuries and illnesses from these conflicts has identified that there are additional domains of health that the health care systems have not uniformly targeted for evaluation and/or personal growth for our service members and their families. The Army has made the first servicewide attempt to consolidate a group of “strengths” for evaluation. They have identified five strengths—physical, social, emotional, family, and spiritual—and have begun to build an Army life cycle program to foster development, improvement, and further growth in each domain. The remaining services have yet to fully implement a similar program that engages the service members and their families in such a comprehensive fashion. This evaluation of needs by the Army has energized the DoD to assess the need for a unified, overarching program for all services.

The Department of Defense provides guidance for all DoD personnel through several types of department directives and instructions. The most encompassing policy guidance comes from the issuance called the Department of Defense Directive (DoDD). Directives are documents that establish policy, delegate authority, and assign responsibility. This includes non-organizational charters, assignment of functions and resources between or among the DoD or Office of the Secretary of Defense (OSD) components, assignment of executive agents, and matters of special interest to the secretary or deputy secretary of defense.⁵ Currently there is only one directive that addresses many of the concepts contained within total fitness. It is DoDD 6200.04, “Force Health Protection,” the only DoD policy that complements the departments full dimensional force protection effort for all members of the active duty and reserve components. Briefly, it mandates that all service members shall be physically and mentally fit to carry out their missions. Furthermore, the commanders, supervisors, individual service members, and the Military Health System shall promote, improve, conserve, and restore the physical and mental well-being of members of the armed forces across the full range of military activities and operations.⁶ It goes on to clarify how the DoD components shall provide a healthy and fit force, to include civilian and contractor personnel who accompany the force. In addition to this above-mentioned directive, DoDD 1010.10, “Health Promotion and Disease/Injury Prevention,” further clarifies the policy and responsibilities for health promotion, disease and injury prevention, and population health with the DoD. It establishes the DoD requirement to implement health promotion, disease and injury prevention programs, and population health to

improve and sustain military readiness and the health, fitness, and quality of life of military personnel, DoD personnel, as well as other beneficiaries.⁷ This DoDD further emphasizes the Healthy People Leading Health Indicators, which were to create a culture within DoD that values health and fitness and empowers individuals and organizations to actualize those values and achieve optimal health. It also delineates who has what responsibilities to coordinate, implement, and evaluate DoD policy.

Using the DoDD policies as base documents, the department produces issuances that provide department-level guidance in the form of a DoD Instruction (DoDI). This guidance delves deeper into specific aspects of programs and procedures that are contained in a directive. DoDI 1308.3, “DoD Physical Fitness and Body Fat Programs Procedure” is the only specific issuance in the physical fitness domain. It states that service members shall maintain physical readiness through appropriate nutrition, health, and fitness habits.⁸ Aerobic capacity, muscular strength, muscular endurance, and desirable body fat composition, form the basis for the DoD Physical Fitness and Body Fat Programs where the criteria for evaluation and body fat measurement is identified within the program design.

Queries for DoD-level guidance on many of the other components of total fitness are limited. DoDI 6490.4 “Requirements for Mental Health Evaluations of Members of the Armed Forces” touches on three components of total fitness—mental, behavioral, and psychological fitness. This instruction addresses the referral, evaluation, treatment, and administrative management of service members who may require mental health evaluation, psychiatric hospitalization, and/or assessment of risk for potentially dangerous behavior and protects the rights of service members referred by their chain of command.⁹ There are no other documents currently written at the DoD level addressing social, environmental, spiritual, or nutritional fitness.

There are two DoDIs that are more holistic in their influence. The first is DoDI 6130.4, “Medical Standards for Appointment, Enlistment or Induction in the Armed Forces,” and the second, DoDI 6490.03, “Deployment Health.” The Medical Standards DoDI focuses on physical fitness and has a limited evaluation on psychological fitness of the individual in regard to military service.¹⁰ The DoDI for Deployment Health is much more proscriptive with a requirement to document and reduce the risk of disease and occupational exposures of deployed personnel along with recording daily locations of these personnel.¹¹ This includes exposures, reporting of data, and submission of health-related lessons learned to their respective services.

Total force fitness for the services, military families, and our civilian workforce faces many challenges ahead. We must clearly define what those fitness components will be, how they will be assessed as individual measures, as well as how they will be applied to the community at large, how they will be “trained,” and who determines and what the “end state”

is—all tasks that lie ahead. The Department of Defense needs to be an active participant in all these discussions as we forge ahead. Effective, well-informed guidance from our senior leaders is paramount to the successful launch of this initiative and ensure that it becomes totally integrated into the entire life cycle of our service members. The individuals within our ranks are our most valuable resource and we need to embark on a journey to maximize their potential to the fullest.

REFERENCES

1. O'Connor FG et al: Human performance optimization: an evolving charge to the Department of Defense. *Mil Med* 2007; 172: 1133–7.
2. Department of Defense: A Roadmap for Medical Transformation. The Military Health System Strategic Plan, p. 15. Washington, DC, DoD, 2008.
3. Department of Defense: Joint Force Health Protection Concept of Operations, Version 0.9, July 2007. Washington, DC, DoD, 2007.
4. Tvaryana AP, Brown L, Miller NL: Managing the Human Weapon System: A Vision for an Air Force Human-Performance Doctrine. *Air Space Power J* 2009; XXIII(2): 34–41.
5. Department of Defense: DoD Instruction 5025.01, DoD Directives Program, October 28, 2007. Washington, DC, DoD, 2007.
6. Department of Defense: DoD Directive 6200.04, Force Health Protection (FHP), October 9, 2004. Washington, DC, DoD, 2004.
7. Department of Defense: DoD Directive 10101.10, Health Promotion and Disease. *Inj Prev* 2003; (November):24.
8. Department of Defense: DoD Instruction 1308.3, DoD Physical Fitness and Body Fat Programs Procedures, November 5, 2002. Washington, DC, DoD, 2002.
9. Department of Defense: DoD Instruction 6490.4, Requirements for Mental Health Evaluations of Members of the Armed Forces, August 28, 1997. Washington, DC, DoD, 1997.
10. Department of Defense: DoD Instruction 6130.4, Medical Standards for Appointment, Enlistment, or Induction in the Armed Forces, January 18, 2005. Washington, DC, DoD, 2005.
11. Department of Defense: DoD Instruction 6490.03, Deployment Health, August 11, 2006. Washington, DC, DoD, 2006.

Why Total Force Fitness?

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ABSTRACT In this article we describe a new paradigm for “Total Force Fitness.” In an age of sustained conflict, fitness requires continuous performance, resilience, and recovery of the whole person, not just the physical body. Injury from these conflicts is physical and mental, social and spiritual. It impacts the service members, their families and communities, and the nation. It is now abundantly clear that if our service members are to protect the freedom and security of our nation, we must move beyond the idea of simply having a sound body to a more holistic view of health and fitness, that includes both mind and body. We illustrate how science supports such a paradigm with research on how mind-body-spirit and community all interact to sustain health and accelerate healing in the path of stress and injury. A shift to total force fitness will be difficult, but essential, perhaps even for our very survival.

—A chain is only as strong as its weakest link.

INTRODUCTION

Warfighters and service members are the most valuable assets in the military for accomplishing our mission of defending the country. This mission has become progressively more complex as the United States is currently engaged in multiple conflicts resulting in unparalleled operational demands. Resilience to changing environments and the strains of war and multiple deployments is clearly required given the current stress on the force. Extensive resources are expended on insuring that equipment and materials are state-of-the-art and in good repair, whereas resources for maintaining and improving human resilience, performance, and health are more limited. Human health and performance optimization (HPO) are increasingly recognized as the cornerstones of an effective and efficient military. Most research has focused on the prevention of disease through physical examinations, vaccinations, health risk screening, enhanced exercise, and the reduction of unhealthy habits, such as smoking and alcohol use. The Department of Defense (DoD) invests a considerable amount in research and delivery of products in these screening, assessment, and treatment areas, but significantly less on health promotion, resilience enhancement, and HPO.

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WHY DO WE NEED A NEW APPROACH TO FITNESS?

Why do we need a new approach to fitness in the military? Why should we change the current approach to fitness, especially in the midst of two wars? And, why now? The answer is that the current paradigm is failing us. The demands on current warfighters and their families are overwhelming the resilience capacity of our service members. The military services are experiencing rampant post-traumatic stress disorder (PTSD), scores of injuries, family casualties, and increasing suicide rates. As described below, the burden is high and the framework of the current response does not match the circumstance or need.

The Scope of Trauma Response

The current wars in Iraq (Operation Iraqi Freedom, OIF) and Afghanistan (Operation Enduring Freedom, OEF) are returning thousands of warfighters with psychological mind injuries such as PTSD and physical mind-body injuries, such as traumatic brain injury (TBI), many with long-term symptomatic and functional consequences.^{1,2} Trauma to the head and neck occurs in 15–20% of all battle injuries, and mild TBI may afflict up to 28% of all deployed warfighters.^{3,4} Over 46% of blast patients and 55% of amputees at Walter Reed Army Medical Center have sustained comorbid brain injury. Nearly 20% of warfighters returning from the wars in Iraq and Afghanistan suffer from diagnosable PTSD,^{5,6} and nearly 40% report stress-related symptoms and dysfunction that significantly compromise reintegration into a full, productive life. As stated by Potash, the wounded veteran presents the health care system with “new challenges” not the least of which is the “... growing number of patients with comorbid chronic pain ... brain trauma and ... attendant cognitive issues.”⁷

Triggered by combined mind-brain/body injuries (MBI), the various manifestations of the trauma response share many common pathophysiological and recovery mechanisms. Evidence supports the potential for the development, expression, and durability of certain types of pain and psychopathologies (of various severities) in which genotypic factors could be either latent or code for differentially expressed phenotypes (e.g., of ion channels, neurotransmitters, receptors, and synaptic

elements). The triggers for differential expression could reflect from the internal and external environmental factors. In such genotypically predisposed individuals, environmental and/or psychosocial insult can induce a core constellation of common symptoms that include:

- (1) psychological and emotional distress (e.g., depression, anxiety, anger),
- (2) cognitive impairment,
- (3) chronic and often refractory pain of organic and psychosomatic origins,
- (4) drug/opioid desensitization (with abuse potential),
- (5) somatic (sleep, appetite, sexual, and energy) dysfunction.

Best estimates suggest that multiple comorbidities after exposure to trauma may be present in a substantial percentage of wounded military personnel. Villano et al.⁸ and Shipherd and coworkers⁹ have shown that psychiatric conditions, such as depression and anxiety, appear to be responsible for the co-occurrence of a syndrome of chronic pain and heightened stress reactivity, including frank presentation of PTSD, in 24 to 66% of combat-wounded veterans of OIF/OEF. The impairment of cognitive abilities in patients with chronic pain and PTSD, and the reported incidence and prevalence of chronic pain, PTSD, other neuropsychiatric conditions, and cognitive deficits in wounded OIF/OEF troops are also described by Beck and colleagues.^{10,11} These results are strengthened by the report that over 60% of these warfighters have been diagnosed with some form of brain injury or apparent constellation of cognitive, emotional, and behavioral features resulting from neural insult.⁹ This constellation of trauma-related manifestations can occur after any trauma but is especially prevalent now as trauma responses. (Fig. 1)

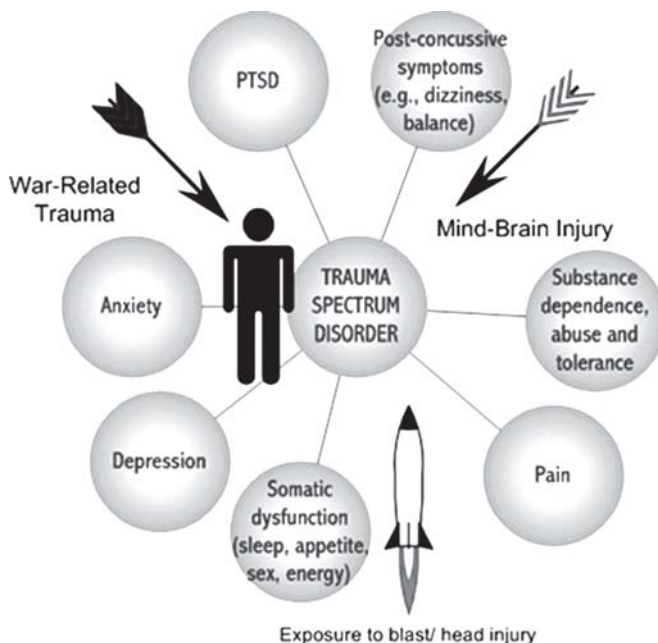


FIGURE 1. Trauma Spectrum Disorder.

Failure to Address the Full Trauma Response

The full expression of the MBI complex often manifests following treatment of the acute neuropsychological symptoms caused by in-theater trauma, with signs and symptoms reflective of progression along this neuropsychopathologic spectrum in these military personnel.¹² This pathological progression may be due to the psychophysiological effects of increased allostatic loads incurred by social, familial, occupational, and/or economic stressors, and it advances many service members down the slippery slope of resilience failure, symptomatic worsening, psychosocial stress, and life disruption.¹³ These persons are then classified into categories on the basis of mind, brain, or bodily damage and sent to specialty clinics (psychiatry, neurology, rehabilitation medicine, etc.) that address selected components of the trauma response (psychological, neurologic, or physical). Often they simply do not show up for care (avoiding treatment altogether for symptoms that carry a social stigma) or show up repeatedly at a later time in primary care clinics with a variety of somatic complaints involving dysfunctions in sleep, appetite, energy and/or sexual activity, or with law enforcement after family and community violence. The former results in under diagnosis and treatment and the latter increases the burden on primary care, social and legal services from chronic, unremitting illness. The latter may arise from so-called “sub-threshold” PTSD or “mild to moderate” TBI, which often goes undiagnosed or ineffectively treated.¹⁴ These patients may present weeks to months after trauma exposure with symptoms and dysfunctions that chronically burden the defense or veteran’s health care delivery systems.^{7,14} During these months they may be performing suboptimally for the mission with increasing risk of becoming casualties during future deployments. Clearly, the zero-sum nature of this situation is not appropriate to the sound practice of health care and the military—both technically and ethically—and calls for a more innovative and comprehensive approach to addressing the full consequences of trauma response.

The Need to Focus on the Whole System of Trauma Response

Clearly this epidemiologic and mechanistic data indicate a large and growing clinical problem (with recent estimates of this pattern of comorbidity within this population of wounded at as much as $n = 10,000$).¹⁵ These patterns of comorbidity may reflect underlying, common pathoetiologic variables and mechanisms, but emphasize the critical need for different approaches to holistically address the confounding variables and mechanisms. Moreover, they equally compel and sustain the need for “... the development of intervention based on a new integrated care model.”¹⁹ In addition, the long-term impact of mind-brain/body injuries extends beyond individuals as it touches their families and communities, a result that too often goes unaddressed by the health care system.¹⁶ From the perspective of the person, family, and community there is good reason to consider the whole person (rather than individual

components) and investigate integrative, multidimensional (mind, body, symptom, function) approaches to classification and treatment.¹⁷

Because of the complex nature of the human trauma response, the current standards of care for the service member are not maximally effective, nor do they fully address the biopsychosocial aspects and spectrum effects of trauma. Such care should address the whole person, family, and community experience of trauma and seek to facilitate prevention, cure, and healing. Such an integrated paradigm includes contextual understanding of person-specific variables, uses innovative approaches based on rigorous methods of empirical evaluation, and should narrow the gap between science, health care, and training.⁸ We cannot sustain our force by staying within the present paradigm. A new paradigm that leverages needs of the current wars, the science we know, and the best we can offer to the whole community is essential. A system that responds to the changing performance demands is imperative in these times of war and multiple deployments. To help frame this new approach, the Chairman of the Joint Chiefs of Staff called for defining "Total Force Fitness for the 21st Century."

THE NEW PARADIGM: TOTAL FORCE FITNESS

From December 6 to December 9, 2009, at the request of Admiral Mullen, Chairman of the Joint Chiefs of Staff (CJCS), 70 experts, drawn from the operational, scientific, and educational communities, came together to integrate the components of health and fitness under the title "Total Force Fitness for the 21st Century." At this conference, the dimensions of total force fitness were defined and some of the currently available metrics for assessing total force fitness were discussed. The following questions were posed: How do we get to total force fitness? What does total force fitness mean? What are the best strategies to move total force fitness into the training of the warfighter? And, how can we measure the components of total force fitness in a simple and integrated fashion? At a previous conference on HPO, Colonel Francis O'Connor outlined the major capability gaps that our warfighters face in mission performance.¹⁸ The conditions that prevent optimal mission performance in the military involve three major areas directly connected to HPO and total force fitness: physical injury, being overweight, and psychosocial dysfunction.

Looking at the psychological components alone, nearly 40% of service members report symptoms and dysfunctions that significantly prevent a full and productive life.⁵ Stress and psychological symptoms reduce the ability to maintain appropriate weight, fitness, and nutrition and increase the likelihood of developing chronic pain and dysfunction. Additionally, being overweight and having poor physical fitness compromises proper performance and often results in the discharge of service members each year. We are losing people due to lack of physical fitness despite mandatory testing. What we do not consistently mandate are programs that would provide the core (basic) physical fitness needed to build onto for the

special physical fitness requirements of the individual's mission. There is also no guidance on how to build both the physical and mental resilience of our warriors and their families so that they can better withstand and recover from the physical and mental insults of military service during training, deployment, war, and reintegration. Finally, lack of physical fitness contributes to injury, which is the number one cause of lost duty days among service members.¹⁸ What became clear at this conference is that these facts represent the tip of the iceberg and that a community approach to the management of health and fitness is required. Although major medical diseases require standard medical treatment, more rapid and widely applicable nonmedical training approaches are needed for the majority of those who cannot perform optimally, for whatever reason. Optimizing stress management skills and maintaining a healthy physiology before and during deployment, coupled with a process for rapid improvement and reintegration into normal life and optimal functioning on return from wartime, may well prevent the progression to PTSD and the development of chronic pain and may well reduce the chances of obesity, injury, and poor performance. Thus, a holistic approach that integrates the current domains of health and function is requisite for achieving total force fitness.

THE DOMAINS OF TOTAL FORCE FITNESS

What are the conditions for optimum performance, human resilience, and flourishing? Converging research reveals that four foundational pillars are required for optimal function: (1) physical fitness (activity) and rest, (2) proper nutrition and substance use, (3) psychological resilience, and (4) social integration. This framework, called the biopsychosocial model of human functioning and its components, creates an optimal healing environment.¹⁹ It postulates that a comprehensive lifestyle approach involving all four components works synergistically to improve function in all major areas that compromise human function and performance in any venue. Does such a holistic framework work? Yes it does. Reviews of research on comprehensive lifestyle programs show that when properly delivered these programs can attain good adherence and improvement in weight, body mass index, cholesterol, physical fitness, and quality of life.²⁰ Components of proven comprehensive lifestyle programs form the basis for optimizing performance and attaining total force fitness for military populations. But, optimum performance requires more than attention to just health. During deployment and upon reintegration into the family unit, warfighters are faced with multiple challenges, which include: (1) alertness and sleep rest management issues; (2) stress management from schedule pressure; (3) endurance and rapid recovery; (4) short- and long-term fatigue and functional sustainment in heat, cold, and altitude; (5) knee, leg, ankle, and spine trauma resulting in premature osteoarthritis; (6) a quick ramp-up in fitness, which is not sustained during deployment; (7) nonmission-specific training to prevent injury or psychological trauma; (8) rapid learning requirements and mental hardiness; (9) drug and supplement

side effects and interactions; and (10) pain—physical, psychological, and spiritual.²¹ All of these issues must be addressed in a holistic, comprehensive, and effective approach to total force fitness.

SORTING OUT THE PERFORMANCE CLAIMS THROUGH EVALUATION RESEARCH

Currently the individual and commander are bombarded with a plethora of products, practices, and programs claiming to enhance performance and improve health and fitness. These include approaches such as team training, mind–body practices, dietary supplements (caffeine), brain stimulation, drugs (sedative hypnotics), electromagnetic machines and special training techniques, functional movement screening, PTSD treatment tapes, stress programs, and meditation. A recent worldwide survey showed that over 60% of service members are regularly taking some type of dietary supplement.²² Usually supplement use is at the advice of the sales clerk or by getting information from magazines or peers. Evidence-based information is rarely available or rarely translated into a form that can be properly used by the warfighter or their commander. How can commanders and warfighters maximize the health, resilience, and performance of their charges? Credible, relevant and timely information or knowledge of total force fitness is difficult to find.

FOUNDATIONS OF TOTAL FORCE FITNESS

The foundations of total force fitness are multilayered as illustrated in Figure 2. First, fitness and performance optimization rest on the foundation of risk reduction, which allows for readiness to respond to challenges and prevent breakdown on physical, psychological, family, and social levels. The next layer of the foundation is health and wellness practices that allow a person to sustain balance and be symptom free. On top of these two levels, are stress resistance and resilience to changing environments. Resilience can only be determined during or after the stress or trauma occurs and the warfighter returns to health and function. Finally, the top layer of this

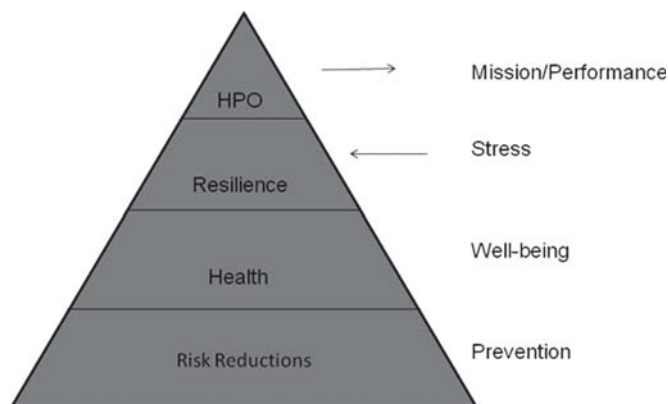


FIGURE 2. Foundations of Total Force Fitness.

foundational pyramid is HPO. Performance optimization is determined when functional excellence results in mission accomplishment or post-traumatic growth. It means going beyond simply resisting the challenges of stress and functioning at a new optimal level to face new missions or challenges. Thus, the foundational layers of total force fitness rest on the bases of risk reduction, health and well-being, resilience, and optimal performance.

Health is important to the maintenance of total force fitness. Nothing works without health. Wars are won and lost on health. Health arises from our capacity to resist breakdown and rapidly heal and recover. But, what is health? We concur with the World Health Organization's (WHO) definition of health, "a state of complete physical, mental, and social well-being and not merely the absence of disease" (<http://www.who.int/about/definition/en/print.html>). To this we would add spiritual well-being as a component of total force fitness. Spiritual well-being should not be confused with religion, however, which may or may not be an important part of one's spiritual well-being. In the military, fitness is manifest in four fundamental ways—prevention, health and well-being, resilience, and optimal functioning. In addition, these foundations must be sustainable throughout the deployment and military lifecycle. Optimal performance during battle and deployment must be balanced against health and sustainable social functioning upon re-entry. This requires a holistic framework wherein all dimensions of human flourishing are addressed.

INTEGRATING FITNESS DOMAINS

The total force fitness charge requires us to seamlessly combine the multiple components of fitness in the mind and the body. Within the category of the mind, we include spiritual, psychological, behavioral, and social fitness, whereas within the category of the body, are physical, nutritional, medical, and environmental fitness (Fig. 3). In the current paradigm, these components are usually addressed independently with

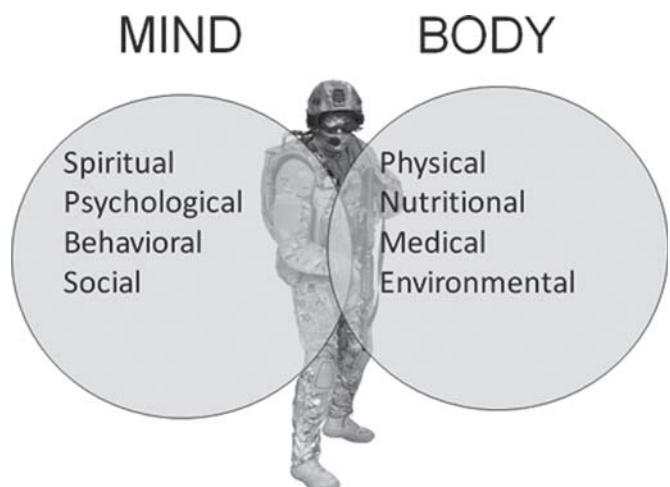


FIGURE 3. Total Force Fitness: The New Paradigm.

some being given more emphasis than others. Physical fitness for example, addressed through the performance of pushups, situps, and endurance training, is a part of the military culture. Medical and environmental fitness is also extensively addressed in the military. Recently, a focus on psychological fitness has begun to emerge. However, each of these components typically has its own specialists and delivery methods and resides within its own silo. To achieve total force fitness, the individual warfighter and commander require a more integrated and streamlined approach for monitoring and delivering the changes needed to be resilient and perform optimally.

Figure 4 illustrates where total force fitness is applied on the health–illness continuum relative to our current disease treatment approach. The healthy individual fluctuates within a certain range of function and optimal functioning occurs within the upper part of that range. Stressors, injury, and aging can force the individual over the threshold toward dysfunction where treatment usually occurs. Total force fitness works to the left of that stress, injury, and/or aging to retain health, reduce risk, improve resilience, and enhance performance. Disease management, on the other hand, focuses on symptoms and treatment after the injury. By focusing to the left of the injury, fitness increases the chances that the individual will return to healthy and optimal functioning in the event of environmental stressors and injury. Note: these factors, for the most part, are not dependent upon underlying gene susceptibility. A single genome when placed within its proper optimal functioning environment can flourish. The same genome when placed within a stressful or dysfunctional social, physical, or nutritional environment will degenerate. The question is: what is the environment that supports optimal fitness and function?

GETTING TO TOTAL FORCE FITNESS

The conference, Total Force Fitness for the 21st Century, began by describing the domains of total force fitness. These domains were derived from a variety of sources including current practices on medical fitness, psychological resilience

(e.g., Comprehensive Fitness Program of the Army and Total Family Fitness being implemented within the Navy and the Combat Operational Stress Program), physical fitness and injury screening (e.g., Special Forces and Marines), and integrative health care approaches being piloted in the Air Force and National Guard. The concept of total force fitness encompasses eight domains including medical, environmental, and social, including family, behavioral, spiritual, psychological, nutritional, and physical fitness. Figure 5 illustrates the domains of fitness derived at the conference. The constructs of health, resilience, and human performance require us to look at the intersections across and within each domain. In the next section of this article we provide examples of why it is essential to integrate these domains and not focus only on the most obvious.

Physical Fitness Is Enhanced by Psychological Factors

Physical fitness, well ingrained in military culture, is assessed regularly through semiannual testing and regular physical exercise. Time is provided during the work day to maintain physical fitness on many military installations. However, many would say we have a culture of testing not fitness. We often do not require warfighters to be fit for what they do, which is much more specific than just being generally physically fit. We know that one can be physically fit but if a job requires a specific physical activity like loading missiles under a wing, general fitness may not protect from injury. Most fitness trainers believe they can optimize physical function and endurance through general exercises, but should physical fitness be addressed only through such exercise? Research shows that other factors can impact physical fitness and endurance, for

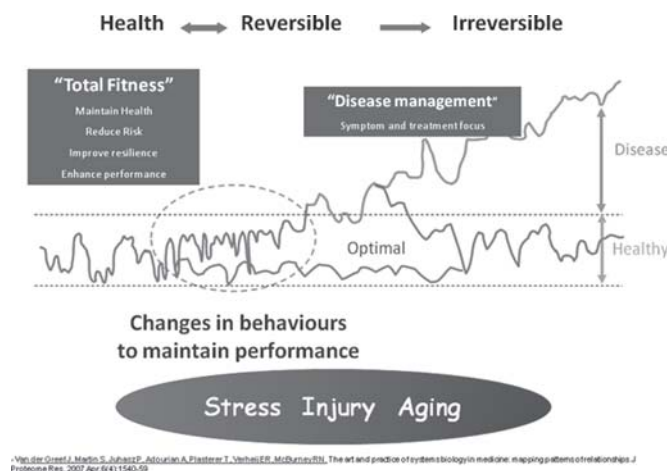


FIGURE 4. Fitness, Health, Performance Continuum.



FIGURE 5. Total Force Fitness Domains.

example, in the psychological domain. A study published in ACE Fitness Matters showed that average lap times could be enhanced by providing athletes something they were told would enhance their performance, even though that substance was a placebo. By calling a drink “super oxygenated water,” subjects ran an average of 83 seconds faster or 3.3 seconds faster per lap than when given “regular” water. Eighty-four percent of the athletes ran faster during the placebo enhancement part of the trial.²³ A recent survey of dietary supplements used in the military showed that service members frequently purchase and consume performance-enhancing products in an attempt to increase their endurance and strength.²² Although the ingredients of these supplements may not impact performance, the psychological aspects of taking them probably do. Thus, total physical fitness requires attention to the psychological, not just the physical components. Similar arguments could be offered for the behavioral domain.

Psychological Fitness Is Enhanced by Nutritional Fitness

Likewise, is it rational to address resilience by focusing only on the psychological fitness domain? A positive psychology enhancement program is currently being delivered and tested by the Comprehensive Soldier Fitness Program in the Army under the leadership of BG Rhonda Cornum. As with physical fitness, evidence indicates that we must step outside of the psychological fitness domain to attain total force fitness even in the mental health realm. For example, adequate nutrition is an essential component of psychological fitness. A meta-analysis of six trials examining the effect of dietary omega-3 fatty acids (FAs) on depression symptoms showed a significant inverse correlation between the amount of omega-3s with depression and psychiatric symptoms.²⁴ Supplementing American warfighters who have low levels of omega-3s might provide significant enhancement of mood and resistance to stress. Omega-3s also seem to be related to suicide. A study published in the *American Journal of Psychiatry* showed that low plasma levels of docosahexaenoic acid or DHA (an omega-3 FA) at baseline predicted future suicide attempts at patient discharge.²⁵ In addition, increased omega-3 FA intake is associated with reduced suicidal ideation.²⁶ Thus, achieving psychological fitness will require attention to nutrition. Resilience cannot be addressed solely by focusing on the psychological fitness domain in isolation.

Medical Fitness Is Enhanced by Social and Spiritual Fitness

The components of medical fitness are well delineated within the health care system. The management of pain and wound healing are major areas of focus for medical treatment. Although current approaches to pain management include nonsteroidal anti-inflammatory drugs, acetaminophen, analgesics, and various types of opioids, it is well accepted that pain is influenced by psychological, social, and even spiritual components. Case studies have shown that hypnosis or

the belief in God’s blessing can help individuals resist pain, reduce bleeding, and accelerate wound healing. These factors can also be trained through various mind–body approaches. For example, Gonsalkorale 2002 in *The American Journal of Gastroenterology*, reported showing that simple imagery and self-hypnotic techniques can improve and maintain lower abdominal pain thresholds for individuals with chronic abdominal pain.²⁷ Other studies have shown that social interactions cannot only reduce pain, but improve immune function and enhance wound healing. For example, a study by Kiecolt-Glasier published in *The Archives of General Psychiatry*, 2005 showed that family conflict can significantly influence physical wound healing. Time to heal was delayed by an entire day following a marital conflict as compared to after a supportive social interaction.²⁸ Dr. Kiecolt-Glasier cites other studies showing that stressful family events can slow local cytokine production at the wound site and promote maladaptive, systematic, proinflammatory production that could lead to accelerated chronic disease later in life.

Mechanisms of these mind–body connections are increasingly being revealed through basic science.²⁹ Stressors that activate the hypothalamic pituitary adrenal axis cause the release of cortisol and other metabolic mediators, which have multiple systemic effects, inducing cytokines that feedback to the brain. Disruption of these feedback systems can impact the ability to properly respond and function, both cognitively and psychologically. The mind, body, and family are not separate functioning entities. Interventions that focus exclusively on nonpsychological aspects of medical fitness cannot withstand scientific scrutiny. The entire human being—mind, brain, and body—function as an integral whole.²⁹ Thus, one should not rely on the results of medical fitness assessments alone when considering even its basic medical issues, such as pain and wound healing, without addressing other domains such as social and family fitness.

Social Fitness Enhances Cell and Unit Fitness

Social fitness is multidimensional and includes friends and family, recreation, religion, and hobbies, as well as bosses and peers. Cohesion is an important construct within social fitness, and minimal attention has been paid to the importance of family cohesion. The importance of family fitness and cohesion cannot be underestimated with regard to total force fitness. PTSD, depression, anxiety and, often, physical injuries, ultimately reside within the family unit, regardless of how a family is defined for long-term management. Is it possible to measure social cohesion easily and in a way that can track whether a family has adequate support? This is an area of great importance as well as a challenge to total force fitness. Losada and others have illustrated that assessing personal connectivity of a team is highly correlated with its performance. The emotional space as measured by “other vs. self” shows that high performance teams have high variability in emotional space and an emotional positivity ratio of 3 to 1.³⁰ Those with lower positivity ratios were shown to be low-performing teams. Thus, unit

and family cohesion are both likely to influence the individual warfighter with regard to unit productivity and performance. Bell and others have proposed a simple metric for assessing the likelihood of social connectivity and its ability to impact individual health and unit performance.^{31,32} Thus, social and family fitness are essential to total force fitness and impact performance from such disparate areas as the rate of wound healing to overall unit functioning.

MEASURING TOTAL FORCE FITNESS

These examples illustrate why a siloed approach to components of fitness is inadequate. Achieving total force fitness involves breaking down the barriers currently between the domains of fitness to develop a system that addresses an integrated whole person, including family, social, physical, and spiritual aspects in addition to providing practical approaches that can change and maintain positive health and behavior within the military environment. To do this, we must develop a comprehensive set of measures of success and use them in an integrated fashion for continual process improvements. Thus, a crucial requirement for moving total force fitness forward is an assessment tool for both the service member and the commander: a “total force fitness index,” if you will.

Measurement of total force fitness would require taking current evidence from each fitness domain and developing simplified, valid, and measurable parameters that can be fed back at the individual, unit, and organizational level. A tool for monitoring and delivering behavioral change of the whole person would be the next step. Figure 6 illustrates what a total force fitness assessment index might look like by using a radar map display for each of the fitness domains in a single graphic. Such a map reflects nutritional, physical, social, spiritual, psychological, behavioral, and medical fitness. By using such a single visual, the strengths and gaps in fitness and performance could be seen as a whole and areas for improvement could be highlighted. A system that provides the command and the DoD with this total force fitness index could provide an overview of where force fitness needs improvement and where it needs to be strengthened. Such a fitness index or map could serve as a guidepost to individuals and commanders and is critical for producing an integrated system for monitoring total force fitness in the DoD.

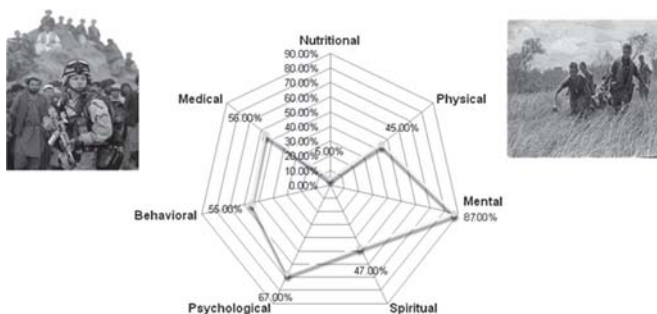


FIGURE 6. A Total Force Fitness Index.

CONCLUSIONS

Monitoring and evaluating total force fitness will require comparative evaluations across approaches, units, and domains. Without ongoing monitoring and research, the effects of programs and policies delivered on the organizational level and the behaviors on the individual level cannot be assessed. Such evaluations will also require a new paradigm of research that uses information systems for rapidly tracking components of total force fitness and providing easy to understand and usable feedback. A coordinated effort that allows for program and outcome evaluation, a clearinghouse for identifying effective programs, and a mechanism for disseminating those results across the military is needed.

Leadership from top levels will be needed to integrate this new paradigm. The military has been a leader in innovation for millennia when it comes to health and human performance. Widespread application of vaccination, water sterilization, surgical techniques, physical fitness training, nutritional research, and now psychological health and resilience have often been applied first in the military before being disseminated to the civilian community for public health benefit. The same opportunity exists for the development and implementation of a new paradigm of total health and fitness. This approach is most important now that legislation for universal health care has been adopted. Embracing the concept of total force fitness requires the individual to take responsibility, but also that appropriate messages regarding total force fitness are disseminated for all to hear, accept, and embrace.

Never before has the scientific knowledge, medical capacity, war-time need, and political resources come together in a cry for change. But will those in the DoD accept this challenge and seize the day? Getting to total force fitness will require that we use the crisis of the wars as the opportunity to create a new reality for health, healing, and human flourishing for the 21st century.

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REFERENCES

1. Erbes C, Westermeyer J, Engdahl B, Johnsen E: Post-traumatic stress disorder and service utilization in a sample of service members from Iraq and Afghanistan. *Mil Med* 2007; 172(4): 359–363.
2. Hoge CW, Auchterlonie JL, Milliken CS: Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA* 2006; 295(9): 1023–1032.
3. Warden D: Military TBI during the Iraq and Afghanistan wars. *J Head Trauma Rehabil* 2006; 21(5): 398–402.
4. Warden DL, French L: Traumatic brain injury in the war zone. *New Engl J Med* 2005; 353(6): 633–634.
5. Engelhard IM, Huijding J, van den Hout MA, de Jong PJ: Vulnerability associations and symptoms of post-traumatic stress disorder in soldiers deployed to Iraq. *Behav Res Ther* 2007; 45(10): 2317–25.

6. Giordano J, Walter J: Pain and psychopathology in military wounded: how etiology, epidemiology sustain an ethics of treatment. *Prac Pain Management* 2007; 7(6): 34–42.
7. Potash M: Chronic pain and co-morbid brain injury from IED trauma. *Prac Pain Management* 2007; 7(5): 12–7.
8. Villano C, Rosenblum A, Magura S: Prevalence and correlate of posttraumatic stress disorder and chronic severe pain in psychiatric outpatients. *J Rehabil Res Dev* 2007; 44(2): 167–78.
9. Shipherd JC, Keyes M, Jovanovic T, et al: Veterans seeking treatment for posttraumatic stress disorder: what about comorbid chronic pain? *J Rehabil Res Dev* 2007; 44(2): 153–66.
10. Beck J, Gudmundsdottir B, Shipherd J: PTSD and emotional distress symptoms measured after a motor vehicle accident: relationship with pain coping profiles. *J Psychopathol Behav Assess* 2003; 54(4): 219–27.
11. Beck J, Palyo S, Winer E, Schwagler B, Ang E: Virtual reality exposure therapy for PTSD symptoms after a road accident: an uncontrolled case series. *Behav Ther* 2007; 38(1): 39–48.
12. Salter M, Woolf C: Cellular and molecular mechanisms of central sensitization. In: *The Neurobiology of Pain (Molecular and Cellular Biology)*. Edited by Hunt S, Koltzenburg M. Oxford, Oxford University Press, 2005.
13. Carofoli E, Klee C: *Calcium as a Cellular Regulator*. NY, Oxford University Press, 1999.
14. Shipton EA, Tait B: Flagging the pain: preventing the burden of chronic pain by identifying and treating risk factors in acute pain. *Eur J Anaesthesiol* 2005; 22(6): 405–412.
15. Iraq Coalition Casualty Count. Available at <http://icasualties.org/>; accessed May 27, 2010.
16. Giordano J: Changing the practice of pain medicine writ large and small through identifying problems and establishing goals. *Pain Physician* 2006; 9(4): 283–285.
17. Institute of Medicine: *Complementary and Alternative Medicine in the United States*. Washington, DC, National Academies, 2005.
18. Deuster P, O'Connor F, Henry K, et al: Human performance optimization: an evolving charge to the Department of Defense. *Mil Med* 2007; 172(11): 1133–7.
19. Jonas W, Chez R: Toward optimal healing environments in health care. *J Altern Complement Med* 2004; 10(1): S1–6.
20. Ornish D: Intensive lifestyle changes and health reform. *Lancet Oncol* 2009; 10(7): 638–9.
21. O'Connor F, Deuster P, DeGroot D, White D: Medical and environmental fitness. *Mil Med* 2010; Suppl 175(8).
22. Greenwood M, Oria M, (editors): *Use of Dietary Supplements by Military Personnel*. Washington, DC, Institute of Medicine, 2008.
23. Porcari J, Foster C: *Mind Over Body*. American Council on Exercise, Fitness Matters, pp 12–13. May/June, 2006. Available at <http://www.acefitness.org/getfit/PlaceboStudy2006.pdf>; accessed June 27, 2010.
24. Freeman MP, Hibbeln JR, Wisner KL, et al: Omega-3 fatty acids: evidence basis for treatment and future research in psychiatry. *J Clin Psychiatry* 2006; 67(12): 1954–1967.
25. Sublette ME, Hibbeln JR, Galfalvy H, Oquendo MA, Mann JJ: Omega-3 polyunsaturated essential fatty acid status as a predictor of future suicide risk. *Am J Psychiatry* 2006; 163(6): 1100–1102.
26. Hibbeln JR: Depression, suicide and deficiencies of omega-3 essential fatty acids in modern diets. *World Rev Nutr Diet* 2009; 99: 17–30.
27. Gonsalkorale W, Houghton L, Whorwell P: Hypnotherapy in irritable bowel syndrome: a large-scale audit of a clinical service with examination of factors influencing responsiveness. *Am Coll Gastroenterology* 2002; 97(4): 954–61.
28. Kiecolt-Glaser JK, Loving TJ, Stowell JR, et al: Hostile marital interactions, proinflammatory cytokine production, and wound healing. *Arch Gen Psychiatry* 2005; 62(12): 1377–1384.
29. Webster JJ, Sternberg EM: Role of the hypothalamic-pituitary-adrenal axis, glucocorticoids and glucocorticoid receptors in toxic sequelae of exposure to bacterial and viral products. *J Endocrinol* 2004; 181(2): 207–221.
30. Losada M: The complex dynamics of high performance teams. *Math Comput Model* 1999; 30: 179–92.
31. Bell IR, Koithan M: Models for the study of whole systems. *Integr Cancer Ther* 2006; 5(4): 293–307.
32. Koithan M, Verhoef M, Bell IR, White M, Mulkins A, Ritenbaugh C: The process of whole person healing: “unstuckness” and beyond. *J Altern Complement Med* 2007; 13(6): 659–68.

Physical Fitness

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ABSTRACT “Total force fitness” is a state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions. Physical fitness, an important component of total force fitness, is the amount of physical training required to achieve a physical work capacity. Due to the austere environments and high physical work capacity required for mission tasks, military service members must sustain a more advanced level of physical fitness than the civilian population. To meet these high demands, physical fitness training must be split into four components: endurance, mobility, strength (including core strength), and flexibility. Both aerobic and anaerobic training need to be utilized. The four components of physical fitness training plus performance testing and injury surveillance/prevention must be well understood and included as part of all military physical fitness programs to ensure our service members are prepared to meet the physical demands of the mission without incurring injury.

INTRODUCTION

“Total force fitness” is a state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions. Physical fitness is one component of total force fitness, which also includes psychological, behavioral, medical, nutritional, spiritual, and social health. Consistent regular exercise can have a positive impact on social health, depression, generalized anxiety, and sleep deprivation.¹⁻⁵ With the interdependencies of the categories of total force fitness, it is very important that military service members be physically fit. The physical fitness level required by a military service member is higher than that of the general population due to the diverse nature of military missions and the large loads carried by service members. Currently, service members must perform missions in austere environments over 6- to 15-month periods. Missions executed in these diverse environments require a large variety of physical skills. The purpose of this article is to discuss how to develop and maximize service members’ physical fitness by aerobically and anaerobically training the four components that make up physical fitness: endurance, mobility, strength (to include core strength), and flexibility; how to use injury surveillance and prevention strategies to train without incurring injury; and to outline current initiatives to improve physical training.

DEFINING PHYSICAL FITNESS

What is physical fitness? The U.S. Department of Health and Human Services separates physical fitness into two categories: health-related fitness and performance-related fitness.⁶ The general public focuses on health-related fitness, which is the amount of physical training required to reduce the risk of disease or injury. Military members focus on performance-related fitness, which is the amount of physical training required to achieve a physical goal, such as climbing a mountain or maneuver chocks and chains on an aircraft carrier.

What exactly is military physical fitness? According to the Army Manual FM 21-20, Physical Training, “War places a great premium upon the strength, stamina, agility, and coordination of the soldier because victory and his life are so often dependent upon them. To march long distances with full pack, weapons, and ammunition through rugged country and to fight effectively upon arriving at the area of combat; to drive fast-moving tanks and motor vehicles over rough terrain; to make assaults and to run and crawl for long distances; to jump into and out of foxholes, craters, and trenches, and over obstacles; to lift and carry heavy objects; to keep going for many hours without sleep or rest—all these activities of warfare and many others require superbly conditioned troops.”⁷ To put it more succinctly, military physical fitness is the ability to physically accomplish all aspects of the mission while remaining healthy/uninjured. Because there are variations in military missions/tasks, it is important to adjust physical fitness training accordingly. Health-related fitness is therefore the same for all military members, but performance-related fitness differs depending on the mission. An Air Force load master who spends 10 hours a day loading planes needs to train differently than a scout who is tasked to patrol 15 miles through the mountains of Afghanistan. Military fitness training needs to be designed to specifically complement the mission tasks required by the service members. This is referred to as “specificity of training.”

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Physical fitness training can be split into four major components allowing for the diversity of training necessary to accomplish mission tasks: endurance, mobility, strength, and flexibility. Endurance is the body's ability to continually accomplish the same task in a repetitive fashion, such as loading supplies onto a ship. Mobility is the ability to move the body in space with the precision necessary to negotiate an obstacle. An example of this is climbing a wall. Strength is the ability to generate force attempting to overcome resistance such as lifting an ammunition can. Finally, flexibility is possessing the optimal joint range of motion such as required to reach overhead. All four aspects of physical fitness are important and essential in creating a physically well-balanced, injury-resistant, and mission-fit service member.

Military fitness programs need to be based on the mission task-oriented fitness philosophy. In fact the most recent physical fitness guidance from the Army and Marine Corps places an emphasis on this philosophy.^{8,9} It isolates individual tasks performed by the service member during a mission and breaks them down into their physical components. An example of this task breakdown is when a squad has to patrol through Baghdad, sprint through the market, kick down a door, and steady their weapons to fire. Many aspects of fitness are being utilized to accomplish this mission. The service member must possess the aerobic endurance to walk the distance of the patrol while wearing combat gear. Sprinting through the market place and jumping through the window require not only the anaerobic ability to sprint but also the ability to change directions quickly to negotiate obstacles. Kicking down the door requires strength. The service member's overall VO_2max must be high enough to allow him or her to accomplish all of these tasks without fatiguing. Failure to accomplish any task in the sequence puts the service member in danger and could result in death. Therefore, suboptimal or poor physical fitness in service members is much more serious than in an athlete and training should reflect this.

An absolute work load is the amount of work required to accomplish a task. A task may require 3 L/min of oxygen consumption. If the service member's VO_2max is 4 L/min, then he or she is working at 75% of his or her maximal capacity. By improving the service member's physical fitness, or maximal capacity, any given task will represent a lower relative work load, i.e., it will be easier. The main purpose of physical training in a service member is to decrease the relative work load required to complete mission tasks. The secondary purpose of military physical training is to increase the service member's overall medical fitness, psychological fitness, and resistance to injury (Fig. 1).

COMPONENTS OF PHYSICAL FITNESS

Endurance

Endurance is the body's ability to continually accomplish the same task in a repetitive fashion. Proper endurance training will increase the service member's ability to perform repeti-

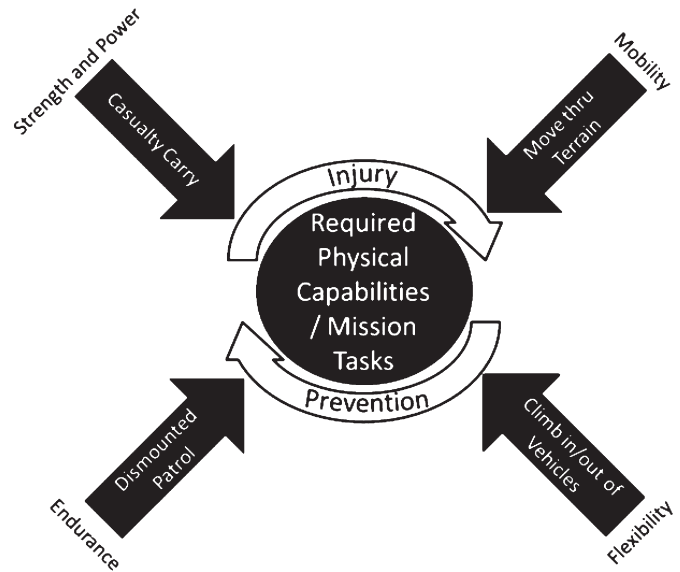


FIGURE 1. Mission tasks can be separated into the four different components. Training these components while using injury prevention strategies can result in well-balanced, uninjured, physically fit service members.

tive tasks at a lower relative work load; patrolling 10 miles will become easier. Endurance is aerobic training which is dependent on the body's ability to take in and utilize oxygen, VO_2max . The American College of Sports Medicine (ACSM) and the American Heart Association recommend a minimum of 30 minutes of moderately vigorous aerobic activity for a minimum of 5 days a week for adults under the age of 65.¹⁰ However, participation in physical activity above the minimum and within the guidelines will increase the health benefits.^{10,11} Since the military requires service members to perform challenging physical tasks, they should perform more than the minimum duration and frequency of aerobic training. Examples of endurance training are long-distance running, swimming, foot marching, cycling, low-weight, high-repetition strength training, and stairmaster. Distance, duration, repetition number, and speed need to be increased gradually to reduce the risk of injury and increase performance. A very general example would be increasing the distance run only 10% per week.

Mobility

Mobility is the ability to move the body in space with the precision necessary to negotiate an obstacle, such as entering a window. Mobility training is designed to increase the service member's speed, balance, jumping, and ability to change direction. Anaerobic training can improve mobility. This involves training with tasks that take no more than 5 minutes. Examples of mobility training include jumping, sprinting, and climbing. Plyometrics (jumping exercises) have been shown to be effective in increasing vertical jump height more than strength training alone.¹²⁻¹⁴ Speed (sprint) training over 11 weeks with 3-4 sets of 3 sprints of 10 m increasing to 50 m has been shown to increase jump height, jump power, jump length, squat strength, sprint speed, and agility.¹⁵

It is important that speed training incorporate changes in direction as well. If a service member is training to accomplish running tasks that require quick directional changes, the principle of specificity of training should be applied; namely, train by sprinting in a straight line as well as with multiple directional changes. Using only straight sprint training results in increases in straight speed but not change-of-direction speed and vice versa.¹⁶ Therefore, a combination of the two training techniques is needed.¹⁷

Strength

The purpose of strength training is to increase the service member's ability to generate force and power, thus lowering the relative work required to complete mission tasks. Muscle strength is the maximum force created by a muscle, muscle endurance is the ability to create a force repetitively or sustain it, and power is the ability to create force quickly across distance. Hence, strength is required to lift a 40-lb box, while power is the ability to move the box 4 feet in 1 second.

Many weight training regimes are based on a one-repetition maximum (1 RM). This is simply the most weight that the service member can lift once. Novice individuals should begin with 60–70% of their 1 RM for 8–12 repetitions and 2–3 sets.¹⁸ However, once a service member has been strength training for 6 months or more, 80% of 1 RM is needed to continue to increase one's strength and 85% has been shown to be most effective in athletes.¹⁸ It is important to remember that even though 80% is stated to be the most successful, this effectiveness is maximized when incorporated into a periodized weight training program.¹⁹ Periodization is a phased training program using a variety of sets, repetitions, weights, and exercises.

The strength program goal always needs to be considered. For maximum strength to increase, one of three things must happen: (1) the load must increase, (2) repetitions must increase, or (3) rest periods must be lengthened.¹⁸ For muscle endurance to increase, repetition speed should be increased and rest time reduced.¹⁸ If the goal is to increase power, light loads (0–60% 1 RM for lower body and 30–60% 1 RM for upper body) are used with fast repetitions.¹⁸ The amount of rest time between sets varies, depending on the goal of the weight lifting program.¹⁹ If the goal is for maximum one-time strength, such as lifting a heavy casualty, then the rest periods between sets need to be longer, at least 2–3 minutes and often up to 5.^{20,21} If the goal of the program is to increase endurance, such as lifting more boxes, then the rest period should be shorter, less than 1 minute for sets of 10–15 repetitions and 1–2 minutes for 15–20 repetition sets.^{22,23} For power, such as pushing up out of the prone, rest periods should be 3–5 minutes between sets.¹⁸ Ballistic exercises use very fast explosive movements and are most effective when training power.¹⁸ It is important to remember that maximum strength, muscle endurance, and power are all inter-related and a general program should include aspects of each one. ACSM recommends that weight lifting be performed 3–4 days a week.¹⁸ It is important

to remember that this does not mean that each muscle group is stressed every day. When performing a whole body routine, the service member should lift a maximum of three times a week or, when using an upper and lower body split workout, the service member should lift 4 days a week: upper body 2 days and lower body 2 days.¹⁸

Core strength is the endurance strength of the abdominal and back muscles and should be included as the foundation of any physical fitness program. Low muscular forces applied at specific areas along the spine during core strengthening will drastically increase the load carriage capability of the spine (combat gear or lifting loads).²⁴ Since this submaximal coactivation must be maintained regardless of which component is being trained (endurance, mobility, strength, or flexibility), endurance is much more important than overall strength for maintaining and increasing load carriage capability.²⁵ Core stability is the biomechanical building block upon which all other training rests. Core stability is also important because low core strength is associated with a high prevalence of low back pain (LBP) and higher core strength is associated with less reoccurrence of LBP; patients were 12 times less likely to have recurrence in LBP for 1 year after receiving core stability training.^{26–29} The core muscles must be conditioned to increase the load carriage capability of the spine, reduce the risk of injury, and keep the body biomechanically efficient.

Flexibility

Flexibility is the fourth physical fitness component. The purpose of flexibility training is to maintain or achieve optimal muscle length–tension relationships across joints that enable a service member to perform military-specific tasks with less likelihood of injury or undue difficulty. Hypo- or hyperflexibility can be detrimental. Poor flexibility is related to injury in the Achilles tendon, hamstrings, patellar tendon, plantar fascia, and iliotibial band.^{30–34} For individuals who require increased flexibility, static stretching (motionless stretches held for 15–30 seconds) should be done at the end of the fitness session.³⁵ If static stretching is performed before the main exercises, there is often a decrease in performance.^{36–41} In fact, one study shows that maximum voluntary muscle contraction was still reduced 9% an hour after stretching.⁴² Hence, to avoid performance decrements, stretching is best done at the end of a work out. It is important to note that it is possible to be too flexible.^{43,44} Those who are hyperflexible do not need to stretch these muscles, as it will not reduce their likelihood of injury.

NON-PERFORMANCE-BASED BENEFITS OF PHYSICAL FITNESS

There are many non-performance-based benefits to being physically fit besides accomplishing the mission. The risk of cardiovascular disease, thromboembolic stroke, hypertension, type 2 diabetes mellitus, osteoporosis, obesity, colon cancer, breast cancer, anxiety, and depression all decrease with an increase in physical activity.¹¹ Endurance training increases

capillary density in working muscle, raises blood volume, and decreases heart rate during exercise.⁴⁵ Mechanical loading of the skeletal system through impact or weight lifting will help increase bone formation in young adults and slow the rate of bone loss in older adults.¹⁰ Fitness programs that include resistance training improve dynamic stability and preserve functional capacity.⁴⁶⁻⁴⁹ Fitness training also improves psychological well-being as well as work performance.^{46,50-52} The end result is that fit service members are physically and psychologically healthier and more productive.

MEASURING PHYSICAL FITNESS

Once unit physical fitness trainers understand the four components of physical fitness and how to create and implement a fitness program, there needs to be a method to measure the service member's and unit's physical fitness. Physical fitness needs to be measured and monitored to ensure that service members are improving or maintaining the required level of fitness to perform their mission tasks with a reduced relative work load. There exist numerous validated tests to measure each component individually. Military fitness tests are not currently designed to measure each component. However, the military physical fitness test design is constrained by ease of administration, minimal requirement for equipment, field settings, and time required to administer. Currently, each military service is using its respective physical fitness test composed of some variation of a distance run, push ups/pull ups/flexed arm hang, and sit ups (Table I). Note that only endurance and flexibility are currently being measured on standard fitness tests. However, current tests are easy to administer and roughly correlate to endurance and strength performance. In the majority of studies, the 2- and 3-mile run have shown good or excellent correlation to VO_2max in subjects.^{53,54} A 1-mile run has shown poor to good correlation with VO_2max .⁵⁴ Previous studies on push ups indicate a good correlation with total upper body strength and endurance.⁵⁴ The Marine Corps has added a com-

bat fitness test (CFT) to complement their standard physical fitness test (PFT). The Marine Corps is currently the only military service evaluating the components of mobility and strength (Table II). The CFT is designed to test tasks similar to those found in a combat environment.

Since service members tend to design their physical training around the fitness test, the ideal fitness test would reflect all components required for mission task accomplishment. The performance measures in Table III provide a possible set of tests to assess all four components. This set is only one example; many combinations of tasks could be used. A complete fitness test could be achieved with several single events or events could be combined into an obstacle course, similar to the CFT. The goal is to measure mobility, strength, and endurance in the entire body and monitor how they change over time. The Marine Corps administers the PFT once a year and separately administers the CFT later in the year. The Air Force, Army, and Navy currently administer their single fitness tests twice a year.

INJURY SURVEILLANCE AND PREVENTION

It is essential that units, commanders, and other overseeing agencies have the ability to monitor injuries and ensure that specific training techniques are not disproportionately increasing injuries. An adequate surveillance system monitors injury incidence and allows injury to be tied to mechanisms of

TABLE I. Standard Physical Fitness Tests of Each Service

Service	Event	Time/Distance	Component
Air Force	Push Ups	1 minute	Endurance
	Sit Ups	1 minute	Endurance
	Run	1.5 miles	Endurance
	Waist Circumference		None
Army	Push Ups	2 minutes	Endurance
	Sit Ups	2 minutes	Endurance
	Run	2 miles	Endurance
	Abdominal Crunch	2 minutes	Endurance
Marine Corps	Pull Ups/ Flexed Arm Hang	To exhaustion	Endurance
	Run	3 miles	Endurance
Navy	Push Ups	2 minutes	Endurance
	Curl Ups	2 minutes	Endurance
	Run ^a	1.5 miles	Endurance
	Sit and Reach		Flexibility

^aA swim or elliptical event can be substituted for the Navy run.

TABLE II. Marine Corps Combat Fitness Test

Event	Time/Distance	Component
Run	880 yds	Endurance
Overhead Lift	2 min	Endurance
Sprint	25 yds	Mobility
Crawl	25 yds	Mobility
Sprint	25 yds	Mobility
Casualty Drag	10 yds	Strength
Casualty Carry	65 yds	Strength
Ammo Can Carry	75 yds	Endurance
Grenade Throw		Mobility
Ammo Can Carry	75 yds	Endurance

TABLE III. Suggested Performance Metrics to Include All Components in Military Fitness Tests

Metric	Measured Component
Push Ups ⁵⁵	Endurance
Sit Ups ⁵⁵	Endurance
2-Mile Run ⁵⁵	Endurance
Illinois Agility Test ^{56,57}	Mobility
Medicine Ball Put ^{58,59}	Strength
Broad Jump ⁶⁰	Mobility
Repetitive Squats ⁶¹	Endurance
Pull Ups ^{62,63} /Flexed Arm Hang ^{64,65}	Endurance
Functional Movement Screen ⁶⁶	Flexibility ^a

^aThe Functional Movement Screen is currently undergoing validation in a military population. It has been shown to correlate with injuries in NFL players.⁶⁶

injury. Ideally, injury data should be linked to readiness reduction due to injury. From this information, medical providers and commanders can identify and modify injury promoting activities, taking steps to decrease injuries and increase unit fitness, productivity, and readiness.

For injury surveillance to be optimally successful, the Department of Defense (DoD) needs to create a standard DoD-wide injury surveillance database. Currently, injury surveillance databases are not uniform either in metrics collected or data entered. In general, it is recommended that a minimum of four data points be collected on all new patients (mechanism of injury, body region, deployability, and unit). Additionally, fitness scores should be included as part of the medical record. The information that is collected must be available for analysis by local medical staff to provide commanders with accurate injury trends and options to correct the likely cause of injury.

Using surveillance, the Army identified that the majority of injuries occur during training. Data collected Army-wide indicated that physical training is the leading cause of outpatient injury visits, accounting for 25 to 40% of all injuries.^{67,68} In Marine Corps basic training, 78% of the injuries were due to overuse and significantly correlated to running and physical training.⁶⁹ Thirty-six percent of female Navy recruits suffered overuse injuries in basic training.⁷⁰ Musculoskeletal injuries resulted in the most lost duty days at the U.S. Air Force Academy.⁷¹ Of the limited duty days received by soldiers, 80–90% are from training-related injuries.⁷² In a study of 15,000 deployed soldiers, the majority of soldiers claimed that physical training was responsible for their musculoskeletal injuries.⁷³ Research has identified risk factors for these injuries in service members. Smoking, greater age, lower muscle endurance, lower fitness level, hyper- and hypo-flexibility, lower VO_2max , and higher running mileage increase the chance that a service member will sustain an injury.^{44,72,74,75}

Once injury surveillance has identified injuries, steps must be taken to reduce them through prevention. The Joint Services Physical Training Injury Prevention Work Group in 2008 systematically reviewed 34 potential injury prevention strategies. Six interventions had strong enough evidence to become recommendations for implementation in all four services: (1) prevent overtraining; (2) perform multiaxial, neuromuscular, proprioceptive, and agility training; (3) wear mouth guards during high-risk activities; (4) wear semirigid ankle braces for high-risk activities (such as airborne training); (5) consume nutrients to restore energy balance within 1 hour following high-intensity activity; and (6) wear synthetic blend socks to prevent blisters. The first two interventions speak to the widespread overuse injuries caused by an over-reliance on endurance running in the military's physical training programs.

CURRENT PHYSICAL FITNESS INITIATIVES

The military has attempted to initiate the six interventions mentioned above as well as several others geared toward mitigating additional risk factors. Service members are given counsel on smoking sensation, custom mouth guards are offered by

dental services, and synthetic blend socks are issued. All four branches of the military have issued new physical fitness guidance with the Army and Marine Corps offering the most in-depth instruction.

The previous Army Fitness Manual, FM 21-20, was published in 1998. Since then, there has been further exercise and injury research as well as a drastic change in the military's operational tempo. This resulted in implementation of several local fitness programs. In addition, Army physical therapists recognized the need for well-rounded fitness programs and created them for several divisions and the Rangers. In these programs, more emphasis has been placed on strength training, core strengthening, mobility drills, and foot marching than found in FM 21-20.

The Army recently created a new doctrine for physical fitness training using the injury prevention approach guidance. TC 3-22.20 Army Physical Readiness Training (PRT) was published in March of 2010. The emphasis is on a well-rounded mission task-oriented approach to physical fitness and includes detailed explanations of proper methods for mobility, strength, endurance, and flexibility training. Soldiers participating in PRT were 46–52% less likely to suffer an injury when compared to units using traditional physical training while scoring the same on the Army physical fitness test (APFT).⁷⁶

The Marine Corps has also been making huge strides in enhancing its physical fitness program and issued new guidance in 2008. Along with creating the CFT the Marine Corps is shifting the focus of its physical fitness training to mission-oriented tasks as well. The Marine Corps has been developing a comprehensive combat fitness program that promotes health and fitness.⁸ The Marine Corps' most recent guidance recommends that aerobic and muscle-strengthening activities be conducted more often, at higher intensity, and for shorter duration as well as points out the need to gradually increase the difficulty of training.⁸

The Air Force has issued its latest physical fitness guidance in 2010.⁷⁷ This guide instructs airmen to train endurance, strength, mobility, and flexibility. The Air Force has increased its fitness testing to twice a year, is making the standards on their fitness test more difficult this year, and is certifying physical training leaders.

The Navy published new guidance on physical fitness training in 2005, emphasizing its importance for mission accomplishment.⁷⁸ Sailors are instructed to train endurance, flexibility, and strength. The Navy has started a command fitness leaders course to create fitness leaders capable of designing fitness programs.

CONCLUSIONS

Physical fitness is composed of the four components: endurance, mobility, strength, and flexibility. Training should include all four components supported by a foundation of core strength and be based on mission tasks the service member is required to perform. Proper physical training should (1) break down mission tasks into physical components,

(2) ensure that all four components are part of physical training in a manner specific to the mission tasks required, (3) monitor physical fitness levels and improvement to ensure performance is increasing and relative work load is decreasing, and (4) prevent improper training through injury surveillance and prevention. The four components of physical fitness training plus performance monitoring and injury surveillance/prevention must be well understood and included as part of all military physical fitness programs to ensure our men and women in uniform are properly prepared to accomplish any mission safely and effectively.

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REFERENCES

1. Cramer SR, Nieman DC, Lee JW: The effects of moderate exercise training on psychological well-being and mood state in women. *J Psychosom Res* 1991; 35(4-5): 437-49.
2. Hassmen P, Koivula N, Uutela A: Physical exercise and psychological well-being: a population study in Finland. *Prev Med* 2000; 30(1): 17-25.
3. De Moor MH, Beem AL, Stubbe JH, Boomsma DI, De Geus EJ: Regular exercise, anxiety, depression and personality: a population-based study. *Prev Med* 2006; 42(4): 273-9.
4. Barbour KA, Blumenthal JA: Exercise training and depression in older adults. *Neurobiol Aging* 2005; 26(Suppl 1): 119-23.
5. Driver HS, Taylor SR: Exercise and sleep. *Sleep Med Rev* 2000; 4(4): 387-402.
6. U.S. Department of Health and Human Services: 2008 Physical Activity Guidelines for Americans, Washington, DC, DHHS, 2008.
7. Department of War: FM 21-20, Physical Fitness. Washington, DC, Government Printing Office, 1946.
8. Department of the Navy: Marine Corps Order 6100.13. Washington, DC, DoD, 2008.
9. Department of the Army: Army Physical Readiness Training. Washington, DC, DoD, 2010.
10. Haskell WL, Lee IM, Pate RR, et al: Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc* 2007; 39(8): 1423-34.
11. Kesaniemi YK, Danforth E Jr, Jensen MD, Kopelman PG, Lefebvre P, Reeder BA: Dose-response issues concerning physical activity and health: an evidence-based symposium. *Med Sci Sports Exerc* 2001; 33(6, Suppl): S351-8.
12. Luebbers PE, Potteiger JA, Hulver MW, Thyfault JP, Carper MJ, Lockwood RH: Effects of plyometric training and recovery on vertical jump performance and anaerobic power. *J Strength Cond Res* 2003; 17(4): 704-9.
13. Fatouros IG, Jamurtas AZ, Leontsini D, et al: Evaluation of plyometric exercise training, weight training, and their combination on vertical jumping performance and leg strength. *J Strength Cond Res* 2000; 14: 470-6.
14. Newton RU, Kraemer WJ, Hakkinen K: Effects of ballistic training on preseason preparation of elite volleyball players. *Med Sci Sports Exerc* 1999; 31(2): 323-30.
15. Markovic G, Jukic I, Milanovic D, Metikos D: Effects of sprint and plyometric training on muscle function and athletic performance. *J Strength Cond Res* 2007; 21(2): 543-9.
16. Young WB, McDowell MH, Scarlett BJ: Specificity of sprint and agility training methods. *J Strength Cond Res* 2001; 15(3): 315-9.
17. Walklate BM, O'Brien BJ, Paton CD, Young W: Supplementing regular training with short-duration sprint-agility training leads to a substantial increase in repeated sprint-agility performance with national level badminton players. *J Strength Cond Res* 2009; 23(5): 1477-81.
18. ACSM: American College of Sports Medicine Position Stand. Progression models in resistance training for healthy adults. *Med Sci Sports Exerc* 2009; 41(3): 687-708.
19. Kraemer WJ, Ratamess NA: Fundamentals of resistance training: progression and exercise prescription. *Med Sci Sports Exerc* 2004; 36(4): 674-88.
20. Ahtiainen JP, Pakarinen A, Alen M, Kraemer WJ, Häkkinen H: Short vs. long rest period between the sets in hypertrophic resistance training: influence on muscle strength, size, and hormonal adaptations in trained men. *J Strength Cond Res* 2005; 19: 572-82.
21. Pincivero DM, Lephart SM, Karunakara RG: Effects of rest interval on isokinetic strength and functional performance after short-term high intensity training. *Br J Sports Med* 1997; 31(3): 229-34.
22. Marciniak EJ, Hodgdon JA, Mittleman K, O'Brien JJ: Aerobic/calisthenic and aerobic/circuit weight training programs for Navy men: a comparative study. *Med Sci Sports Exerc* 1985; 17(4): 482-7.
23. Wilmore JH, Parr RB, Girandola RN, et al: Physiological alterations consequent to circuit weight training. *Med Sci Sports* 1978; 10(2): 79-84.
24. Kiefer A, Shirazi-Adl A, Parnianpour M: Stability of the human spine in neutral postures. *Eur Spine J* 1997; 6(1): 45-53.
25. Barr KP, Griggs M, Cadby T: Lumbar stabilization: core concepts and current literature, Part 1. *Am J Phys Med Rehabil* 2005; 84(6): 473-80.
26. Mannion AF, Muntener M, Taimela S, Dvorak J: Comparison of three active therapies for chronic low back pain: results of a randomized clinical trial with one-year follow-up. *Rheumatology (Oxford)* 2001; 40(7): 772-8.
27. Bayramoglu M, Akman MN, Kilinc S, Cetin N, Yavuz N, Ozker R: Isokinetic measurement of trunk muscle strength in women with chronic low-back pain. *Am J Phys Med Rehabil* 2001; 80(9): 650-5.
28. Greene HS, Cholewicki J, Galloway MT, Nguyen CV, Radebold A: A history of low back injury is a risk factor for recurrent back injuries in varsity athletes. *Am J Sports Med* 2001; 29(6): 795-800.
29. Hides JA, Jull GA, Richardson CA: Long-term effects of specific stabilizing exercises for first-episode low back pain. *Spine* 2001; 26(11): E243-8.
30. Puniello MS: Iliotibial band tightness and medial patellar glide in patients with patellofemoral dysfunction. *J Orthop Sports Phys Ther* 1993; 17(3): 144-8.
31. Garrett WE Jr, Califf JC, Bassett FH 3rd: Histochemical correlates of hamstring injuries. *Am J Sports Med* 1984; 12(2): 98-103.
32. Kibler WB, Goldberg C, Chandler TJ: Functional biomechanical deficits in running athletes with plantar fasciitis. *Am J Sports Med* 1991; 19(1): 66-71.
33. Leach RE, James S, Wasilewski S: Achilles tendinitis. *Am J Sports Med* 1981; 9(2): 93-8.
34. Worrell TW: Factors associated with hamstring injuries. An approach to treatment and preventative measures. *Sports Med* 1994; 17(5): 338-45.
35. LaRoche DP, Connolly DA: Effects of stretching on passive muscle tension and response to eccentric exercise. *Am J Sports Med* 2006; 34(6): 1000-7.
36. Rubini EC, Costa AL, Gomes PS: The effects of stretching on strength performance. *Sports Med* 2007; 37(3): 213-24.
37. Yamaguchi T, Ishii K: Effects of static stretching for 30 seconds and dynamic stretching on leg extension power. *J Strength Cond Res* 2005; 19(3): 677-83.
38. McMillian DJ, Moore JH, Hatler BS, Taylor DC: Dynamic vs. static-stretching warm up: the effect on power and agility performance. *J Strength Cond Res* 2006; 20(3): 492-9.

39. Amako M, Oda T, Masuoka K, Yokoi H, Campisi P: Effect of static stretching on prevention of injuries for military recruits. *Mil Med* 2003; 168(6): 442–6.
40. Jones AM: Running economy is negatively related to sit-and-reach test performance in international-standard distance runners. *Int J Sports Med* 2002; 23(1): 40–3.
41. Brandenburg JP: Duration of stretch does not influence the degree of force loss following static stretching. *J Sports Med Phys Fitness* 2006; 46(4): 526–34.
42. Fowles JR, Sale DG, MacDougall JD: Reduced strength after passive stretch of the human plantarflexors. *J Appl Physiol* 2000; 89(3): 1179–88.
43. Stewart DR, Burden SB: Does generalised ligamentous laxity increase seasonal incidence of injuries in male first division club rugby players? *Br J Sports Med* 2004; 38(4): 457–60.
44. Knapik JJ, Sharp MA, Canham-Chervak M, Hauret K, Patton JF, Jones BH: Risk factors for training-related injuries among men and women in basic combat training. *Med Sci Sports Exerc* 2001; 33(6): 946–54.
45. Kubukeli ZN, Noakes TD, Dennis SC: Training techniques to improve endurance exercise performances. *Sports Med* 2002; 32(8): 489–509.
46. Stewart KJ, Mason JM, Keleman M: Three-year participation in circuit weight-training improves strength and self-efficacy in cardiac patients. *J Cardiopulm Rehabil* 1988; 8: 292–6.
47. Keleman MH, Stewart KJ, Gillian RE, et al: Circuit weight training in cardiac patients. *J Am Coll Cardiol* 1986; 7: 38–42.
48. Ghilarducci LE, Holly RG, Amsterdam EA: Effects of high resistance training in coronary artery disease. *Am J Cardiol* 1989; 64(14): 866–70.
49. Evans WJ: Exercise training guidelines for the elderly. *Med Sci Sports Exerc* 1999; 31(1): 12–7.
50. Ewart CK: Psychological effects of resistive weight training: implications for cardiac patients. *Med Sci Sports Exerc* 1989; 21(6): 683–8.
51. Norris R, Carroll D, Cochrane R: The effects of aerobic and anaerobic training on fitness, blood pressure, and psychological stress and well-being. *J Psychosom Res* 1990; 34(4): 367–75.
52. Pronk NP, Martinson B, Kessler RC, Beck AL, Simon GE, Wang P: The association between work performance and physical activity, cardiorespiratory fitness, and obesity. *J Occup Environ Med* 2004; 46(1): 19–25.
53. Mello RP, Murphy MM, Vogel JA: Relationship between a two mile run for time and maximal oxygen uptake. *J Appl Sport Sci Res* 1988; 2(1): 9–12.
54. Knapik J: The Army Physical Fitness Test (APFT): a review of the literature. *Mil Med* 1989; 154(6): 326–9.
55. Department of the Army: Physical Fitness Training. Washington, DC, DoD, 1998.
56. Roozen M: Illinois Agility Test. *NSCA's Perform Train J* 2004; 3(5): 5–6.
57. Miller MG, Herniman JJ, Ricard MD, Cheatham CC, Michael TJ: The effects of a 6-week plyometric training program on agility. *J Sports Sci Med* 2006; 5: 459–65.
58. Wyss T, Hubner K, Mader U: Seated shot put as a measurement of explosive upper body power. In: *International Congress on Soldiers' Physical Performance*. Edited by Häkkinen K, Kyolainen H, Jyväskylä, Finland, University of Jyväskylä, 2005.
59. Sharp MA, Knapik JJ, Walker LA, et al: Physical fitness and body composition after a 9-month deployment to Afghanistan. *Med Sci Sports Exerc* 2008; 40(9): 1687–92.
60. Harman EA, Gutekunst DJ, Frykman PN, et al: Effects of two different eight-week training programs on military physical performance. *J Strength Cond Res* 2008; 22(2): 524–34.
61. Kraemer WJ, Nindl BC, Gotshalk LA, et al: Prediction of military relevant occupational tasks in women from physical performance components. In: *Advances in Occupational Ergonomics and Safety*, pp 719–722. Edited by Kumar S. Burke, VA, IOS Press, 1998.
62. Department of the Army: Physical Training, Vol FM 21-20. Washington, DC, Government Printing Office, 1950.
63. Department of the Navy: Headquarters United States Marine Corps: Marine Corps Order P6100.12. Washington, DC, DoD, 2002.
64. President's Council on Physical Fitness and Sport: The President's Challenge, 2009. Bloomington, IN. Available at http://www.presidentschallenge.org/pdf/2009_PC_Brochure.pdf; accessed October 1, 2009.
65. Eisenmann JC, Malina RM: Age- and sex-associated variation in neuromuscular capacities of adolescent distance runners. *J Sports Sci* 2003; 21: 551–7.
66. Kiesel K, Plisky PJ, Voight M: Can serious injury in professional football be predicted by a preseason Functional Movement Screen? *North Am J Sports Phys Ther* 2007; 2(3): 76–81.
67. Knapik J, Darakjy S, Jones S, et al: Injuries and physical fitness before and after deployment by the 10th Mountain Division to Afghanistan for Operation Enduring Freedom 2007: Report Number 12-MA-05SD-07. U.S. Army Center for Health Promotion and Preventive Medicine, Edgewood, MD.
68. Knapik JJ, Jones SB, Darakjy S, et al: Injury rates and injury risk factors among U.S. Army wheel vehicle mechanics. *Mil Med* 2007; 172(9): 988–96.
69. Almeida SA, Williams KM, Shaffer RA, Brodine SK: Epidemiological patterns of musculoskeletal injuries and physical training. *Med Sci Sports Exerc* 1999; 31(8): 1176–82.
70. Shaffer RA, Brodine SK, Ito SI, Le AT: Epidemiology of illness and injury among U.S. Navy and Marine Corps female training populations. *Mil Med* 1999; 164(1): 17–21.
71. Billings CE: Epidemiology of injuries and illnesses during the United States Air Force Academy 2002 Basic Cadet Training program: documenting the need for prevention. *Mil Med* 2004; 169(8): 664–70.
72. Jones BH, Knapik JJ: Physical training and exercise-related injuries. Surveillance, research and injury prevention in military populations. *Sports Med* 1999; 27(2): 111–25.
73. Sanders JWPS, Frankart C, Frenck RW, et al: Impact of illness and non-combat injury during Operations Iraqi Freedom and Enduring Freedom (Afghanistan). *Am J Trop Med Hyg* 2005; 73(4): 713–9.
74. Bell NS, Mangione TW, Hemenway D, Amoroso PJ, Jones BH: High injury rates among female army trainees: a function of gender? *Am J Prev Med* 2000; 18(3, Suppl): 141–6.
75. Jones BH, Bovee MW, Harris JM 3rd, Cowan DN: Intrinsic risk factors for exercise-related injuries among male and female army trainees. *Am J Sports Med* 1993; 21(5): 705–10.
76. Knapik JJ, Hauret KG, Arnold S, et al: Injury and fitness outcomes during implementation of physical readiness training. *Int J Sports Med* 2003; 24(5): 372–81.
77. Secretary of the Air Force: Air Force Instruction 36-2905 Personnel Fitness Program. Washington, DC, DoD, 2010.
78. Department of the Navy: OPNAV Instruction 6110.1H: Office of the Chief of Naval Operations, Washington, DC; 2005.

Psychological Fitness

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ABSTRACT The dramatic increase in psychological demands associated with current military operations makes psychological fitness of our military personnel more vital than ever. Psychological fitness is defined as the integration and optimization of mental, emotional, and behavioral abilities and capacities to optimize performance and strengthen the resilience of warfighters. The present article proposes a military demand-resource (MDR) model as a comprehensive and integrated model of psychological fitness for the total force. The model emphasizes the importance of identifying military-driven and evidence-informed variables, and selecting operational outcome measures for resilience and performance. The model integrates the roles of internal (personal) and external (environmental) resources specifically for developing, sustaining, and restoring psychological resources, similar to the maintenance of physical fitness and health. Equal attention to the psychological component is critical for achieving the mind-body balance as desired in a total force fitness framework for military forces today.

INTRODUCTION

Contemporary sustained armed conflicts pose unparalleled challenges. These challenges include conflict with nonstate adversaries using guerrilla and terrorist tactics while operating under stringent rules of engagement, protracted conflicts requiring multiple deployments, and increased flow and ambiguity of information and tasks, noncombat roles, autonomy, and responsibility at lower levels (e.g., small teams), and coordination among joint, interagency, and multinational operations.^{1,2} These challenges translate into significant psychological demands on service members, which include the amount and speed of information and tasks, ambiguity of roles and responsibilities, necessity for quick and accurate

decisions, and a range of other acute and cumulative challenges associated with military operations.³⁻⁷

Given the psychological demands on service members, psychological fitness is more vital than ever. Psychological fitness is defined as the integration and optimization of mental, emotional, and behavioral abilities and capacities to optimize performance and strengthen the resilience of warfighters. The service members' resilience (ability to withstand, recover, grow, and adapt under these challenging circumstances) is vital to force protection. In addition, without such resilience, service members' performance (ability to successfully complete tasks) suffers and their fitness and readiness for deployment is adversely affected. This article proposes a comprehensive and integrated model of operational psychological fitness for enhancing mission-critical performance and resilience in service members.

METHODS/APPROACH

To consider and develop such a model that addresses psychological fitness in the armed services, a diverse team of military and civilian health and human systems professionals collaborated on reviewing the best available evidence cited in the literature across a range of disciplines to develop an integrated model of psychological fitness. The group included representatives from all services, joint forces command, and special operations command. The primary literature sources were prepublication drafts of systematic reviews on performance factors by the Army Center for Enhanced Performance⁸ and resilience factors by RAND.⁹ The team used a concept analysis approach¹⁰ to review the empirically based factors, refine definitions of key terms, and identify subdomains of psychological fitness. The team then divided into subteams that focused on each of the different subdomains. Additional literature reviews included military topics and research pertaining

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to sports, human factors, organizational, neuropsychological, health, and clinical psychology review articles and research. In addition, the team consulted with subject matter experts in a variety of areas including outcome metrics and tools for skill training.

Military Demand-Resource Model

This article proposes a military demand-resource (MDR) model, which has several key features. First, the model is a systems model that accounts for key interactions across the full range of demands and resources in predicting resilience and performance outcomes. Second, the model is also based on the proposition that it is possible to identify and develop psychological fitness similar to physical fitness, which has important implications for military culture. Third, the criteria for selecting the core framework of the model are based on relevance for use with the military system, operations, and outcomes. How these criteria are met is best understood by discussing the model origins and components first.

The model is based on an integration of the conservation of resources (COR) theory¹¹ and the job demand-resource model,¹² both of which suggest that resources and demands must be continuously monitored to ensure that resources that are needed to address environmental demands are sufficiently maintained. The MDR model identifies the following types of variables that interact to determine outcomes: demands, external resources, and internal resources.

Demands are aspects of the environment that require physical, psychological, social, and spiritual resources. Primary psychological demands identified in the current military operational environment include the amount and speed of information and tasks, challenging roles and responsibilities (unclear, changing, and competing), necessity for quick and accurate decisions, all of which are part of the range of stressors associated with military operations and activities of daily living. The range of additional stressors can also be acute (e.g., exposure to real risk of serious injury or the aftermath of violence, traumatic loss, or moral conflict) and/or chronic (e.g., repeated long work days and limited time for rest, extended sense of powerlessness). In addition, it is important to recognize that the military lifestyle includes demands not associated with combat and operational challenges. Some of these additional demands include frequent moves, training requirements, expected social behaviors, and career enhancing additional duties.

There are two types of variables in the resource environment: internal and external. Both internal (personal) and external (environmental) resources are called upon to accomplish mission goals, meet demand challenges, and stimulate personal growth and development. Internal resources identified in the model include awareness, beliefs and appraisals, coping, decision making, and engagement. External resources, in turn, include aspects of and from the environment that can be helpful. The COR evaluation provides a list of general

resources that ranges from adequate money and transportation to loyalty of friends.¹³ In a military system, external resources can include leadership, unit members, families, educational and training programs, and community support organizations and programs.

There are also three important characteristics of resources identified in COR theory. The first is the primacy of resource loss, which means that resource loss has a more pronounced degree and speed of impact than resource gain.¹⁴ This means that the adverse impacts of a resource loss will be much greater than the benefits associated with an equal and opposite gain in resources. The second is that resource investment is an important strategy to protect against resource loss, recover from losses, and gain resources.¹⁵ In other words, those with fewer resources are disadvantaged in two ways: (1) by being more vulnerable to resource loss and (2) by being less capable of generating resource gains. The third is that resource environments can provide direct support and facilitate learning skills for developing resources similar to Hobfoll's concept of resource caravans and passageways.¹⁶ Examples include stability, safety, and support from family, neighborhood, and community.

An illustration of the MDR model is shown below in Figure 1. Some key features of this model include:

- (1) Primary components are sequenced chronologically with inputs (demands) first, mediators (resource environment) in the middle, and outcomes (psychological fitness end state of resilience and performance) last.
- (2) Internal and external resources are in a larger box representing the resource environment, which can either facilitate or hinder transfer of resources and resource development skills. The mobilization of resources depends upon the nature of the resource and the skill to use the available resources. A robust resource environment is immaterial if the service member does not have the skill to use the resource. Conversely, people who are skilled in using their resources often need fewer resources to achieve positive resilience and performance outcomes.

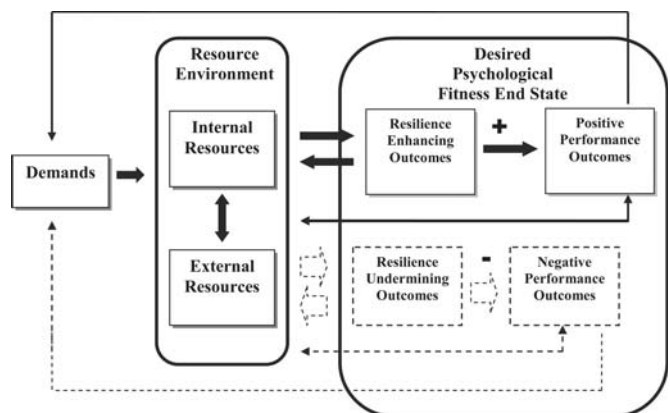


FIGURE 1. Military Demand-Resource Model.

- (3) Desired psychological fitness end state is represented by a large box around resilience-enhancing and positive performance outcomes.
- (4) Paths between resources and performance can be either direct or mediated by resilience (e.g., decision making skills can directly impact the quality of decisions or could be mediated by fatigue).
- (5) Path to negative resilience/performance outcomes is indicated by dashed lines. These arrows are shorter and thicker to represent that resource losses are greater in degree and speed than resource gains.
- (6) Cyclical nature of model includes paths from the performance outcomes back to resources (e.g., positive performance can lead to increased competence and confidence) as well as from performance outcomes to operational demands (e.g., success in combat can lead to decreased threats).

The model also proposes that psychological fitness can be developed using the same training principles as physical fitness. These training principles include increasing awareness and skills through education, repeated practice, feedback mechanisms, performance incentives, and sufficient challenge to push skills to their limit but not exceed limits. Training may increase the capability for better effectiveness under stress and faster recovery from psychological stress. Likewise, capabilities can become degraded with either underuse or overextension due to excessively severe or chronic demands and/or limited resources, which is consistent with the model's emphasis on the importance of managing resources effectively.

The framing of psychological fitness as a parallel focus to physical fitness has important cultural implications related to the military's ability to leverage psychological fitness fully. First, a broadening of the view of psychological health to a continuum of functioning that ranges from optimal to impaired will hopefully decrease stigma around mental health issues and normalize getting treatment when needed, just as one would naturally do for a physical injury or illness. Second, by developing a lexicon of psychological fitness domains, the military can move toward systematic approaches to better understand and improve how we develop and measure these areas of functioning (e.g., increasing awareness, developing core skills, and mission readiness) and encourage all levels of the military system to take more responsibility for their development.

The criteria for selecting and developing features of the MDR model also describe the main utility of this model. To best capture the complexity of human and military systems, the criteria included a model that could: (1) use a strengths-based approach to assess what resources are available and what resources are needed based on demands, (2) understand and optimize the interactions between a person's mind-body internal resources and the complexities of the military's demands and external resources, and (3) assess dynamic interaction demands and resources over time. The comprehensive and dynamic focus of the MDR model is especially impor-

tant for measuring, managing, and leveraging a multifaceted system that involves the complex force structures, multiple deployments, protracted asymmetrical warfare, limited resources, and military lifestyle challenges.

Outcomes and Metrics

The use of appropriate metrics is essential for evaluating the effectiveness of efforts designed to improve psychological fitness. Metrics can be generally classified as either objective (e.g., frequencies of activities, scores on tasks and tests, ratings by clinicians and supervisors and, physiologic measures and biomarkers) or subjective (i.e., self-report or ratings by clinicians and supervisors). Descriptive and outcome data can be collected on multiple levels (e.g., individual, group, and population levels).

Selection of metrics ultimately depends on whether the metric is feasible, can measure the desired outcome, and can assess whether a program is effectively meeting its goals. In general, objective measures are preferred because they are less subject to natural human biases.¹⁷ Confidence in findings is also increased when using multiple methods of measuring variables.¹⁸ Tables I and II provide a sample of either objective or empirically validated subjective metrics that can be used to measure intermediate and operational outcomes related to psychological fitness. Table I provides sample metrics for intermediate outcomes, which are defined as changes in the internal resources themselves (i.e., awareness, beliefs and appraisals, coping, decision making, and engagement) that are thought to influence operational outcomes. In contrast, Table II describes potential metrics for operational outcomes, which are defined as changes in resilience and performance aspects of force protection, readiness, and operational capabilities.

For each outcome variables listed in Tables I and II information about the following selection considerations are included:

- (1) One or more options for metrics to measure the outcome.
- (2) Definition/explanation of the outcome and/or the metric.
- (3) Summary of evidence from peer-reviewed publications supporting the reliability and validity of the metric(s). To be included in these tables, metrics must have had:
 - (a) At least one article published on the psychometric properties of the metric.
 - (b) Evidence of reliability (i.e., the consistency of scores from one assessment to another) through either a correlation across repeated measures of ≥ 0.5 ¹⁹ or a Cronbach's α (internal consistency) of ≥ 0.70 .²⁰
 - (c) Evidence of validity (i.e., the ability of the test to measure what it says it measures) thorough a correlation coefficient ≥ 0.1 .²¹
 - (d) Description of relevance to military operations, including tailoring testing and use in military and veteran populations.

TABLE I. Internal Resource Outcomes, Variables, and Metrics

Internal Resource Variable	Options for Metrics	Description (D), Evidence (E), Relevance (R), and Practicality (P)
Awareness	Metacognitive Awareness Inventory	D: Self-report inventory designed to measure two categories of metacognitive awareness in adults: knowledge of cognition and regulation of cognition. E: Cronbach's $\alpha = 0.90$, Pearson's $r = 0.54$ df ^a R: Metacognitive awareness is essential for service members to have skills for recognizing changes in physical and emotional states to effectively regulate one's own stress responses and to relate effectively with others. P: 52 items.
Awareness	Attention Network Test (ANT)	D: Computerized battery designed to evaluate alerting, orienting, and executive attention. Composed of three independent behavioral components of attention: conflict resolution (ability to overcome distracting stimuli), spatial orienting (the benefit of valid spatial precues), and alerting (the benefit of temporal precues). E: Study with 40 normal adult subjects indicates that ANT produces reliable single subject estimates of alerting, orienting, and executive function. ^b R: Using ANT, mental training has been shown to improve the ability to orient attention, allow for improved alerting skills, and protect against functional impairments in WMC. These findings are significant in the dynamic, high-stress, and resource-scarce combat environment. ^{c-d} P: 30-min testing session.
Beliefs and Appraisals	Post-Traumatic Cognitions Inventory (PTCI)	D: Self-report measure of cognitive responses to trauma. Composed of three factors: (a) negative cognitions about self, (b) negative cognitions about the world, and (c) self-blame. E: Internal consistency measures for three subscales (negative cognitions about the self, $\alpha = 0.97$; negative cognitions about the world, $\alpha = 0.88$; self-blame, $\alpha = 0.86$). ^e R: Validated in individuals who sought assessment and possible treatment for mental health problems following an accident involving actual or threatened death or serious injury and their emotional response included intense fear, helplessness, horror, or the perception that they would die. P: 33 items.
Beliefs and Appraisals	Situational Self-Efficacy (SSE) Scale	D: Developed for investigating the predictive power of efficacy expectations about behavior or task performance. ^f SSE asks to rate (from 1 to 10) level of confidence in ability to do well. E: Has been found to be associated with multitask performance with military personnel. ^g R: There is extensive evidence that self-efficacy is associated with higher levels of motivation and performance for civilian and military populations. ^h P: High. This is a single-item questionnaire.
Beliefs and Appraisals	Dispositional Resilience Scale DRS-15; Psychological Hardiness	D: Self-report measure of hardiness—resilience in response to stress. Composed of three facets: (a) commitment, (b) control, and (c) challenge. E: Cronbach's $\alpha = 0.82$ for total hardiness; facets range from 0.68 to 0.77; ⁱ 3-week test-retest reliability = 0.78. ^j R: Well validated in U.S. and international military samples. ^k P: 15 items rated on a 4-point Likert scale; 2–3 minutes to complete.
Coping	Coping Self-Efficacy Scale (CSES)	D: Self-report inventory designed to measure perceived self-efficacy for coping with challenges and threats. Focuses on changes in a person's confidence in his or her ability to cope effectively. E: Internal consistency and test-retest reliability are strong for all three factors. ($\alpha = 0.91$ and 0.80, respectively). ^l Concurrent validity analyses show these factors assess self-efficacy for different types of coping. R: 3 military-relevant factors: problem-focused coping (6 items, emotion-focused coping thoughts (4 items), and ability to get social support (3 items). P: CSES has 13 items.
Coping	Brief COPE Scale	D: Self-report scale to measure coping ability. Scales include: self-distraction, active coping, denial, substance use, items, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, self-blame. E: Based on the well-validated COPE inventory. ^m R: Psychometric properties of the Brief COPE are reported from a sample of adults participating in a study of the process of recovery after Hurricane Andrew. P: 28 items.
Decision Making	Cognitive Flexibility Scale	D: Self-report scale: subjects rate 19 adjective pairs that capture flexibility in regard to themselves, others, and the environment. E: Internal consistency 0.92, test-retest 0.77, split-half 0.87. ⁿ R: Emphasizes need in flexibility of thinking before acting. P: 19 items.

TABLE I. Continued

Internal Resource Variable	Options for Metrics	Description (D), Evidence (E), Relevance (R), and Practicality (P)
Engagement	Utrecht Work Engagement Scale (UWES)	D: Self-report inventory designed to measure physical fatigue, cognitive weariness and emotional exhaustion. Composed of three subscales: vigor, dedication, and absorption. E: Internal consistency, Cronbach's α between 0.80 and 0.90. ¹ Two-year stability coefficients for vigor, dedication, and absorption are 0.30, 0.36, and 0.46, respectively. ⁹ R: Has been validated in military police officers. ⁹ P: UWES-9 version contains 9 items. ⁹
Active Disengagement	Gallup Q12 ⁷	D: Self-report instrument. Respondents are asked to rate their response to each question (on a scale of one to five) about key satisfaction elements that indicate the presence of deep worker engagement. E: To identify the 12 items, Gallup conducted thousands of interviews in many types of organizations and industries across the world. These 12 emerged as the best predictors of employee and work group performance. ⁸ R: Results have shown a strong link between high survey scores and worker performance. P: 12 items.

¹Schraw G, Dennison RS. Assessing metacognitive awareness. *Contemporary Educational Psychology*. 1994;19:460–475. ²Fan J, McCandliss BD, Sommer T, et al. Testing the Efficiency and Independence of Attentional Networks. *Journal of Cognitive Neuroscience*. 2002;14(3):340–7. ³Jha AP, Krompinger J, Baime MJ. Mindfulness training modifies subsystems of attention. *Cognitive Affective Behavioral Neuroscience*. 2007;7(2):109–19. ⁴Jha AP, Stanley EA, Kiyonaga A, et al. Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion*. 2010;10(1):54–64. ⁵Foa EB, Ehlers A, Clark DM, et al. The Posttraumatic Cognitions Inventory (PTCI): Development and validation. *Psychological Assessment*. 1999;11:303–314. ⁶Bandura, A. Self-Efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review*. 1977, 84, 191–215. ⁷Branscome TA, Swoboda JC, Fatkin LT. An Initial Investigation of Factors Affecting Multi-Task Performance; ARL-TR-4025; U.S. Army Research Laboratory: Aberdeen Proving Ground, MD 2007. ⁸Fatkin LT, Hudgens GA. Stress Perceptions of Soldiers Participating in Training at the Chemical Defense Training Facility: The Mediating Effects of Motivation, Experience, and Confidence Level; ARL-TR-365; U.S. Army Research Laboratory: Aberdeen Proving Ground, MD 1994. ⁹Bartone PT. Hardiness protects against war-related stress in Army reserve forces. *Consulting Psychology Journal*. 1999;51:72–82. ¹⁰Bartone PT. Test-retest reliability of the Dispositional Resilience Scale -15, a brief hardiness scale. *Psychological Reports*. 2007;101:943–4. ¹¹Hystad SW, Eid J, Johnsen BH, et al. (2010). Psychometric properties of the revised Norwegian dispositional resilience scale. *Scandinavian Journal of Psychology*. (available online). ¹²Chesney MA, Neilands TB, Chambers DB, et al. A validity and reliability study of the coping self-efficacy scale. *British Journal of Health Psychology*. 2006; 11(3):421–37. ¹³Carver CS. You want to measure coping but your protocol's too long: Consider the Brief COPE. *International Journal of Behavioral Medicine*. 1997;4:92–100. ¹⁴Bilgin, M. Developing a cognitive flexibility scale: Validity and reliability studies. *Social Behavior and Personality*. 2009;37(3):343–54. ¹⁵Seppälä P, Mauno S, Feldt T, Jari et al. The Construct Validity of the Utrecht Work Engagement Scale: Multisample and Longitudinal Evidence. *Journal of Happiness Studies*. 2009;10(4). ¹⁶Bakker AB, Demerouti E, Euwema MC. Job resources buffer the impact of job demands on burnout. *Journal of Occupational Health Psychology*. 2005;10(2):170–80. ¹⁷Schaufeli WB, Bakker AB. (2003). Utrecht Work Engagement Scale Preliminary Manual. Occupational Health Psychology Unit, Utrecht University 2003:12. ¹⁸Thackery, J. Feedback for Real. *Gallup Management Journal*. 2001. Accessed 12/11/09 at <http://gmj.gallup.com/content/811/Feedback-Real.aspx> ¹⁹Harter JK. Taking Feedback to the Bottom Line. *Gallup Management Journal*. 2001. Accessed 2/23/10 at <http://gmj.gallup.com/content/814/Taking-Feedback-Bottom-Line.aspx>

TABLE II. Operational Outcomes, Variables, and Metrics Related to Performance

Operational Outcome Variable	Options for Metrics	Description (D), Evidence (E), Relevance (R), and Practicality (P)
Team/Organizational Job and Task Performance	Performance Scenarios, Inspections and Surveys	D: Objective measures, including evaluation of team coordination and maneuvering in simulated performance scenarios, organization inspections, and unit surveys. E: Objective data. R: Measures team performance and effectiveness and unit climate. P: Already evaluated in military.
Individual Organizational Job and Task Performance	Performance Appraisals and Test Scores	D: Objective measures, including annual performance appraisals as part of promotion system and scores on written and practical tests. E: Objective data. R: Standard measures of job knowledge and performance in military. P: Already evaluated in military.
Individual Organizational Job and Task Performance	World Health Organization's Health and Work Performance Questionnaire (HPQ)	D: Self-report instrument designed to estimate the workplace costs of health problems in terms of reduced job performance, sickness absence, and work-related accidents-injuries. E: Good calibration with archival measures of work performance and absenteeism. ^a R: A DoD draft version of the HPQ has been developed and is available, but it has not been sufficiently validated. P: 21 items.

(continued)

TABLE II. Continued

Operational Outcome Variable	Options for Metrics	Description (D), Evidence (E), Relevance (R), and Practicality (P)
Retention	Early Separation	D: Number of personnel who separate with either: (a) less than 3 years of service (YOS) or (b) between 3 and 8 YOS in 7 separation categories (Convenience of the Government, Drugs, Physical, Psychological, etc.). E: Objective data. R: Majority of early separations are not known with enough advanced notice and therefore impact force readiness. In the majority of early separation cases, there is a negative impact from loss. Stressor on the force for potential inability to deploy and stressor on the families of those who are separated.
Multiperspective Ratings of Performance	360 Survey	D: Raters from multiple perspectives (superior, peer, subordinate) assess dimensions of performance. ^b E: Tacit Knowledge for Military Leadership (TKML) 360 has been shown to have adequate reliability and validity with Army officers. ^c R: Self-ratings can be inflated. ^d P: Multisource assessment feedback (MSAF) 360 survey is being utilized for leadership development at the Army's Center for Leadership Development, Fort Leavenworth, KS and is available online.
Organizational Citizenship Behaviors (OCB)	Organizational Citizenship Behaviors Questionnaire ^e	D: Self-report measure designed to measure altruism, conscientiousness about commitments, ability to work supportively under pressure, thoughtfulness toward others, and commitment to community. E: Individual OCBs = 0.89, Organization OCBs = 0.79. R: Positive relationships between OCB and individual-level performance, ^g aggregated individual performance, ^g group-level measures of performance ^h and organizational-level measures of performance. ⁱ While supportive, these efforts have not utilized methodologies that establish causal priorities among the variables and show some inconsistencies in their findings. P: 24 items.
Resilience	Connor-Davidson Resilience Scale (CD-RISC)	D: Distinguishes between those with greater and lesser resilience. E: Good test-retest reliability, sound construct validity, and psychometric properties. ^j R: Has been used in military populations. P: CD-RISC 2 takes less than 30 seconds to complete. ^k
Safety Mishaps (Motorcycle fatalities, etc.)	DoD-wide rates for civilian injuries, private motor vehicle fatalities, and flight class A mishaps.	D: Defense Safety Oversight and common OSHA metric (lost day rate), based on time cards/days away. Does not assume whether mishaps are intentional or accidental. Assumes that mishaps are severe enough to impact deployment. E: Objective data. R: Safety mishaps have a direct impact on deployment. P: Already collected in military, available through DUSD (R).
Burnout	Shirom-Melamed Burnout measure (SMBM)	D: Self-report questionnaire that assesses physical fatigue (6 items), emotional exhaustion (4 items), and cognitive weariness at work (6 items). Consists of two subscales: physical fatigue and cognitive weariness. Respondents completing the SMBM are asked to rate the frequency of appearance of each feeling during their work. All items are scored on a 7-point frequency scale, ranging from 1, almost never, to 7, almost always. E: Cronbach's $\alpha = 0.92$, Pearson's $r = 0.45-0.89$. ^l R: Sample included 325 human service professionals from five organizations. P: 16 items.
Well-Being, Health-Related Quality of Life, and Functional Health Status	The Veterans RAND 12-Item Health Survey (VR-12), aka Veterans SF-12	D: Derived from the Veterans RAND 36-Item Health Survey (VR-36), ^m developed using extensive research and normative data from the VR-36 in the VHA. Consists of the 12 most important items from the VR-36 for construction of the physical and mental component summary scales. E: Strong psychometric properties of VR-36 well established. Two summary component scales derived from the VR-12 explain over 90% of the variance in scales of the VR-36. ⁿ R: VR-12 has been administered in national VA surveys in 1997 and 1998 to over 60,000 patients. Since 2002, the VA has administered the VR-12 to approximately 432,000 patients annually as part of its quality management program. ^o P: 12 items.

TABLE II. Continued

Operational Outcome Variable	Options for Metrics	Description (D), Evidence (E), Relevance (R), and Practicality (P)
Mental Health Symptoms	Post-Deployment Health Assessment and Re-Assessment (PDHA, PDHRA) and Patient Health Questionnaire (PHQ-2)	D: PDHA includes a face-to-face interview with a trained health care provider and directed at the individual's health status and concerns at redeployment. PDHRA identifies health concerns that have emerged over time following the most recent deployment. Included in the PDHA is the Patient Health Questionnaire (PHQ-2) is a 2-item depression instrument that inquires about the frequency of depressed mood and anhedonia. Returning deployers with DD2796 (PDHA) or DD2900 (PDHRA) on file; positive screen or referral on either form is counted. E: PHQ-2 has high construct and criterion validity.^p R: Can lead to other risk behaviors or family maltreatment that can disrupt readiness. Can be directly related to deployment risk (hospitalization or discharge). Evaluations reflect either behavioral mental health issues or other behavioral/social issues that lead to indiscipline, family maltreatment, separation, etc. Behavioral/mental health issues higher prevalence in returning deployers (PTSD, etc.). P: Already collected in military. Source: ASD.
Family Maltreatment	Annual Rate of Child Victims of Active Component and Civilian Parent Substantiated Abusers	D: Includes both married and unmarried abusers; does not include noncaregiving mode child abuse (samples too small); collected over several years (comfortable with since FY 2000). E: Objective data. R: Both an indicator of stress and potential deterrent to deployment due to indiscipline. P: Already collected in military, available through DUSD (MC and FP) and DMDC Master Database.
Alcohol Abuse	Single-Item Alcohol Screening Questionnaire (SASQ)	D: "On any single occasion during the past 3 months, have you had more than 5 drinks containing alcohol?" E: Accurately identifies patients who meet DSM criteria for alcohol abuse or dependence.^q R: Antecedent to individual risk behaviors. P: One question.
Alcohol Screenings	Number of Alcohol Program Screenings/Assessments Conducted in Each Service During the Quarter Compared to Baseline Level for That Quarter	D: Reflection of rate of actual usage/abuse. E: Objective data. R: Severe alcohol abuse can lead to safety mishaps or death, other risk behaviors, and indiscipline. P: Already collected in military.
Illicit Drug Use	Quarterly Illicit Drug Positive Rate	D: Number of service members with an illicit drug positive specimen in the calendar year divided by number of unique service members tested. Drug abuse not defined by specific type(s) of abused drug. E: Objective data. R: Rates reflect both abusers as well as short-term/single event users. Can lead to safety mishaps or death, other risk behaviors, and indiscipline. P: Already collected in military. Source: ASD (HA).
Daytime sleepiness	Epworth Sleepiness Scale	D: Asks the subject to rate his or her probability of falling asleep on a scale of increasing probability from 0 to 3. E: Pearson correlation coefficients range from 0.70 to 0.80; high specificity (100%) and sensitivity (93.5%).^r R: Daytime sleepiness = decreased focus. Has been tested in an Army MTF sleep clinic.^s P: 8 items.
Military Suicides	Number of Probable and Confirmed AD Suicides by Quarter	D: Time period chosen because the variation in suicide rates was relatively normal; probable suicide equates to confirmed suicides. E: Objective data. R: Clear link to inability to deploy, also impacts morale across unit or force. P: Already collected in military. Source: ASD (HA).
Divorce Rates	Percentage of Personnel Who Were Already Married at the Beginning of the Fiscal Year but Were Divorced at the End of the Fiscal Year	D: See left. No appropriate way to compare military divorce rates to civilian divorce rates. E: Objective data. R: Can be an indicator of increased stress, lead to other risk behaviors, and delay deployment due to legal proceedings. P: Already collected in military. Source: DUSD (MC and FP).

(continued)

TABLE II. Continued

Operational Outcome Variable	Options for Metrics	Description (D), Evidence (E), Relevance (R), and Practicality (P)
Indiscipline (Courts-Martial, Nonjudicial Punishment, Desertions)	Number of Service Members Convicted at General or Special Courts-Martial per Fiscal Year. Number of Nonjudicial Punishment Proceedings Administered per Fiscal Year; Number of Desertions per Fiscal Year	D: Loss of service members on average reflect a negative loss to the force (despite the negative behavior, the assumption is made that the lost service member was at one time considered a deployable member). E: Objective data. R: Clear relationship with deployment and readiness. P: Already collected in military. Source: DUSD (PI).

¹Kessler RC, Barber C, Beck A, et al. The World Health Organization Health and Work Performance Questionnaire (HPQ). *Journal of Occupational and Environmental Medicine*. 2003;45(2):156–74. ²Church AH, Bracken DW. Advancing the state of the art of 360-degree feedback: Guest editors' comments on the research and practice of multirater assessment methods. *Group & Organization Management*. 1997;22:149–91. ³Psotka J, Gray DM. Collaboration and Self-Assessment: How to Combine 360 Assessments to increase Self-Understanding (Research Note 2007-03). Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences 2007. ⁴Bass B, Yammarino F. Congruence of self and others' leadership ratings of naval officers for understanding successful performance. *Applied Psychology: An International Review*. 1991;40:141–63. ⁵Smith CA, Organ DW, Near JP. Organizational citizenship behavior: Its nature and antecedents. *Journal of Applied Psychology*. 1983;68:653–63. ⁶MacKenzie SB, Podsakoff PM, Fetter R. Organizational citizenship behavior and objective productivity as determinants of managerial evaluations of salespersons' performance. *Organizational Behavior and Human Decision Processes*. 1991;50:123–50. ⁷George JM, Bettenhausen K. Understanding prosocial behavior, sales performance, and turnover: A group-level analysis in a service context. *Journal of Applied Psychology*. 1990;75:698–709. ⁸Karambayya R. Good organizational citizens do make a difference. *Proceedings of The Administrative Sciences Association of Canada*. Whistler, British Columbia 1990:110–9. ⁹Walz SM, Niehoff BP. Organizational citizenship behaviors: Their relationship to organizational effectiveness. *Journal of Hospitality and Tourism Research*. 2000;24(1):108–26. ¹⁰Campbell-Sills L, Stein, MB. Psychometric Analysis and Refinement of the Connor-Davidson Resilience Scale (CD-RISC): Validation of a 10-Item Measure of Resilience. *Journal of Traumatic Stress*. 2007;20(6):1019–1028. ¹¹Vaishnavi S, Connor K, Davidson JR. (2007). An abbreviated version of the Connor-Davidson Resilience Scale (CD-RISC), the CD-RISC2: psychometric properties and applications in psychopharmacological trials. *Psychiatry Research*. 2007;152(2–3):293–7. ¹²Shirom A, Melamed S. A Comparison of the Construct Validity of Two Burnout Measures in Two Groups of Professionals. *International Journal of Stress Management*. 2006;13(2):176–200. ¹³Kazis LE, Miller DR, Skinner KM, et al. Applications of Methodologies of the Veterans Health Study in the VA Health Care System: Conclusions and Summary. *Journal of Ambulatory Care Management*. 2006;29(2):182–8. ¹⁴Jones D, Kazis L, Lee A, Rogers W, et al. Health status assessments using the Veterans SF-36 and SF-12. Methods for evaluating outcomes in the Veterans Health Administration. *Journal of Ambulatory Care Management*. 2001;24(3):1–19. ¹⁵Iqbal SU, Rogers W, Selim A, et al. The Veterans Rand 12 Item Health Survey (Vr-12): What It Is And How It Is Used. Section for Pharmaco-Outcomes and Epidemiology Center for Health Quality, Outcomes and Economic Research CHQOERs Veterans Administration Medical Center, Bedford MA and Center for the Assessment of Pharmaceutical Practices (CAPP) Boston University School of Public Health. Available on line at: www.chqoer.research.va.gov/CHQOER/docs/VR12.pdf. Accessed 28 Feb 2010. ¹⁶Kroenke K, Spitzer R, Williams J. The PHQ-9 Validity of brief depression survey measure. 2001;16(9):606–13. ¹⁷Taj N, Devera-Sales A, Vinson DC. Screening for problem drinking: Does a single question work? *Journal of Family Practice*. 1998;46(4):328–35. ¹⁸Johns, MW Sensitivity and specificity of the multiple sleep latency test (MSLT), the maintenance of wakefulness test and the epworth sleepiness scale: failure of the MSLT as a gold standard. *Journal of Sleep Research*. 2000;9(1):5–11. ¹⁹DeZee KJ, Jackson JL, Hatzigeorgiou C, et al. The Epworth sleepiness scale: relationship to sleep and mental disorders in a sleep clinic. *Sleep Medicine*. 2006;7(4):327–32.

- (e) Summary of the metric's practicality, including ease of administration, length of questionnaire, response burden, and whether metrics exist in other measures that are already routinely administered or in pre-existing databases.

Internal Resources Specific to Psychological Fitness

The internal resources include five subdomains of psychological fitness: awareness, beliefs and appraisals, coping, decision making, and engagement. The descriptions of these subdomains includes a line definition of each subdomain and supporting factors, samples of empirical evidence for how the factors relate to performance and resilience, and samples of the evidence for the effectiveness of identified factors.

Awareness

Virtually all of the factors that contribute to resilience in relation to performance are contingent on the ability to attend appropriately.²² That is, individuals must maintain a sufficient level of awareness of their own environment and their relation

to and functioning within it before an appropriate response can be activated.²³

Self-awareness is broadly defined as the self-descriptions that a person ascribes to oneself that influence one's actual behavior, motivation to initiate or disrupt activities, and feelings about oneself.²⁴ Self-awareness can be developed over time and has been shown to be a significant factor in inferential processes and intelligence.²⁵ Individuals must also have situation awareness,²⁶ or knowledge of what is going on around them for accurately interpreting and attending to appropriate cues in the environment.

Self-awareness and situation awareness are both multidimensional constructs composed of various psychological and cognitively oriented factors that influence processing abilities and play a critical role in resilience and performance.^{27–30} Emotional and cognitive awareness are two underlying mechanisms that comprise self-awareness. Emotional awareness includes awareness of one's own emotions and the emotions of others. It has been found to impact psychological resilience and coping,³¹ as well as performance.³² Cognitive awareness, or metacognition, is awareness and regulation of one's cognitive

functioning and the factors that affect it.³³ Metacognitive strategies can be employed to manage uncertainty in a situation,³⁴ and research indicates that using metacognitive strategies can enhance adaptability^{35,36} and on-the-job performance.³⁷

Attention allows individuals to accurately perceive information in the environment³⁸ and can be degraded under stressful conditions,³⁹ thereby limiting resilience and performance. However, some individuals have better control of their attentional focus. Individual differences in attentional control include the abilities to selectively attend to goal-relevant information while ignoring goal-irrelevant information⁴⁰ and to divide and switch attention as needed.⁴¹ Although many of the underlying mechanisms related to both self- and situation awareness are biologically based, there are also aspects of attention that can be taught and developed. Training programs with continuous individualized adaptive feedback have been shown to enhance attention control⁴² and could be developed to improve cognitive and situational awareness.⁴³

Beliefs and Appraisals

Beliefs are defined as psychological states in which an individual holds a premise to be true.⁴⁴ In contrast, cognitive appraisals represent a process through which people evaluate a situation or experience. Pre-existing beliefs play an important role in influencing the appraisal process.⁴⁵ For example beliefs about one's ability to control the environment can impact how much confidence one has in his/her ability to accomplish an endeavor.

Appraisals have been theoretically linked with responses to stress and performance outcomes. Stress responses are conceptualized as the interaction between the perception or appraisal of demand, perceived ability to cope, and the perception of the importance of being able to cope with the demand.⁴⁶ A person's perception and appraisal of an event help determine whether the event is experienced as threatening, and whether one feels able to adequately cope, which, in turn, can lead to decreased or increased experiences of stress.⁴⁷ Appraisals have also conceptually been associated with performance. In general, a negative evaluation of a situation often leads to a negative outcome while positive evaluation appears to improve task performance by reducing subjective distress and possibly enhancing cognitive function in addition to improving objective performance.⁴⁸

Studies on Bandura's social cognitive theory provide evidence that beliefs and appraisals influence how people deal with a range of stressors. This theory focuses on the role of a person's appraisal of personal capabilities to manage events (coping self-efficacy). Findings indicated that a sense of mastery (competence and perceived control over their life) enables an individual to better handle stressors by mobilizing and sustaining active coping efforts.⁴⁹ In addition, higher levels of mastery are associated with recovery from post-traumatic stress disorder (PTSD)⁵⁰ and with less distress following trauma⁵¹ and a greater perception of societal and family support.⁵²

Evaluations of controllability and predictability of potential external threats can also play a central role in how a person responds to a potentially traumatic event. PTSD is characterized

by individuals' catastrophic interpretations about the threatening nature of their environment and their self-evaluated inability to cope. In contrast, the greater the perception of predictability and controllability of a trauma, the less likely that this traumatic experience will result in persistent psychological dysfunction and disorders.⁵³ The ability to predict an adverse event helps an individual generate resources to help deal with the event and provides a sense of mastery and control over a traumatic, uncontrollable experience.^{54,55}

Studies have also shown that a profile of beliefs or attitudes summarized as psychological hardiness can influence coping appraisals, health, and performance in response to stress.⁵⁶⁻⁵⁸ This attitude profile incorporates a strong belief of control (that one can influence events), commitment (that life is interesting and meaningful), and challenge (that change is valued as a normal part of experience).⁵⁹ Studies with military groups have shown that hardiness beliefs predict successful performance in Army Special Forces candidates,⁶⁰ fewer PTSD symptoms in response to combat stress,⁶¹ and improved leader performance in officer cadets.⁶² A relevant study with Dutch military personnel finds that hardiness beliefs influence problem-focused coping style, which in turn affects positive coping behaviors.⁶³ Thus, hardiness (commitment, control, and challenge) beliefs appear to be an important individual-level factor that can influence healthy or unhealthy coping appraisals and strategies in response to a range of stressors. Additional studies suggest that leaders can have a substantial influence on hardiness cognitions and related appraisals and coping behaviors demonstrated by unit members.⁶⁴

Multiple studies have demonstrated that self-efficacy is related to successful performance across a variety of work-related and academic tasks,^{65,66} problem solving, and analytic thinking.⁶⁷⁻⁶⁸ Studies on reappraisal techniques provide examples of methods for modifying these factors. For example, the ability to re-evaluate a traumatic experience and one's responses to a traumatic experience can be taught through cognitive behavioral techniques such as cognitive processing therapy (CPT), which has been used in the treatment and prevention of PTSD following traumatic exposure.⁶⁹ Positive appraisal of a mission and an individual's role in executing it may help develop resilience instead of negative appraisal of a traumatic situation.⁷⁰ The Penn Resiliency Program is an intervention that combines cognitive restructuring techniques, behavioral activation, interpersonal skills, relaxation and coping techniques. These activities have been associated with decreases in depressive and anxiety symptoms and increased well-being and optimism in high-risk adolescents and college students.^{71,72} Other studies also suggest that optimism is a valuable resilience resource in coping with stress.^{73,74}

Studies on stress inoculation also provide examples of techniques for enhancing mastery, self-efficacy, and a sense of control over threat. Stress inoculation, as the name suggests, attempts to immunize an individual from reacting negatively to stress exposure. This process takes place before experiencing the stressful conditions of concern. One critical hallmark of stress inoculation

is the requirement for increasingly realistic pre-exposure through training simulation. The model proposes that through successive exposure approximations, one builds a sense of expectancy and outcome that is integrated into positive cognitive appraisal and a greater sense of mastery and confidence. As previously mentioned, this habituation to anxiety may in turn diffuse affective states that would otherwise draw upon performance resources and hamper efficient information processing (as discussed previously). This cognitive-behavioral, pre-emptive approach to stress prevention has been implemented in a variety of settings to include work with the military, law enforcement, fire fighters, medical personnel, and many others.⁷⁵

Tough realistic training that approximates actual military operations can be a key method for stress inoculation as well as other psychological benefits related to beliefs and appraisals. These potential additional benefits include a sense of psychological preparedness and self-efficacy.⁷⁶

Coping

A core component of resilience as it relates to warfighter performance is the ability to cope with stress. Coping can be broadly defined as thoughts and behaviors a person uses to manage the demands of stress and to maintain optimal levels of energy and capacity to work.⁷⁷ Several coping strategies have been empirically linked to enhanced performance and resilience in both civilian stress and coping as well as military mental health research. These include problem-focused coping, emotion-focused coping, maladaptive coping, recharging, energy management, and cognitive load management.

Problem-focused coping (PFC) refers to active efforts to confront and manage situational demands and to reduce the discrepancy between a current situation and a desirable outcome.^{78,79} PFC has been found to be associated with greater resilience (decreased likelihood of developing mental health difficulties) in studies with both civilians and military members.⁸⁰⁻⁸² Haney and Long also found evidence that PFC is associated with increased confidence and enhanced performance.⁸³

In contrast to the active nature of PFC, maladaptive coping involves attempts to cope with stress through activities that may reduce stress initially, but create greater stress in the long term.⁸⁴ Maladaptive coping practices such as uncontrolled anger, alcohol abuse, aggression toward others, and self-harm, have been shown to be inversely related to both physical and psychological well-being.^{85,86}

Emotion-focused coping (EFC) involves regulating emotions through a broad range of activities such as seeking emotional support, building emotional awareness, working toward acceptance, and positive reappraisal. Civilian literature suggests that two EFC techniques in particular, structured meditation and building positive emotions, may be helpful to enhancing immunity to a variety of physical ailments (e.g., headache, and chronic pain) as well as building resilience to psychological illnesses (e.g., anxiety and depression)⁸⁷⁻⁹⁰

In addition, as part of their program for enhancing the fitness of Army soldiers, the Army Comprehensive Soldier Fitness

(CSF) program is integrating the broaden and build theory of positive emotions^{91,92} and the Penn Resiliency Program's cognitive behavioral intervention for enhancing positive emotions such as optimism and happiness.⁹³

The next coping strategy that merits consideration is described as "recharging," which includes practices to restore energy and counterbalance stress that can offset adverse mood and deteriorating performance.⁹⁴⁻⁹⁷ Research demonstrates that taking long recovery periods away from work is associated with decreased levels of burnout.⁹⁸⁻¹⁰¹ Moreover, military research indicates that providing sufficient down time between deployments can reduce the risk of developing a range of post-deployment mental health difficulties.¹⁰²

In addition to breaks from work, the ability to strategically manage energy, or proactively regulate physical and emotional arousal, can promote optimal performance¹⁰³ as well as enhance endurance.¹⁰⁴ Two tools shown to be particularly effective in managing energy include relaxation and energization.¹⁰⁵ These techniques utilize imagery, meditation, and muscle relaxation to produce marked changes in physiological arousal that can be harnessed to quickly and efficiently conserve as well as maximize energy when needed.

Lastly, cognitive load management techniques are mental strategies (planning, prioritizing, tracking, executing, chunking) used to achieve more efficient task performance or to manage complex or ambiguous information. One example of interference that tasks create for each other can be seen in literature related to the effects of talking on the phone while driving.^{106,107} Moreover, prolonged attention to tasks that are mentally taxing without sufficient breaks often results in attention lapses or vigilance decrements^{108,109} as well as slowed reaction time.¹¹⁰ Finally, in research examining truck drivers as well as medical personnel, accidents have been linked to decrements in vigilance as well as to sleepiness and fatigue.^{111,112} These negative consequences of cognitive overload may similarly arise from demands of asymmetrical warfare when large amounts of information must be processed in potentially lethal, time-sensitive, and ambiguous situations under continuous operations.

Decision Making

Decision making is defined as thoughts and behaviors used for evaluating and choosing courses of action to solve a problem or reach a goal. The operational relevance of decision making is demonstrated in the increased operational intensity, tempo, and scope, the interrelationships between humans, agencies, and technology, and the uncertainty that places increased value on the human capabilities of quick and accurate thinking, planning, acting, assessing feedback, and modifying plans. The decision making factors include problem solving, goal setting, adaptive thinking, and intuitive thinking. These factors are inter-related with those of the awareness subdomain and belief and appraisal subdomain. For example, Nezu's social problem solving model identifies orientation (beliefs and expectancies) variables such as self-efficacy as key predictors of how well problem solving tasks are completed.¹¹³

Problem solving and goal setting are structured decision making factors seen in many aspects of military operations, especially systematic goal setting, and during all mission-related activities. Problem solving can be applied to identifying effective or adaptive ways of coping with problematic situations encountered in everyday living.¹¹⁴ Problem solving is a systematic and objective process of finding root causes of problems and potential solutions and acting on them. Goal setting, which can often complement problem solving, is described as a cognitive process of identifying specific, measurable, and time-targeted objectives.

Adaptive and intuitive thinking are less structured forms of decision making. Adaptive thinking includes cognitive processes that involve monitoring and adjusting to unanticipated and ambiguous circumstances to exploit advantages, minimize harm, and successfully complete tasks. As such, adaptive thinking is an umbrella term that includes current adaptive thinking and performance variables^{115,116} and a range of related variables such as creativity and divergent thinking,¹¹⁷ cognitive flexibility,¹¹⁸ and dialectical thinking.¹¹⁹ Intuition is defined as the process of quick and confident decision making based on insights that are often below the conscious level.¹²⁰ Intuitive decision making is especially important in an era of irregular warfare where unpredictable events such as well-hidden improvised explosive devices (IEDs) are the norm. Thus, a critical operational skill set has become intuitive decision making, where heightened danger in a naturalistic setting is quickly sensed and an appropriate response is quickly activated.^{121,122}

Decision making factors are related to a variety of resilience and performance outcomes. Studies have found evidence that social problem solving is related to several resilience outcomes including effective coping responses to intrapersonal and interpersonal stressors,^{123,124} stress experiences,¹²⁵ anxiety,¹²⁶ depressive experiences,¹²⁷ and more severe clinical forms of distress such as suicidal ideation and hopelessness.¹²⁸

Sports psychology research provides evidence of relationships between goal setting and performance. A meta-analysis of 36 studies found an effect size of 0.34 for enhanced athletic performance associated with specific goal-setting conditions versus no-goal or "do-your-best" goal-setting conditions.¹²⁹ In addition, the most recent comprehensive review of goal-setting interventions in sport found that of 88 studies examined, 70 studies demonstrated moderate to strong effects on a variety of sport performance measures.¹³⁰

Research has shown that various aspects of adaptive thinking are related to resilience and performance in response to novel and ill-defined problems.^{131,132} Drawing from the preliminary adaptability, or adaptive thinker profile, characterized by Svensson and colleagues in Stokes et al.,¹³³ research has supported a model whereby various factors associated with adaptive thinking combine to predict performance in the face of challenge and uncertainty.¹³⁴ In the empirical study, subjects that performed best in response to an unexpected and challenging task condition displayed creative, innovative, and

flexible thinking.¹³⁶ Thus, being capable of such an adaptive response is critical for resilience in a performance context.¹³⁷

There is also evidence that intuition is linked to performance outcomes. Klein and colleagues found that expert chess players and firefighters had a larger base of tacit knowledge to draw from, resulting in better intuitive decisions.¹³⁷

Studies have also demonstrated that decision making skills are modifiable through training. Training programs that incorporate self-regulatory skills such as metacognition offer a method to enhance adaptive thinking.¹³⁸ Skilled intuition in decision making can be enhanced through training programs that provide an environment of sufficiently high validity and adequate opportunity to practice the skill desired.¹³⁹ Incorporating these empirically supported training characteristics in combat training simulators that replicate the extremes of combat in a secure environment (e.g., Strategic Operations, Inc. in San Diego and the Infantry Immersion Trainer at Marine Corps Base Camp Pendleton) offers a method for enhancing desired decision making skills and improving resilience in combat scenarios.

Engagement

Operationally, engagement is an important countermeasure for the constant physical and psychological demands of performance that increase the risk for disengagement and burnout. Engagement is a sustained experience of strong identification with unit members, unit, and mission characterized by high levels of energy and full involvement in mission tasks.^{140,141} Engagement is characterized by three factors: dedication, vigor, and flow. Dedication is the identification with work and feelings of inspiration, pride, and challenge. Vigor includes readiness and energy one exhibits and being resilient. Flow, adapted from Csikszentmihalyi, is a sense of being completely involved in an activity and a sense of heightened clarity about goals, tasks, and skills to successfully meet challenges.¹⁴²

There is evidence that engagement is associated with resilient responses to stress, whereas lack of engagement is associated with burnout. Britt et al. found that engaged soldiers are less likely to report negative consequences under high levels of training.¹⁴³ In contrast, burnout has been characterized as a function of decreased engagement with one's job demonstrated in emotional exhaustion, cynicism, and decreased self-efficacy.¹⁴⁴

Studies have also found evidence that engagement is related to performance. In general, engagement of the employee at work has been associated with organizational performance outcomes.¹⁴⁵⁻¹⁴⁷ In addition, a study of over 50,000 employees found engagement was associated with performance as well as probability of retention.¹⁴⁸

Flow has been found to be related to performance directly¹⁴⁹ as well as motivation¹⁵⁰ and task interest.¹⁵¹ Burnout has been shown to be negatively related to job performance.¹⁵² Specifically, workers who have higher emotional exhaustion, rate low in performance by themselves and supervisors.¹⁵³

A review of research supports two methods for preserving and increasing engagement. For example, engagement can be fostered by focusing on a person's strengths. Managers' performance has been found to be associated with their practice of matching employee talents to tasks and placing emphasis on individual strengths, which subsequently led to increases in employee engagement.¹⁵⁴ A second method is ensuring a balance among resources such as job control, supervisor support, access to information,^{155,156} performance feedback, and social support.¹⁵⁷ For example, workers who perceive sufficient recovery during leisure time report experiencing a higher level of work engagement during the next work day.¹⁵⁸

Another method for increasing engagement is using a narrative and beliefs-based approach of changing one's personal story (e.g. more effective self-talk).¹⁵⁹ Although this method has not been studied adequately, this approach can be conceptualized as integrating cognitive-behavioral techniques that are supported by evidence in related contexts. These techniques include leveraging self-talk^{160,161} and increasing intrinsic motivation.^{162,163}

Internal Resources Across Total Force Fitness Domains

Psychological fitness is one of the eight total force fitness (TFF) domains of mind-body functioning. The TFF domains interact to achieve a state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions. Therefore, it is important to understand and leverage interactions across these domains. A sample of key interactions between psychological fitness, internal resources, and other TFF domains are summarized below.

Exercise and physical activity can affect cognitive performance and mood. Research on physical exercise has consistently demonstrated a positive impact on mood and affect.¹⁶⁴ Moreover, physical fitness has a low to moderate effect on reducing anxiety and stress¹⁶⁵ and decreasing depression.^{166,167} Finally, it has recently been shown that one hour of moderate exercise can facilitate attentional process.¹⁶⁸

There is also evidence that eating behaviors, supplement use, and preventing dehydration can potentially enhance psychological fitness for the warfighter. Research has shown that late afternoon snacks can positively affect cognitive tasks requiring sustained performance.¹⁶⁹ In addition, carbohydrate supplementation has been found to enhance cognitive performance for soldiers in sustained operations in which high levels of energy are expended.¹⁷⁰ Also, caffeine may provide the best example of a substance that at low doses can enhance "mental energy" related to heightened alertness¹⁷¹⁻¹⁷⁴ as well as self-reported vigor, efficiency, and clearheadedness^{175,176} with doses as low as 32 mg.^{177,178} In addition, studies have shown that the amino acid tyrosine can sustain cognitive performance on selected tasks in the face of acute stressors, such as sleep deprivation and cold stress.¹⁷⁹⁻¹⁸² Whereas certain nutrients and food products may enhance mental capacity, dehydration ($\geq 2\%$ reduction) will adversely impact cognitive functioning.¹⁸³

Social fitness is also inter-related with different aspects of psychological fitness including attention to social cues, regulation of emotion, social problem solving, and adaptability and flexibility to changing cultural and social rules. For example, beliefs and appraisals can set expectations and influence one's ability to develop and make use of social resources.¹⁸⁴ Likewise, beliefs and appraisals associated with psychological hardiness are thought to enhance one's ability to both develop and utilize effectively social support systems.¹⁸⁵ There is also evidence that teaching people how to use social support and individual mastery resources can enhance coping skills and subsequently lead to a reduction in emotional exhaustion.¹⁸⁶

There is also evidence that spiritual and psychological fitness are inter-related. Two examples include (1) behaviors related to spiritual practice and (2) thoughts about purpose and meaning. Several randomized controlled trials (RCTs) have indicated that mindfulness, which can be used as a form of spiritual practice, and body-mind training can improve attention and self-regulation.^{187,188} For example, Lutz and colleagues found that 3 months of intensive training in focused-attention meditation enhanced attentional stability, reduced mean reaction time, improved target detection times, and increased efficiency by reducing task effort.¹⁸⁹ These practices have also been associated with an enhanced ability to positively reframe the stressors of deployment and recover more quickly from mental and psychological stress,¹⁹⁰ protection against functional impairments in working memory capacity,¹⁹¹ and enhancement resilience and recovery following combat.¹⁹² In addition, the spiritual fitness domain of "purpose and meaning" overlaps with the psychological fitness domains of beliefs and appraisals and coping. Evidence shows that cultivating purpose and meaning, which includes ability to find religious significance,^{193,194} improves coping ability. For example, finding positive meaning is associated with greater acceptance of difficult situations and opportunities for post-traumatic growth leading to spiritual resilience¹⁹⁵ as well as better psychological adjustment.¹⁹⁶

External Resources

External resources are environmental resources that can serve as aids to (1) achieving work goals, (2) reducing job demands and their associated physiological and psychological costs, and (3) stimulating personal growth and development.¹⁹⁷ These resources support the individual's ability to thrive. The military provides a multitude of external resources that target resilience and prevention, promote healthy behaviors, and enhance performance. Leadership, unit, family, training, policy, and research serve as six key external resources for strengthening individual performance and resilience.

Leadership has been shown to be the most influential external resource because it impacts multiple areas of a service member's life. Research indicates that effective leadership includes communicating and modeling constructive beliefs/behaviors, reducing service member stress by providing clear

expectations for performance, enhancing service member confidence and performance by ensuring appropriate education and training, providing constructive feedback, creating psychological safety, and empowering service members by trusting them with complete tasks independently.¹⁹⁸ Leadership is pervasive throughout a unit and affects all aspects of the military operational environment. It is thought that leadership can be extremely detrimental when it is bad, but when it is good it can serve as a protective factor to developing mental illness and can be incredibly effective by creating a climate of trust, growth and development, which can enhance performance.

The unit is the environment in which the individual can grow, develop, and strengthen. No service member can perform the mission without the unit. Units provide esprit de corps, motivation, satisfaction, mutual friendship and caring, shared goals, teamwork, group pride, prestige, and status. If service members are to be resilient, they must be able to draw not only upon their own internal reserves, but those of their unit as well.

Training, policy, and research are three key external resources that also support individual growth and development. From the first day a recruit enters the military, the recruit is trained to become a member of a team. Services should continue to explore opportunities to integrate psychological fitness training into life-cycle training.

Policy fulfills multiple functions. It establishes standards and expectations for productive and healthy activities, creates a safe and supportive work environment, provides a structure for compliance with legislation affecting the employer–employee relationship, establishes a basis for behavioral accountability, and provides structure that may help offset uncertainty.

In the Department of Defense (DoD), there is a wide range of programs for increasing resilience, but limited outcomes data. More information about the variety of resilience programs can be found in an overview of DoD resilience programs by Bowles and Bates.¹⁹⁹ In addition, a forthcoming RAND report on resilience, which is overseen by the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE), will include data about existing DoD programs and their consistency with research evidence on resilience.

One final important external resource is knowledge about resilience resources that can be gained from systematic environmental scans, gaps analyses, and program evaluations. The DCoE is also sponsoring several program evaluation pilots of leading resilience-building programs to identify key principles and components for each program. These studies will be conducted with military populations and will utilize operational outcome metrics.

BOTTOM LINE FOR THE LINE

The MDR model can provide military leaders and supervisors with a framework to leverage internal and external resources for assessing, supporting, and enhancing the psychological fitness of their unit members and those they lead. This can

be illustrated with examples for the psychological fitness domains of beliefs and appraisals, coping, and engagement.

Leaders can influence beliefs and appraisals associated with enhanced resilience and performance. For example, leaders can model optimism and self-confidence for their unit members. In addition, leaders can enhance self-confidence by creating training and job performance scenarios that are likely to challenge but not overwhelm unit members, providing constructive feedback for substandard performance, and providing recognition for well-performed tasks.

Leaders can target multiple aspects of the coping domain. They can target specific skill areas such as managing information and task cognitive overload by encouraging and modeling ways to effectively managing mental workload by prioritizing tasks. In addition, they can emphasize the importance of minimizing multitasking as much as possible, both for improved performance and conserving mental energy by reducing task switching. They can also encourage the preservation and restoration of overall energy and cognitive functioning by providing information and guidance to support healthy sleep practices and limit disruptive influences.

Leaders can also leverage the engagement subdomain to lead to enhance resilience and performance. Leaders can facilitate engagement by learning about each unit member's strengths, maximizing how unit members' strengths are used in different jobs and parts of the mission, and encouraging them to develop areas of strength. In a similar way, leaders can increase engagement by talking with unit members to understand what they value and how they could approach parts of the mission that could provide them meaning and intrinsic motivation. Leaders can also help unit members find greater understanding and meaning in difficult experiences as a way to stay connected with others and for a sense of purpose.

DISCUSSION

This article presents a comprehensive and integrated model of psychological fitness based on an assessment of current and future operational demands and the best available evidence about psychological fitness variables. The intent of the article was to provide an initial framework with which to comprehend and measure psychological fitness.

Recommended next steps include ways to address some of the inherent challenges identified by this review. These challenges included: (1) subjective and multifactorial/level nature of psychological processes, (2) context-specific nature of relationships between variables, (3) variability of the evidence supporting the role of different variables and, (4) lack of operational and population-based metrics.

First, it will be important to continue to develop objective and complementary measures to counter the subjective nature of these variables. Models and studies may benefit from increased multidisciplinary research within and outside of the military mental health sector as well as the civilian social science arenas as research moves toward integrating our understanding of the interactions between mind and brain²⁰⁰

and increasing our understanding of the interactions that span biological, physiological, cognitive, emotional, behavioral, social, and spiritual functioning.

Second, program implementation and research efforts need to account for the role of contextual factors, especially in terms of differences across services and components, individuals and groups, and specialties. One way of understanding contextual factors is to seek input from a variety of service members, units, services, and occupational communities and to take steps to better understand their operational context.

Third, given the limited conclusive empirical evidence on psychological fitness programs in military contexts, this review is advocating two concurrent approaches to program development, evaluation, and research to answer the critical question of “what works for whom?” The first is a practical approach to identify the most promising programs in the near term before stronger evidence about outcomes can be established. This practical approach includes integrating available empirical evidence with evaluations of operational relevance and feasibility, and recommendations from subject matter experts. Then pilot programs could be systematically implemented and evaluated in the military. At the same time, individual programs could enhance their own program evaluation efforts. Many programs could benefit by enhancing their program evaluations efforts to gain more understanding of program effectiveness as well as collect data for process improvements.

Finally, the DoD could benefit from an integrated set of population-based measures of psychological fitness variables. This type of database could provide our senior leaders with an ongoing assessment of total force levels of functioning and trends over time, a view of the general population functioning across multiple metrics, and a safeguard against potentially misleading interpretations when looking at single metrics. There are multiple examples of population-based metrics, each with the potential to inform an enterprisewide approach for the DoD. The DoD Suicide Event Report collects over 250 data points for suicide completions across the DoD. The Health Affairs Well-Being of the Force metrics pulls and integrates data from multiple health and personnel databases. Two other programs that integrate data from multiple pre-existing datasets are the Naval Health Research Center’s Millennium Cohort study²⁰¹ and the U.S. Army Public Health Command’s (provisional, formerly U.S. Army Center for Health Promotion and Preventive Medicine) Army Behavioral Health Integrated Data Environment (ABHIDE). The Army CSF is also employing a measure called the Global Assessment Tool that is designed to assess each of the fitness domains and includes a survey completed by Army members. Yet another approach is the Gallup approach of daily random sampling of well-being measures. These different approaches for population-based assessment and tracking of psychological fitness domains could potentially be leveraged enterprisewide in support of readiness and force protection.

The MDR model can provide an integrated and systemic framework of psychological fitness for proactive and enterprisewide population-based applications such as surveillance and monitoring the fitness of the force. In addition, the MDR model can also enhance program identification, information sharing, gap analyses, program development, and program evaluation of psychological fitness resources across services and specialty communities. In these ways, the framework will hopefully provide the next step in facilitating collaboration, effective and efficient use of resources, and synergy in DoD efforts to support the optimal psychological fitness of our total force.

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REFERENCES

1. Department of Defense: Quadrennial Defense Review, 2010. Available at <http://www.defense.gov/qdr/>; accessed April 30, 2006.
2. U.S. Joint Forces Command: Joint Operating Environment. Available at <http://usjfc.com.dodlive.mil/tag/joint-operating-environment-2010/>; accessed April 30, 2006.
3. Bartone PT. Resilience under military operational stress: Can leaders influence hardiness? *Mil Psychol* 2006; 18(s): 131–48.
4. Burke S, Pierce L, Salas E: Understanding Adaptability: A Prerequisite for Effective Performance Within Complex Environments. Cambridge, MA, Elsevier Science, 2006.
5. Klein HA, Steele-Johnson D: Preparing for multinational collaboration: from the laboratory to the field. In: Hoffman’s R. R. (Ed.), *Expertise out of Context: Proceedings of the Sixth International Conference on Naturalistic Decision Making*. Mahwah, NJ, Erlbaum, 2007.
6. Krueger GP: Contemporary and future battlefields: soldier stresses and performance. In: *Performance Under Stress*, pp 19–44. Edited by Hancock PA, Szalma JL. Burlington, VT, Ashgate, 2008.
7. Raybourn EM: Training Approaches for Honing Junior Leader Adaptive Thinking, Cultural Awareness and Metacognitive Agility. I/ITSEC 2007 Proceedings, Interservice/ Industry Training, Simulation and Education Conference Proceedings, November 26–29, 2007, Orlando, Florida.
8. Ulmer G, Burton D: Applied Mental Skills Training Interventions in Sport and Military Populations: A Review of Literature (Research Report). West Point, NY, Army Center for Performance Enhancement, 2009.
9. Meredith LS: Review of Literature to Identify Evidence-Based Practices that Promote Resilience (Project Memorandum-3439-OSD). Santa Monica, CA, RAND Corporation, 2009.
10. Wilson J: *Thinking with Concepts*. Cambridge, Cambridge University Press, 1963.
11. Hobfoll SE: Conservation of resources: a new attempt at conceptualizing stress. *Am Psychol* 1989; 44(3): 513–24.
12. Demerouti E, Bakker AB, Nachreiner F, et al: The job demands-resources model of burnout. *J Appl Psychol* 2001; 86: 499–512.
13. Hobfoll SE, Lilly RS: Resource conservation as a strategy for community psychology. *J Commun Psychol* 1993; 21: 128–48.
14. Hobfoll SE: The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory. *Applied Psychology: An International Review*. 2001; 50(3): 337–421.

15. Hobfoll SE: The influence of culture, community, and the nested-self in the stress process: advancing conservation of resources theory, 337–421.
16. Hobfoll SE: Conservation of Resources theory: its implications for stress, health, and resilience. In: *Oxford Handbook of Stress*. Edited by Folkman S. Health, and Coping.
17. Furnham A, Henderson M: The good, the bad and the mad: response bias in self-report measures. *Pers Individ Dif* 1982; 3(3): 311–20.
18. Campbell DT, Fiske DW: Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychol Bull* 1959; 56: 81–105.
19. Cohen J: A power primer. *Psychol Bull* 1992; 112: 155–9.
20. Nunnally JC, Bernstein IH: *Psychometric Theory*, Ed 3, New York, McGraw-Hill, 1994.
21. Cohen J: A power primer, 155–9.
22. Janelle CM, Hatfield BD: Visual attention and brain processes that underlie expert performance: implications for sport and military psychology. *Mil Psychol* 2008; 20(Suppl 1): S39–69.
23. Demetriou A, Kazi S: The emerging self: the convergence of mind, personality and thinking styles. *Dev Sci* 1999; 21(4): 387–422.
24. Demetriou A, Kazi S, Georgiou S: The emerging self: the convergence of mind, self, and thinking styles. *Dev Sci* 1999; 2(4): 387–409.
25. Demetriou A, Kazi S: Self-awareness in g (with processing efficiency and reasoning). *Intelligence* 2006; 34: 297–317.
26. Endsley MR: A survey of situation awareness requirements in air-to-air combat fighters. *Int J Aviat Psychol* 1993; 3(2): 157–68.
27. Endsley MR: Toward a theory of situation awareness in dynamic systems. *Hum Factors* 1995; 37: 32–64.
28. Endsley MR, Bolstad CA: Individual differences in pilot situation awareness. *Int J Aviat Psychol* 1994; 4(3): 241–64.
29. Hippe J: Self-awareness: a precursor to resiliency. *Reclaiming Children and Youth*. 2004; 12(4): 240–2.
30. Young M, Dulewicz V: Relationships between emotional congruent self-awareness and performance in the British Royal Navy. *J Manag Psychol* 2006; 22(5): 465–78.
31. Tugade MM, Fredrickson BL, Barrett LF: Psychological resilience and positive emotional granularity: examining the benefits of positive emotions on coping and health. *J Pers* 2004; 72(6): 1161–90.
32. Lyons JB, Schneider TR: The influence of emotional intelligence on performance. *Pers Individ Dif* 2004; 39: 693–703.
33. Soliman AM, Mathna EK: Metacognitive strategy training improves driving situation awareness. *Soc Behav Pers* 2009; 37(9): 1161–70.
34. Klein G: An overview of naturalistic decision making application. In: *Naturalistic Decision Making*, pp 49–59. Edited by Zsombok CE, Klein G. Mahwah, NJ, Lawrence Erlbaum Associates, 1997.
35. Chen G, Thomas B, Wallace J: A multilevel examination of the relationships among training outcomes, mediating regulatory processes, and adaptive performance. *J Occup Organ Psychol* 2005; 78: 615–32.
36. Smith EM, Ford KJ, Kozlowski SWJ: Building adaptive expertise: implications for training design strategies. In: *Training for a Rapidly Changing Workplace: Applications of Psychological Research*, pp 89–118. Edited by Quiñones MA, Ehrenstein A. Washington, DC, American Psychological Association, 1997.
37. Westman M, Hobfoll SE, Chen S, et al: Organizational stress through the Lens of Conservation of Resources (COR) Theory. In: *Research in Occupational Stress and Well-Being*, pp 167–220. Edited by Perrewé P, Ganster DC. Vol 4. Oxford, England, JAI Press/Elsevier, 2005.
38. Endsley, MR: Toward a theory of situation awareness in dynamic systems, 32–64.
39. Bourne LE, Yaroush, RA. Stress and cognition: a cognitive psychological perspective. National Aeronautics and Space Administration (Final Report; Grant no. NAG2-1561) 2003.
40. Pratt J, Hommel B: Symbolic control of visual attention: the role of working memory and attentional control settings. *J Exp Psychol Hum Percept Perform* 2003; 29(5): 835–45.
41. Anzeneder CP, Bosel R: Modulation of the spatial extent of the attentional focus in high-level volleyball players. *Eur J Cogn Psychol* 1998; 10(3): 247–67.
42. Bherer L, Kramer AF, Peterson MS, et al: Transfer effects in task-set cost and dual-task cost after dual-task training in older and younger adults: further evidence for cognitive plasticity in attentional control in late adulthood. *Exp Aging Res* 2008; 34: 188–219.
43. Soliman AM, Mathna EK: Metacognitive strategy training improves driving situation awareness, 1161–70.
44. Lazarus RS, Folkman S: *Stress, Appraisal, and Coping*. New York, Springer Publishing, 1984.
45. Folkman S, Lazarus RS, Dunkel-Schetter C, et al: The dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *J Pers Soc Psychol* 1986; 50: 992–1003.
46. McGrath JE: Stress and behavior in organizations. In: *Handbook of Industrial and Organizational Psychology*, pp 1351–1395. Edited by Dunnette MD. Chicago, Rand McNally, 1976.
47. Lazarus RS, Folkman S: *Stress, Appraisal, and Coping*, 1984.
48. Staal MA, Bolton AE, Yaroush RA, et al: Cognitive performance and resilience to stress. In: *Biobehavioral Resilience to Stress*, pp 259–299. Edited by Lukey B, Tepe V. London, Francis and Taylor, 2008.
49. Benight CC, Bandura A: Social cognitive theory of posttraumatic recovery: the role of perceived self-efficacy. *Behav Res Ther* 2004; 42(10): 1129–48.
50. Alim TN, Feder A, Graves RE, et al: Trauma, resilience, and recovery in a high-risk African-American population. *Am J Psychiatry* 2008; 165(12): 1566–75.
51. Cieslak R, Benight CC, Caden Lehman V: Coping self-efficacy mediates the effects of negative cognitions on posttraumatic distress. *Behav Res Ther* 2008; 46(7): 788–98.
52. Ben-Zur H: Personal resources of mastery-optimism, and communal support beliefs, as predictors of posttraumatic stress in uprooted Israelis. *Anxiety Stress Coping* 2008; 21(3): 295–307.
53. Whealin JM, Ruzek JJ, Southwick S: Cognitive-behavioral theory and preparation for professionals at risk for trauma exposure. *Trauma Violence Abuse* 2008; 9: 100–13.
54. Geer JH, Maisel E: Evaluating the effects of the prediction-control confound. *J Pers Soc Psychol* 1972; 23: 314–9.
55. Kuch K: Enigmatic disability after minor accidents. *Mod Med Can* 1989; 44: 38–41.
56. Bartone PT, Eid J, Johnsen BH, et al: Big five personality factors, hardiness, and social judgment as predictors of leader performance. *Leadersh Organ Dev J* 2009; 30: 498–521.
57. Waysman M, Schwarzwald J, Solomon S: Hardiness: an examination of its relationship with positive and negative long term changes following trauma. *J Trauma Stress* 2001; 14: 531–48.
58. Kobasa SC, Maddi SR, Puccetti MC, et al: Effectiveness of hardiness, exercise, and social support as resources against illness. *J Psychosom Res* 1985; 29: 525–33.
59. Maddi SR: Hardiness: the courage to grow from stresses. *J Posit Psychol* 2006; 1: 160–8.
60. Bartone PT: Resilience under military operational stress: can leaders influence hardiness? *Mil Psychol* 2006; 18s: 131–48.
61. Bartone PT: Hardiness protects against war-related stress in army reserve forces. *Consulting Psychology Journal*. 1999; 51: 72–82.
62. Bartone PT, Eid J, Johnsen BH, et al: Big five personality factors, hardiness, and social judgment as predictors of leader performance, 498–521.
63. Delahaij R, Gaillard AWK, Dam K: Hardiness and the response to stressful situations: investigating mediating processes. *Pers Individ Dif* 2010 (in press).
64. Bartone PT: Resilience under military operational stress: can leaders influence hardiness, 131–48.
65. Stajkovic AD, Luthans F: Self-efficacy and work-related performance: a meta-analysis. *Psychol Bull* 1998; 124(2): 240–61.
66. Multon KD, Brown SD, Lent RW: Relation of self-efficacy beliefs to academic outcomes: a meta-analytic investigation. *J Couns Psychol* 1991; 38(1): 30–8.
67. Bandura A, Wood R: Effect of perceived controllability and performance standards on self-regulation of complex decision making. *J Pers Soc Psychol* 1989; 56(5): 805–14.

68. Wood R, Bandura A, Bailey T: Mechanisms governing organizational performance in complex decision-making environments. *Organ Behav Hum Decis Process* 1990; 46(2): 181–201.
69. Monson CM, Schnurr PP, Resick PA, et al: Cognitive processing therapy for veterans with military-related posttraumatic stress disorder. *J Consult Clin Psychol* 2006; 74(5): 898–907.
70. Whealin JM, Ruzek JI, Southwick S: Cognitive-behavioral theory and preparation for professionals at risk for trauma exposure, 100–13.
71. Seligman MEP, Schulman P, DeRubeis RJ, et al: The prevention of depression and anxiety. *Prev Treat* 1999; 1999: 2.
72. Seligman MEP, Schulman P, Tryon A: Group prevention of depression and anxiety symptoms. *Behav Res Ther* 2007; 45: 1111–26.
73. Scheier MF, Carver CS: Effects of optimism on psychological and physical well-being: theoretical overview and empirical update. *Cognit Ther Res* 1992; 16: 201–28.
74. Peterson C: The future of optimism. *Am Psychol* 2000; 55: 44–55.
75. Meichenbaum D: Stress inoculation training. New York, Pergamon Press, 1985.
76. Armfield F: Preventing post-traumatic stress disorder resulting from military operations. *Mil Med* 1994; 159: 739–46.
77. Lazarus RS, Folkman S: Stress, Appraisal, and Coping, 1984.
78. Lazarus RS: Emotion and Adaptation. New York, Oxford University Press, 1991.
79. Lazarus RS: Cognitive-motivational-relational theory of emotion. In: *Emotions in Sport*, pp 39–63. Edited by Hanin YL. Champaign, IL, Human Kinetics, 2000.
80. Dolan CA, Huffman AH, Adler AB, et al: Coping with the stress of a military deployment: psychological and physical health. Paper presented at the 22nd Annual Stress and Anxiety Research International Conference, Mallorca, Spain, 2001.
81. Parkes KR: Coping, negative affectivity, and the work environment: additive and interactive predictors of mental health. *J Appl Psychol* 1990; 75(4): 399–409.
82. Solomon Z, Mikulincer M, Flum H: Negative life events, coping responses, and combat-related psychopathology: a prospective study. *J Abnorm Psychol* 1988; 97: 302–7.
83. Haney CJ, Long BC: Coping effectiveness: a path analysis of self-efficacy, control, coping, and performance in sport competitions. *J Appl Soc Psychol* 1995; 25: 1726–46.
84. Carver CS, Scheier MF, Weintraub JK: Assessing coping strategies: a theoretically based approach. *J Pers Soc Psychol* 1989; 56(2): 267–83.
85. Donnelly TT: Contextual analysis of coping: implications for immigrants' mental health care. *Issues Ment Health Nurs* 2002; 23(7): 715–32.
86. Wong DFK: Stage-specific and culture-specific coping strategies used by mainland Chinese immigrants during resettlement in Hong Kong: a qualitative analysis. *Social Work Health and Mental Health*. 2002; 35(1/2): 479–99.
87. Fredrickson BL: The role of positive emotions in positive psychology: the broaden-and-build theory of positive emotions. *Am Psychol* 2001; 56: 218–26.
88. Miller JJ, Fletcher K, Kabat-Zinn J: Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psychiatry* 1995; 17: 192–200.
89. Kabat-Zinn J, Massion AO, Kristeller J, et al: Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *Am J Psychiatry* 1992; 149: 936–43.
90. Shapiro SL, Schwartz GE, Bonner G: Effects of mindfulness-based stress reduction on medical and premedical students. *J Behav Med* 1998; 21: 581–99.
91. Fredrickson BL: What good are positive emotions? *Rev Gen Psychol* 1998; 2: 300–19.
92. Frederickson BL, Coffey KA, Pek J, et al: Open hearts build lives: positive emotions, induced through loving-kindness meditation, build consequential personal resources. *J Pers Soc Psychol* 2008; 95(5): 1045–62.
93. Brunwasser SM, Gillham JE, Kim ES: A meta-analytic review of the Penn Resiliency Program's effect on depressive symptoms. *J Consult Clin Psychol* 2009; 77(6): 1042–54.
94. Repetti RL: Short-term effects of occupational stressors on daily mood and health complaints. *Health Psychol* 1993; 12: 125–31.
95. Totterdell P, Spelten E, Smith L, et al: Recovery from work shifts: how long does it take? *J Appl Psychol* 1995; 80: 43–57.
96. Zohar D: When things go wrong: the effect of daily work hassles on effort, exertion and negative mood. *J Occup Organ Psychol* 1999; 72: 265–83.
97. Meijman TF, Mulder G: Psychological aspects of workload. In: *Handbook of Work and Organizational Psychology*, Vol. 2, pp 5–33. Edited by Drenth PJD, Thierry HT, Wolff CJ, Hove, UK, Psychology Press 1998.
98. Sluiter JK, Van der Beek AJ, Frings-Dresen MHW: The influence of work characteristics on the need for recovery and experienced health: a study on coach drivers. *Ergonomics* 1999; 42: 573–83.
99. Etzion D, Eden D, Lapidot Y: Relief from job stressors and burnout: reserve service as a respite. *J Appl Psychol* 1998; 83: 577–85.
100. Westman M, Eden D: Effects of a respite from work on burnout: vacation relief and fade-out. *J Appl Psychol* 1997; 82: 516–27.
101. Westman M, Etzion D: The impact of vacation and job stress on burnout and absenteeism. *Psychol Health* 2001; 16: 595–606.
102. MacGregor AJ, Han PP, Garlarneau MR: Multiple deployments during Operation Iraqi Freedom: Does dwell time matter? Poster presentation at the 12th Annual Force Health Protection Conference, Albuquerque, NM, August, 2009.
103. Burton D, Raedeke TD: *Sport Psychology for Coaches*. Champaign, IL, Human Kinetics, 2008.
104. Loehr J, Scharzt T: *The Power Of Full Engagement: Managing Energy, Not Time, Is The Key To High Performance and Positive Renewal*. Crows Nest, NSW, Australia, Allen and Unwin, 2003.
105. Williams J, Harris DV: Relaxation and energizing techniques for regulation of arousal. In: *Applied Sport Psychology: Personal Growth to Peak Performance*, Ed 5, pp 285–305. Edited by Williams JM. Mountain View, CA, Mayfield Publishing, 2006.
106. Beede KE, Kass SJ: Engrossed in conversation: the impact of cell phones on simulated driving performance. *Accid Anal Prev* 2006; 38: 415–21.
107. Strayer DL, Drews FA: Profiles in driver distraction: effects of cell phone conversations on younger and older drivers. *Hum Factors* 2004; 46: 640–9.
108. Mackworth JF: Vigilance, arousal and habituation. *Psychol Rev* 1968; 75: 308–22.
109. Dinges DF, Powell JW: Sleepiness impairs optimum response capabilities. *Sleep Res* 1989; 18: 366.
110. Boksem MA, Meijman TF, Lorist MM: Effects of mental fatigue on attention: an ERP study. *Brain Res Cogn Brain Res* 2005; 25: 107–16.
111. Landrigan CP, Rothschild JM, Cronin JW, et al: Effects of reducing interns' work hours on serious medical errors in intensive care units. *N Engl J Med* 2004; 351: 1838–48.
112. Arnedt JT, Owns J, Crouch M, et al: Neurobehavioral performance of residents after heavy night call vs after alcohol ingestion. *JAMA* 2005; 294: 1025–33.
113. D'Zurilla TJ, Nezu AM: *Problem-Solving Therapy: A Social Competence Approach to Clinical Intervention*, Ed 1, New York, Springer, 1986.
114. D'Zurilla TJ, Nezu AM: *Problem-Solving Therapy: A Social Competence Approach to Clinical Intervention*, 1986.
115. Lussier JW, Shadrick SB, Prevou MI: *Think Like a Commander prototype: instructor's guide to adaptive thinking (ARI Research Product 2003-01)*. Alexandria, VA, U.S. Army Research Institute for the Behavioral and Social Sciences, 2003.
116. Stokes CK: *Adaptive performance: an examination of convergent and predictive validity*. Wright State, Ohio Unpublished dissertation manuscript, 2008.

117. Metzl ES, Morrell MA: The role of creativity in models of resilience: theoretical exploration and practical applications. *J Creativity Ment Health* 2008; 3(3): 303–18.
118. Spiro RJ, Feltovich PJ, Jacobson MJ, et al: Cognitive flexibility, constructivism and hypertext: random access instruction for advanced knowledge acquisition in ill-structured domains. In: *Constructivism and the Technology of Instruction*, pp 57–75. Edited by Duffy T, Jonassen D. Hillsdale, NJ, Lawrence Erlbaum, 1992.
119. Basseches M: The development of dialectical thinking as an approach to integration. *Integral Review*. 2005; 1: 2005.
120. Kahneman D, Klein G: Conditions for intuitive expertise: a failure to agree. *Am Psychol* 2009; 64(6): 515–6.
121. Kahneman D, Klein G: Conditions for intuitive expertise: a failure to agree, 515–6.
122. Zachary WW, Ryder JM, Hicinbothom JH: Cognitive task analysis and modeling of decision making in complex environments. In: *Making Decisions Under Stress: Implications for Individual and Team Training*, pp 315–344. Edited by Cannon-Bowers JA, Salas E. Washington, DC, American Psychological Association, 2008.
123. D’Zurilla TJ, Goldfried MR: Problem solving and behavior modification. *J Abnorm Psychol* 1971; 78(1): 107–26.
124. Heppner PP, Petersen CH: Personal problem solving: a descriptive study of individual differences. *J Couns Psychol* 1982; 29(6): 580–90.
125. D’Zurilla TJ, Sheedy CF: Relation between social problem-solving ability and subsequent level of psychological stress in college students. *J Pers Soc Psychol* 1991; 61(5): 841–6.
126. Nezu AM, Ronan GF: Social problem solving as a moderating variable between negative life stress and depressive symptoms. *Cognit Ther Res* 1986; 10(5): 489–98.
127. Hogarth RM: *Educating Intuition*, 2001.
128. Dixon WA, Heppner PP, Anderson WP: Problem-solving appraisal, stress, hopelessness, and suicide ideation in a college population. *J Couns Psychol* 1991; 38(1): 51–6.
129. Kylo LB, Landers DM: Goal setting in sport and exercise: a research synthesis to resolve the controversy. *J Sport Exerc Psychol* 1995; 17: 117–37.
130. Burton D, Weiss C: The fundamental goal concept: the path to process and performance success. In: *Advances in Sport Psychology*, Ed 3, pp 339–375. Edited by Horn TS. Champaign, IL, Human Kinetics, 2008.
131. LePine JA, Colquitt JA, Erez A: Adaptability to changing task contexts: effects of general cognitive ability, conscientiousness, and openness to experience. *Person Psychol* 2000; 53: 563–93.
132. Reder LM, Schunn CD: Bringing together the psychometric and strategy worlds: predicting adaptivity in a dynamic task. *Attention and Performance*. 1999; 17: 315–42.
133. Stokes CK, Schneider TR, Lyons JB: Predicting adaptive performance in multicultural teams: a causal model. RTO-MP-HFM-142. Available at <http://ftp.rta.nato.int/public//PubFullText/RTO/MP/RTO-MP-HFM-142//MP-HFM-142-19.doc>; accessed July 1, 2010.
134. Stokes CK: Adaptive performance: an examination of convergent and predictive validity. Unpublished doctoral dissertation, Wright State University, Ohio 2008.
135. Stokes CK: Adaptive performance: an examination of convergent and predictive validity. Unpublished doctoral dissertation, 2008.
136. Schneider TR, Stokes CK, Lyons JB: Predicting resourcefulness in multicultural teams. In MJ Celinski & KM Gow Eds. *Continuity versus Creative Response to Challenge; The Primacy of Resilience and Resourcefulness in Life and Therapy* (in press).
137. Klein GA, Calderwood R, Clinton-Cirocco A: Rapid decision making on the fireground. In: *Proceedings of the Human Factors and Ergonomics Society 30th Annual Meeting*, Vol 1. Norwood, NJ, Ablex 1986; 576–80.
138. Smith EM, Ford KJ, Kozlowski SWJ: Building adaptive expertise: implications for training design strategies. In: *Training for a Rapidly Changing Workplace: Applications of Psychological Research*, pp. 89–118.
139. Hogarth RM: *Educating Intuition*. Chicago, University of Chicago Press, 2001.
140. Bakker AB, Schaufeli WB, Leiter MP, et al: Work engagement: an emerging concept in occupational health psychology’. *Work Stress* 2008; 22(3): 187–200.
141. Kahn WA: Psychological conditions of personal engagement and disengagement at work. *Acad Manage J* 1990; 33: 692–724.
142. Csikszentmihalyi M: The flow experience and its significance for human psychology. In: *Optimal Experience: Psychological Studies of Flow in Consciousness*. Edited by Csikszentmihalyi M, Csikszentmihalyi I. Cambridge, Cambridge University Press, 1988.
143. Britt TW, Castro CA, Adler AB: Self engagement, stressors, and health: a longitudinal study. *Pers Soc Psychol Bull* 2005; 31: 1475–86.
144. Maslach C, Schaufeli WB, Leiter MP: Job burnout. *Annu Rev Psychol* 2001; 52: 397–422.
145. Harter JK, Schmidt FL, Hayes TL: Business unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis. *J Appl Psychol* 2002; 87(2): 2678–2679.
146. Schaufeli WB, Bakker AB: Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. *J Organ Behav* 2004; 25: 293–315.
147. Bakker AB, Demerouti E, Verbeke W: Using the job demands-resources model to predict burnout and performance. *Hum Resour Manage* 2004; 43(1): 83–104.
148. Corporate Leadership Council: *Driving employee performance and retention through engagement* (catalog no. CLC12PV0PD). Washington, DC, Corporate Executive Board, 2004.
149. Demerouti E: Job characteristics, flow, and performance: the moderating role of conscientiousness. *J Occup Health Psychol* 2006; 11: 266–80.
150. Kowal I, Fortier MS: Motivational determinants of flow: contributions from self determination theory. *J Soc Psychol* 1999; 139: 355–68.
151. Csikszentmihalyi M, Rathunde K, Whalen S: *Talented Teenagers*. Cambridge, UK, Cambridge University Press, 1993.
152. Wright TA, Cropanzano R: Emotional exhaustion as a predictor of job performance and voluntary turnover. *J Appl Psychol* 1998; 83: 486–93.
153. Parker PA, Kulik JA: Burnout, self- and supervisor-rated job performance, and absenteeism among nurses. *J Behav Med* 1995; 18(6): 581–99.
154. Harter JK, Schmidt FL, Hayes TL: Business unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis, 2678–2679.
155. Maunoma S, Kinnunen U, Ruokolainen M: Job demands and resources as antecedents of work engagement: a longitudinal study. *J Vocat Behav* 2007; 70(1): 149–71.
156. Hakanen JJ, Bakker AB, Schaufeli WB: Burnout and work engagement among teachers. *J Sch Psychol* 2006; 43: 495–513.
157. Hakanen JJ, Bakker AB, Schaufeli WB: Burnout and work engagement among teachers, 495–513.
158. Sonnentag S: Recovery, work engagement, and proactive behavior: a new look at the interface between non-work and work. *J Appl Psychol* 2003; 88: 518–28.
159. Loehr J: *The Power of Story*. New York, NY, Free Press, 2007.
160. Hardy J: Speaking clearly: a critical review of the self-talk literature. *Psychol Sport Exerc* 2006; 7: 81–97.
161. Hatzigeorgiadis A, Zourbanos N, Mpoumaki S, et al: Mechanisms underlying the self-talk-performance relationship: the effects of motivational self-talk on self-confidence and anxiety. *Psychol Sport Exerc* 2009; 10: 186–92.
162. McAuley E, Wraith S, Duncan TE: Self-efficacy, perceptions of success, and intrinsic motivation for exercise. *J Appl Soc Psychol* 1991; 21: 139–55.
163. Ryan RM, Deci EL: Self-Determination Theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol* 2000; 55(1): 68–78.
164. Biddle SJH: Emotion, mood and physical activity. In: *Physical Activity and Psychological Well-Being*, pp 63–87. Edited by Biddle SJH, Fox KR, Boutcher SH. London, UK, Routledge, 2000.

165. Taylor AH: Physical activity, anxiety and stress. In: *Physical Activity and Psychological Well-Being*, pp 10–45. Edited by Biddle SJH, Fox KR, Boutcher SH. London, UK, Routledge, 2000.
166. Mutrie N: The relationship between physical activity and clinically defined depression. In: *Physical Activity and Psychological Well-Being*, pp 46–62. Edited by Biddle SJH, Fox KR, Boutcher SH. London, UK, Routledge, 2000.
167. Paffenbarger RS, Lee IM, Leung R: Physical activity and personal characteristics associated with depression and suicide in American college men. *Acta Psychiatr Scand* 1994; (Suppl 377): 16–22.
168. Travlos AK: Effects of submaximal steady-state aerobic exercise and fitness in random number generation test. *J Biol Exercise* 2009; 5(2): 41–50.
169. Kanarek RB, Swinney D: Effects of food snacks on cognitive performance in male college students. *Appetite* 1990; 14: 15–27.
170. Lieberman HR: Nutrition, brain function and cognitive performance. *Appetite* 2003; 40(3): 245–54.
171. Fine BJ, Kobrick JL, Liberman HR, et al: Effects of caffeine and diphendramine on visual vigilance. *Psychopharmacology (Berl)* 1994; 114: 233–8.
172. Clubley M, Bye CE, Henson, et al: Effects of caffeine and cyclizine alone in combination on human performance, subjective effects and EEG activity. *BR J Clin Psychopharmacol* 1979; 7: 157–163.
173. Lieberman HR, Wurtman RJ, Emde GG, Covielle ILG: The effects of caffeine and aspirin on mood and performance. *Psychopharmacology (Berl)* 1987; 7: 315–20.
174. Lieberman HR, Wurtman RJ, Emde GG, et al: The effects of low doses caffeine on human performance and mood. *Psychopharmacology (Berl)* 1987; 92(3): 308–12.
175. Amendola CA, Gabrieli JDE, Lieberman HR: Caffeine's effects on performance and mood are independent of age and gender. *Nutr Neurosci* 1998; 1: 269–80.
176. Millar K, Wilkinson RT: The effects upon vigilance and reaction speed of the addition of ephedrine hydrochloride to chlorpheniramine maleate. *Eur J Clin Pharmacol* 1981; 20: 351–7.
177. Lieberman WR, Wurtman RJ, Emde GG: The effects of low doses caffeine on human performance and mood, 1987.
178. Smith A, Sturgess W, Gallagher J. Effects of a low dose of caffeine given in different drinks on mood and performance. *Human Psychopharmacology—Clinical and Experimental*. 1999; 14: 473–82.
179. Wilson J: *Thinking with concepts*, 1963.
180. Hobfoll SE: Conservation of resources: a new attempt at conceptualizing stress, 1989.
181. Lieberman HR: Nutrition, brain function and cognitive performance, 254–54.
182. Magill RA, Waters WF, Bray GA, et al: Effects of tyrosine, phentermine, caffeine D-amphetamine, and placebo on cognitive and motor performance deficits during sleep deprivation. *Nutr Neurosci* 2003; 6: 237–46.
183. Lieberman HR: Hydration and cognition: a critical review and recommendations for future research. *J Am Coll Nutr* 2007; 26: 555–615.
184. Lazarus RS, Folkman S: *Stress, Appraisal, and Coping*. New York, Springer, 1984.
185. Maddi SR, Kobasa SC, Puccetti M, et al: Relative effectiveness of hardiness, exercise and social support as resources against illness. *J Psychosom Res* 1986; 29: 525–33.
186. Freedy JR, Hobfoll SE: Stress inoculation for reduction of burnout: a conservation of resources approach. *Anxiety Stress Coping* 1994; 6: 311–25.
187. Tang YY, Ma Y, Wang J, et al: Short-term meditation training improves attention and self-regulation. *Proc Natl Acad Sci USA* 2007; 104(43): 17152–6.
188. Jha AP, Krompinger J, Baime MJ: Mindfulness training modifies subsystems of attention. *Cogn Affect Behav Neurosci* 2007; 7(2): 109–19.
189. Lutz A, Brefczynski-Lewis J, Johnstone T, Davidson RJ: Regulation of the neural circuitry of emotion by compassion meditation: effects of meditative expertise. *PLoS ONE* 2008; 3(3).
190. Stanley EA, Jha AP: Mind fitness and mental armor: enhancing performance and building warrior resilience. *Joint Force Quarterly*. 2009; 55: 144–51.
191. Jha AP, Stanley EA, Kiyonaga A, Wong L, Gelfand L: Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion* 2010; 10(1): 54–64.
192. Dewey L: *War and Redemption: Treatment and Recovery in Combat-Related Post-Traumatic Stress Disorder*. Burlington, VT, Ashgate, 2004.
193. Pargament KI, Koenig HG, Perez LM: The many methods of religious coping: development and initial validation of the RCOPE. *J Clin Psychol* 2000; 56: 519–43.
194. Pargament K, Smith B, Koenig HG, et al: Patterns of positive and negative religious coping with major life stressors. *J Sci Study Relig* 1998; 37: 710–24.
195. Litz BT, Stein N, Delaney E, et al: Moral injury and moral repair in war veterans: a preliminary model and intervention strategy. *Clin Psychol Rev* 2009; 29(8): 695–706.
196. Owens G: Posttraumatic stress disorder, guilt, depression, and meaning in life among military veterans. *J Trauma Stress* 2009; 22(6): 654.
197. Bakker AB, Demerouti E, Verbeke W: Using the job demands-resources model to predict burnout and performance, 83–104.
198. Britt TW, Davison J, Bliese PD, Castro CA: How leaders can influence the impact that stressors have on soldiers. *Mil Med* 2004; 169(7): 541–5.
199. Bowles SV, Bates MJ: Military organizations contributing to resilience building. *Mil Med* 2010; 175(6): 382–5.
200. National Research Council: *A Report on Grand Challenges of Mind and Brain*. National Science Foundation. Washington, DC, National Academy Press, 2006.
201. Smith TS: The US Department of Defense Millennium Cohort Study: career span and beyond longitudinal follow-up. *J Occup Environ Med* 2009; 51(10): 1193–201.

Behavioral and Occupational Fitness

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ABSTRACT Behavioral health and occupational health contribute substantially to a healthy military force. To assist commanders in monitoring and supporting their troops, we review the role of behavioral health on military fitness, including substance abuse (alcohol, tobacco, and illicit drugs) and psychophysical behaviors associated with weight and sleep problems. We also examine the role of occupational health, including psychosocial factors (stress and social influence), and environmental factors (physical, chemical, and biological stressors). We summarize components that negatively affect service members' mental and physical functioning, greatly reducing readiness. The military's stand on illicit drug use and fitness has significantly reduced problems within these domains. Some progress has been made in reducing problems associated with alcohol, tobacco, and accident prevention. Little headway, however, has been made in the prevention and treatment of insomnia. Recommendations are offered for further improving behavioral and occupational health within the context and capacity of current military environments.

INTRODUCTION

Background and Context

The United States has a professional military trained in a broad range of skills to be prepared for any military eventuality. Even so, today's military service members are under increasing pressure to perform at consistently optimal levels, carrying out military duties for extended periods of time in a fast-paced, hectic, and sometimes dangerous environment. Because of the multidimensional complexity of operational demands, the U.S. Department of Defense (DoD) is moving toward preparing service members not only in physical fitness for duty, but also in behavioral, psychological, medical, nutritional, spiritual, and social facets. Taken together, these domains of military life represent a holistic view of fitness that the military can target to ensure a more completely fit, ready, and resilient fighting force.

Behavioral and occupational fitness plays a significant role in both long-term health outcomes and current performance. A recent study found that tobacco use, excess weight, and high alcohol consumption cost DoD an estimated \$2.1 billion annually in medical care.¹ Over and above the financial costs, however, behavioral and occupational problems take a toll on military readiness—one of DoD's primary concerns in light of today's high operational tempo and multiple deployments. Thus, behavioral health and occupational health lay the foundation upon which the very readiness DoD seeks is based.

The purpose of this article is to characterize current knowledge and metrics regarding behavioral health and occupational health, as well as their relationship to total force fitness. The intent is not to present extensive original research, nor to be an exhaustive literature review. Rather, following the mandate from the Chairman of the Joint Chiefs of Staff and the Total Force Fitness working group, the goal is to highlight the problems in the various areas of behavioral and occupational health, discuss measures that can be used to assess these areas, and describe interventions that are being used or could be used to address problems. Under behavioral health, we first examine substance misuse, including alcohol, tobacco, and illicit drug use. We follow this with a discussion of psychophysical health, including the problems associated with excessive weight and sleep difficulties. We then consider occupational issues affecting overall military performance, including selected psychosocial factors (job stress, family stress, social influences, but omit psychological health and fitness since they are covered in another domain in this supplement) and environmental factors, including injuries and accidents, hygiene and illness, and exposures to physical, chemical, and biological stressors. For each area, we address the significance of the component in terms of military fitness, how commanders can recognize when a problem exists, and methods that can assist them in promoting healthy behavioral and occupational fitness. The intent is to assist line commanders to better support their troops.

Operational Definition of Behavioral and Occupational Fitness

Behavioral health refers to the relationship between one's behaviors and their positive or negative health outcomes. Although there is some overlap between behavioral health and psychological health (indeed, many health behaviors share a relationship with mental health outcomes), this fitness domain incorporates health-related behaviors rather than underlying

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psychological factors. Occupational health refers to the relationship between one's occupational exposures to physical, chemical, and biological stressors and related health outcomes as well as occupational performance levels. Service members in physically demanding occupations or military occupational specialties (MOS) may experience higher than expected rates of injuries or illness. Some types of work may also be more stressful psychologically. Environmental factors—such as coming into contact with chemical contaminants and high-impulse noise events (e.g., explosions, exposure to disease vectors)—also play a role in overall health and fitness. Because personal, leader, and unit behavior can reduce negative environmental influences, we consider these factors within the behavioral fitness arena.

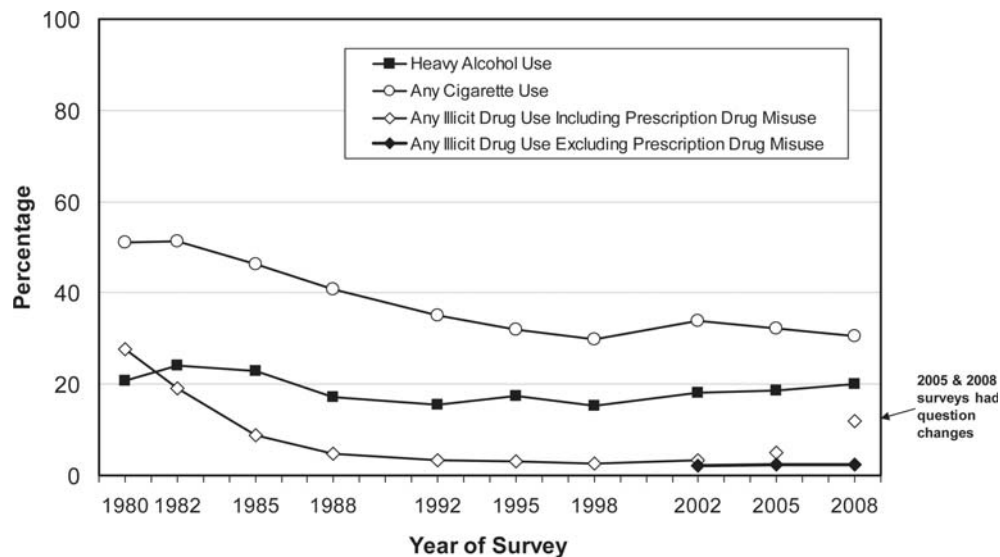
BEHAVIORAL HEALTH—SUBSTANCE ABUSE

Substance use and abuse, including heavy alcohol use, tobacco use, and illicit drug use, have long been associated with military life. Together, over half of all service members use one or more of these substances.^{2,3} Figure 1 presents trends from 1980 to 2008 from comprehensive population-based health behavior surveys of the active duty force who engaged in heavy alcohol use, cigarette use, and illicit drug use during the past 30 days. As shown, there have been large reductions in cigarette use and illicit drug use over the years, but less improvement in heavy drinking.³

Table I provides information about the characteristics of the heavy alcohol, illicit drug, and cigarette users from the 2008 DoD Survey of Health Related Behaviors Among Active

Duty Personnel (HRB Survey).³ It presents prevalence estimates and odds ratios adjusted for all of the other characteristics in the table. As shown, the overall prevalence of heavy drinkers was 20%. The highest rates of heavy alcohol users occurred among persons who were serving in the Marine Corps or Army, were men, were white or Hispanic, had less than a college degree, were single or married but unaccompanied by their spouse, and were in any pay grade except senior officers (O4–O10). Cigarette use prevalence was 30.7%. Smokers were more likely to be serving in the Army, Navy, or Marine Corps and were more likely to be men, to be white non-Hispanic, to have less than a college degree, to be single, to be enlisted (especially pay grades E1–E6), and to be stationed outside the continental United States (OCONUS). The overall prevalence of illicit drug use (including prescription drug misuse) was 12.0%. Drug users were most likely to be serving in the Army, but also in the Navy or Marine Corps relative to the Air Force, were more likely to be women, to be Hispanic or other race/ethnicity, to be married but unaccompanied by their spouse, and to be enlisted pay grade.³ The demographic characteristics are highly similar for heavy alcohol users and cigarette users. Of further interest (not shown in the table), during 2008, 10.3% of service members reported serious alcohol-related consequences (highest at 22.7% among heavy drinkers), 15.7% reported lost productivity (highest at 31.9% among heavy drinkers), and 4.5% reported symptoms of dependence (highest at 14.2% among heavy drinkers).³

Comparisons of the 2008 health behavior survey were also made with the civilian population (using data from the



Heavy Alcohol Use = 5 or more drinks on the same occasion at least once a week in past 30 days.

Any Illicit Drug Use Including Prescription Drug Misuse = use of marijuana, cocaine (including crack), hallucinogens (PCP, MDA, MDMA, and other hallucinogens), heroin, methamphetamine, inhalants, GHB/GBL, or non-medical use of prescription-type amphetamines/stimulants, tranquilizers/muscle relaxers, barbiturates/sedatives, or pain relievers.

Any Illicit Drug Use Excluding Prescription Drug Misuse = use of marijuana, cocaine (including crack), hallucinogens (PCP, MDA, MDMA, and other hallucinogens), heroin, inhalants, or GHB/GBL.

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FIGURE 1. Substance use trends, past 30 days, total DoD, 1980–2008.

TABLE I. Sociodemographic Correlates of Past 30 Days Heavy Alcohol Use, Cigarette Use, and Illicit Drug Use Including Prescription Drug Misuse, 2008

Sociodemographic Characteristics	Heavy Alcohol Use				Cigarette Use				Illicit Drug Use				
	Adjusted Prevalence	Odds Ratio			Adjusted Prevalence	Odds Ratio			Adjusted Prevalence	Odds Ratio			
		Adjusted	95% CI			Adjusted	95% CI			Adjusted	95% CI		
Service (row no.)													
Army (1)	21.6 (2.3) ⁴	1.49*	(1.11–1.99)	33.5 (2.2) ⁴	1.62*	(1.30–2.02)	15.8 (0.7) ^{2,3,4}	2.21*	(1.92–2.54)				
Navy (2)	17.9 (0.7) ^{3,4}	1.16	(0.99–1.35)	31.2 (1.3) ⁴	1.44*	(1.24–1.68)	10.0 (0.6) ^{1,4}	1.31*	(1.11–1.54)				
Marine Corps (3)	25.2 (1.1) ^{2,4}	1.84*	(1.53–2.22)	32.3 (1.6) ⁴	1.53*	(1.27–1.83)	11.5 (0.8) ^{1,4}	1.53*	(1.28–1.82)				
Air Force (4)	15.9 (0.9) ^{1,2,3}	1.00		24.5 (1.1) ^{1,2,3}	1.00		7.9 (0.3) ^{1,2,3}	1.00					
Gender (row no.)													
Male (1)	21.8 (1.2) ²	2.97*	(2.49–3.56)	31.9 (1.2) ²	1.61*	(1.41–1.84)	11.7 (0.4) ²	0.85*	(0.76–0.94)				
Female (2)	8.9 (0.8) ¹	1.00		23.3 (1.5) ¹	1.00		13.5 (0.6) ¹	1.00					
Race/Ethnicity (row no.)													
White, Non-Hispanic (1)	21.6 (1.1) ^{2,4}	1.00		35.3 (1.4) ^{2,3,4}	1.00		11.0 (0.5) ^{2,4}	1.00					
African American, Non-Hispanic (2)	14.3 (1.2) ^{1,3,4}	0.59*	(0.52–0.67)	19.6 (1.1) ^{1,3,4}	0.42*	(0.38–0.46)	14.5 (0.8) ¹	1.38*	(1.16–1.63)				
Hispanic (3)	20.7 (1.6) ^{2,4}	0.94	(0.83–1.08)	23.4 (1.1) ^{1,2,4}	0.53*	(0.48–0.59)	12.9 (0.9)	1.20	(0.98–1.47)				
Other (4)	17.4 (1.3) ^{1,2,3}	0.75*	(0.63–0.88)	29.4 (1.6) ^{1,2,3}	0.74*	(0.63–0.88)	13.0 (0.8) ¹	1.21*	(1.05–1.40)				
Education (row no.)													
High School or Less (1)	23.4 (1.4) ^{2,3}	1.98*	(1.57–2.49)	36.5 (1.4) ^{2,3}	2.60*	(2.10–3.22)	12.9 (0.6) ²	1.14	(0.88–1.47)				
Some College (2)	19.6 (1.0) ^{1,3}	1.56*	(1.22–1.98)	29.9 (1.2) ^{1,3}	1.89*	(1.58–2.25)	11.5 (0.3) ¹	1.00	(0.79–1.26)				
College Graduate or Higher (3)	13.8 (1.3) ^{1,2}	1.00		19.0 (1.4) ^{1,2}	1.00		11.5 (1.2)	1.00					
Family Status (row no.)													
Not Married (1)	24.3 (1.4) ^{2,3}	1.83*	(1.63–2.06)	31.7 (1.3) ³	1.14*	(1.06–1.22)	12.4 (0.6)	1.11	(0.99–1.24)				
Married, Spouse Not Present (2)	20.9 (1.5) ^{1,3}	1.50*	(1.27–1.77)	32.2 (1.6)	1.16	(0.98–1.39)	13.2 (0.9) ³	1.20*	(1.02–1.41)				
Married, Spouse Present (3)	15.3 (0.9) ^{1,2}	1.00		29.3 (1.3) ¹	1.00		11.3 (0.3) ²	1.00					
Pay Grade (row no.)													
E1–E3 (1)	18.8 (1.5) ^{2,6}	2.27*	(1.47–3.51)	33.6 (2.8) ^{3,4,5,6}	5.02*	(2.94–8.56)	13.6 (0.8) ^{4,5,6}	1.86*	(1.21–2.87)				
E4–E6 (2)	22.6 (1.1) ^{1,3,4,5,6}	2.92*	(1.96–4.33)	34.7 (0.8) ^{3,4,5,6}	5.28*	(3.30–8.45)	13.0 (0.6) ^{4,5,6}	1.77*	(1.21–2.60)				
E7–E9 (3)	16.2 (1.0) ^{2,6}	1.88*	(1.26–2.80)	23.6 (1.4) ^{1,2,4,5,6}	2.97*	(1.80–4.90)	11.8 (1.0) ^{4,5,6}	1.59*	(1.13–2.22)				
W1–W5 (4)	17.3 (1.5) ^{2,6}	2.05*	(1.36–3.10)	14.5 (1.6) ^{1,2,3}	1.59	(0.82–3.07)	5.6 (2.2) ^{1,2,3}	0.69	(0.25–1.92)				
O1–O3 (5)	16.7 (1.6) ^{2,6}	1.95*	(1.36–2.81)	16.5 (1.5) ^{1,2,3,6}	1.86*	(1.16–3.00)	5.7 (0.7) ^{1,2,3}	0.70	(0.44–1.11)				
O4–O10 (6)	9.5 (1.6) ^{1,2,3,4,5}	1.00		9.8 (2.0) ^{1,2,3,5}	1.00		7.8 (1.3) ^{1,2,3}	1.00					
Region (row no.)													
CONUS (1)	19.4 (1.6)	0.89	(0.73–1.08)	29.6 (1.6) ²	0.85*	(0.73–0.98)	12.4 (0.5)	1.13	(0.98–1.31)				
OCONUS (2)	21.2 (0.7)	1.00		32.8 (1.1) ¹	1.00		11.2 (0.5)	1.00					
Total	20.0 (1.1)			30.7 (1.2)			12.0 (0.4)						

Prevalence estimates are percentages among military personnel in each sociodemographic group that were classified as heavy alcohol users, cigarette users, or illicit drug users in the past 30 days. The standard error of each estimate is presented in parentheses. Adjusted prevalence is a model-based, standardized estimate. The main effects of service, gender, race/ethnicity, education, family status, pay grade, and region were included in the standardization model. Heavy alcohol use is defined as consumption of five or more drinks on the same occasion at least once a week in the past 30 days. Any illicit drug use, including prescription drug misuse, is defined as the use of marijuana, cocaine (including crack), hallucinogens (PCP/LSD/MDMA, and other hallucinogens), heroin, methamphetamine, GHB/GBL, inhalants, or the nonmedical use of prescription-type amphetamines/stimulants, tranquilizers/muscle relaxers, barbiturates/sedatives, or pain relievers. NA, Not applicable or data not available. Significance tests were conducted between all rows within the same sociodemographic group. A superscripted number beside an estimate indicates the estimate is significantly different from the estimate that appears in row no. within the same sociodemographic group. For example, consider the race/ethnicity rows in this table: ¹Indicates estimate is significantly different from the estimate in row no.1 (white, non-Hispanic) at the 95% confidence level. ²Indicates estimate is significantly different from the estimate in row no. 2 (African American, non-Hispanic) at the 95% confidence level. ³Indicates estimate is significantly different from the estimate in row no. 3 (Hispanic) at the 95% confidence level. ⁴Indicates estimate is significantly different from the estimate in row no. 4 (Other) at the 95% confidence level. Odds ratios were adjusted for service, gender, race/ethnicity, education, family status, pay grade, and region. An asterisk "*" beside an estimate indicates the estimate is significantly different from the reference group. 95% CI = 95% confidence interval of the odds ratio. CONUS, personnel who were stationed within the 48 contiguous states in the continental United States; OCONUS, personnel who were stationed outside the continental United States or aboard afloat ships. Source: DoD Survey of Health-Related Behaviors Among Military Personnel, 2008.

National Survey on Drug Use and Health).³ After adjusting for demographic differences between service members and civilians, military personnel aged 18 to 25 (25.7% vs. 16.4%) or aged 26 to 34 (17.7% vs. 11.1%) were significantly more likely than civilians in those age groups to have engaged in heavy drinking, whereas this pattern was reversed for those aged 46 to 64 (3.9% vs. 8.5%).³ Rates of past-month cigarette use were lower for military personnel aged 36 to 45 (16.9% vs. 20.3%) or aged 46 to 64 (10.7% vs. 17.9%) than for civilians in those age groups, whereas there was no significant difference between military personnel and civilians in the younger age groups. Service members aged 18 to 25 were less likely than their civilian counterparts to engage in illicit drug use (14.0% vs. 19.8%), whereas this pattern was reversed for service members aged 36 to 45 (10.4% vs. 6.5%) or aged 46 to 64 (12.9% vs. 6.6%). The higher rates in the military among these older age groups are due to the misuse of prescription drugs (mainly pain relievers); when looking just at illicit drug use excluding prescription drugs, the rates were lower for service members than for civilians in each age group (2.3% vs. 12.0% overall).³

One question that arises regarding substance use is whether service members are current or prior users when they enter the military or whether they begin use after joining. Some evidence suggests that both processes may be operating for some substance use behaviors. For example, 26% to 27% of sailors and airmen engaged in heavy drinking before joining the military,^{4,5} but current rates of heavy drinking are lower among service members (20%).³ Similarly, 38% of sailors and 32% of airmen smoked cigarettes in the month before joining.^{4,6} Approximately 15% of military personnel (30% of current smokers) started cigarette use after joining the military.³ About 30% of Navy recruits reported using illicit drugs in the year before joining.⁴ The most recent rates from 2008 for the past year are much lower: 6% excluding prescription drug misuse and 21% including prescription drug misuse.³ Further, military deployments have been shown to increase substance use.⁷⁻⁹

Alcohol Use

High alcohol consumption costs the DoD an estimated \$425 million per year in medical care costs.¹ The HRB Survey found that 47% of service members engaged in binge drinking (i.e., five or more drinks—four or more for women—on a single occasion at least once in the past month). The highest rate was 58% in the Marine Corps.³

Binge drinking and heavy drinking (five or more drinks at least weekly in the past 30 days) can result in job productivity loss because of being hurt in an on-the-job accident, being late for work or leaving early, not coming to work, performing below an expected level of performance, poor judgment, poor interpersonal interactions with co-workers, and many other factors.^{3,10} Job performance and military readiness can also be affected by alcohol-related injury or violence. Aggression toward others or being a victim of assault are highly associated

with alcohol, as are accidents due to alcohol-related risk taking. Overall, 20% of service members report heavy drinking in the past month, with the highest rate (30%) occurring among 21 to 25 year olds.³ Heavy drinkers reported having five or more drinks per occasion on 11 of the past 30 days (37% of the days, on average).³

Combat deployment may drive the use of heavy alcohol consumption even higher.^{7,9} Similarly, psychological factors, such as depression and stressful life events, both common outcomes of combat deployments, can be associated with increased alcohol use.^{3,11,12}

Measures and Components

There are several definitions of alcohol misuse, typically referring to the severity of the problem. We use the definitions consistent with the Centers for Disease Control and Prevention (CDC), the U.S. Department of Health and Human Services (HHS), the National Institute for Alcohol Abuse and Alcoholism, and the Diagnostic and Statistical Manual (DSM) of the American Psychiatric Association (APA). A drink typically refers to a 12 oz. beer (or 8 oz. malt liquor), a 5 oz. glass of wine, or a shot (1.5 oz.) of distilled liquor.

Moderate Drinking

Generally, the term “moderate drinking” refers to no more than one drink per day for women and two drinks per day for men. More than this would be considered excessive alcohol use. Of course, no alcohol is recommended during pregnancy, while operating heavy or dangerous machinery (including driving), or while taking prescription medications that can interact with alcohol or in themselves affect performance. Any alcohol use is also discouraged for those with a history of alcohol or drug dependence.

Heavy Drinking and Binge Drinking

The term “heavy drinking” is typically defined as having five or more drinks (four or more for women) on a single occasion (i.e., within 1 or 2 hours of each other) on a weekly basis. “Binge drinking” is typically defined as having five or more drinks (four or more for women) on a single occasion at least once in the past 30 days. Binge drinking is a subset of heavy drinking but both heavy drinking and binge drinking are of concern because they are related to negative outcomes at significantly higher rates than more moderate drinking.^{3,10}

Alcohol Abuse

The term “alcohol abuse” is functionally defined as involving negative effects of drinking. It involves a pattern of drinking that results in harm to one’s health, interpersonal relationships, or ability to work. This could include a failure to fulfill responsibilities at work, school, or home; drinking in dangerous situations, such as while driving; legal problems associated with alcohol use; and continued drinking despite problems that are caused or worsened by drinking. In the military, such problems

may include reporting issues such as being passed over for promotion, receiving a lower score on a performance rating, Uniform Code of Military Justice punishment, and driving under the influence charges, to name a few.

Alcohol Dependence

“Alcohol dependence” is characterized by at least three of the following within a 12-month period: (1) tolerance (need for larger amounts to achieve desired effect or diminished effect with continued use of same amount); (2) withdrawal; (3) larger amounts used or taken over a longer period than intended; (4) persistent desire or unsuccessful efforts to cut down; (5) great deal of time spent obtaining/using/or recovering; (6) giving up or reducing important social, occupational, or recreational activities; and (7) use is continued despite physical or psychological problems.¹³ DoD-wide, an estimated 4.5% of personnel are likely dependent on alcohol.³

Much of alcohol misuse in the military occurs among the enlisted population in pay grades E1–E6. These personnel for the most part are not alcohol dependent but rather drink at binge or heavy levels that lead to impairment and often to associated problems.³

In many cases, commands may limit assessment and care referral for alcohol-related problems to those who have legal difficulty. However, preventing binge or heavy drinking from becoming a legal issue may be possible through regular screening and effective prevention and intervention programs.

Alcohol Problems

Symptoms of alcohol abuse and dependence can be measured in a number of ways, but two of the most commonly used are the Alcohol Use Disorders Identification Test (AUDIT) and the CAGE. The AUDIT, developed by the World Health Organization as a simple method of screening, consists of 10 questions geared toward categorizing drinkers as engaging in hazardous drinking, harmful drinking, and possibly alcohol dependence (http://whqlibdoc.who.int/hq/2001/WHO_MSD_MSB_01.6a.pdf).¹⁴ Across the 10 questions in the AUDIT, 3 deal with alcohol consumption, 3 relate to alcohol dependence, and 4 consider alcohol-related problems. The CAGE¹⁵ is a briefer instrument, frequently used in doctors’ offices as an initial screening tool. It asks 4 questions, with any 2 positive responses suggesting the need for further evaluation: (1) Have you ever felt you needed to **C**ut down on your drinking? (2) Have people **A**nnoyed you by criticizing your drinking? (3) Have you ever felt **G**uilty about drinking? (4) Have you ever felt you needed a drink first thing in the morning (**E**ye-opener) to steady your nerves or to get rid of a hangover? More accurate, but less practical for global assessment of alcohol use, are objective measures, including blood tests (typically taken in the emergency room following an injury where alcohol is suspected of being involved) and breathalyzer tests (typically used by law enforcement during traffic stops).

Outcomes/Benefits of the Fitness Domain and Components

The key benefits of preventing excessive alcohol use among service members are to prevent poor work and family functioning, along with breaks in deployment readiness due to legal problems or medical treatments. Secondary benefits include preventing future illnesses and accidents, as well as improving retention in the military.

How This Fitness Domain Is Being Addressed With Current Programs

Currently, there are several areas of emphasis regarding alcohol abuse within the military: prevention, intervention, and treatment or rehabilitation. Prevention typically occurs through Departments of Health Promotion and Preventive Medicine. Service branches stress prevention through training and education classes. Health messages are communicated to service members on weekends and especially around holidays that warn them not to drink and drive. Telephone numbers are available that personnel can call to get a ride if they are inebriated. Underage drinking on base is prohibited. All branches of the U.S. military have made efforts to deglamorize the use of alcohol, providing nonalcoholic beverages at functions where alcohol is served and emphasizing that alcohol use before or during work hours is unacceptable. The Navy’s “Right Spirit” campaign calls for removing alcohol from traditional ceremonies, providing alternatives to drinking, recognizing the effects of alcohol use, and promoting personal responsibility concerning alcohol use.¹⁶ The Navy Alcohol and Drug Abuse Prevention Program credits this campaign for a nearly 40% reduction in alcohol-related incidents (i.e., infractions in which alcohol played a role) from 1996 to 2000, and for a nearly 50% decline in arrests for driving under the influence (<http://www.npc.navy.mil/CommandSupport/NADAP/RightSpirit/History.htm>).¹⁷

A survey of Air Force officers attending Air Command and Staff College (ACSC) sought to determine the degree to which the Air Force deglamorization campaign is reflected in the alcohol use norms of ACSC students. Survey respondents generally agreed that the ACSC environment was supportive of alcohol deglamorization but noted that despite the deglamorization efforts, students’ attention often was focused on alcohol, bringing alcohol to social activities is emphasized, and the student population does not consistently view drinking during the workday as unacceptable.¹⁸ The author recommended that the ACSC command structure and faculty support the deglamorization campaign by continuing to emphasize responsible alcohol use, encouraging the use of designated drivers, and recommending alcoholism treatment when necessary.

Interventions include additional efforts that support wellness of service members and their families and may involve a community-based working group to provide leadership, encourage individual responsibility, and involve the base and local communities. Some interventions based on principles of motivational interviewing have shown promise.¹⁹

Substance Abuse and Rehabilitation Programs (SARPs) for heavy drinkers are offered at all major military installations and medical treatment facilities. In 2009, nearly 9,200 soldiers sought treatment for alcohol abuse—a 56% increase since the beginning of the war in Iraq (<http://abcnews.go.com/Health/army-alcoholics-soldiers-look-for-treatment-alcohol-abuse/story?id=9863321>).²⁰ Often command liaison personnel are embedded with operational commands where medical officers, commanders, and even military personnel themselves can discuss treatment options. Often, referral to a SARP consists of those mandated by the courts or commands once a serious infraction has occurred. Self-referral is limited because SARP attendance has been heavily stigmatized. One reason for such stigmatization is that treatment often requires absence from one's workplace. And if treatment is mandated, then a future failure (recidivism) can mean expulsion from service with no or limited benefits. Such a strict policy can be helpful to those engaged in treatment but limits the number of those willing to self-refer for treatment.

Research suggests that alcohol use and related problems are reduced when alcoholic beverage prices are increased.²¹ DoD policies, however, allow alcoholic beverages sold in military stores to be discounted below prices in local civilian stores. Voas and colleagues²² found that a policy change that required Marines stationed at Camp Pendleton, California, to receive written permission to cross the border into Mexico had a positive effect in reducing alcohol problems. After the policy was implemented, the number of underage Marines returning across the Mexican border was reduced by 78%, and the number returning with blood alcohol content of 0.08% or higher was reduced by 84%.

Tobacco Use

Tobacco use has also been common among military personnel, and its use was sanctioned in the U.S. military beginning in the early years of the 20th century. Tobacco use costs DoD an estimated \$564 million per year.¹ As shown in Figure 1 above, cigarette use has shown large declines in the military since 1980 but has had some increases since 1998; currently, the past-month prevalence is 31%.^{2,3,23} Table I above provides information on the demographic characteristics of cigarette smokers.³ As shown, smokers were more likely to be serving in the Army, Navy, or Marine Corps than the Air Force and were more likely to be men, to be white non-Hispanic, to have less than a college degree, to be single, to be enlisted (especially pay grades E1–E6), and to be stationed OCONUS. Since 1995, past-month smokeless tobacco rates have ranged from 12% to 15%. Males aged 18 to 24 are most likely to be users (19.0%).³ Past-year cigar use in 2008 showed a prevalence of 23.6%.³

Although the long-term effects of tobacco use are well known (e.g., cancer, cardiovascular disease, pulmonary disease, gastrointestinal disease, reproductive disturbances, oral disease), tobacco can also affect a user's current military readiness and performance.²⁴ Physical work capacity and endurance

are compromised by cigarette smoking. Reduced maximal oxygen consumption (which reflects aerobic capacity) and exercise duration can be seen among younger smokers.²⁵ Smokers have lower scores on the Army physical training test than nonsmokers,²⁶ and smokers have poorer night vision,²⁷ greater hearing loss,^{28,29} increased motor-vehicle collisions,³⁰ and increased absenteeism due to issues such as illnesses and accidents.³¹

Tobacco dependence can affect mission performance since deprivation of nicotine has been shown to result in decreased vigilance and cognitive function^{32,33} and in decreased performance during aviation³⁴ and diving³⁵ activities. In addition, irritability and mood are affected when tobacco is not available for long stretches of time, such as during certain combat missions or military jobs where smoking breaks may not be feasible.

Components

Tobacco use can be divided into smoked tobacco and smokeless tobacco. Whereas the problems associated with cigarettes and cigars are well known, the problems of chewing tobacco are just starting to be appreciated. Long-term effects on health, such as cancer and cardiovascular disease, have been found from using chewing tobacco.³⁶ Short-term effects are also problematic, however, because nicotine in any form affects the brain's nicotine receptors, and nicotine withdrawal, including negative mood and irritation, is associated with chewing tobacco.³⁷

As with other substances, the effects of tobacco can be psychological and physiological. The heavier the tobacco use, the more likely the short-term and long-term effects. Nicotine dependence is characterized by physical and psychological withdrawal symptoms.

Outcomes/Benefits of the Fitness Domain and Components

The primary outcomes associated with activities addressing tobacco use, including cigarettes, cigars, pipes, and smokeless tobacco, are (1) the prevention of tobacco use onset and the reduction in current use and (2) reduced short-term tobacco-related performance issues, such as impaired fitness and withdrawal symptoms. Important secondary outcomes include improved long-term health outcomes, including reducing chronic diseases such as emphysema, cancer, and chronic obstructive pulmonary disease.

Metrics

Assessment of tobacco use is typically straightforward and includes simply asking the user for type and frequency of use. Common definitions are drawn from several large-scale studies (e.g., National Survey on Drug Use and Health,³⁸ HRB Survey³).

Current Cigarette Smokers

"Current smokers" are typically defined as having smoked one or more cigarettes during the past 30 days and having smoked

at least 100 cigarettes during one's lifetime (some studies omit the 100 cigarette criterion).

Heavy Cigarette Smokers

"Heavy smokers" are defined as persons who have smoked one or more packs of cigarettes per day during the past 30 days.

Current Smokeless Tobacco Use

"Current smokeless tobacco use" is defined as use of smokeless tobacco at least once during the past 30 days.

Strength of Evidence for Domain and Component

Evidence is strong that tobacco negatively affects health and moderately strong that tobacco use decreases current physical and cognitive performance levels.²⁴ This can affect readiness during military missions where tobacco is not immediately available.

How This Fitness Domain Is Being Addressed With Current Programs

Current public health education efforts and a change in attitudes and laws about indoor smoking have helped reduce overall smoking rates. Such efforts can be found in departments of Preventive Medicine, Health Promotion, and others. Moratoriums during basic training and parts of advanced training and in certain work environments may also contribute to lower smoking rates. However, smokeless tobacco rates have increased, and smoking rates for enlisted personnel are high.³ Therefore, stronger efforts directed at these groups need to be attempted.

Illicit Drug Use

Drug use has been a known problem in the military, largely beginning with the Vietnam War in the 1960s and 1970s, when heroin and opium were widely used among service members, in part as a way to tolerate the difficulties of war and to cope with a threatening environment. Approximately 20% of Vietnam War veterans reported having used narcotics on a weekly basis, and 20% also were considered to be addicted, based on reported symptoms of dependence.³⁹ Although few personnel continued using heroin when they returned home, there were concerns about addiction. This finding, along with the subsequent discovery in the 1980s that drug use was more widespread among military personnel,^{3,23} led the DoD to develop policies and approaches to reduce it.⁴⁰ In 1981, the DoD instituted its current urine testing program for detecting illicit drug use. Urine tests, which are conducted either randomly or when an individual is suspected of using drugs, have become a major tool for the detection and deterrence of illicit drug use in all branches of the military.⁴¹ The services vary in how they handle offenders, but administrative discharge can be the result. DoD labs test 60,000 urine samples each month. All active duty members must undergo a urinalysis at least once per year. DoD labs are equipped to test for marijuana, cocaine,

amphetamines, LSD, opiates (including morphine and heroin), barbiturates, and PCP. Every sample is tested for marijuana, cocaine, and amphetamines, including ecstasy. Tests for other drugs are done at random on different schedules for each lab with some laboratories testing every sample for every drug.⁴²

The first HRB survey, conducted in 1980, showed overall rates of illicit drug use at 28%, with rates for junior enlisted personnel at 47%.^{3,23} Since then, as shown in Figure 1, the rates of use have declined dramatically over the years to relatively low levels (2% for illicit drug use excluding prescription drug misuse).³ Marijuana has been the drug used most often by military personnel since 1980. Although no formal evaluation has been made of the urinalysis testing program, the policy of zero tolerance of illicit drug use and the accompanying large reductions in use over the years have largely been attributed to the impact of the testing program.

Components

Illicit drug use is considered to be the use of any illegal substance as well as inappropriate use of prescription medications. Illegal drug use includes psychoactive substances such as marijuana, LSD, ecstasy, and PCP; opiates, including raw opium and heroin; stimulants, such as methamphetamine, cocaine, and crack; and others. Prescription drugs for pain, muscle relaxants, anxiety, sleep, and treatment of attention deficit hyperactivity disorder can be obtained from someone else legally prescribed those medications or can be used inappropriately by the person receiving an appropriate prescription.

Illicit drug use leads to significant impairment of physical and cognitive functioning and, by regulation, is defined as illegal behavior. The consequences of being caught using drugs often leads to legal repercussions, including incarceration and less-than-honorable discharge.

Measures of Illicit Drug Use

Measures of illicit drug use often take the form of survey questions because the topic is sensitive in nature and respondents are less likely to report these behaviors accurately in the presence of (or if directly asked by) others during an interview. The HRB Survey is the major survey for assessing illicit drug use and examines a broader range of drugs than the urinalysis testing program. The 2008 HRB Survey asked questions separately about illicit drug use and prescription drug misuse. Separate definitions were developed for illicit drug use including and excluding prescription drugs.

"Any illicit drug use including prescription drug misuse" is defined as the use of marijuana, cocaine (including crack), hallucinogens (including PCP, LSD, and MDMA), heroin, methamphetamine, inhalants, GHB/GBL, or the nonmedical use of prescription-type amphetamines/stimulants, tranquilizers/muscle relaxers, barbiturates/sedatives, or pain relievers.

"Any illicit drug use excluding prescription drug misuse" is defined as the use of marijuana, cocaine (including crack), hallucinogens (including PCP, LSD, and MDMA), heroin, inhalants, or GHB/GBL.

“Any prescription drug misuse” is defined as the nonmedical use of prescription-type amphetamines/stimulants (including any use of methamphetamine), tranquilizers/muscle relaxers, barbiturates/sedatives, or pain relievers.

“Nonmedical use of prescription-type drugs” is defined as any use of these drugs, either without a doctor’s prescription, in greater amounts or more often than prescribed, or for any reasons other than as prescribed, such as for the feelings they caused.

Outcomes/Benefits of the Fitness Domain and Components

The primary outcome for this domain should be the near elimination of illicit drug use by active duty personnel, including reduction of inappropriate use of one’s own or others’ prescription medication. Secondary outcomes include reduction in lowered functioning and in illness and accidents resulting from illicit drug use.

Metrics

Drug use can be determined in three ways: self-report, other report, and drug testing.

Self-Report of Illicit Drug Use

Obviously, few active duty members will reveal illicit drug use to the command. However, anonymous reports have been obtained in the HRB survey (although there is likely some under-reporting).

Other Reporting

Although a useful source of information for the command, there are no reports on frequency of co-workers reporting drug use for their peers.

Drug Testing

By far, the most effective method of controlling illicit drug use is random drug testing. When conducted frequently, randomly, and properly to ensure accuracy of sample and analysis, this approach appears to be the most effective means of controlling drug use. It is neither effective for drugs not included on the panel (e.g., muscle relaxants, sleep aids, and some street drugs) nor for inappropriate use of one’s own prescription drugs.

Strength of Evidence for Domain and Component

The HRB Survey has shown clear evidence of lowered use of illicit drug use over the years.^{2,3} In general, military rates are lower than those found in the civilian community, but the consequences in the military are often more grave, given the duties facing active duty personnel. Comparing the HRB Survey, an anonymous survey, with nonanonymous surveys shows an expected discrepancy in accuracy when identifiable reporting is required. Treatment programs for illegal drug use have modest results, at best.

How This Fitness Domain Is Being Addressed With Current Programs

Random drug testing clearly has been a beneficial program for reducing illegal substance use and prescription drug use in those not holding a current prescription for that drug. Existing severe penalties for illegal drug use are a useful deterrent. However, repercussions for abuse of one’s own prescription drugs are rarely severe, at least for initial detection.

Substance abuse subcomponents, desired outcomes, metrics, current policies, and recommendations are summarized in Table II.

BEHAVIORAL HEALTH—PSYCHOPHYSICAL FACTORS

Although psychological factors play an important role in military fitness, this component is considered elsewhere in this supplement. Here, we will focus on weight and sleep—primary psychophysical behavioral factors that influence fitness for duty. Other behaviors such as eating and exercise affect weight, and psychological factors (anxiety, depression, stress), substances (caffeine, alcohol), or biological factors (snoring, sleep apnea, hormonal changes) may lead to sleep problems. Sleep function is associated with quality of performance and quality of life and affects up to 85% of deployed service members.⁴³ Weight is directly addressed by the military, whereas sleep, although no less important, is given far less attention.

Weight

Overweight among military personnel is a growing concern, and it affects both immediate performance and eventual health consequences.⁴⁴ Excess weight and obesity cost DoD an estimated \$1.1 billion in medical care costs annually.¹ Fortunately, behavioral interventions, such as regular physical activity and proper weight control, can reduce the risks of coronary heart disease, can prevent or help control high blood pressure, and are important for weight control.^{45–48} Physical activity can also reduce depression and anxiety.^{49,50}

Being overweight in the military has both health and career consequences. The military has generally set a body mass index (BMI) <25 as acceptable weight standards (as determined by height and weight), assessed during twice annual physical fitness tests. Surpassing this threshold can lead to enrollment in a diet and fitness program, a disciplinary report in one’s record, and discharge if weight remains out of standards, especially during recruit training.⁵¹ Individuals can experience health consequences of being overweight as well. Approximately 70% of the relative risk for heat during basic training has been associated with exceeding body fat standards.⁵²

Similar to civilian society, weight levels have been increasing in the military, but there have been recent improvements. From 1995 to 2005, the percentage of personnel under 20 years of age with a BMI ≥25 rose from 28% to 45%, but in

TABLE II. Behavioral Health—Substance Abuse

Fitness Domains	Domain Components	Outcomes/Benefits	Metrics	Strength of Evidence	Currently Addressed
Alcohol	Heavy drinking Binge drinking Alcohol abuse Alcohol dependence	Primary: Prevent poor work and family functioning; prevent breaks in deployment readiness due to legal problems or medical treatments. Secondary: Prevent future illnesses and accidents; improve military retention.	CAGE: brief screening tool. Alcohol Use Disorders Identification Test. (AUDIT) Breathalyzer and blood tests. Objective measure commonly used by law enforcement.	Evidence is strong for the influence of alcohol on (a) current functioning, (b) risk of injury, (c) development of chronic illness, and (d) the value of alcohol rehabilitation programs.	Prevention: (1) Departments of Health Promotions, (2) command trainings and orientations. Treatment: Substance abuse rehabilitation programs.
Tobacco	Methods of ingestion: smoked, smokeless Heavy use Dependence	Primary: Prevent onset tobacco use and reduce current use. Secondary: Reduction of tobacco-related performance decrement, reduction in tobacco-related illness and disease.	Surveys asking about current tobacco use.	Evidence is strong for (a) the deleterious influence of tobacco on long-term health outcomes, (b) the value of tobacco cessation programs. Evidence is moderate for the effects of tobacco on current functioning.	Prevention: Departments of Health Promotion. Treatment: Tobacco cessation programs, moratorium during basic training, work environments, combat missions.
Illicit Drugs	Illegal substances Prescription substance misuse	Primary: Near elimination of illicit substance use in and out of the military workplace. Secondary: Reduction of lowered functioning and increased illnesses and accidents.	Anonymous surveys: Random drug screening.	Evidence is strong for random drug screening detecting and reducing illicit drug use. Evidence is moderate for the detection of drug use through anonymous surveys and for the benefits of drug rehabilitation programs. Evidence is poor for the detection of drug use through identifiable surveys in the military.	Prevention: Random drug screening and severe penalties for service members are effective in reducing prevalence of illegal drug use; however, screening for abuse of one's own prescription drugs is less effective. Treatment: Substance abuse rehabilitation programs exist for eligible service members.

2008 the percentage dropped to 35%. For those aged 20 years or older, BMI ≥ 25 rose from 51% (1995) to 62% (2005) and remained at that level in 2008.³ Obesity levels (BMI ≥ 30) show a similar pattern and in 2008 were 13%, with 3% among those less than 20 years and 13% among those 20 years or older.³ Still, the overall rate of overweight and obesity (BMI ≥ 25) was 60% in 2008.³ As might be expected, overweight increases as age increases.³

The increases in weight are surprising in the military in view of the emphasis on exercise among service members. Indeed, we see fairly high and increasing rates of exercise, with over 77% reporting moderate or vigorous exercise in 2005 and 83% in 2008.³ This suggests that increases in weight gain cannot be explained simply as a lack of physical activity by service members and that weight gain is more complex, involving such factors as genetics, dietary intake, and other health behaviors related to energy balance.

Components and Metrics

The National Institutes of Health now define normal weight, overweight, and obesity according to the BMI rather than the traditional height and weight charts. BMI is defined as the individual's body weight divided by the square of his or her height. The formula universally used in medicine produces a unit of measure of kg/m² but is usually obtained from a simple height and weight chart. Since the BMI describes body weight relative to height, it correlates strongly (in adults) with total body fat content.

Typically, "overweight" has, for the most part, been defined as BMI ≥ 25 or, strictly, BMI from 25.0 to 29.9. "Obesity" is defined as a BMI ≥ 30 (about 30 pounds overweight in an average individual). Note, however, that some very muscular people may have a high BMI without undue health risks, and this is often found in military populations and among athletes. A BMI of 40 is considered to be morbidly obese, whereas a BMI of less than 18.5 is considered underweight.

Percent body fat is most typically estimated from BMI calculations; however, this approach is less accurate than several other methods.⁵³ The most accurate measure of percent body fat is determined via DexiScan, a type of bone density scan costing several hundred dollars per test. Less expensive, but far less pleasant, is to totally submerge an individual for about 30 seconds in a large tub to see how much water has been displaced. A calibrated pinch test, taking measures of skin folds from selected parts of the body, is fairly accurate and inexpensive. A recent method, which uses the body's electrical impedance and typically costs between \$50 and \$100, uses a scale that detects with good accuracy the body's fat content. The BMI calculation remains the easiest method, is the most widely used in medical offices, and is a fair approximation of body fat.

Factors that influence weight include genetic makeup, diet, fitness, and psychological well-being. These are considered in other fitness domains of this special supplement and are not addressed here.

Outcomes/Benefits of the Fitness Domain and Components

Maintaining the military at minimum weight standards is a primary outcome and can be accomplished through improved health behaviors such as improved nutrition and exercise, as well as stress reduction resulting in a greater sense of psychophysical well-being. Reduction in weight-related illnesses is a secondary benefit.

Strength of Evidence for Domain and Component

The prevalence rates of those above military standards are known. All of the factors that influence being overweight and efforts to meet standards are unclear, although age is a key factor.

How This Fitness Domain Is Being Addressed With Current Programs

A culture of fitness generally exists in the military, especially in basic training, for special operations, and when preparing for combat deployment. However, many commands do not continue to emphasize exercise and often (ironically, in terms of weight standards) emphasize exercise even less so for a sedentary occupational specialty. Most commands have mandatory programs once individuals exceed minimum weight standards. Most commands also have inexpensive or free food that includes a large percentage of fried and fatty foods, as well as sugared desserts and sodas—all major contributors to weight gain. Some commands have weight management programs offered through Departments of Health Promotion. Programs in place for recruits entering service in excess of standards show that the majority are able to obtain and maintain standards.⁵⁴ Studies also show that those who surpass weight standards but who are able to increase exercise tolerance are no less likely to be discharged than normal weight service members.⁵⁵ Therefore, a combination of exercise and healthy diet programs are recommended for those surpassing weight standards.

Sleep Problems

Sleep problems affect the general population, with close to 10% experiencing sleep disturbance at any given time and over 50% experiencing periods of sleep disturbance at some point in their lives.^{56,57} In the military, sleep disturbance is a common complaint both during and after deployment. Poor sleep quality can greatly reduce work effectiveness and increase accidents, with those experiencing poor sleep performing similarly on neurocognitive tests to those who have consumed three alcoholic drinks. Fortunately, research has consistently shown that more than 70% of those with even chronic primary insomnia lasting a decade or those with insomnia subsequent to trauma can receive substantial relief with a targeted intervention program.^{58,59}

Key Components

Sleep disturbance can include difficulty falling asleep, staying asleep, or sleeping deeply. "Primary insomnia" refers to long-term

sleep disturbance that is not currently caused by some other factors. Factors that cause sleep disturbance, including psychological factors (anxiety, depression, stress), substances (caffeine, alcohol, medications), or other biological factors (snoring, sleep apnea, restless leg syndrome, or hormonal changes), are referred to as “secondary insomnia.” Daytime fatigue, or sleepiness, is a consequence of poor sleep.

Strength of Evidence for Domain and Component

Evidence is strong regarding the impact of sleep disturbance on cognitive and work functioning and also regarding the ability to improve sleep functioning through behavioral interventions.

Feasible Domain Metrics

Assessment of sleep quality is accomplished through self-report measures, such as the Pittsburgh Sleep Quality Index (PSQI),⁶⁰ the Stanford Sleepiness Scale (SSS),⁶¹ or through a medical sleep study performed overnight in a clinic setting. Self-report measures are adequate for the majority of sleep problems. However, persistent insomnia or daytime sleepiness should be referred to a specialist who may request a sleep study.

How This Fitness Domain Is Being Addressed with Current Programs

Behavioral interventions for insomnia, including sleep hygiene and relaxation training, are available at most large commands and are successful in the great majority of sufferers.⁶² Yoga and meditation classes, also available at many bases, have proven effective in reducing insomnia.⁶³ If this proves ineffective, or for those deployed to a combat zone, seeking medical support for sleep medications can aid temporarily and improve daytime functioning. Although behavioral interventions are most effective, the majority of sleep problems are typically self-treated with over-the-counter or prescription medications,^{59,64} although more intransigent problems are addressed by primary care physicians’ prescription of several newer sleep aids. Although prescription medications can be discouraged during deployment, they can offer temporary relief while service members learn self-help approaches.⁶⁵

Psychophysical behavioral health subcomponents, desired outcomes, metrics, current policies, and recommendations are summarized in Table III.

OCCUPATIONAL HEALTH

Occupational health is a broad field, spanning psychosocial areas such as stress and social influences and environmental factors such as physical, chemical, and biological stressors. Some of these areas are covered under different domains, such as medical and psychological fitness. We focus here on the psychosocial and environmental factors involved in occupational health.

TABLE III. Behavioral Health—Psychophysical Factors

Fitness Domains	Domain Components	Outcomes/Benefits	Metrics	Strength of Evidence	Currently Addressed
Overweight/Obesity	Overweight (BMI ≥25) Obese (BMI ≥30)	Primary: Reduce prevalence of overweight and obese personnel through improved nutrition, exercise, and stress management. Secondary: Reduce weight-related chronic illnesses.	Body Mass Index (BMI) Taken from measuring weight and height (kg/m ²).	Evidence is strong regarding the influence of obesity on chronic illness. Evidence is weak regarding the causes of obesity.	Prevention: All commands have biannual fitness assessments. Some commands emphasize ongoing fitness training, although this varies greatly. Some commands encourage healthy eating options. Treatment: Weight management and fitness programs are sometimes available through Departments of Health Promotions.
Sleep	Primary insomnia Secondary insomnia Daytime fatigue	Primary: Improved sleep functioning for all service members experiencing sleep disturbance. Secondary: Improved daytime alertness and work functioning.	Self-report questionnaires (e.g., PSQI; SSS) for most insomnia. Sleep lab study to rule out medical causes, if needed.	Evidence is strong regarding the impact of sleep disturbance on cognitive and work functioning, and also regarding the ability to improve sleep functioning through behavioral interventions.	Prevention: Little is currently done to prevent the onset or exacerbation of insomnia, even though much is known. Treatment: Behaviorally based insomnia programs are occasionally held at major medical treatment facilities. However, most often, patients use over-the-counter medications or see physicians who offer sleep medication for temporary relief.

Psychosocial Factors

Job Stress

Some degree of work stress is to be expected and, unless excessive, need not be avoided. However, in response to the question, "During the past 12 months, how much stress did you experience at work or while carrying out your military duties?" 27% of military members in 2008 reported that they experienced high stress while performing their military job or duties, down from 32% in 2005.³ Still, job stress is of concern, especially associated with deployment.³ Command atmosphere is often a factor, with trust in one's chain of command a large factor in morale and general outlook.

Family Stress

The 2008 HRB Survey also found that 18% of service members reported high stress from family relationships, about the same as reported in 2002 (19%).³ This was in response to an item asking: "During the past 12 months, how much stress did you experience in your family life or in a relationship with your spouse, live-in-fiancé, boyfriend or girlfriend, or the person you date seriously?"

Deployment Stress

Prior deployment (not only to combat arenas) is a factor in military fitness. Marital status can also affect other health behaviors that in turn affect job functioning. More previously deployed service members report being heavy users of alcohol and tobacco, having higher rates of depression, symptoms of post-traumatic stress disorder, and suicidal ideation.⁶⁶ Moreover, single service members, as well as married service members who deployed without their spouses, report higher problems of these types than married service members who deployed with their spouses. Therefore, although some service members report stress at home affecting their military functioning, marriage appears to be a protective factor.⁶⁶

Social Influences

Peer influences, including stigma for problems, can be a negative influence on health behaviors. For example, smoking habits of Air Force recruits following basic training showed an increased likelihood of smoking if one's drill instructor smoked.⁶⁷ Similarly, having friends who smoke and view smoking as important increases service members' risk of smoking.⁶ Stigma can be a factor in preventing improvement of those factors. Studies in military populations with mental health concerns have found stigma to be a major barrier to military members seeking treatment that could increase their fitness for duty.^{3,68,69} Social influence can also have a positive effect on behavioral fitness. Recently, the military leadership has attempted to reduce stigma and improve attitudes toward seeking mental health care through a number of measures, including eliminating the requirement to report the solicitation of counseling for marital counseling or postdeployment-related

stress.⁷⁰ The Army's BattleMind briefings and the Marines' Combat Operational Stress Control orientation are meant to normalize the consequences of combat and encourage a buddy system where peers watch out for each other.^{71,72}

Environmental Factors

Physical Stressors

Deployment of military forces to harsh environments, such as hot desert or mountainous terrains, presents combatants with physiological, biological, and psychological stresses that affect mood and motivation, decrease job performance, make accidents more likely, and lead to increases in illnesses and nonbattle injuries.⁷³ Safety factors outside of the military environment—such as wearing seatbelts, helmet use, driving and road rage, cell phone use and texting during driving, and dangerous recreational activities—all affect military readiness. Using safety goggles and hearing protection in an occupational setting can also greatly affect military readiness. Combat eye protection use from 2003 to 2006 in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) resulted in a 9% reduction in eye injuries when comparing those wearing combat eye protection vs. those who did not.⁷⁴ Noncombat injuries, such as work-related injuries and motor vehicle accidents (MVAs), have been identified as the single leading cause of deaths, disabilities, hospitalizations, outpatient visits, and manpower losses among military service members.⁷⁵ MVAs have been shown to account for one-third of all military fatalities over 25 years, including combat and noncombat periods.⁷⁶ From 1998 to September 2009, MVAs accounted for over 4,000 service member deaths, 23% of which were due to motorcycle accidents.⁷⁷ Prior combat deployment has been associated with increased motor vehicle accidents and fatalities, often due to increased alcohol use following combat deployment.⁷⁸ Fatalities are greatest for younger single males who served on the ground in combat.⁷⁹

Chemical Stressors

Exposures to hazardous chemicals and materials in the environment are nearly certain and are capable of impacting human health and mission readiness.^{80,81} These hazards can be present in all compartments of the environment (air, food, soil, and water).⁸² Coping with the inevitability of these stressors requires service members to make behavioral and operational adaptations to maintain peak performance. A study examining Navy personnel from 1974 to 1985 reported 1,371 hospitalizations and 136 deaths associated with exposure to hazardous materials. Carbon monoxide (CO), a product of fuel-burning devices, was responsible for 74% of these deaths.^{83,84} Even low-to-moderate exposures to CO have been shown to impair vision and hearing.^{27,85} Exposure to JP-8 while incinerating human waste led to 24 medical evacuations due to burns in a 2-year period during OIF.⁸⁶ Exposures to contaminants in other environmental compartments, such as food and water, have the potential to impact readiness as well.⁸⁰ However, less than 50% of a study population consisting of OEF and

OIF deployment service members realized the importance of avoiding unprocessed tap water.⁸⁷

Simple behavioral changes such as using fuel-burning devices outdoors, redirecting engine exhaust, and using proper ventilation can significantly reduce the risk of many airborne chemicals such as CO.⁸⁸ Similarly, leader-enforced use of personal protective equipment (PPE) and training before handling flammable liquids have been shown to decrease burn severity in deployed service members.⁸⁶ Research has shown a positive association between the number of social models, such as leaders using PPE and the number of people who use PPE for a given task.⁸⁹ This research shows promise for a command-directed approach toward changing attitudes and behaviors in regard to PPE compliance and is a way of addressing the stigma associated with using PPE.

Biological Stressors

Exposure to biological stressors such as viruses, bacteria, and parasites requires service members to modify behaviors to maintain fitness. Historically, disease has accounted for the majority of injuries encountered by military personnel.^{90,91} Sanders et al. reported that 74.5% of study participants from OEF and OIF were affected by diarrhea, half of whom sought medical care, and a 69.1% incidence of respiratory infections, 17% of whom sought medical attention.⁹² Vector-borne diseases such as malaria and leishmaniasis have the potential to significantly affect readiness as well.⁹³ Army Medical Surveillance Activity (AMSA) reported over 1,200 cases of leishmaniasis in deployed service members from 2001 to 2007.⁹⁴

Practicing and enforcing proper hygiene and personal protective techniques are behaviors that have been found to protect individual and force health. Proper hand washing has been associated with a 47% decrease in the risk of diarrhea and a 45% reduction in outpatient visits for respiratory illness.^{27,95,96} Personal protective techniques, such as the use of DEET and bed nets, are effective in reducing the risk of disease transmission by arthropods.⁹⁷ Despite the proven benefits of these behaviors, rates of hand washing and use of DEET are surprisingly low.^{92,96,98}

Outcomes/Benefits of the Fitness Domain and Components

Primary outcomes for this component include the awareness of and reductions in (1) work, family, deployment, and peer-related stressors and (2) health and safety behaviors that mediate between occupational stressors and military functioning. A secondary outcome is improved military retention, a factor influenced by work and family stress, as well as injury.

Metrics

Other than occasional surveys assessing aggregate health of service members, occupational health problems rely on self-report to command medical departments of injury or distress. Readiness for deployment can also reveal problems that might have otherwise gone undetected.

Strength of Evidence for Domain and Component

Evidence is strong regarding the impact of illness and injury on military fitness. Psychosocial factors in occupational health have a moderate level of research support.

How This Fitness Domain Is Being Addressed With Current Programs

Most commands are interested in ensuring that their personnel are able to function optimally in their specialty, and commands have various formal and informal methods to support this. Periodic surveys, suggestion boxes, and sending feedback up the chain of command are all currently employed on a widespread basis. Postdeployment questionnaires (Post-Deployment Health Assessment Process/Post-Deployment Health Reassessment Program) are also regularly given to determine overall stress and health after returning from combat deployment. Noncommissioned officer (NCO) and officer trainings with regard to leadership and supporting personnel are also common. Commands are increasingly using work environment feedback to assess and improve the work environment and to train leadership in improved command interactions. Family stress issues can be referred to Family Services, available at most bases. MilitaryOneSource.com can also be used as a resource for family and work stress issues. Preventive and Occupational Medicine departments are tasked with prevention through assessment and education of occupational health issues, especially those regarding infectious disease and hygiene. Unit physicians are responsible for following the health of their service members and referring them for care if needed. Comprehensive health evaluations are required both pre- and postdeployment and, often, when changing duty stations.

Occupational health subcomponents, desired outcomes, metrics, current policies, and recommendations are summarized in Table IV.

THE BOTTOM LINE FOR THE LINE

Given the above review of behavioral and occupational health factors affecting military readiness, retention, and overall health of service members, specific recommendations can be made that are able to be implemented within most current commands without a great deal of cost or effort and that build on current practices. These are summarized below for each domain.

Substance Abuse

Alcohol Abuse

The evidence linking excessive alcohol use to health problems, aggression and victimization, and poor work performance is overwhelmingly clear. Less clear is what can be done about preventing the many problems associated with binge and heavy alcohol use. Certainly, continuing with public health messages about the dangers of excessive alcohol use, especially when driving, is important. However, for those commanders who take the problem of heavy drinking seriously, it is also important to change the military culture regarding

TABLE IV. Occupational Health

Fitness Domains	Domain Components	Outcomes/Benefits	Metrics	Strength of Evidence	Currently Addressed
Occupational Health	Psychosocial factors: Job stress, family stress, stress due to deployment, stigma and social influences. Environmental factors: Physical stressors (climate, altitude, noise, injuries); biological stressors (bacteria, viruses, parasites, and other disease causing agents); chemical stressors (heavy metals, gases, fuels, solvents).	Primary: Awareness of and reductions in work, family, deployment, and peer-related stressors, and health and safety behaviors that affect military functions. Secondary: Improved military retention.	Questionnaires asking about job and family stress (see the Health-Related Behavior Survey³). Regular screenings for change of duty station or deployment. Reliance upon self-report for illness or injury. Personal protection equipment/procedures compliance rates. Noncombat-related injury rates.	Evidence is strong regarding the impact of illness and injury on military fitness. Evidence is moderate regarding the impact of psychosocial stressors on military functioning and retention.	Prevention: Health evaluations are required pre- and postdeployment and often when changing duty stations. Annual updates address occupational health risks at many commands. Leadership trainings are offered to officers and NCOs to optimize workplace performance. Treatment: Family support centers are available at most commands to assist with family stress. Medical clinics exist to address illness and injury.

heavy alcohol use. This can be done at the local level by not sponsoring parties where alcohol is present (or at least a central component); by making it clear that heavy drinking, even on weekends, is unacceptable, because it decreases functioning for several days and readiness in case one is suddenly called up for duty; by using proven intervention approaches and programs such as those based on principles of motivational interviewing; and by referring those with problem drinking issues to treatment before a crisis occurs. Regular self-assessments can also be of value since understanding how one's drinking pattern compares with that of others can begin to let personnel know that they may have a problem that needs addressing.

Tobacco Use

Buy-in from the command at all levels and a cultural shift among military leaders regarding the harmful effects of tobacco are paramount to countering the long- and short-term ill effects of tobacco use. Continuing tobacco bans in basic training (and beyond, in advanced training), in closed environments, and during trainings, as well as reducing availability of tobacco products in stores on base, will help reduce use and problems associated with tobacco use. In addition, following the recommendation from a recent Institute of Medicine (IOM) committee,²⁴ DoD should implement a comprehensive tobacco-control program that includes appropriate therapeutic and communication interventions, surveillance mechanisms, and regular evaluation of the programs' effectiveness.

Illicit Drug Use

Since drugs not detected in the typical urinalysis testing panel can be used without detection, the service branches should consider inclusion of a wider range of popular drug screening to include those that do not contain currently detected substances. In addition, medical officers should find ways to be more vigilant after prescribing psychoactive substances such as narcotics for medication for pain or benzodiazepines for anxiety or sleep because there are some who misuse these drugs. Increasing the frequency of drug testing, including occasional unannounced recall during weekends or holidays, could further reduce use.

Psychophysical Factors

Weight

Maintaining and enhancing a view of body fitness will be important for commanders concerned about reducing the number of overweight persons within their command. Encouraging healthy eating (and reducing unnecessary and unhealthy food choices), encouraging regular fitness (through competition, group exercise, and incentives), and monitoring psychological well-being can go far in maintaining a fit and healthy force.

Sleep

An informational program should be instituted for insomnia awareness and prevention, explaining the importance of

TABLE V. Bottom Line for the Line

Substance Abuse
Alcohol:
Closer monitoring and regulations of heavy abuse outside of the workplace through anonymous AUDIT and aggregate reporting to the command.
Discouraging alcohol at command-sponsored activities and having officers and senior enlisted discourage binge drinking at all times, much as they do with drinking and driving.
Tobacco:
Closer monitoring and discouraging tobacco use inside and outside of the workplace through regular assessments and more smoking cessation programs.
Illicit drugs:
Continued regular random drug screening of all service members.
Improved monitoring of pain, sleep, anxiety, and stimulant medication by physicians through random checks of drug blood levels.
Psychophysical Factors
Weight:
Continued regular fitness assessments; continued regular weight and fitness support programs for those who do not meet standards.
Consider interim assessments to assist those who might not meet standards.
Continue to boost an atmosphere of physical health and readiness by encouraging healthy eating and exercise.
Provide health events, sports events, lectures, healthy options in cafeterias, and reduced availability of sodas and unhealthy snacks.
Sleep:
Institute an informational program of insomnia awareness and prevention, explaining the importance of sleep on health, quality of life, and job performance, as well as the roles played by caffeine and alcohol, irregular schedules, and other factors that influence sleep.
Institute behaviorally based insomnia programs for those experiencing primary and secondary insomnia.
Identify a physician who is specially trained in sleep disturbance for specialty support.
Occupational Health
Psychosocial factors:
Increase emphasis on work and family functioning through similar mechanisms used for prevention and treatment of physical health issues.
Environmental factors:
Continue health checks before deployment, postdeployment, and on change of duty station.
Boost messages of health and safety for driving, handwashing, ear and eye protection, sexual hygiene, and other illness and injury protection through annual updates, unit lectures, and public health announcements.
Social modeling approach to enforce the desired behaviors such as wearing personal protective equipment.

sleep on health, quality of life, and job performance, as well as the roles played by caffeine and alcohol, irregular schedules, and other factors that influence sleep. In addition, behaviorally based insomnia programs should be made available for those experiencing primary and secondary insomnia. Finally, each command should identify a primary care physician who is specially trained in sleep disturbance and can coordinate command-wide resources.

Occupational Health

Psychosocial Factors

Current metrics for psychosocial issues are often focused on command climate and rarely examine other dimensions, such as stigma, for seeking support for personal problems and family-related issues. Expanding standard inquiries to include these other components will inform the command about the state of their personnel and suggest mechanisms of support that could be helpful. Such support can come in the form of seminars, briefings to destigmatize efforts to seek individual or family support, and additional training for leaders in supporting their troops.

Environmental Factors

Occupational health, safety, prevention, and treatment policies and practices are in place in most commands. These can be improved on with additional leader emphasis on personal and unit status of adequate hygiene and occupational health-related training, equipment, and supplies, as well as model-

ing appropriate occupational behaviors such as wearing PPE. A summary of recommendations for line commanders is presented in Table V.

CONCLUSION

Behavioral and occupational health not only affect long-term health (and retention) but also immediate mental and physical functioning, and, therefore, military fitness. The components discussed above should not be viewed as independent factors that are able to be understood and improved on in isolation. Rather, they are part of a complex system that includes physical, psychological, medical, nutritional, spiritual, and social dimensions that all interact to offer resilience to these risk factors or sensitize one to succumb to them. Yet specifically targeting these factors, while also appreciating the influence of other factors, will lead to the best possible chance to maintain a fit fighting force.

The U.S. military has instituted many policies and procedures to reduce accidents and illness and to detect and correct problems that arise. However, just as in society at large, behavioral and occupational problems continue to exist and, in many cases, are increasing in prevalence. Although detrimental to society, such problems can particularly affect service members' current military functioning, force readiness, and overall health for years to come. Fortunately, most of these problems can be curtailed through conscientious prevention and early treatment.

The military environment has a unique opportunity to influence service members' health to ensure force health. The military's emphasis on fitness standards and also drug screening are excellent examples of how a concerted effort can be made to reduce behavioral and occupational problems in the workforce. These efforts can be used as examples of how other health concerns, such as alcohol and tobacco use, sleep disturbance, and illness and injury prevention, can be improved. By instituting regular metrics, preventive programs, and readily available treatment programs, the total health of our service members can be greatly improved, resulting in a more effective military force.

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REFERENCES

- Dall TM, Zhang Y, Chen YJ, et al: Cost associated with being overweight and with obesity, high alcohol consumption, and tobacco use within the military health system's TRICARE Prime-enrolled population. *Am J Health Promot* 2007; 22: 120–39.
- Bray RM, Pemberton MR, Lane ME, Hourani LL, Mattiko MJ, Babeu LA: Substance use and mental health trends among U.S. military active duty personnel: key findings from the 2008 DoD Health Behavior Survey. *Mil Med* 2010; 175(6): 390–9.
- Bray RM, Pemberton M, Hourani LL, et al: 2008 Department of Defense Survey of Health-Related Behaviors Among Military Personnel. Final Report [prepared under Contract No. GS-10F-0097L, Task Order No. W81XWH-07-F-0538 for the Assistant Secretary of Defense (Health Affairs) and Task Order No. HSCG23-07-F-PMD047 for the U.S. Coast Guard]. Research Triangle Park, NC, RTI International, 2009.
- Ames GM, Cunradi CB, Moore RS: Alcohol, tobacco, and drug use among young adults prior to entering the military. *Prev Sci* 2002; 3(2): 135–44.
- Bray RM, Brown JM, Pemberton MR, Williams J, Jones SB, Vandermaas-Peeler R: Alcohol use after forced abstinence in basic training among United States Navy and Air Force trainees. *J Stud Alcohol Drugs* 2010; 71: 15–22.
- Haddock CK, Klesges RC, Talcott GW, Lando H, Stein RJ: Smoking prevalence and risk factors for smoking in a population of United States Air Force basic trainees. *Tob Control* 1998; 7: 232–5.
- Federman B, Bray RM, Kroutil LA: Relationships between substance use and recent deployments among women and men in the military. *Mil Psychol* 2000; 12(3): 205–20.
- Smith B, Ryan MA, Wingard DL, Patterson TL, Slymen DJ, Macera CA: Millennium Cohort Study Team. Cigarette smoking and military deployment: a prospective evaluation. *Am J Prev Med* 2008; 35(6): 539–46.
- Jacobson IG, Ryan MA, Hooper TI, et al: Alcohol use and alcohol-related problems before and after military combat deployment. *JAMA* 2008; 300(6): 663–75.
- Stahre MA, Brewer RD, Fonseca VP, Naimi TS: Binge drinking among U.S. active-duty military personnel. *Am J Prev Med* 2009; 36: 208–17.
- Pham-Kanter G: Substance abuse and dependence in *The Gale Encyclopedia of Medicine*, Ed 2. Edited by Longe JL. Farmington Hills, MI, Gale Group, 2001.
- King KM, Chassin L: Adolescent stressors, psychopathology, and young adult substance dependence: a prospective study. *J Stud Alcohol Drugs* 2008; 69: 629–38.
- American Psychiatric Association: *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*, 4th edition, text revision, Washington, DC, American Psychiatric Association, 2000.
- Babor TF, Higgins-Biddle JC, Saunders JB, Monteiro MG: *AUDIT: The Alcohol Use Disorders Identification Test: guidelines for use in primary care*, second edition. Available at http://whqlibdoc.who.int/hq/2001/WHO_MSD_MSB_01.6a.pdf; accessed June 24, 2006.
- Buchsbaum DG, Buchanan RG, et al: Screening for alcohol abuse using CAGE scores and likelihood ratios. *Ann Intern Med* 1991; 115(10): 774–7.
- Bickford AJ, Ames GM, Moore RS: Alcohol Policy in the United States Navy. Poster presentation at the Research Society on Alcoholism Annual Scientific Meeting, Vancouver, BC, June 2004.
- Navy US: Right Spirit Campaign History, 2005. Available at <http://www.npc.navy.mil/CommandSupport/NADAP/RightSpirit/History.htm>; accessed May 6, 2010.
- Lyman CH: Alcohol deglamorization and norms of alcohol use at air command and staff college. Maxwell Air Force Base. AL, Air Command Staff College, Air University, 1999.
- Williams J, Herman-Stahl M, Calvin SL, Pemberton MR, Bradshaw MR: Mediation mechanisms of a military web-based alcohol intervention. *Drug Alcohol Depend* 2009; 100: 248–57.
- Netter S: Army alcoholics: More soldiers hitting the bottle. Available at <http://abcnews.go.com/Health/army-alcoholics-soldiers-look-for-treatment-alcohol-abuse/story?id=9863321>; accessed March 30, 2010.
- Cook PJ, Moore MJ: Economics of alcohol abuse and alcohol-control policies. *Health Aff* 2002; 21: 120–33.
- Voas RB, Johnson M, Lange J: Permission to cross the border: effective policy reduces high-risk drinking by marines. *J Stud Alcohol* 2002; 63: 645–8.
- Bray RM, Hourani LL: Substance use trends among active duty military personnel: findings from the United States Department of Defense health-related behavior surveys, 1980–2005. *Addiction* 2007; 102(7): 1092–101.
- Institute of Medicine (IOM): *Combating tobacco use in military and veteran populations*. Washington, DC, National Academies Press, 2009.
- Hirsch GL, Sue DY, Wasserman K: Immediate effects of cigarette smoking on cardiorespiratory responses to exercise. *J Appl Physiol* 1985; 58(6): 1975–81.
- Zadoio V, Fengler S, Catterson M: The effects of alcohol and tobacco use on troop readiness. *Mil Med* 1993; 158(7): 480–4.
- McFarland RA: The effects of exposure to small quantities of carbon monoxide on vision. *Ann N Y Acad Sci* 1970; 174(1): 301–12.
- Cruikshanks KJ, Kelen R, Klein BE, Wiley TL, Nondahl DM, Tweed TS: Cigarette smoking and hearing loss: the epidemiology of hearing loss study. *JAMA* 1998; 279(21): 1715–9.
- Sharabi Y, Reshef-Haran I, Burstein M, Eldad A: Cigarette smoking and hearing loss: lessons from the young adult periodic examinations in Israel (YAPEIS) database. *Isr Med Assoc J* 2002; 4(12): 1118–20.
- Hutchens L, Senserrick TM, Jamieson PE, Romer D, Winston FK: Teen driver crash risk and associations with smoking and drowsy driving. *Accid Anal Prev* 2008; 40(3): 869–76.
- Athanasou JA: Smoking and absenteeism. *Med J Aust* 1979; 1(6): 234–6.
- Hirshman E, Merritt P, Rhodes DK, Zinser M: The effect of tobacco abstinence on recognition memory, digit span recall, and attentional vigilance. *Exp Clin Psychopharmacol* 2004; 12(1): 76–83.
- Mancuso G, Lejeune M, Ansseau M: Cigarette smoking and attention: processing speed or specific effects? *Psychopharmacology (Berl)* 2001; 155(4): 372–8.
- Sommese T, Patterson JC: Acute effects of cigarette smoking withdrawal: a review of the literature. *Aviat Space Environ Med* 1995; 66(2): 164–7.
- Tetzlaff K, Theysohn J, Stahl C, Schlegel S, Koch A, Muth CM: Decline of FEV1 in scuba divers. *Chest* 2006; 130(1): 238–43.
- Winn DM: Epidemiology of cancer and other systemic effects associated with the use of smokeless tobacco. *Adv Dent Res* 1997; 11(3): 313–21.

37. Coffey SF, Lombardo TW: Effects of smokeless tobacco-related sensory and behavioral cues on urge, affect, and stress. *Exp Clin Psychopharmacol* 1998; 6(4): 406–18.
38. Office of Applied Studies (OAS): Results from the 2007 National Survey on Drug Use and Health: national findings (Office of Applied Studies, NSDUH Series H-34, DHHS Publication No. SMA 08-4343). Rockville, MD, Office of Applied Studies, 2008.
39. Robins LN, Helzer JE, Davis DH: Narcotic use in Southeast Asia and afterward: an interview study of 898 Vietnam returnees. *Arch Gen Psychiatry* 1975; 32: 955–61.
40. Bray RM, Marsden ME, Mazzuchi JF, Hartman RW: Prevention in the military. In: *Prevention and Societal Impact of Drug and Alcohol Abuse*. Edited by Ammerman RT, Ott PJ, Tarter RE. Mahwah, NJ, Lawrence Erlbaum Associates, 1999.
41. Department of Defense: Directive no. 1010.4: alcohol and drug abuse by DoD personnel. 1010.4 supersedes and cancels August 25, 1980, version of Directive No. 1010.4 and September 23, 1985, version of Directive No. 1010.3. Washington, DC, Department of Defense, September 3, 1997.
42. Department of Defense: Urinalysis (Drug Test) Program. Washington, DC, Department of Defense. Available at <http://usmilitary.about.com/od/therorderlyroom/l/bldrugtests.htm>; accessed May 6, 2010.
43. Peterson AL, Goodie JL, Satterfield WA, Brim WL: Sleep disturbance during military deployment. *Mil Med* 2008; 173(3): 230–5.
44. Pi-Sunyer FX: Medical hazards of obesity. *Ann Intern Med* 1993; 119(7, Pt. 2): 655–60.
45. U.S. Department of Health and Human Services/U.S. Department of Agriculture (HHS/USDA): Dietary guidelines for Americans. Washington, DC, U.S. Government Printing Office, 2005.
46. Paffenbarger RS, Hyde RT, Wing AL, Hsieh CC: Physical activity, all-cause mortality, and longevity of college alumni. *N Engl J Med* 1986; 314: 253–87.
47. Piani AL, Schoenborn CA: Health promotion and disease prevention: United States, 1990 (Vital and Health Statistics, Series 10: data from the National Health Survey, No. 185; DHHS Publication No. PHS 93-1513). Hyattsville, MD, National Center for Health Statistics, 1993.
48. Siscovick DS, LaPorte RE, Newman JM: The disease-specific benefits and risks of physical activity and exercise. *Public Health Rep* 1985; 100: 180–8.
49. U.S. Department of Health and Human Services: Physical activity and health: a report of the Surgeon General (S/N 017-023-00196-5). Atlanta, GA, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
50. Taylor CB, Sallis JF, Needle R: The relation of physical activity and exercise to mental health. *Public Health Rep* 1985; 100: 195–202.
51. Vanderburgh PM, Crowder TA: Body mass penalties in the physical fitness tests of the Army, Air Force, and Navy. *Mil Med* 2006; 171(8): 753–6.
52. Bedno SA, Li Y, Han W, et al: Exertional heat illness among overweight U.S. Army recruits in basic training. *Aviat Space Environ Med* 2010; 81(2): 107–11.
53. Romero-Corral A, Somers VK, Sierra-Johnson J, et al: Accuracy of body mass index in diagnosing obesity in the adult general population. *Int J Obes* 2008; 32(6): 959–966.
54. Bedno SA, Lang CE, Daniell WE, Wiesen AR, Datu B, Niebuhr DW: Association of weight at enlistment with enrollment in the army weight control program and subsequent attrition in the assessment of recruit motivation and strength study. *Mil Med* 2010; 175(3): 188–93.
55. Niebuhr DW, Scott CT, Li Y, Bedno SA, Han W, Powers TE: Preaccession fitness and body composition as predictors of attrition in U.S. Army recruits. *Mil Med* 2009; 174(7): 695–701.
56. Ancoli-Israel S, Roth T: Characteristics of insomnia in the United States: results of the 1991 National Sleep Foundation Survey. *Sleep* 1999; 22(Suppl. 2): S347–53.
57. Morin CM, LeBlanc M, Daley M, Gregoire JP, Merette C: Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. *Sleep Med* 2006; 7: 123–30.
58. Davis J, Wright D: Randomized clinical trial for treatment of chronic nightmares in trauma-exposed adults. *J Trauma Stress* 1997; 20(2): 123–33.
59. Edinger JD, Wohlgenuth WK, Radtke RA, et al: Cognitive behavioral therapy for treatment of chronic primary insomnia: a randomized controlled trial. *JAMA* 2001; 285(14): 1856–64.
60. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ: The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989; 28(2): 193–213.
61. Hoddes E, Zarcone V, et al: Quantification of sleepiness: a new approach. *Psychophysiology* 1973; 10(4): 431–6.
62. Hryshko-Mullen AS, Broeckl LS, Haddock CK, Peterson AL: Behavioral treatment of insomnia: the Wilford Hall insomnia program. *Mil Med* 2000; 165(3): 200–7.
63. Patra S, Telles S: Heart rate variability during sleep following the practice of cyclic meditation and supine rest, *Appl Psychophysiol Biofeedback* 2009; Oct 17.
64. Dingemans J: Pharmacotherapy of insomnia: practice and prospects. *Pharm World Sci* 1995; 17: 67–75.
65. McLay RN, Spira JL: Use of a portable biofeedback device to improve insomnia in a combat zone. *Appl Psychophysiol Biofeedback* 2009; 34(4): 319–21.
66. Bray RM, Spira JE, Lane M: The single service member: substance use, stress and mental health issues. In: *Military Families under Stress*. Edited by Wadsworth SM, Riggs D. New York, Springer. (in press).
67. Green KJ, Hunter C, Bray RM, Pemberton MR, Williams J: Peer and role model influences for cigarette smoking in a young adult military population. *Nicotine Tob Res* 2008; 10: 1533–41.
68. Hoge CW, Auchterlonie JL, Milliken CS: Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA* 2006; 295(9): 1023–1032.
69. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL: Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med* 2004; 351: 13–22.
70. Baker III FW: DoD Changes Security Clearance Question on Mental Health. Department of Defense American Forces Press Service: 2008. Available at <http://www.defense.gov/news/newsarticle.aspx?id=49735>.
71. Adler AB, Bliese PD, McGurk D, Hoge CW, Castro CA: Battlemind debriefing and Battlemind training as early interventions with soldiers returning from Iraq: randomization by platoon. *J Consult Clin Psychol* 2009; 77(5): 928–40.
72. Adler AB, Castro CA, McGurk D: Time-driven Battlemind psychological debriefing: a group-level early intervention in combat. *Mil Med* 2009; 174(1): 21–8.
73. Krueger GP: Environmental medicine research to sustain health and performance during military deployment: desert, arctic high altitude stressors. *J Therm Biol* 1993; 18(5-6): 687–90.
74. Thomas R, McManus JG, et al: Ocular injury reduction from ocular protection use in current combat operations. *J Trauma* 2009; 66(4, Suppl): S99–103.
75. Jones BH, Perrotta DM, Canham-Chervak ML, Nee MA, Brundage JF: Injuries in the military: a review and commentary focused on prevention. *Am J Prev Med* 2000; 18(3, Suppl. 1): 71–84.
76. Krahll PL, Jankosky CJ, Thomas RJ, Hooper TI: Systematic review of military motor vehicle crash-related injuries. *Am J Prev Med* 2010; 38(Suppl. 1): S189–96.
77. Armed Forces Health Surveillance Center (AFHSC): Motor vehicle-related deaths, U.S. Armed Forces, 2009. *MSMR* 2010; 17: 2–5.
78. Hooper TL, DeBakey SF, Bellis KS, et al: Understanding the effect of deployment on the risk of fatal motor vehicle crashes: a nested case-control study of fatalities in Gulf War era veterans, 1991–1995. *Accid Anal Prev* 2006; 38: 518–25.

79. Gackstetter G, DeBakey S, Cowan D, et al: Fatal motor vehicle crashes among veterans of the Gulf War era: a nested case-control study. *Ann Epidemiol* 2006; 12: 509–10.
80. USACHPPM: Technical Guide 230, Chemical Exposures Guidelines for Deployed Military Personnel. Aberdeen Proving Ground, MD, USACHPPM, 2003.
81. Hauschil VD, Lee AP: Assessing chemical exposures during military deployments. *Mil Med* 2004; 169(2): 142–6.
82. Miller RD, Roberts WC: Environmental Health. Washington, DC, Office of the Surgeon General, 2003.
83. White MR, McNally MS: Morbidity and mortality in U.S. Navy personnel from exposures to hazardous materials, 1974–85. *Mil Med* 1991; 156(2): 70–3.
84. Duplessis CA, Gumpert B: Inhalational diesel exhaust exposure in submariners: observational study. *Mil Med* 2008; 173(7): 671–6.
85. Fechter LD, Chen GC, et al: Chemical asphyxiants and noise. *Noise Health* 2002; 4(14): 49–61.
86. Kauvar DS, Baer DG: Effect of a targeted education intervention on the incidence of waste-burning injuries in a military population. *J Burn Care Res* 2009; 30(4): 700–4.
87. Sanders JW, Putnam SD, et al: The epidemiology of self-reported diarrhea in operations Iraqi Freedom and Enduring Freedom. *Diagn Microbiol Infect Dis* 2004; 50(2): 89–93.
88. Centers for Disease Control and Prevention (CDC): Carbon monoxide poisoning deaths associated with camping—Georgia, March 1999. *MMWR* 1999; 48: 705–6.
89. Olson R, Grosshuesch A, et al: Observational learning and workplace safety: the effects of viewing the collective behavior of multiple social models on the use of personal protective equipment. *J Safety Res* 2009; 40(5): 383–7.
90. Cook GC: Influence of diarrhoeal disease on military and naval campaigns. *J R Soc Med* 2001; 94(2): 95–7.
91. Murray CK, Horvath LL: An approach to prevention of infectious diseases during military deployments. *Clin Infect Dis* 2007; 44(3): 424–30.
92. Sanders JW, Putnam SD, et al: Impact of illness and non-combat injury during Operations Iraqi Freedom and Enduring Freedom (Afghanistan). *Am J Trop Med Hyg* 2005; 73(4): 713–9.
93. Gupta RK, Robert LL. et al: Arthropods of military importance. Washington, DC, Office of the Surgeon General, 2003.
94. Army Medical Surveillance Activity (AMSA): Leishmaniasis in relation to service in Iraq/Afghanistan, US Armed Forces, 2001–2006. *MSMR* 2007; 14: 2–5.
95. Curtis V, Cairncross S: Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet Infect Dis* 2003; 3(5): 275–81.
96. Ryan M, Christian RS, Wohlrabe J: Handwashing and respiratory illness among young adults in military training. *Am J Prev Med* 2001; 21: 79–83.
97. AFPMB: Technical Guide No. 36, Personal protective measures against insects and other arthropods of military significance. Washington, DC, Department of Defense, 2009.
98. Surgeoner BV, Chapman BJ, et al: University students' hand hygiene practice during a gastrointestinal outbreak in residence: what they say they do and what they actually do. *J Environ Health* 2009; 72(2): 24–8.

Medical and Environmental Fitness

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ABSTRACT Total force fitness is an emerging concept defined as a state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions. Medical and environmental fitness are two of the component domains in the total force fitness framework. These domains have purposely been combined as they are inextricably intertwined: a warfighter must be able to function, free of any anticipated medical condition that could compromise either individual or unit effectiveness, while potentially confronting multiple environmental challenges. Medical fitness, best described as a state of general mental and physical well-being, is determined by medical metrics. Environmental fitness is defined as the ability to perform mission-specific duties in any environment and withstand the multiple stressors of deployment and war. This article defines the domains of medical and environmental fitness, describes the benefits of a medically and environmentally fit force, and identifies current and future metrics to assist in future programming.

INTRODUCTION

The United States is currently engaged in multiple conflicts resulting in unparalleled force operational demands. In addition, the term “the long war,” coined by Gen. John Abizaid in 2006, then U.S. Central Command (CENTCOM) commander, underscores the fact that our current adversary is engaged in a generational conflict that will continue to challenge our nation’s military.¹ Units, commanders, warfighters, and families have and continue to endure multiple deployments as they answer the call to serve our nation. The operational tempo has additionally translated into an increase in morbidity and mortality at home and abroad, in particular with regard to psychological casualties secondary to post-traumatic stress and suicide.² Such events demand the Department of Defense (DoD) to reassess its definition of fitness as our need for well-trained and “totally fit” warfighters has never been greater. A model or framework that embraces every aspect of the warfighter’s health and performance, as well as that of his/her family, community, and unit is requisite for force health protection. Thus, the concept of total force fitness for the 21st century is envisioned.

A concept comparable to total fitness is also emerging throughout the civilian sector wherein medical facilities are merging with fitness facilities to holistically integrate healthy behaviors and lifestyles, to include diet and exercise, as part of the overall treatment of disease. As the health-challenged civilian and military populations expand, the management and prevention of both acute and chronic health conditions has become increasingly critical. Only with a clearly identified conceptual framework of total fitness, with standards, guidelines, and organizationally derived metrics, will we be able to

meet the challenge of force health protection. This article, one in a series of papers prepared in response to the conference on total fitness, addresses the domains of medical and environmental fitness and their contribution to total fitness for the 21st century warfighter.

OPERATIONAL DEFINITIONS OF MEDICAL AND ENVIRONMENTAL FITNESS

The medical and environmental fitness domains have been combined for the purpose of this review, because the two are inextricably intertwined: a warfighter must be able to function, free of any anticipated medical condition or predisposition that could impair or compromise both individual and unit effectiveness over the duration of a deployment, which may present a combination of multiple environmental challenges. Accordingly, military medical and environmental fitness, as two domains of total fitness, integrate measures of mental and physical well-being as a function of environment.

Medical fitness is defined as a condition of mental and physical well-being as determined by medical metrics that establish prerequisites for individual mission accomplishment and worldwide deployability. The goal of medical fitness is to determine whether an individual warfighter is fit to perform his or her job without risk to himself or others and to ascertain whether the warfighter has the physiological and psychological capacities to adapt to their specific occupational environment. The categories that establish medical fitness are both service and military occupation specialty (MOS) specific, but generally include the following: wellness; immunizations; behavioral and disease risk factors; disease surveillance; chemoprophylaxis; and personal protection, e.g., inserts in a mask to accommodate for vision.

Environmental fitness is defined as the ability to perform mission-specific duties in any environment and withstand the multiple stressors of deployment and war. Many theater-specific environmental stressors can be identified, assessed, and mitigated before deployment. These stressors are typically

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categorized by their physical, chemical, or biological parameters and include heat, cold, altitude, ionizing radiation, noise, hazardous chemicals, ultrafine particulate matter, as well as biologic agents in food, water, or other media.³ Mitigation of these stressors can improve the environmental fitness of a military unit.

Risk associated with each parameter and their potential interactions are difficult to quantify and present additional challenges that cannot be fully resolved before deployment. Additionally, training for one particular environment may compromise performance in another.⁴

DEFINITION AND DESCRIPTION OF THE COMPONENTS

The primary components of military medical fitness include medical, dental, and psychological readiness. Medical fitness specifically establishes the following for the individual warfighter:

- Free of contagious diseases that would likely endanger the health of other personnel.
- Free of medical conditions or physical defects that would require excessive lost duty time for treatments or hospitalization or would likely result in separation from the Army for medical unfitness.
- Medically capable of satisfactorily completing any and all required training.
- Medically capable of performing duties without aggravation of existing physical defects or medical conditions.

Environmental fitness is composed of physiological readiness and personal protection preparing warfighters to optimally perform military missions while encountering various environmental stressors typically classified as:

- Physical (temperature, altitude, noise, and radiation).
- Biological (food, water, and vector-borne disease).
- Chemical (food, water, and occupational and environmental contaminants).

Varied environmental conditions may require specific physiological and behavioral adaptations as well as personal protective equipment and training to achieve or sustain optimal environmental fitness. Typical actions taken to improve environmental fitness in military deployments include: proper use of vision and hearing protection, DoD insect repellent system, water purification techniques, and physiological adaptations to the environment through acclimatization, acquired tolerance, and acquired cross-tolerance.

Acclimatization is an adaptive process that reduces the physiological strain produced by the environmental stressor(s) and enhances sustainment of cognitive and physical performance.^{5–11} The term acclimation is also typically used to describe a change in only one environmental factor under laboratory conditions, while acclimatization occurs under natural conditions and the full range of changing environmental factors.⁷ Whereas acclimatization typically refers to both

physiologic and behavioral adaptations, “acquired tolerance” refers to upregulation of selective cellular processes that help an organism adapt to and be protected against environmental stressors.^{12–20} The concept, although derived primarily from studies of thermotolerance in plants,^{12,13} also applies to other conditions, such as acquiring the ability to survive in conditions of limited oxygen supply.^{21,22} Finally, cross-tolerance refers to exposing or adapting an organism to one stressor and having those adaptations serve as protection against the insults of a novel stressor, without prior exposure to that new stressor.^{14–20} Importantly, the concepts of acquired and cross-tolerance are relatively new to human physiology under environmental conditions.

OUTCOMES/BENEFITS OF MEDICAL AND ENVIRONMENTAL FITNESS

The principal benefit to having medically and environmentally fit warfighters is maximizing an operational commander’s ability to accomplish the mission. An accurately performed assessment of military medical and environmental fitness can discriminate between those individuals who can participate effectively in accomplishing the unit stated mission, those who cannot, and those who might become a risk for others in the occupational or deployed environment. Proper identification of potential problems can lead to effective prevention and intervention strategies and directly translate into lower rates of disease/nonbattle injury and theater evacuation rates. Two secondary outcomes would include the availability of baseline health data for future health surveillance programs and a prediction of future health care costs.

CURRENT AND FUTURE METRICS FOR MEDICAL AND ENVIRONMENTAL FITNESS

Current Metrics

Medical Fitness

The military medical system routinely utilizes metrics to both assess and select warfighters, essentially quantifying medical fitness and/or establishing medical readiness. Medical fitness metrics are intended to establish prerequisites for individual mission accomplishment and worldwide deployability under any and all environmental conditions. Military medical metrics are published and updated regularly by each service in the form of military regulations or instructions, e.g., Army AR 40-501 Standards of Medical Fitness.²³ In addition, health affairs and theater commands publish and regularly update deployment medical standards and metrics.^{24,25} Military metrics used to establish medical fitness include, but are not limited to, those items identified in Table I. In addition to individual warfighter medical metrics, the military medical system utilizes system metrics to assess community access standards, e.g., balanced score cards. An individual warfighter cannot optimally function in a deployed environment without the knowledge that his family members are being adequately cared for in a timely manner.

TABLE I. Military Medical Metrics

Medical Nondeployable Profile ^a
DNA Sample in Storage
Dental Readiness
HIV Free
Immunization Profile
Limited Duty Profile (as indicated by no. 1, but of a transient nature)
Periodic Health Assessment
Vision Readiness
Hearing Readiness
Pregnancy

^aSix factors are utilized and rated 1–4 in the Army to account for general physical capacity, upper extremities, lower extremities, hearing, eyes, and psychiatric. A rating of 3 or 4 indicates a significant limitation that may affect deployability.

Environmental Fitness

Metrics for assessing environmental fitness are currently incompletely defined for most environments, with the exception of risk factors or previous personal or family history of environmental injury (e.g., heat stroke). Commanders and warfighters presently rely on published technical bulletins and guides to mitigate physical, biological, and chemical environmental hazards and maximize operational effectiveness in varied environments.^{26–28} DoD instruction 6490.03 requires service members be trained on theater-specific environmental stressors.²⁹ However, definitive metrics or environmental fitness and exposure biomarkers for many environmental stressors such as hazardous chemicals, heat, altitude, cold tolerance, or the degree of acclimatization are needed.³⁰

Future Metrics

Medical Fitness

A large number of metrics currently exist for assessing medical fitness so the challenge will be in determining which ones are critical for evaluating total fitness and then streamlining and building the assessment on the basis of evidence that meets the goals for the evaluation. Traumatic brain injury is presently one of the signature wounds of the current conflicts in the Middle East, and accordingly there is great interest in developing valid tools for baseline neurocognitive assessments before deployment. The military is currently implementing and studying such tools as the Automated Neuropsychological Assessment Metrics (ANAM) and Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT). The ANAM traumatic brain injury battery consists of six performance tests and two subjective scales. Vincent et al.³¹ recently published standard reference values in a sample of healthy active duty soldiers ($N = 5,247$) who had taken the ANAM as part of a concussion surveillance program.

Environmental Fitness

Metrics for physical, chemical, and biological parameters, to include thermal, hypobaric, hyperbaric, chemical sensitivity, and acclimatization, are needed. These future metrics may

include functional outcomes, such as physiological measures and/or environmental exposure dose/duration relationships, training history, and new biomarkers.

Thermal metrics are urgently needed given the fact that current deployment environments place warfighters in environmental extremes. One potential metric for cold and heat tolerance/acclimatization is the degree of discomfort or distress experienced by the person when exposed to a standardized environmental condition,⁷ but such subjective measures are imprecise and at best unreliable. Another currently available metric that may have merit, but has had limited use, is the physiological strain index (PSI), which is calculated on the basis of heart rate and rectal temperature changes during exposure to warm conditions.^{32,33} The PSI has promise as a metric because it combines physiological systems and is evidence based.^{32,33} The best characterized biomarker for acquired thermotolerance is production of heat shock proteins (HSPs), which are functionally linked to cellular chaperone activities and homeostasis.^{13,14,20,34,35} Although several of the HSPs have been shown to increase with heat acclimation,³⁵ tremendous variability exists and no standard protocols are available.

With regard to altitude, studies in cultured cells and genetic mouse models indicate cells can undergo multiple adaptations that allow them to function under hypoxic conditions.¹⁰ These findings in cells and mice must be evaluated as a function of whole-body physiology and acclimatization to altitude before metrics will be available. Metrics for predicting Gz tolerance and sustainment of +Gz tolerance after a layoff from flying are needed in the future.^{36–38} Research being conducted by Mikuliczyn et al.³⁹ found that a 2- to 4-week lay-off from flying significantly decreased +Gz tolerance, however definitive metrics were not provided.

Additional research is ongoing in the area of hyperbaric metric determination. Pontier et al.¹¹ recently showed venous bubble formation by pulsed Doppler at selected time intervals upon surfacing from a hyperbaric exposure was reduced after repeated scuba dives and regular physical activity; they postulated that this reduction was likely to protect against decompression sickness risk. Thus, bubble formation is being investigated as a diving metric.

Tufts et al.⁴⁰ reviewed various metrics of auditory fitness and concluded that any metric determining auditory fitness for duty should first establish the relationship between performance on the test and occupational performance. Despite the goal of identifying all possible deployment environmental factors and developing internal service member adaptations to increase the ability to perform mission-specific duties in any environment, there are times when protection from exposure is required, for example, proper use of combat hearing protection to decrease the risk of tympanic membrane perforation from improvised explosive device blast overpressure.⁴¹ Physiologic adaption to impulse noise at these levels is not possible, making exposure risk identification and primary prevention key to preserving operational readiness.

Finally, new advances in molecular studies that use genomics, proteomics, and metabolomics hold great promise for yielding environmental fitness and exposure biomarkers across the physical, chemical, and biological domains. Several studies have elucidated genomic responses to heat acclimation^{14,15} and more are expected. Likewise metabolomics, the scientific field concerned with quantifying naturally occurring, low molecular weight organic metabolites within a cell, tissue, or biofluid,⁴² offer prospects for environmental biomarkers.^{42–45} The Centers for Disease Control and Prevention recently released the Fourth National Report on Human Exposure to Environmental Chemicals measuring biomarkers for 212 chemicals in blood and urine from respondents to the National Health and Nutrition Examination Survey.⁴⁶ Storage of pre- and postdeployment sera for all service members at the DoD Serum Repository allow opportunities for potential future environmental fitness serum-specific biomarkers spanning a service member's entire career.⁴⁷ Within the plant and animal arenas, environmental metabolomics, or the "application of metabolomics to characterize the interactions of organisms with their environment," is rapidly expanding^{42,48} with particular emphasis on temperature, light, and circadian rhythms. Although we are not yet as sophisticated in the environmental metabolomics of humans, evidence and lessons learned from this discipline may be useful in the future.

Finally, acclimation to heat, and possibly other environmental conditions, involves an acute, transient, disturbed phase followed by a longer period during which cellular homeostasis begins to develop. A systems biology approach will greatly enhance our understanding of individual functioning and provide an integrated perspective on stress responses as we seek to delineate the time- and tissue-dependent nature of adaptive responses to environmental stressors.

STRENGTH OF EVIDENCE FOR MEDICAL AND ENVIRONMENTAL FITNESS

Medical Fitness Metrics

The medical fitness domain involves multiple components to answer the question of whether the warfighter is medically fit. These components principally include immunizations, chemoprophylaxis against disease, periodic health assessments, hearing and vision assessments, dental health, and a behavioral health assessment. To date the multiple components and metrics are not evidence based, with perhaps one exception: vaccination and chemoprophylaxis to protect against infectious disease.

With regard to vaccinations, the U.S. military has a long history of immunizing warfighters to maintain their health and enhance the success of their missions.^{49–51} In the current theater of operations treating warfighters with medications to prevent malaria has been a major concern. This strategy is critical, as the consequences of malaria are devastating to the unit and individual. Multiple reports have noted the consequences of not taking malaria prophylaxis or utilizing effective

vector control methods.⁵² Systematic reviews have unequivocally concluded that malaria prophylaxis is not only efficacious, but safe, and clearly assists in maintaining force readiness.⁵³

Occupational medicine communities have examined the scientific basis and effectiveness of pre-employment examinations, which are relevant to medical fitness, and have concluded that evidence demonstrating beneficial outcomes is lacking.^{54–56} Their consensus was that medical conditions do not determine fitness for work, with the exception of selected psychiatric conditions.^{55,56} The Royal Netherlands Army developed a new fitness examination system based on assessing an individual's ability to meet the task-specific requirements of their jobs and compared it to their ongoing system, which focused on diagnosis and detection of diseases and infirmities.^{54,56–58} They found the new system of assessing fitness for work was a better predictor of work days lost, future health outcomes, and health care costs than medical diagnoses.^{54,57,58}

A recently published review of medical evacuation diagnoses from both Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) highlights the high rates of disease nonbattle injury (DNBI) rates, in particular musculoskeletal and connective tissue disorders. The commentary specifically identifies the requirement for primary preventive measures, which would certainly include insuring optimal physical fitness, medical fitness, and musculoskeletal readiness, before deployment.² However, we do not have conclusive evidence identifying appropriate screening metrics.

Environmental Metrics

No specific metrics are currently available to assess fitness for the environmental condition where a service member will deploy; however, completion of environmental health training has been associated with decreased rates of diarrheal diseases and leishmaniasis in OIF and OEF^{51,59} as well as febrile respiratory illness in military recruits.⁶⁰

Unlike most environmental stressors, physiological evidence for environmental acclimatization is clear.^{5–7,10,11,17,61,62} For example, successive exposure to heat results in lower body temperatures and heart rate and greater sweating rates during exercise-heat stress than before exposure.^{5,6,61,63} Resting heat exposure and a high degree of physical fitness each confer partial heat tolerance.^{61,64} Additionally, dynamic intermittent hypoxic training conferred acclimation to various altitudes as indicated by higher arterial oxygen saturation than before exposure.⁶² Importantly, substantial evidence demonstrates that physiologic and cellular adaptations to any environment are lost over time,^{39,65,66} and different metrics may be required for each condition.

Phenomena that will be important in the future are acquired and cross-tolerance, which are mediated by multiple molecular changes.^{10,12,13,22,35,43,67,68} In particular, heat acclimation and hypoxic preconditioning may confer protection and accelerate repair from thermal, hypoxic, and oxidative stresses.^{8,14–20,69} Examples of acquired cross-tolerance

from these exposures include improved cognitive performance and improved blood–brain barrier integrity following closed head injury, reduced myocardial damage following ischemia, sustained immune function, or hypoxia.^{18–20,22,68,70,71} The resulting cellular changes allow a person to survive an exposure that would otherwise be lethal. Lastly, one study has shown cross-tolerance of intermittent hypoxia alone to cold tolerance at sea level.⁸ However, as noted above, the precise time course of acquired tolerance induction, persistence, and decay are not fully understood, nor are all of the cellular mechanisms mediating this adaptive response. The links between physiological function and molecular expression of protective effects are just beginning to be understood and this must happen before evidenced-based metrics become available.

Summary of Metrics

All metrics for assessing medical and environmental fitness should be appropriate, specific to occupational requirements of the individual warfighter, and cost effective. Moreover, they should be valid and have known specificities. In a systematic review Serra et al.⁷² defined assessment of fitness for work “as the evaluation of the individual’s capacity to work without risk to their own or others’ health and safety.” Medical fitness currently seeks to assess each warfighter in an effort to prevent future health and safety risks for the warfighter, commander, and unit. However, no evidence indicates it is cost effective to examine each and every worker.⁷² Clearly an examination of the metrics used in our current system is needed.

CURRENT PROGRAMS AND RESOURCES

Health Affairs regularly publishes and updates critical documents that pertain specifically to determining warfighter medical fitness and readiness for deployment.²⁴ A second critical resource document for establishing warfighter medical fitness is Modification 9 to USCENTCOM Individual Protection and Individual/Unit Deployment Policy.²⁵ This document, which pertains specifically to medical fitness in CENTCOM, is currently used by medical providers to establish who is medically fit to deploy to the current theater of war operations, and the required medical protections, e.g., malaria prophylaxis, medications, routine immunizations, protective eyewear, etc. Medical fitness for deployment additionally includes dental and psychological health.

Each service maintains individual regulations and instructions for establishing medical fitness and unique tracking systems that assist in establishing individual warfighter and unit medical fitness. These database systems (e.g., Army utilization of The Medical Protection System/MEDPROS; Air Force utilization of Preventive Health Assessment and Individual Medical Readiness/PIMR; Navy utilization of Medical Readiness Reporting System/MRRS) integrate multiple factors to determine an individual’s medical fitness and ultimately medical readiness for deployment. The systems

also assist in integrating the data of an entire unit for a commander or unit surgeon to assess medical fitness and readiness for deployment. Published medical technical bulletins (TB-MED) and technical guides (TG) addressing physical, chemical, and biological stressors are available to assist warfighters, providers, and commanders to enhance environmental fitness.⁷³

Programs for the Future

Warfighter medical and environmental fitness, as previously described, requires an integrated system to answer one question for the commander: Will the warfighter, with established metrics, be medically able to operate and be effective on the battlefield when confronted with multiple environmental exposures? We believe the services currently do an excellent job of applying medical metrics to address the aforementioned question; as previously described, however, environmental metrics are distinctly lacking at this time.

The current operational tempo, as well as ongoing and emerging medical and environmental challenges have created new requirements that urgently need to be addressed. For example, as illustrated by Cohen et al.,² more work is needed in the area of risk factor analysis to assess the musculoskeletal system for hardiness against injury. Hearing screening is part of medical fitness and protective measures are in place with documented readiness and healthcare cost benefits.⁷⁴ However, quantifying biomarkers for other components of environmental fitness need baseline and prospective measures of environmental chemical, biological, and physical exposure to identify threats and test environmental fitness interventions. In addition, we have little to no insight into how to quantify when an individual has recovered or “reset” from the rigors of a deployment. No task-specific baseline functional assessments are included in our assessment, yet evidence confirms that work-specific task metrics are critical fitness-for-duty measures.^{48–52} Research is also needed to elucidate whether interventions in the literature for preventing or mediating neurocognitive and traumatic injuries in animals^{17,18,62} are effective in humans. If so, new evidence-based programs can be developed. As previously identified, we lack programs that medically assess environmental hardiness for single, much less for multiple physical, chemical, or biological exposures. Finally, no integrated checklists exist that review utilization of targeted strategies for human performance optimization, e.g., sleep strategies, or omega-3 fatty acid supplementation for neural/joint protection. Overall, much work is needed to accurately assess both medical and environmental fitness.

A COMMANDER’S “TOTAL FORCE FITNESS CHECKLIST”

The authors’ assessment is that current service database systems, as previously described, offer useful models for a potential commander’s checklist. These database systems integrate multiple factors to determine an individual’s medical

TABLE II. Commander's Medical and Environmental Fitness Checklist

Periodic Health Assessment to Include DNA
Disease Surveillance to include HIV/TB
Routine Immunizations
Chemoprophylaxis
Dental Readiness
Vision Readiness
Hearing Readiness
Baseline Neurocognitive Assessment
Training (Medical Threat, Field Sanitation)
Risk Factor Assessment (Disease and Injury)
Family History
Nutrition
Behavioral
Prior Environmental Injury (Heat, Cold)
Mission Targeted Human Performance Optimization Assessment
Supplements/Nutraceuticals
Drugs
Techniques (Acclimatization)
Machines
Equipment/Supplies (Personal Protective Equipment)

fitness and ultimately medical readiness for deployment. The first author's personal communication with the MEDPROS staff has identified that the system is largely untapped. The traffic-light approach used by MEDPROS is simple and effective with red, amber, and green indicating states of fitness/readiness. The authors could envision traffic lights for medical and environmental fitness metrics as well as the other fitness domains, which would be integrated and interactive depending upon the specific deployment situation/environment, e.g., green for Panama, red for Afghanistan because immunizations or altitude acclimatization are not appropriate for the environment. A potential subchecklist that details the medical and environmental fitness elements is listed in Table II.

RECOMMENDATIONS

Creating one standard database system for all services would be beneficial and would be particularly important to commanders of joint commands, who presently need to utilize multiple systems to assess the health of their personnel. The task of moving back and forth between data bases can be difficult, time consuming, and ultimately detrimental to operational readiness. Such a system, if accessible by medics and the line, would allow all services and component commanders (COCOMs) to easily add and track medical indicators and identify real-time changes in individual and collective high-risk behaviors that might require interventions. The minimum standard in such a system could be a Department of Defense definition of fully medical ready (FMR). This metric would ensure a high likelihood of maintaining a state of health that would allow mission accomplishment, worldwide deployability, and a low likelihood of being medically evacuated for DNB.

Specific metrics to be considered in the future for assessing medical and environmental fitness as components of warfighter total fitness could include the following:

- The medical status/fitness of family members should be considered for development and incorporation into the individual's medical fitness assessment.
- The AUDIT C for alcohol screening, rates of alcohol-related incidents (e.g., DUI/DWI, assaults, sexual assaults), and rates of tobacco use (captured in Preventive Health Assessments [PHAs] and Armed Forces Health Longitudinal Application [AHLTA]) would capture the contributions of some behaviors to medical fitness. In the case of tobacco use, these contributions include higher morbidity and mortality from H1N1, decreased cardiovascular fitness, slower wound healing, and reduced night vision.
- A body mass index (BMI) would also be a useful addition for medical fitness at the individual and aggregate levels. BMI has been consistently demonstrated to be associated with fitness, as well as risk for environmental injury.
- Sleep and recovery are important, if not critical, components of medical fitness. Restorative sleep has been associated with improved cognitive performance, improved judgment, fewer accidents, reduced obesity, inflammation, and cardiovascular disease, improved resilience, and more rapid recovery from traumatic brain injury (TBI), behavioral health problems, and injury and illness. Sleep could be measured through self-reporting, or by adding a sleep instrument, such as the Pittsburgh Sleep Quality Index (PSQI) or the Epworth Scale to the PHA, postdeployment health assessment (PDHA), and the postdeployment health reassessment (PDHRA).
- Potential future environmental readiness metrics of acclimatization could include dosage monitors and status algorithms that would automatically calculate a warfighter's risk level in a certain environment. The identification of metabolomic biomarkers might also provide insight into acquired cross-tolerance. Future research is required in this vitally important area.

REFERENCES

1. Wikipedia: The Long War, 2006. Available at http://en.wikipedia.org/wiki/Long_War; accessed November 24, 2009.
2. Cohen SP, Brown C, Kurihara C, Plunkett A, Nguyen C, Strassels SA: Diagnoses and factors associated with medical evacuation and return to duty for service members participating in Operation Iraqi Freedom or Operation Enduring Freedom: a prospective cohort study. *Lancet* 2010; 375: 301–9.
3. Lounsbury DE (editor): Textbook of Military Medicine. Washington, DC, Office of the Surgeon General, Department of the Army, 2003.
4. Fregly MJ: Cross-acclimatization between cold and altitude in rats. *Am J Physiol* 1954; 176: 267–74.
5. Bass DE, Kleeman CR, Quinn M, Henschel A, Hegnauer AH: Mechanisms of acclimatization to heat in man. *Medicine (Baltimore)* 1955; 34: 323–80.

6. Glaser EM: Acclimatization to heat and cold. *J Physiol* 1949; 110: 330–7.
7. Hellon RF, Jones RM, Macpherson RK, Weiner JS: Natural and artificial acclimatization to hot environments. *J Physiol* 1956; 132: 559–76.
8. Launay JC, Besnard Y, Guinet-Lebreton A, Savourey G: Acclimation to intermittent hypobaric hypoxia modifies responses to cold at sea level. *Aviat Space Environ Med* 2006; 77: 1230–5.
9. Leblanc J: Evidence and meaning of acclimatization to cold in man. *J Appl Physiol* 1956; 9: 395–8.
10. Murray AJ: Metabolic adaptation of skeletal muscle to high altitude hypoxia: how new technologies could resolve the controversies. *Genome Med* 2009; 1: 117.
11. Pontier JM, Guerrero F, Castagna O: Bubble formation and endothelial function before and after 3 months of dive training. *Aviat Space Environ Med* 2009; 80: 15–9.
12. Sung DY, Kaplan F, Lee KJ, Guy CL: Acquired tolerance to temperature extremes. *Trends Plant Sci* 2003; 8: 179–87.
13. Senthil-Kumar M, Kumar G, Srikanthbabu V, Udayakumar M: Assessment of variability in acquired thermotolerance: potential option to study genotypic response and the relevance of stress genes. *J Plant Physiol* 2007; 164: 111–25.
14. Horowitz M: Heat acclimation and cross-tolerance against novel stressors: genomic-physiological linkage. *Prog Brain Res* 2007; 162: 373–92.
15. Horowitz M, Eli-Berchoer L, Wapinski I, Friedman N, Kodesh E: Stress-related genomic responses during the course of heat acclimation and its association with ischemic-reperfusion cross-tolerance. *J Appl Physiol* 2004; 97: 1496–507.
16. Maloyan A, Eli-Berchoer L, Semenza GL, Gerstenblith G, Stern MD, Horowitz M: HIF-1 α -targeted pathways are activated by heat acclimation and contribute to acclimation-ischemic cross-tolerance in the heart. *Physiol Genomics* 2005; 23: 79–88.
17. Paz Z, Freeman S, Horowitz M, Sohmer H: Prior heat acclimation confers protection against noise-induced hearing loss. *Audiol Neurotol* 2004; 9: 363–9.
18. Shein NA, Horowitz M, Alexandrovich AG, Tsenter J, Shohami E: Heat acclimation increases hypoxia-inducible factor 1 α and erythropoietin receptor expression: implication for neuroprotection after closed head injury in mice. *J Cereb Blood Flow Metab* 2005; 25: 1456–65.
19. Shein NA, Horowitz M, Shohami E: Heat acclimation: a unique model of physiologically mediated global preconditioning against traumatic brain injury. *Prog Brain Res* 2007; 161: 353–63.
20. Tetievsky A, Cohen O, Eli-Berchoer L, et al: Physiological and molecular evidence of heat acclimation memory: a lesson from thermal responses and ischemic cross-tolerance in the heart. *Physiol Genomics* 2008; 34: 78–87.
21. Aragonés J, Fraisl P, Baes M, Carmeliet P: Oxygen sensors at the crossroad of metabolism. *Cell Metab* 2009; 9: 11–22.
22. Fraisl P, Aragonés J, Carmeliet P: Inhibition of oxygen sensors as a therapeutic strategy for ischaemic and inflammatory disease. *Nat Rev Drug Discov* 2009; 8: 139–52.
23. U.S. Army: Standards of Medical Fitness, 2008. Available at http://www.army.mil/usapa/epubs/pdf/r40_501.pdf; accessed February 10, 2010.
24. DeploymentSupport: Available at http://www.pdhealth.mil/dcs/pre_deploy.asp; accessed November 23, 2009.
25. U.S. Army: Modification 9 USCENTCOM Individual Protection and Individual/Unit Deployment Policy. USCENTCOM. Available at http://www.pdhealth.mil/dcs/pre_deploy.asp; accessed February 25, 2010.
26. Dot A (editor): Occupational and Environmental Health Food Sanitation, p 176. Washington, DC, DoD, 2002.
27. Butler FK Jr: Diving and hyperbaric ophthalmology. *Surv Ophthalmol* 1995; 39: 347–66.
28. Weiss M: Standards on medical fitness examinations for Navy divers. *Int Marit Health* 2003; 54: 135–43.
29. DOD: DOD Instruction, Number 6490.03 Deployment Health. Washington, DC, Department of Defense, 2006.
30. May LM, Weese C, Ashley DL, Trump DH, Bowling CM, Lee AP: The recommended role of exposure biomarkers for the surveillance of environmental and occupational chemical exposures in military deployments: policy considerations. *Mil Med* 2004; 169: 761–7.
31. Vincent AS, Bleiberg J, Yan S, et al: Reference data from the automated Neuropsychological Assessment Metrics for use in traumatic brain injury in an active duty military sample. *Mil Med* 2008; 173: 836–52.
32. Buller MJ, Latzka WA, Yokota M, Tharion WJ, Moran DS: A real-time heat strain risk classifier using heart rate and skin temperature. *Physiol Meas* 2008; 29: N79–85.
33. Moran DS, Pandolf KB, Heled Y, Gonzalez RR: Combined environmental stress and physiological strain indices for physical training guidelines. *J Basic Clin Physiol Pharmacol* 2003; 14: 17–30.
34. Horowitz M, Robinson SD: Heat shock proteins and the heat shock response during hyperthermia and its modulation by altered physiological conditions. *Prog Brain Res* 2007; 162: 433–46.
35. McClung JP, Hasday JD, He JR, et al: Exercise-heat acclimation in humans alters baseline levels and ex vivo heat inducibility of HSP72 and HSP90 in peripheral blood mononuclear cells. *Am J Physiol Regul Integr Comp Physiol* 2008; 294: R185–91.
36. Liu Y, Zhang LF, Lu HB, Zhang GP, Pu HS: Mathematical modeling of the push-pull effect for various acceleration profiles and countermeasures. *Aviat Space Environ Med* 2009; 80: 781–9.
37. van Lieshout EJ, van Lieshout JJ, Krol J, Simons M, Karemaker JM: Assessment of cardiovascular reflexes is of limited value in predicting maximal +Gz-tolerance. *Aviat Space Environ Med* 1992; 63: 21–6.
38. Zawadzka-Bartczak E, Kopka L: Tilt-table testing as a predictor of +GZ tolerance. *Indian J Med Sci* 2005; 59: 471–9.
39. Mikuliszyn R, Kowalski W, Kowalczyk K: Impact of the lay-off length on +Gz tolerance. *J Gravit Physiol* 2002; 9: 333–4.
40. Tufts JB, Vasil KA, Briggs S: Auditory fitness for duty: a review. *J Am Acad Audiol* 2009; 20: 539–57.
41. Ritenour AE, Wickley A, Ritenour JS, et al: Tympanic membrane perforation and hearing loss from blast overpressure in Operation Enduring Freedom and Operation Iraqi Freedom wounded. *J Trauma* 2008; 64: S174–8; discussion S8.
42. Viant MR: Recent developments in environmental metabolomics. *Mol Biosyst* 2008; 4: 980–6.
43. Tissot van Patot MC, Murray AJ, Beckey V, et al: Human placental metabolic adaptation to chronic hypoxia, high altitude: hypoxic preconditioning. *Am J Physiol Regul Integr Comp Physiol* 2010; 298: R166–72.
44. Miller MG: Environmental metabolomics: a SWOT analysis (strengths, weaknesses, opportunities, and threats). *J Proteome Res* 2007; 6: 540–5.
45. Rezzi S, Martin FP, Alonso C, et al: Metabotyping of biofluids reveals stress-based differences in gut permeability in healthy individuals. *J Proteome Res* 2009; 8: 4799–809.
46. CDC: Fourth National Report on Human Exposure to Environmental Chemicals, p 529. Atlanta, GA, CDC, 2009.
47. Rubertone MV, Brundage JF: The Defense Medical Surveillance System and the Department of Defense serum repository: glimpses of the future of public health surveillance. *Am J Public Health* 2002; 92: 1900–4.
48. Bundy JG, Davey MP, Viant MR: Environmental metabolomics: a critical review and future perspectives. *Metabolomics* 2009; 5: 3–21.
49. Artenstein AW: Vaccines for military use. *Vaccine* 2009; 27(Suppl 4): D16–22.
50. Grabenstein JD, Pittman PR, Greenwood JT, Engler RJ: Immunization to protect the US Armed Forces: heritage, current practice, and prospects. *Epidemiol Rev* 2006; 28: 3–26.
51. Murray CK, Horvath LL: An approach to prevention of infectious diseases during military deployments. *Clin Infect Dis* 2007; 44: 424–30.
52. Porter WD: Imported malaria and conflict: 50 years of experience in the U.S. Military. *Mil Med* 2006; 171: 925–8.
53. Nakato H, Vivancos R, Hunter PR: A systematic review and meta-analysis of the effectiveness and safety of atovaquone proguanil (Malarone) for chemoprophylaxis against malaria. *J Antimicrob Chemother* 2007; 60: 929–36.
54. de Raad J, Redekop WK: A comparison between two systems for pre-employment medical assessment in the Royal Netherlands Army by a randomized, controlled study. *Mil Med* 2004; 169: 437–43.

55. Pachman J: Evidence base for pre-employment medical screening. *Bull World Health Organ* 2009; 87: 529–34.
56. Sorgdrager B, Hulshof CT, van Dijk FJ: Evaluation of the effectiveness of pre-employment screening. *Int Arch Occup Environ Health* 2004; 77: 271–6.
57. de Raad J, Nijhuis FJ, Willems JH: Difference in fitness for duty among soldiers on a mission: can these be explained by a difference in the pre-employment assessment? *Mil Med* 2005; 170: 728–34.
58. de Raad J, Redekop WK: Analysis of health factors as predictors for the functioning of military personnel: study of the factors that predict fitness for duty and medical costs of soldiers of the Royal Netherlands Army. *Mil Med* 2005; 170: 14–20.
59. Sanders JW, Riddle MS, Tribble DR, et al: The epidemiology of self-reported diarrhea in operations Iraqi freedom and enduring freedom. *Diagn Microbiol Infect Dis* 2004; 50: 89–93.
60. Ryan MA, Christian RS, Wohlrabe J: Handwashing and respiratory illness among young adults in military training. *Am J Prev Med* 2001; 21: 79–83.
61. Pandolf KB, Burse RL, Goldman RF: Role of physical fitness in heat acclimatization, decay and reinduction. *Ergonomics* 1977; 20: 399–408.
62. Hetzler RK, Stickley CD, Kimura IF, et al: The effect of dynamic intermittent hypoxic conditioning on arterial oxygen saturation. *Wilderness Environ Med* 2009; 20: 26–32.
63. Syndham CH, Strydom NB, Morrison JF, Du Toit FD, Kraan JG: A new method of acclimatization to heat. *S Afr J Med Sci* 1954; 19: 171.
64. Pandolf KB, Stroschein LA, Drolet LL, Gonzalez RR, Sawka MN: Prediction modeling of physiological responses and human performance in the heat. *Comput Biol Med* 1986; 16: 319–29.
65. Saat M, Sirisinghe RG, Singh R, Tochihara Y: Decay of heat acclimation during exercise in cold and exposure to cold environment. *Eur J Appl Physiol* 2005; 95: 313–20.
66. Wyndham CH, Jacobs GE: Loss of acclimatization after six days of work in cool conditions on the surface of a mine. *J Appl Physiol* 1957; 11: 197–8.
67. Guy C, Kaplan F, Kopka J, Selbig J, Hinch DK: Metabolomics of temperature stress. *Physiol Plant* 2008; 132: 220–35.
68. Umschwief G, Shein NA, Alexandrovich AG, Trembovler V, Horowitz M, Shohami E: Heat acclimation provides sustained improvement in functional recovery and attenuates apoptosis after traumatic brain injury. *J Cereb Blood Flow Metab* 2010; 30: 616–27.
69. Falk B, Radom-Isaac S, Hoffmann JR, et al: The effect of heat exposure on performance of and recovery from high-intensity, intermittent exercise. *Int J Sports Med* 1998; 19: 1–6.
70. Shohami E, Novikov M, Horowitz M: Long term exposure to heat reduces edema formation after closed head injury in the rat. *Acta Neurochir Suppl (Wien)* 1994; 60: 443–5.
71. Shein NA, Tsenter J, Alexandrovich AG, Horowitz M, Shohami E: Akt phosphorylation is required for heat acclimation-induced neuroprotection. *J Neurochem* 2007; 103: 1523–9.
72. Serra C, Rodriguez MC, Delclos GL, Plana M, Gomez Lopez LI, Benavides FG: Criteria and methods used for the assessment of fitness for work: a systematic review. *Occup Environ Med* 2007; 64: 304–12.
73. DOD: Army Medical Publications, 2010. Available at <http://www.army.mil/usapa/med/index.html>; accessed April 29, 2010.
74. Ohlin D: Cost effectiveness of hearing loss prevention programs. *Proceedings of North Atlantic Treaty Organization Research and Technology Organization. RTO Lecture Series 219*, June, 2000.

Nutritional Fitness

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ABSTRACT Total force fitness is a holistic health approach to enhancing warrior health and resilience. Nutritional fitness is an essential component of total force fitness as poor nutrition degrades mission readiness and contributes to a variety of other health disorders. This article describes the components of nutritional fitness, considers ways of assessing it at both the population and individual levels, and discusses challenges that must be overcome to attain nutritional fitness. The article concludes with recommended actions for improving the nutritional fitness of the force.

INTRODUCTION

Deployment-related stressors are placing strain on our young men and women serving in the armed forces leading to compromised health.^{1,2} Adoption of a holistic approach to warrior health is being advocated to provide our military personnel with the personal attributes to cope with the emotional, intellectual, spiritual, and physical challenges associated with military service. This holistic approach has been termed total force fitness. Proper fueling of the warfighter should be considered an essential domain of total force fitness since poor nutrition degrades mission readiness and contributes to a variety of other health disorders.³

Proper nutrition prevents illness, improves health,⁴ and optimizes emotional, cognitive, and physical capabilities.^{5,6} Food confers these benefits by providing the macro- and micro-nutrients to protect against disease, support injury-healing processes, and fuel immediate bioenergetic, emotional, and spiritual needs. Yet, how (e.g., fast or slow), when, and where (e.g., alone or in a group) an individual consumes a particular meal can impact warrior fitness independent of the individual foodstuffs consumed.

The purpose of this article is to describe the components of nutritional fitness, consider ways of assessing it at both the population and individual levels, and discuss challenges that must be overcome to attain nutritional fitness. The article concludes with recommended actions for improving the nutritional fitness of the force.

NUTRITIONAL FITNESS

Nutritional fitness refers to the provision and consumption of foodstuffs in quantities, quality, and proportions sufficient to preserve mission performance and to protect against disease and/or injury. Consistent with the Joint Force Health Protection Concept of Operations, nutritional fitness optimizes wellness

for peacetime forces, maintains the health/fitness of deployed forces, and facilitates physical and mental resilience of redeployed forces. Sound nutritional fitness establishes habits that last a lifetime. As illustrated in Figure 1, nutritional fitness can be broken into three components: diet quality, healthy food choices, and specific nutritional requirements.

Diet Quality

Diet quality includes the nutritional composition of food, the impact of food preparation (e.g., cooking, storage), consumer acceptability, and the variety of food components available to accommodate personal food choices. Physical factors that hinder food availability and/or consumption (e.g., dining hall hours, availability of necessary utensils, food preparation procedures, consumption constraints, etc.) have an additional impact on diet quality. To be nutritionally fit, the right food must be available at the right time and must be consumed in the right quantities.

Healthy Food Choices

Even with proper food that is readily available, optimal nutritional fitness will not be achieved unless warriors make healthy food choices. For example, to reap the health benefits associated with regular intake of fruits and vegetables, these foods must be consumed in sufficient quantity.^{7,8} Likewise, energy intake in excess of daily requirements leads to weight gain, increased adiposity, and the adverse health consequences associated with excess body fat.^{4,9} A poorly designed diet and inappropriate use of dietary supplements can negatively impact human performance and health outcomes.^{6,10–12} Healthy ad libitum eating, therefore, is a key component of nutritional fitness, provided it is not done to excess.

Individual food choices are influenced not only by the food itself, but also by individual, cultural, and environmental factors.¹³ Food factors include portion size, appearance, labeling, packaging, presentation, variety, and sensory-specific satiety.¹³ Individual factors include age, gender, and ethnic or cultural influences. Other individual factors include the influence of marketing and education, personal food attitudes, commensality (e.g., nonobese versus obese), and interaction between foods and an individual's mood or emotions.¹³ Environmental factors include location, meal appropriateness for time of day,

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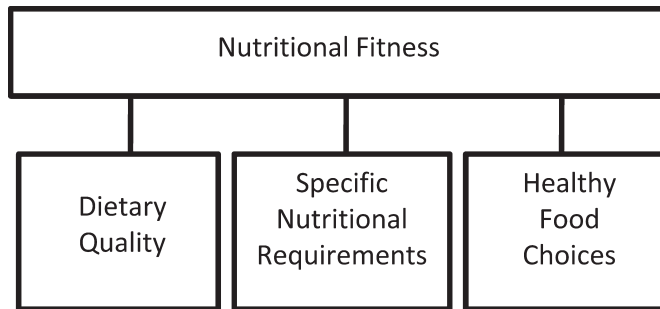


FIGURE 1. The components of nutritional fitness.

meal presentation, ambiance, convenience and access (i.e., effort and time), price, and value.¹³

Nutritional Requirements

Nutritional needs are not one size fits all. Daily fluid and energy requirements depend on body mass, physical activity, and the environment in which the work is performed.^{14–16} Water and energy requirements vary severalfold, depending on specific mission requirements.^{15–18} Micronutrient needs also vary between individuals.¹⁹ For example, women must consume considerably higher dietary iron than men to prevent development of anemia.¹⁹ To ensure optimal nutritional fitness, sufficient food and fluid to meet individual warrior needs must be readily available.

NUTRITION MATTERS

The importance of nutrition for sustaining soldier health and performance was recognized nearly 150 years ago. Dr. John Ordonaux, an Army surgeon, discussed the importance of diet in maintaining soldier health and performance, stressing the "... necessity of making the soldier's dietary an important part of the discipline of an army... [and] ... furnishing him with such qualities of aliment as will keep his physical energies always at par."²⁰ Experimental research has since characterized the energy and nutrient requirements of soldiers and the consequences of not eating enough.^{21–24} For example, a series of studies during World War II, decisively established the criticality of adequate and appropriate feeding in maintaining soldiers' ability to sustain work.²¹ In short, soldiers that were not fed well did not perform well; when adequate nutrition was restored—particularly adequate energy and carbohydrates—so too was performance. During the same time period, Adolph et al. demonstrated the adverse consequences of dehydration.²⁵ Military research has since established the unique nutritional demands imposed by environmental stress.^{26–32}

Nutrition Standards

In 1940, concerns about the nutritional status of young military enlistees, as well as Americans in general, led to the development of a Committee on Food and Nutrition—now the Institute of Medicine's (IOM) Food and Nutrition Board (FNB). This

committee was tasked with advising the government on food and nutrition problems related to national defense;²³ one of its first responsibilities was to develop a set of dietary standards to define minimum requirements and safety margins for nutrient intake, which could be used to evaluate military and civilian diets.²⁴ In 1941, the FNB approved its first set of recommendations and these standards were adopted by the military (the first National Nutrition Conference for Defense) later that year.²⁴

Since 1941, the IOM's FNB has continued to update, revise, and expand its nutrient recommendations^{23,24} to incorporate evolving knowledge of nutrient requirements for health and disease prevention; recommendations are based on the strength of evidence regarding specific nutrient deficiencies and associated adverse health outcomes (e.g., protein-calorie malnutrition, anemia, scurvy). In the mid 1990s, the IOM replaced the recommended dietary allowances with a new, broader set of guidelines called the dietary reference intakes (DRIs).

DRIs

The DRI process establishes recommended daily allowance (RDA) by reviewing the available scientific evidence. Estimated average requirements (EARs) are defined as the intake levels that would meet the requirements for half of the individuals in the population of interest, based on age and gender. These EARs, in turn, are used to establish the RDA, which is the intake sufficient to meet the nutritional requirements for 97–98% of the population. For nutrients where insufficient data are available to define an EAR and a RDA, levels of adequate intake (AI) are defined. Upper limits of nutrient intakes are also published to avoid adverse health consequences associated with excess consumption of certain nutrients. The RDA and AI values are intended as a goal for daily individual intake.

MDRIs

The military dietary reference intakes (MDRIs) are a set of guidelines designed to meet the unique nutritional needs of military personnel (e.g., higher energy expenditure and/or increased sweating secondary to differences in anthropometrics and/or activity levels).¹⁹ The Department of Defense (DoD) nutritional standards,³³ as well as the DRI documents,^{34–37} are regularly updated. The MDRIs were adapted from the DRIs,^{19,33} and for many nutrients, the standards are identical; however, for certain nutrients—notably, sodium—the MDRIs have been adjusted to account for known differences.^{19,33} Each of the services is required to meet the DoD nutritional standards in their food service programs, but may determine their own program/standard for meeting the nutrient requirements.³³ For example, Army Pamphlet 30-22, "Operating Procedures for the Army Food Program," outlines service-specific menu standards which, if followed, provide consumers the opportunity to achieve the MDRIs.³⁸

The Armed Forces Recipe Service has recipes to assist military foodservice operations in producing menu items that are both acceptable to the consumer and nutritionally adequate.

Nutrient Excesses—Too Much of a Good Thing?

Historically, military nutrition research has been concerned primarily with the adverse effects of underfeeding and of specific macro/micronutrient deficits. A new threat to nutritional fitness and force readiness has emerged, namely, overconsumption and resultant overweight/obesity.³⁹

Overweight soldiers are more susceptible to factors that would impede mission success (e.g., decreased physical endurance, higher rates of heat exhaustion and musculoskeletal injury).^{40–43} There is also a financial cost—in 2006, DoD spent an estimated \$1.1 billion in medical care costs associated with overweight and obesity; another \$167 million was incurred covering nonmedical costs related to excess weight, such as absenteeism, which has been reported to be more frequent in soldiers who are overweight or obese.⁴⁴ Annually, the DoD is discharging approximately 1,200 first-term military enlistees for being overweight.³⁹

Overweight/obesity develops as a consequence of consuming energy in excess of daily energy expenditure. While it can be debated whether the increase in prevalence has been caused by increased energy intake versus decrease in energy expenditure, it arose concurrently with increased availability and consumption of commercially prepared, energy-dense food and beverages. Weight loss strategies employing increased school-time physical activity without constraining energy intake have been unsuccessful.⁴⁵

Dietary Supplements

Dietary supplements are products that contain one or more dietary ingredients—such as vitamins, minerals, herbs, or amino acids—that are intended to supplement the diet.⁴⁶ They are popular among active duty military personnel, who commonly report using supplements to increase energy, lose weight, and/or improve performance or health;^{11,47} some individuals take supplements to compensate for an unhealthy diet.⁴⁸ Nutritional supplements may indeed be beneficial in certain circumstances. For example, caffeine may provide advantages in military jobs and duties where attentiveness is necessary (e.g., aviators, sentry duty);¹¹ supplements may also benefit individuals who are deficient in a particular nutrient (e.g., vitamin D or B12).

The consumer needs to be aware, however, that dietary supplements are only loosely regulated. Manufacturers are not required to demonstrate either efficacy or safety.⁴⁹ Furthermore, the consumer is vulnerable to poor quality control and mislabeling. There have been multiple reports of supplement contamination with controlled substances (e.g., sibutramine, ephedrine, or steroids) that have known adverse health effects.^{50–52} Still, users perceive dietary supplements to be safe.⁴⁷ As such, they may be prone to misuse these products—for example, consuming more than the recommended amount or combining multiple

supplements; and such misuse increases the chance that the user will experience undesirable side effects (e.g., bleeding, seizures).^{53,54} Improper use of dietary supplements, or inadvertent consumption of contaminants, may compromise the nutritional fitness of the warfighter.

ASSESSMENT OF NUTRITIONAL FITNESS

To adequately assess nutritional fitness, one must consider both how well the provided diet meets the needs of the community and the quality of individuals' eating behavior and nutritional knowledge.

Community Assessment—Food Environment

The Choose Healthy Options for Wellness (CHOW) and the Develop Improved Nutrition Environment (DINE) are assessment tools designed to measure the accessibility of healthy options in a military community or worksite environment (e.g., dining facilities, minimarts, vending machines, kitchen/break areas); the CHOW and the DINE are used by the U.S. Navy (USN)/U.S. Marine Corps (USMC) and the U.S. Air Force (USAF), respectively. Using a list of environmental factors and policies that would support healthy food choices, these tools identify areas that need improvement and score the facilities as being “fully,” “mostly,” or “not/partially supportive” of healthy eating. Electronic versions of the CHOW and DINE are available from the Navy and Marine Corps Public Health Center website (<http://www-nehc.med.navy.mil>).

To assess whether the food prepared in the dining facilities is sufficient to meet the population's predetermined needs, commanders can check with the installation's food program management office—or similar organization or personnel—to determine whether food preparation complies with menu standards and recipe cards. For example, in the Army, one could check with the food program manager (FPM), who maintains production schedule records indicating what foods were prepared and served for a given meal; other responsibilities of the FPM include ensuring that healthy choices are available throughout each meal and that food service personnel are trained on healthy food preparation techniques.³⁸ The Navy food management teams perform similar functions, inspecting food preparation practices on Navy vessels.

Community Assessment—Community Needs

The adequacy of the provided diet will depend on the average nutritional requirements of the population being served. The energy demands placed on warfighters varies considerably. Combat foot soldiers, for example, expend considerable energy when on patrol operations. As illustrated in Figure 2, total daily energy expenditures of combat units during training exercises ranges from 15.5 to 29.8 MJ (3,700 to 7,120 kcal/day), with the highest values occurring during cold-weather operations.¹⁶ Mission tasks may require individuals to carry heavy loads of up to 77% of body mass.⁵⁵ Conversely, some other military occupations are considerably more sedentary.

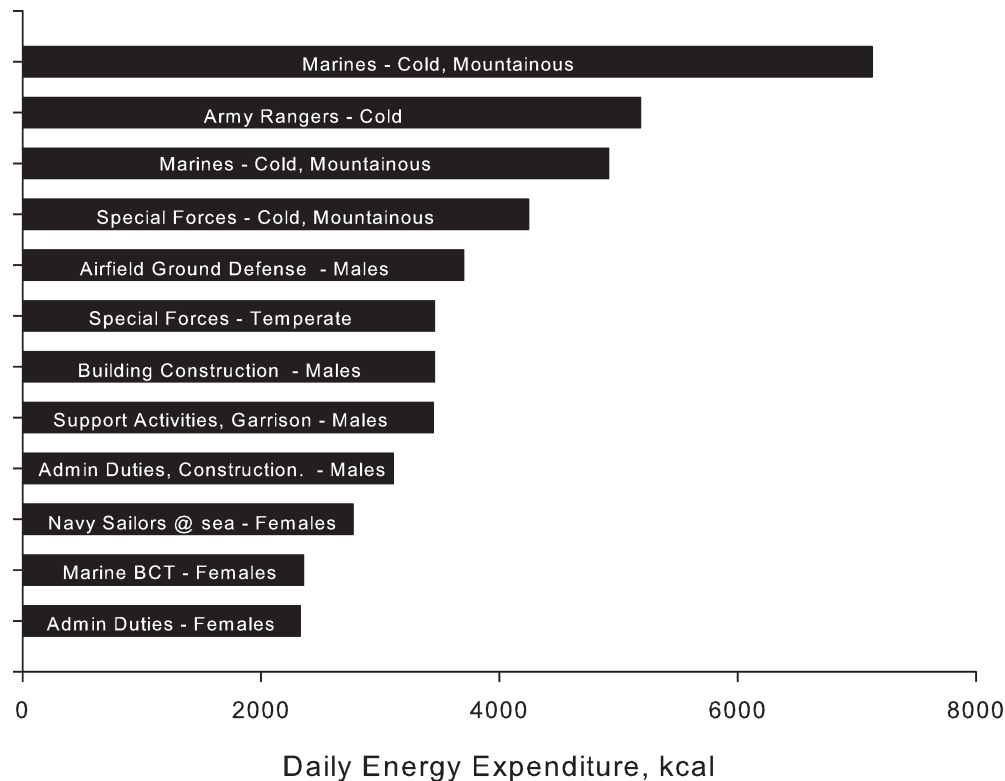


FIGURE 2. Daily energy expenditures of various military populations performing mission duties in a range of environments. (Source: Tharion et al., 2005)

Personnel performing ground defense, engineering/construction duties, or general support duties have energy requirements of approximately 13–15 MJ/day (3,200–3,700 kcal/day).¹⁶ Even lower total energy expenditures (10–11.7 MJ/day or 2,200–2,800 kcal/day) have been measured in military women, in part because of their small total body and lean mass.

Reference databases that include the energy requirements of individual military tasks, and those that present average daily energy expenditures of military personnel performing a variety of mission-specific tasks, such as those described above, can be used to estimate the energy requirements of a given military population.¹⁶ Online calculators are also available for estimating the energy expenditures from activity diaries (e.g., <http://www.shapeup.org/interactive/phys1.php>, <http://www.mypyramidtracker.gov/>). Similar tools are available for estimating water and electrolyte requirements.^{15,56}

Individual Assessment—Food Choices and Knowledge

The adequacy of individual food choices can be assessed by survey or direct observation or inferred by measuring specific physiologic biomarkers. The Department of Defense regularly conducts a large scale survey assessing military lifestyle; the most recent survey included several questions related to dietary practices.⁵⁷ The California Dietary Practices Survey is an example of a more robust survey tool that could be used by the military to assess dietary behaviors, (<http://cdph.ca.gov/>

<http://programs/cpns/pages/californiastatewidesurveys.aspx>). Food frequency questionnaires, such as the Block Dietary Data Systems Assessment Survey (<http://www.nutritionquest.com>) and the Dietary History Questionnaire (<http://riskfactor.cancer.gov/DHQ>) provide information on the adequacy of individuals' usual intakes for meeting their recommended nutrient intakes.

Direct observation of both the acceptability of individual items and the quantity of the rations that warriors eat is used by the combat feeding directorate to develop new menus and food components for ration packs such as the Meals, Ready to Eat (MREs) and First Strike Rations.

Physiologic biomarkers of nutritional fitness include body mass and percent body fat, as well as analytes from blood, saliva, or other cellular samples that are reflective of specific nutrient adequacy.

Tools for assessment of nutritional knowledge are also available. The Diet and Health Knowledge Survey (<http://ars.usda.gov/services>) and the Nutrition Knowledge Questionnaire (<http://www.ucl.ac.uk/hbrc/resources.html>) are two examples. The latter has been validated and has a scoring system, enabling both between- and within-group comparisons.

DIETARY PRACTICES AND NUTRITION KNOWLEDGE—THE STATUS QUO

Relatively few military personnel are eating a diet that meets the recommended dietary guidelines for Americans (DGA) (see Table I) or achieve Healthy People 2010 objectives for

TABLE I. The Dietary Guidelines for Americans 2005 Recommended Diet for a 75 kg Physically Active Male

Food Groups	3,200 Calorie Eating Plan	Serving Size Equivalents (What counts as 1 ounce or 1 cup)	Objective
Grains	10 ounces	1 slice of bread, 1 cup of dry cereal, or half cup cooked rice, pasta, or cereal.	Aim for at least 5 ounces of whole grains a day.
Vegetables	4 cups	1 cup of raw or cooked vegetables or vegetable juice, 2 cups of raw leafy greens, 2 medium carrots; 1 ear of corn.	Vary vegetable type and color.
Fruits	2.5 cups	1 cup of cut fruit or 100% fruit juice; 1/2 cup of dried fruit; 1 small apple; 1 large banana, orange, or peach.	Eat a variety of fruit; go easy on fruit juices.
Milk	3 cups	1 cup of milk or yogurt, 1.5 ounces (or 2 slices) of hard cheese, 2 cups of cottage cheese, 1.5 cups of ice cream.	Choose low-fat or fat-free milk, yogurt, or cheese.
Meat and Beans	7 ounces	1 ounce of meat, poultry or fish, quarter cup cooked dry beans, 1 egg, 1 tablespoon of peanut butter, or half ounce of nuts or seeds.	Choose low-fat or lean meats and poultry; choose more fish, beans, peas, nuts, and seeds.

fruit, vegetable, and grain consumption.^{58,59} Only 28% of service members surveyed consumed two or more servings of fruit per day, and only 49% reported consuming three or more servings of vegetables per day.⁵⁷ Less than 10% achieved the goal of five servings of fruits and vegetables daily. Similarly, few service members meet the recommended intakes for daily whole grain or dairy.

Many service members have a poor understanding of basic nutrition. Only 50% of Army Special Forces personnel were able to correctly answer general questions dealing with fluids and hydration, general nutrition, and nutritional supplements.⁶⁰ Similar results were obtained in a Navy survey of 3,000 service members, as only 40–65% of nutrition knowledge questions were answered correctly.^{61,62}

As noted above, dietary supplements are popular among military personnel. Half of USMC recruits report that they have used nutritional supplements.¹⁶ In the Army, 53% of members consume at least one dietary supplement.⁴⁷ Sixty-four percent of U.S. Army Special Forces and Ranger candidates use nutritional supplements at least occasionally, with 35% reporting daily use.⁶³ Multivitamins are most commonly used (38%) followed by protein and amino acid products (19%).⁶⁴ Eighty-four percent of these warriors are somewhat-to-extremely confident that the products are effective and 56% are extremely confident that they are safe.⁶⁴

CHALLENGES TO ACHIEVING UNIVERSAL NUTRITIONAL FITNESS AMONG MILITARY PERSONNEL

In garrison, military personnel eat from a variety of food sources. The 2005 Department of Defense Survey of Health-Related Behaviors revealed that military dining facilities are frequented for relatively few meals.⁵⁷ Breakfast is often skipped or prepared at home. Lunch comes from a variety of sources with 43% reporting they bring it from home at least twice per week and 27–28% reporting eating food prepared by

a military facility or restaurant at least twice per week. While 63% report eating dinner at least twice per week at home, 30% report eating dinner in a restaurant or from restaurant take-out services at least two times per week. Importantly, half of all service member respondents reported consuming fast food three or more times per week.

Food sources during deployment depend on location. Personnel operating from established bases typically have access to military or contractor-prepared meals (including fast food establishments). Personnel performing duties away from established bases subsist on individual or small group operational rations. Due to limitations of time and space, these individuals may have a difficult time achieving adequate energy and nutritional intake.^{10,65} Units on foot patrol in Afghanistan, for example, typically take two MREs per man per day, which provide ~2,600 kcal/man/day.^{55,66} The amount of food consumed is influenced by the mission activities. Warfighters often eat as time permits in situations not conducive to food preparation. Taste fatigue can also develop when units over-rely on individual and small group ration menus for subsistence. As a result, it is common to lose weight during mission execution. A survey of combat foot soldiers operating in Afghanistan revealed that many had unintentionally lost ~15 pounds during their tour.⁶⁶

STRATEGIES TO IMPROVE NUTRITIONAL FITNESS

Field Feeding

The military has on-going efforts to improve the food supplied to forward-deployed warfighters. A good example is the First Strike Ration. This small, lightweight ration pack includes a full-day supply of food using ready-to-eat food components nutritionally formulated to sustain the warrior during work in austere environments.⁶⁵ Warrior feedback suggests that the First Strike Ration enhances an individual's capability to eat what they need, when they need it. A second example

is the introduction of the Unitized Group Ration–Express, a nutritionally complete meal-in-a-box group ration capable of self-heating and providing a well-balanced meal for 18 warriors.

Research on Improving Dining Facilities

Civilian and military research is examining the effectiveness of various strategies for improving eating behavior. The approaches include educational displays, instruction, social marketing, adoption of detailed labeling, increasing the percentage of “healthy” selections, price subsidies, and verbal prompts by food servers to encourage fruit selection.^{67–71} An ongoing Army research project is applying nutrition “best practices” to determine whether soldier food selections can be shifted to more closely approximate national guidelines for fiber, fruits, vegetables, and unsaturated fat consumption.⁷²

Primary Prevention/Education

An important organizational impediment in the transition of nutrition knowledge to military members is the lack of dietetic professionals available for primary prevention activities. Military dietitians are primarily assigned to hospitals where they perform clinical duties; others are assigned to administrative positions. Assignment of dietitians to duties where they could apply their expertise toward primary prevention, the expansion of nutrition education programs, or putting in place “best practices” at military dining facilities, has the potential to substantially impact the nutritional fitness of the force.

Online tools may be useful to improve or maintain nutritional fitness through education and behavioral change. For example, “Be Warrior Ready with Good Nutrition” is maintained by the Army Public Health Command (<http://phc.amedd.army.mil/home/>), and provides information on health, nutrition, weight loss and maintenance, behavior management, dietary supplements, and physical training. “Army Move!” (<https://www.us.army.mil/suite/page/248187>) and “Hooah Bodies” (<https://www.us.army.mil/suite/page/343315>) are online communities that provide similar information to Army Knowledge Online (AKO)/Defense Knowledge Online (DKO) users.

CONCLUSION

Nutritional fitness is a necessary component to achieve total force fitness. Chronic, poor dietary choices can compromise both health and performance. To facilitate nutritional fitness within their troops, commanders are encouraged to take necessary actions to ensure that their troops have access to eating environments that provide foods with high dietary quality and in the necessary quantities to meet warrior needs, and to include nutrition education as part of their troops’ training curriculum. This article has provided resources to accomplish these tasks. By taking the proposed actions, commanders will provide our warriors with the opportunity to consume a nutritious diet and provide them with the requisite knowledge of nutrition principles and portion sizes to make healthy food choices.

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REFERENCES

1. LeardMann CA, Smith TC, Smith B, Wells TS, Ryan MAK: Baseline self reported functional health and vulnerability to post-traumatic stress disorder after combat deployment: prospective US military cohort study. *BMJ* 2009; 338: b1273.
2. Wells TS, LeardMann CA, Fortuna SO, et al: A prospective study of depression following combat deployment in support of the wars in Iraq and Afghanistan. *Am J Public Health* 2010; 100: 90–9.
3. Deuster PA, Weinstein AA, Sobel A, Young AJ: Warfighter nutrition: current opportunities and advanced technologies report from a Department of Defense workshop. *Mil Med* 2009; 174: 671–7.
4. World Health Organization: Diet, Nutrition and the Prevention of Chronic Diseases—Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series No. 916. Geneva, World Health Organization, 2003.
5. Arija V, Esparo G, Fernandez-Ballart J, Murphy MM, Biarnes E, Canals J: Nutritional status and performance in test of verbal and non-verbal intelligence in 6 year old children. *Intelligence* 2006; 34: 141–9.
6. Rodriguez NR, DiMarco NM, Langley S, et al: Nutrition and Athletic Performance. *Med Sci Sports Exerc* 2009; 41: 709–31.
7. Steinmetz KA, Potter JD: Vegetables, fruit, and cancer prevention: a review. *J Am Diet Assoc* 1996; 96: 1027–39.
8. Ness AR, Powles JW: Fruit and vegetables, and cardiovascular disease: a review. *Int J Epidemiol* 1997; 26: 1–13.
9. Haslam DW, James WP: Obesity. *Lancet* 2005; 366: 1197–209.
10. Committee on Military Nutrition Research: Institute of Medicine: Not Eating Enough: Overcoming Underconsumption of Military Operational Rations. Washington, DC, National Academies Press, 1995.
11. Committee of Dietary Supplement Use by Military Personnel, Food Nutrition Board, Institute of Medicine: Use of Dietary Supplements by Military Personnel. Washington, DC, National Academies Press, 2008.
12. Montain SJ, Young AJ: Diet and physical performance. *Appetite* 2003; 40: 255–67.
13. Hirsch ES, Kramer FM, Meiselman HL: Effects of food attributes and feeding environment on acceptance, consumption and body weight: lessons learned in a twenty-year program of military ration research US Army Research (Part 2). *Appetite* 2005; 44: 33–45.
14. Baker-Fulco CJ, Jones TE, King N, Jezior DA, Fairbrother BN, Askew EW: Nutrition for health and performance. Nutritional guidance for military operations in temperate and extreme environments. Technical Note TN-01/4. Natick, MA, U.S. Army Research Institute of Environmental Medicine, 2001.
15. Headquarters, Department of the Army and Air Force: Heat Stress Control and Heat Casualty Management. Technical Bulletin Medical 507/Air Force Pamphlet 48-152 (I). Washington, DC, Headquarters, Department of the Army and Air Force, 2003.
16. Tharion WJ, Lieberman HR, Montain SJ, et al: Energy requirements of military personnel. *Appetite* 2005; 44: 47–65.
17. Committee on Military Nutrition Research, Food Nutrition Board, Institute of Medicine: Nutritional Needs in Hot Environments. Washington, DC, National Academies Press, 1993.
18. Committee on Military Nutrition Research, Institute of Medicine: Nutritional Needs in Cold and High-Altitude Environments: Applications for Military Personnel in Field Operations. Washington, DC, National Academies Press, 1996.
19. Committee on Mineral Requirements for Cognitive and Physical Performance of Military Personnel, Committee on Military Nutrition

- Research, Food Nutrition Board, Institute of Medicine: Mineral Requirements for Military Personnel: Levels Needed for Cognitive and Physical Performance During Garrison Training. Washington, DC, National Academies Press, 2006.
20. Ordronaux J: Hints on the preservation of health in armies: for the use of volunteer officers and soldiers, pp 62–63. New York, NY, Appleton, 1861.
21. Johnson RE, Kark RM: Feeding Problems in Man as Related to Environment. An Analysis of United States and Canadian Army Ration Trials and Surveys, 1941–1946. Chicago, IL, Quartermaster Food and Container Institute for the Armed Forces, Research and Development Branch, U.S. Army Medical Nutrition Laboratory, 1947.
22. Keys A: II, The Biology of Human Starvation. Vol I. St. Paul, MN, University of Minnesota Press, 1950.
23. Harper AE: Origin of recommended dietary allowances—an historic overview. *Am J Clin Nutr* 1985; 41: 140–8.
24. Military Nutrition: 1861 to Present: History of Military Nutrition Research, 2008. Available at <http://www.military-nutrition.com/Default.aspx>; accessed April 24, 2010.
25. Adolph EF: Tolerance to heat and dehydration in several species of mammals. *Am J Physiol* 1947; 151: 564–75.
26. Ryer R, Grossman MI, Friedemann TE, et al: The effect of vitamin supplementation on soldiers residing in a cold environment, 2. Psychological, biochemical, and other measurements. *J Clin Nutr* 1954; 2: 179–94.
27. Ryer R, Grossman MI, Friedemann TE, et al: The effect of vitamin supplementation on soldiers residing in a cold environment, 1. Physical performance and response to cold exposure. *J Clin Nutr* 1954; 2: 97–132.
28. Consolazio C, Masterson JE, Shapiro R, Mckinzie PS: Energy requirements of men in extreme heat. *J Nutr* 1961; 73: 126–33.
29. Consolazio CF, Harding RS, Nelson RA, Canham JE, Matoush LO: Excretion of sodium, potassium, magnesium and iron in human sweat and relation of each to balance and requirements. *J Nutr* 1963; 79: 407–15.
30. Baker EM, McDowell ME, Sauberlich HE, Canham JE, Nunes WT: Vitamin B6 requirement for adult men. *Am J Clin Nutr* 1964; 15: 59–66.
31. Consolazio CF, Johnson HL, Krzywicki HJ, Daws TA: Metabolic aspects of acute altitude exposure (4,300 meters) in adequately nourished humans. *Am J Clin Nutr* 1972; 25: 23–9.
32. Askew EW: Environmental and physical stress and nutrient requirements. *Am J Clin Nutr* 1995; 61: S631–7.
33. U.S. Departments of the Army, Navy, and Air Force: Nutrition Standards and Education. June 15. Army Regulation 40-25/BUMEDINST 10110.6/AFI 44-141. Washington, DC, Headquarters, Departments of the Army, Navy, and Air Force, 2001.
34. Panel on Dietary Antioxidants and Related Compounds: Subcommittees on Upper Reference Levels of Nutrients and Interpretation and Uses of DRIs, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food Nutrition Board, Institute of Medicine: Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids. Washington, DC, National Academies Press, 2000.
35. Panel on Micronutrients: Subcommittees on Upper Reference Levels of Nutrients and of Interpretation and Uses of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food Nutrition Board, Institute of Medicine: Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Washington, DC, National Academies Press, 2001.
36. Subcommittee on Interpretation and Uses of Dietary Reference Intakes and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes: Food Nutrition Board, Institute of Medicine: Dietary Reference Intakes: Applications in Dietary Planning. Washington, DC, National Academies Press, 2003.
37. Panel on Dietary Reference Intakes for Electrolytes and Water Standing Committee on the Scientific Evaluation of Dietary Reference: Food Nutrition Board, Institute of Medicine: Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington, DC, National Academies Press, 2005.
38. U.S. Department of the Army: Operating Procedures for the Army Food Program. February 6. Army Pamphlet 30-22. Washington, DC, Headquarters, Department of the Army, 2007.
39. Mission: Readiness, Military Leaders for Kids: Report: Too Fat to Fight: Retired Military Leaders Want Junk Food Out of America's Schools. Washington, DC, Mission: Readiness, 2010.
40. Patton JF, Daniels WL, Vogel JA: Aerobic power and body fat of men and women during army basic training. *Aviat Space Environ Med* 1980; 51: 492–6.
41. Gardner JW, Kark JA, Karnei K, et al: Risk factors predicting exertional heat illness in male marine corps recruits. *Med Sci Sports Exerc* 1996; 28: 939–44.
42. Reynolds K, Cosio-Lima L, Creedon J, Gregg R, Zigmont T: Injury occurrence and risk factors in construction engineers and combat artillery soldiers. *Mil Med* 2002; 167: 971–7.
43. Bedno SA, Li Y, Han W, et al: Exertional heat illness among overweight U.S. Army recruits in basic training. *Aviat Space Environ Med* 2010; 81: 107–11.
44. Dall TM, Zhang Y, Chen YJ, et al: Cost associated with being overweight and with obesity, high alcohol consumption, and tobacco use within the military health system's TRICARE prime-enrolled population. *Am J Health Promot* 2007; 22: 120–39.
45. Harris KC, Kuramoto LK, Schulzer M, Retallack JE: Effect of school-based physical activity interventions on body mass index in children: a meta-analysis. *Can Med Assoc J* 2009; 180: 719–26.
46. National Institutes of Health: Office of Dietary Supplements: Dietary Supplements: Background Information: What is a Dietary Supplement? Office of Dietary Supplements (Internet); updated July 9, 2009. Available at <http://ods.od.nih.gov/factsheets/dietarysupplements.asp#h1>; accessed April 28, 2010.
47. Lieberman HR, Stavinoha T, McGraw S, White A, Hadden L, Marriott B: Use of dietary supplements among active duty U.S. Army soldiers. *Med Sci Sports Exerc* 2009; 41: 185–6.
48. O'Dea JA: Consumption of nutritional supplements among adolescents: usage and perceived benefits. *Health Educ Res* 2003; 18: 98–107.
49. National Center for Complementary and Alternative Medicine: Using Dietary Supplements Wisely. NCCAM Publication No. D426. Washington, DC, National Institutes of Health, U.S. Department of Health and Human Services, 2010.
50. Martello S, Felli M, Chiarotti M: Survey of nutritional supplements for selected illegal anabolic steroids and ephedrine using LC-MS/MS and GC-MS methods, respectively. *Food Addit Contam* 2007; 24: 258–65.
51. Geyer H, Parr MK, Koehler K, Mareck U, Schanzer W, Thevis M: Nutritional supplements cross-contaminated and faked with doping substances. *J Mass Spectrom* 2008; 43: 892–902.
52. U.S. Food and Drug Administration: FDA News Release (revised January 8, 2009): FDA Expands Warning to Consumers About Tainted Weight Loss Pills. Silver Spring, MD, U.S. Food and Drug Administration, 2009. Available at <http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/2008/ucm116998.htm>; accessed April 25, 2010.
53. Dinehart SM, Henry L: Dietary supplements: altered coagulation and effects on bruising. *Dermatol Surg* 2005; 31: 819–26.
54. Haller CA, Meier KH, Olson KR: Seizures reported in association with use of dietary supplements. *Clin Toxicol (Phila)* 2005; 43: 23–30.
55. Dean CE, Dupont F: Modern Warrior's Combat Load—Dismounted Operations in Afghanistan. Letter Report. Fort Leavenworth, KS, U.S. Army Center for Army Lessons Learned, 2003.
56. Force Development Directorate: Water Planning Guide. Fort Lee, Virginia, U.S. Army Combined Arms Support Command, November 25, 2008.
57. Bray RM, Hourani LL, Rae Olmstead KLR, et al: 2005. Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel. Report RTI/7841/106-FR, pp 157–158. Research Triangle Park, NC, RTI International, 2006.
58. U.S. Department of Health and Human Services: U.S. Department of Agriculture: Dietary guidelines for Americans. Washington, DC,

- U.S. Department of Health and Human Services, U.S. Department of Agriculture, 2005.
59. U.S. Department of Health and Human Services: Office of Disease Prevention and Health Promotion: Healthy People 2010: Objective for Improving Health (Focus Area 19, Nutrition and Overweight). Available at <http://www.healthypeople.gov/Document/HTML/Volume2/19Nutrition.htm>; accessed April 28, 2010.
 60. Bovill ME, Tharion WJ, Lieberman HR: Nutrition knowledge and supplement use among elite U.S. army soldiers. *Mil Med* 2003; 168: 997–1000.
 61. Conway TL, Hervig LK, Vickers RR Jr: Nutrition knowledge among Navy recruits. *J Am Diet Assoc* 1989; 89: 1624–8.
 62. Trent LK: Nutrition knowledge of active-duty Navy personnel. *J Am Diet Assoc* 1992; 92: 724–8.
 63. Arsenault J, Kennedy J: Dietary supplement use in U.S. Army Special Operations candidates. *Mil Med* 1999; 164: 495–501.
 64. Lieberman HR, White A, Stavinoha T, McGraw S, Hadden L, Marriott B: Use of dietary supplements among active duty U.S. army soldiers. *Am J Clin Nutr* (in review).
 65. Committee on Optimization of Nutrient Composition of Military Rations for Short-Term HS: Committee on Military Nutrition Research, Food Nutrition Board, Institute of Medicine: Nutrient Composition of Rations for Short-Term, High-Intensity Combat Operations. Washington, DC, National Academies Press, 2005.
 66. Koenig CA: Nutritional and Environmental Factors Facing American Soldiers in Afghanistan. USARIEM Information Paper. Natick, MA, U.S. Army Research Institute of Environmental Medicine, November 15, 2004.
 67. Schwartz MB: The influence of a verbal prompt on school lunch fruit consumption: a pilot study. *Int J Behav Nutr Phys Act* 2007; 4: 1–5.
 68. Foster GD, Sherman S, Borradaile KE, et al: A policy-based school intervention to prevent overweight and obesity. *Pediatrics* 2008; 121: E794–802.
 69. Michels KB, Bloom BR, Riccardi P, Rosner BA, Willett WC: A study of the importance of education and cost incentives on individual food choices at the Harvard School of Public Health cafeteria. *J Am Coll Nutr* 2008; 27: 6–11.
 70. Chu YH, Frongillo EA, Jones SJ, Kaye GL: Improving patrons' meal selections through the use of point-of-selection nutrition labels. *Am J Public Health* 2009; 99: 2001–5.
 71. Schetzina KE, Dalton WT, Lowe EF, et al: A coordinated school health approach to obesity prevention among Appalachian youth: the Winning With Wellness Pilot Project. *Fam Community Health* 2009; 32: 271–85.
 72. Sanders LF, Young AJ, Campagne C, Smith TJ, McClung HL: Testing the Efficacy of Modifying Serving Practices in Military Dining Facilities. USARIEM Research Protocol H09-14. Natick, MA, U.S. Army Research Institute of Environmental Medicine, 2009.

Spiritual Fitness

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ABSTRACT Spirituality, as distinct from psychological and other variables, is now recognized as a crucial element in the total force fitness of service members. There is substantial literature available for the development of evidence-based policies and programs for spiritual support and the treatment of spiritual distress and moral injury. These developments should be integrated within existing programs, and this will require that commanders be proactive. Chaplains provide a primary resource and should be enabled to operate within integrated teams of support personnel. This has not been the case historically, and only the leadership of commanders can bring this about. Programs should utilize existing instruments for monitoring purposes, but should also include proactive plans for service members before deployment and whenever events such as large-scale civilian casualties increase the overall risk of spiritual distress. Behavioral science experts should be utilized in a collaborative role with chaplains in developing spiritual support. Leaders should receive elementary training in cultural competence and spiritual diversity to provide the needed support for spiritual fitness program development.

INTRODUCTION

Operational Demands That Require Consideration of Spiritual Fitness

Today, counterinsurgency and asymmetric warfare have become the new norm in the context of full spectrum (offensive, defensive, stability, and support) operations. The Quadrennial Defense Review 2006¹ emphasizes that the global operational environment requires unprecedented emphasis on operational balance. The Joint Operating Environment report² predicts that future integrated close combat will place increased demands on the physical, psychological, and spiritual domains of fitness. This will require that leaders be well versed on the human dimension of combat, including spiritual dimensions and ethical decision making at all personnel levels.

For many on the front lines, spirituality and religion are the only “safe haven” amidst intense operational or combat experiences that can test one’s faith. The danger of spiritual and moral trauma is real, and it can initiate a downward spiral of physical, psychological, and behavioral problems in the service member. We lack proven methods to build spiritual fitness, prevent moral injury, and heal the spiritually distressed in the military setting, but research in these areas is growing. For example, Litz et al. have recently reviewed the literature, defined terms, and offered a working conceptual framework and a set of intervention strategies for repairing “moral injury.”³

The role of religious ideology in contemporary conflicts and the increasing spiritual diversity of the U.S. Armed Forces, make leadership’s attention to spirituality more pressing and more challenging at the same time. As noted in this article,

there is much in spirituality that can encourage unit cohesion and commitment to mission. But religious and spiritual differences are also well known as potential flashpoints for conflict. Commanders must develop policies that will promote a coherent and effective approach to the spiritual needs of service members. This is essential for maintaining readiness.

The Field of Spirituality and Health

The scientific study of spirituality and health is a very new field. Figure 1 illustrates the five-fold increase in research on spirituality and religion, which from 1990 to 2007 reflects the growing interest in this topic within healthcare.

Because the field is so new, most research has been basic rather than applied. Metrics for spiritual belief, practice, and experience have been developed, but research linking these factors to fitness and health is only beginning. There is a general consensus that such links exist and are clinically important,⁴ but the evidence base delineating these associations and developing practical applications is in its infancy.⁵ Given the inherently subjective nature of spirituality and the inability to measure spiritual fitness directly and objectively, a rigorous mixed-methods approach is required for their evaluation. The lack of systematic qualitative research in this field, however, is an important gap.

METHODS/APPROACH

In preparation for a December 2009 conference entitled “Defining Total Force Fitness for the 21st Century,” we collaborated with a multidisciplinary “spiritual fitness working group” on the creation of an article that explored how spiritual fitness might contribute to Department of Defense (DoD) goals such as unit cohesion, performance, readiness, resilience, and force protection. The conference was focused on developing a conceptual framework and metrics for total force fitness and formed the foundation for a practical Chairman of the Joint Chiefs of Staff Instruction (CJCSI) on total force fitness. This diverse working group was composed of academic experts, chaplains representing each service, and representatives of other DoD components, including the

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Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE).⁶ Entitled “Spiritual Fitness and Ethical Fitness in the Armed Services,” the preconference article was intended as “...only a beginning toward integrating the key components of spirituality and ethical fitness into the total fitness initiative.”⁷ Starting with this preconference article and the CJCSI, we then reviewed the scientific literature on spirituality and health to provide an evidence base that would support the spiritual fitness goals of the CJCSI.⁸

Our literature review included the 1,600 studies identified by Koenig et al. in their Handbook of Religion and Health (2001),⁴ the results of several searches of Ovid MEDLINE on spirituality and religion, references from the researchers’ files, and a series of searches specifically for scales and measures for spirituality. The resulting database was composed of more than 3,000 titles.

As additional sources for the postconference literature review, we used databases currently in development from (1) a literature review on mind–body practices and therapies for treatment and prevention of stress- and trauma-related illnesses and con-

ditions in military, veteran, and first responder populations, and (2) a systematic review of integrative skills training programs for the management of stress and associated disorders. These databases contain 850 and over 11,000 articles, respectively.

FINDINGS

Operational Definition of the Fitness Domain

The Meaning of Spirituality

The definition of “spiritual” and related terms has been a serious problem in research on spirituality and health. Care providers often use the words spiritual and spirituality broadly to capture an array of domains including values, feelings, aspirations, and so forth, typically reflecting common theological assumptions about the human spirit (see Table I). This can be appropriate and useful in the context of care, such as by military chaplains. Therefore, this kind of pragmatic definition was used in the CJCSI on spiritual fitness. However, in research it is necessary to employ a definition that is more specific and standardized (to allow comparison among different studies and different populations) that helps to distinguish spirituality from psychology, that is applicable to its varied manifestations in diverse religions, and that reflects ordinary usage of the term by the subjects being studied. Below, we review the definitions of *spiritual* and its cognates that are common English language usage and that are most useful in spirituality research:

In ordinary English usage, spirit, spiritual, and spirituality have had stable meanings for centuries:

Spirituality: the quality or condition of being spiritual.

Spiritual: Of, pertaining to, or affecting the spirit or soul, especially from a religious aspect.

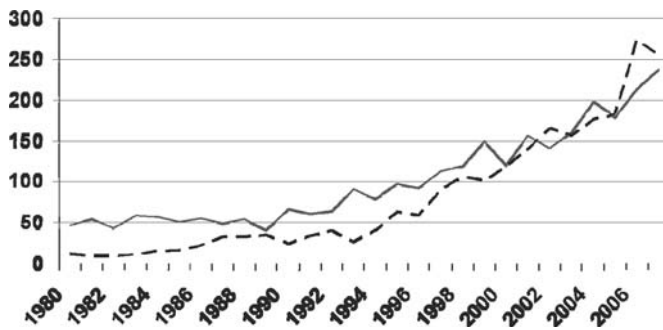


FIGURE 1. Growth in research on spirituality and religion

TABLE I. Definitions

Term	Definition	Source
Spiritual-Lexical Definition	“Of, pertaining to or affecting the spirit or soul, esp. from a religious aspect.” ⁷⁶	Dates to Middle English, roughly the 11 th through the 15 th centuries.
Spirituality- Theological Definition	“... The sum of all the uniquely human capacities and functions: self awareness, self transcendence, memory, anticipation, rationality (in the broadest sense), creativity, plus the moral, intellectual, social, political, aesthetic, and religious capacities, all understood as embodied.” ⁷⁸	
Spirituality- Typically Ambiguous Clinical Definition, After Tillich	“That which allows a person to experience transcendent meaning in life. This is often expressed as a relationship with God, but it can also be about nature, art, music, family, or community—whatever beliefs and values give a person a sense of meaning and purpose in life.” ⁷⁹	Christina Puchalski, MD, of George Washington University, one of the leading researchers in spirituality and health.
Spirit	“The animating principle in humans and animals. 2. The immaterial part of a corporeal being.” ⁷⁶	Dates to Middle English
Spirit- Theological Definition	“The unity of power and meaning.... spirit appears fully only in humanity, in freedom, self-transcendence, morality, rationality, creativity, selfhood....”	Paul Tillich, (1886–1965), among the most influential of 20 th century theologians.
Religions	Those community institutions such as Buddhism, Christianity, Judaism and Islam that are based on spirituality.	
Psychospiritual	Refers to the larger realm where spirituality intersects with other domains, especially psychology. Acknowledges that the psychology/spirituality distinction will be drawn very differently by different people.	(For example, belief, meaning and purpose are words often associated with spirituality that also have purely nonspiritual meanings.)

- Spirit: (1) The animating principle in humans and animals.
(2) The immaterial part of a corporeal being.⁹

Religion refers to spiritual institutions (e.g., Christianity, Buddhism, etc.). Therefore, spiritual fitness would mean fitness of “the spirit or soul, especially from a religious aspect.” Spirituality, then, depends on diverse beliefs about the soul, theological debates, and so forth. Within particular religious and spiritual traditions one finds very different definitions of spiritual fitness, such as being saved (evangelical Christian), being in a state of grace (Catholic), and being able to stay “in the moment” and maintain a self-transcendent view during stressful situations (Buddhism). To assert that some meaning of these concepts is correct, that it is *true spirituality*, would endorse some spiritual viewpoints while dismissing others. That would be inappropriate to scientific inquiry as well as to the U.S. military. Given the spiritual diversity of the United States, each instance of the spiritual must be interpreted within the context of a particular tradition. All of these traditions share fundamental aspects of the meanings of spirit, but each has unique interpretations of its referents and associated values. This presents several difficulties for the study of spirituality and health, especially in the military.

The most common response to the “belief problem” has been to follow the pattern of Christian Existential theology in making definitions that are more secular, and less specific. These definitions tend to make all humans and all human behavior spiritual. Many believers hold this view, but these universalizing definitions are the reason that many investigators have said that the meaning of spirituality is “fuzzy”¹⁰ and “vague and contradictory.”¹¹ These definitions also conflate spiritual, religious, and psychological factors, reducing the validity of many outcomes studies; when a psychological factor such as optimism, often associated with spirituality, is employed in spirituality metrics the results are confounded, and often become tautological. When the meaning of research terms deviates from everyday usage, the resulting studies lack ecological validity. These conceptual difficulties are reflected in the common complaint that discussions of the importance of spirituality suggest that very spiritual people are somehow “better” than others, or that one must be spiritual to be moral, ethical, and compassionate. It is the use of excessively broad definitions that universalize spirituality that creates this problem, and this can be especially damaging in a pluralistic context, as in science and military settings.

Spirituality Is Not the Same as Religion

Although religions are institutions based on spirituality, the importance of distinguishing religion from spirituality is widely recognized by researchers.¹² For some, all spiritual belief and practice lie within the framework of their religion. For others, 20–30% of Americans, their spirituality is largely or entirely outside religion,^{13,14} although some occasionally attend religious services. A Pew Forum survey (December 2009) found that 24% of Americans say they attend services of at least one faith other than their own. Spiritual and religious pluralism is the norm in the United States, and has been since Colonial times.^{15,16} Among the powerful influences shaping

American religious heterodoxy are the influential spiritual traditions of Asia, principally Buddhism and Hinduism (especially yoga), and spiritual experiences.

Psychospiritual Fitness: The Intersection with Other Domains

Because spiritual factors per se make sense only within specific spiritual traditions, as noted above, spirituality affects fitness in ways appropriate to the military primarily as it interacts with other domains, especially psychology. Research has established strong links between spirituality and physical, psychological, and medical health,^{4,17–20} most of them positive but some of them negative, depending on the specifics of belief and practice.²⁰ Many of these outcomes are at least in part attributable to the behavioral and social ramifications of spirituality.

The term “psychospiritual” refers to this larger realm where spirituality intersects with other domains. *Psychospiritual* acknowledges that the psychology/spirituality distinction will be drawn very differently by different people. (For example, belief, meaning, and purpose are words often associated with spirituality that also have purely nonspiritual meanings.) While adopting policies favoring one spiritual tradition over another would be wrong, it is appropriate to develop coherent psychospiritual policies. We have adopted the conventional use of “spiritual fitness” to refer to “psychospiritual fitness,” because it is so widely used. But for all technical purposes, the distinction should be kept in mind.

An example of how spiritual practices can encourage cohesion (by facilitating tolerance) as well as improve fitness is mindfulness-based meditation. Although developed from a Buddhist practice, this meditation is now widely taught in a secularized form²¹ and has been shown to have wide-ranging benefits therapeutically as well as for wellness and performance enhancement.^{22–27} It is possible to tailor mindfulness meditation to one’s own religion, making it one’s own and, according to some studies, enhancing its effectiveness.

A structured mindfulness training program that has demonstrated feasibility and preliminary effectiveness for improving attentional functioning and reducing the negative effects of stress,²⁵ mindfulness-based stress reduction (MBSR) is currently being offered at multiple Veterans Administration (VA) hospitals to Operations Iraqi Freedom and Enduring Freedom (OIF/OEF) veterans returning with post-traumatic stress disorder (PTSD). Based on Mindfulness-Based Stress Reduction (MBSR) and tailored to the predeployment training cycle, the Mindfulness-Based Mind Fitness Training (MMFT) program includes evidence-based techniques and exercises for enhancing mental agility, emotion regulation, attention, and situational awareness. Pilot research on the MMFT program in Marine Reservists suggests that MMFT may bolster mental fitness and resilience against stressors.²⁸

An important caveat to the secularization of traditionally religious practices is the danger of contradicting the intention and goal for which these practices were originally developed, by removing their historical context and spiritual and moral foundations. While the archetype of the “spiritual warrior” pervades the history of several religious traditions,²⁹ extracting just

the methods themselves can have dire individual and organizational consequences. For example, encouraging the use of Zen meditation techniques used by the Samurai to eliminate fear of death and guilt over killing,³⁰ might suggest hypocrisy given combatants' approaches in the war on terrorism. The risk of practicing these techniques in a way that is immoral or antithetical to their roots³¹ can be minimized by including in skills training programs appropriate discussions of spiritual context and consequences of these practices. When the authors presented this ethical dilemma to respected authorities in Buddhism (the religious and philosophical tradition from which many of these meditative practices are drawn), these experts advised focusing on their potential effectiveness in post-deployment recovery (Fritts M. Personal communication with Ven. Tsoknyi Rinpoche III, facilitated by Ven. Tenzin Lhamo, 2010).

Description of Components of Spiritual Fitness

The components of spirituality are traditional rather than scientific categories. Therefore they overlap, interpenetrate, and have somewhat different meanings in different traditions.

Spiritual Beliefs

Beliefs are ideas held to be true. Belief in a non-physical dimension of life is a defining element of spirituality: belief in the existence and goodness of God, and belief that the human spirit is real and survives death are central to most traditions. Spiritual values, and the core issues of meaning and purpose in life, are also beliefs. Spiritual beliefs are basic to many peoples' understanding of the world and their place in it. These beliefs provide support in times of stress, and threats to these beliefs cause anxiety and threaten performance. Psychospiritual fitness requires not only positive and helpful beliefs, but also that those beliefs be stable under stress. Leadership and well-trained support staff, especially chaplains, are necessary to that stability during and following combat. This is not a simple task, because of the religious and spiritual diversity of modern troops. Commanders will need guidance regarding this diversity. With leadership appropriate to the spiritual diversity of the force, spirituality can be a powerful force for unit cohesion. Without proper leadership, spirituality can be a divisive factor that reduces cohesion and readiness.

Spiritual Values

"Value," from the Latin *valere*, to be worth, refers to that which makes something desirable. Human values are rules for making right decisions in life. Morality and ethics are sets of such values, varying somewhat from one culture or social group to another. Moral codes serve positive social purposes, helping to make interactions predictable and to recruit support to avoid or redress injury. In the military, moral conduct is crucial to unit cohesion and to compliance with rules of war. Although morality is logically independent from religion,³² spiritual endorsement of particular values is universal and strongly motivating.

Spiritual traditions offer endorsements of some secular moral rules (e.g., honesty), add others (e.g., faith in God), and challenge others (e.g., pacifist religions). Strong morals in a religious framework have been shown to promote health

by reducing unhealthy and risky behavior (alcohol consumption, smoking, risky sexual behavior)⁴ thus supporting fitness. Good morals, defined from a spiritual standpoint, are often taught as requirements for reward in the afterlife, providing strong motivation for compliance among believers.

Spiritual Practices

"Military commanders are responsible to provide for the free exercise of religion of those under their authority."³³

Each of the service branches charges its commanders to provide for the free expression of religion and exercise of spiritual practice, with the caveat that these activities do not interfere with mission situations and requirements. These spiritual practices are the behavioral expression of personal spirituality, and they take varied forms that may or may not follow specific religious traditions. Spiritual practices from the Abrahamic religions (Christianity, Judaism, and Islam) include prayer, sacred scripture study, worship, music, fasting, practicing charity and service to community. Spiritual practices from nontheist belief systems include social activism, work, education, and mindfulness.³⁴

Spiritual practices also include mind-body techniques practiced for thousands of years by warriors throughout the world, particularly in Eastern cultures, including techniques to enhance the mind's capacity to affect symptoms and physical functioning. Examples are breathing exercises, positive mental imagery, systematic relaxation, prayer, meditation, yoga, and creative outlets such as art, music, or journaling. Mind-body skills can be easily practiced by service members with little or no equipment and in a variety of settings. Small teams and units can include mind-body skills training in standard pre-deployment routines to improve functioning and performance, enhance concentration and focus, and prevent and treat a variety of stress-related diseases.^{25,26,28}

Core Beliefs: Purpose and Meaning

Who am I? Why am I here? What is my purpose in life? What happens after I die?

These cosmic enigmas about the meaning and purpose of life are ancient and powerful existential questions. From the materialist (i.e., absent spirit) point of view, the answers are simple and obvious: the purpose of your life is what you make it, and after you die nothing happens. Spiritual beliefs offer more complex, and usually more consoling, answers. Belief that spirit is real, and that there is a Divine plan behind the seemingly random events of the world, gives rise to meanings with far-reaching implications, "making sense of it all."

In combat situations, perpetrating, failing to prevent, or witnessing acts that transgress deeply held values can shatter an individual's beliefs about the purpose and meaning of life, challenge belief in God, induce moral conflict, and even precipitate an existential crisis: often called "moral injury" in the literature.³ For the spiritual person, undeserved suffering, whether illness or injury, raises the question of how God could allow such a thing ("theodicy"). This question may become central to service members who take part in or witness experiences that potentially shatter deeply held spiritual values.

Therefore, leaders and chaplains have an obligation to help foster an understanding and acceptance of suffering that involves mystery and may be beyond complete human understanding. Leaders can help alleviate moral conflict and injury by using the services of military chaplains; encouraging advance preparation for the horrors of war through facilitated pre-deployment discussions with family members and loved ones about the possibility of moral conflict, severe disability and death; using after-action reviews to assist service members who have seen or done things that lead to serious moral conflict; and honoring the fallen through memorial services.

Self-Awareness: Reflection and Introspection

Introspection and self-awareness can be cultivated through contemplative practices from varied religions, as well as through secular techniques of meditation. One example is mindfulness training, which involves developing an objective awareness of one's own thoughts and feelings. With group instruction and regular individual practice, mindfulness training can enable service members to respond to situations and make decisions from a reflective and objective mindset, rather than out of fear, habit, or emotionally charged reactivity. Used in the U.S. military since 1985, mindfulness training can also enhance pre-combat negotiations and national security decision making by cultivating cultural, situational, and self-awareness³⁵ and introducing a "choice point" between stimuli and habitual, unconscious and emotional reactions,³⁶ thereby enabling decisions that are more supportive of mission goals.³⁷

Cultivating and maintaining self-awareness, introspection, and reflection can require regular, focused practice over relatively long periods of time. By contrast, some meditative practices (such as mindfulness training and Christian prayers such as the Jesus prayer or the rosary) are very portable and may be done in the midst of highly distracting situations such as combat. Mental training can blend well with the "hurry up and wait" aspect of military operations and the need to maximize downtime ("white space") between tasks, in an effort to conserve and protect the quality and quantity of personal resources within the force.^{38,39} With encouragement from leadership, service members can find a connection in meditative practice with their peers from different spiritual traditions. The divisive alternative is to see the practices of others as "superstition" in contrast to one's own "authentic" spirituality.

Transcendence: Relationships Beyond the Self

Central to Judaism, Christianity, and Islam is the command to believe in and love God as well as to "love your neighbor as yourself." Eastern philosophies and religions such as Buddhism highlight the importance of transcending a limited view of the self as an isolated, self-sufficient entity. The ideal view is one that sees all humanity as interdependent and inter-related, and therefore naturally replaces insatiable drives to fulfill individual interests with a prosocial and compassionate attitude that cherishes the well-being and happiness of others, even more than personal happiness. These values point

to transcendence of self, both in relation to the Divine and to fellow humans. The association of such transcendent relationships with ultimate spiritual values is a powerful motivation to prosocial behavior for the believer.

Transcendence need not be vertical, relying on a belief in God. Spiritual atheists, for example, often acknowledge relationships or nature as their higher power. Transcendence is allegiance to something greater than oneself, not necessarily to a particular power. All branches of the armed services require the individual to acknowledge this process through connecting to the greater good of the unit. This horizontal transcendence has an outward focus that engenders citizenship behaviors, team spirit, and service for the collective good. The tri-service ideal of deference of self-interest is similar to religious ideals of self-sacrifice and is exemplified by the "unit before self" motto and the fourth tenet of the Army's Warrior Ethos and the Soldier's Creed: "Never leave a fallen comrade."⁴⁰

The theological virtue of charity, derived from the Latin *caritas*, meaning affection or love, promotes transcendence by urging compassion, generosity, and forbearance in the treatment of others. Compassion, meaning "the deep feeling of sharing the suffering of another, together with the inclination to give aid or support or to show mercy,"⁴¹ motivates powerfully prosocial behavior, including generosity, forgiveness, and self-sacrifice.

The relationship of service members to their families is another aspect of transcendence motivated by love. The need to communicate with family and to know that loved ones are safe is well recognized in the military. Spirituality adds a powerful dimension to this connection, transcending space and time as family members pray for and with one another, and in most religious traditions hope for reunion that transcends death. The way that spiritual belief and practice cognitively reframe the rigors of military life often relies on this loving transcendence of self.

Transcendence is closely related to developing meaning and purpose, since these usually arise through connection to something greater than oneself. Fry suggests that "...as group members model the values of altruistic love to one another, they jointly develop a common vision, which generates hope/faith and a willingness to 'do what it takes' in pursuit of a vision of transcendent service."^{42,43}

Exceptional Spiritual Experiences

"*Exceptional Human Experiences* (EHEs) ... touch on areas outside the common sense reality of our everyday world, e.g., a sense of enlightenment or certainty, a feeling of unity."^{44,45} This is a psychospiritual term including both spiritual experiences (e.g., "mystical experiences") and psychological experiences (e.g., Maslow's "peak experience" category).

Spiritual experiences can be either interpretive or direct. Interpretive spiritual experience is spiritual "not because of any unusual features of the experience itself, but because it is viewed in the light of a prior [spiritual] interpretive framework."⁴⁶ Spirituality allows the individual to find spiritual meaning in all sorts of situations, enhancing positive experiences

and mitigating negative ones through cognitive reframing of events as implicitly spiritual experiences.

In addition to interpretive spiritual experiences, a number of “directly” spiritual experiences are now well established in the psychiatric literature as normal, beneficial, and common. These are “bereavement visits” (perceived visits by the deceased)^{47–54} and “near-death experiences.”^{50,55,56} These experiences are associated with the death of someone emotionally close or one’s own close brush with death. These situations are especially common in combat, so these experiences may be expected to be especially prevalent in the military during conflict. These experiences are salutogenic, changing potentially traumatic events into occasions of growth and consolation.

Before the 1970s, these experiences were consistently viewed as pathological hallucinations, but contemporary psychiatric textbooks describe them as normal and conducive to psychological health. Both experiences reduce fear of death and encourage prosocial growth.^{56,57} Unfortunately, despite progress in the published psychiatric literature, both clergy and health care providers still often misinterpret reports of such experiences as psychiatric symptoms.

Though positive, these experiences can produce anxiety if experiencers cannot speak about them openly and receive social support.⁵³ In the military, where perceived stigma reduces utilization of mental health services, it is especially important that care and support personnel understand these experiences and help to create an environment that facilitates their positive effects and avoids the negative effects of stigma.

Outcomes/Benefits of Spiritual Fitness

Operationally Relevant Outcomes

Spiritual fitness is key to ensuring optimal force readiness and protection and enhancing resilience and recovery following combat-related trauma. The early identification of spiritual risk factors in individuals can minimize future dysfunction and negative impact on the unit. Table II, described in more detail below, includes four categories of operationally relevant outcomes: (1) resilience and recovery from deployment- and combat-related trauma, (2) optimized prevention and/or resolution of moral injury, (3) cohesive unit climate supportive of peak performance, and (4) mature and engaged spirituality that fosters finding meaning/purpose and effective coping.

Benefits of Spiritual Fitness Components

Most of the health benefits of spirituality are not limited to specific components, but flow from the combined effect of multiple components across domains. The following benefits are documented in Koenig et al.’s 2001 Handbook of Religion and Health (which incorporates spiritual and religious factors and analyzed 1,200 studies): hope and optimism, less depression, fewer suicides, less anxiety, less alcohol and drug abuse, greater marital stability, less risky behavior, and lower mortality from various causes.⁴ Table II summarizes the evidence for these general benefits of spirituality. Table III includes the components of psychospiritual fitness, a summary of the

evidence supporting the benefits of each component, and references for benefits for which empirical evidence is relevant.

Metrics

Most measures for particular components of spirituality have not been validated within the military. The association of many of these scales with health has involved either seriously ill patients or the elderly. Furthermore, they tend to be designed for research purposes, not practical application in time-pressured settings. For the monitoring of fitness-relevant spirituality, therefore, the brief general assessments noted below are much more useful for monitoring purposes in the military.

The evidence accumulated through research measures, however, does provide a solid basis for the development of programs and policies intended to enhance spirituality and fitness. The research metrics then can be used in evaluation research to assess the effectiveness of evidence-based programs and policies. They may also be useful in working with service members identified as having mission-relevant spiritual problems.

Metrics for Operationally Relevant Outcomes

Practical and empirically validated metrics are available to commanders for measuring and monitoring service member’s levels of spiritual readiness and resilience predeployment and while in theater and assessing risk factors for potential moral trauma and spiritual injury immediately postdeployment. For each of the four categories of operationally relevant outcomes listed above, Table IV describes several related outcome variables and possible validated metrics for assessing each of these variables. For each category, one outcome variable and one metric are highlighted, referenced, and described in more detail. These highlighted metrics were selected based on several criteria: (1) validity (ability to actually measure the targeted outcome variable),⁵⁸ (2) reliability (consistency of scores from one assessment to another),⁵⁹ (3) relevance to military operations (including whether the metric has been used and/or tested in military and veteran populations), and (4) practicality (including response burden, number of questions, whether a professional is required for administration, and whether the metric exists in extant databases or can be easily integrated into standard pre- and post-deployment health assessments).

Commanders can assess service members’ and their units’ overall levels of spiritual well-being and health before, during, and after deployment using the Spiritual Attitudes Inventory (SAI).⁶⁰ As a follow-up to the SAI and in service members who screen positive for mental health problems or appear to have low spiritual fitness, commanders can direct chaplains or mental health professionals to administer one or more of the fourteen scales from the Deployment Risk and Resiliency Inventory (DRRI).⁶¹ Service members who demonstrate risk factors for moral injury or spiritual problems or who screen positive for mental health problems, should be referred immediately to a chaplain or mental health professional for appropriate follow-up, including chaplain-sponsored programs, skills training, and counseling.

Commanders can monitor their unit’s resilience and capacity for recovery from spiritual injury throughout the deployment

TABLE II. Supporting Evidence for General Benefits of Spirituality

Benefit	Supporting Evidence ⁴
Hope and Optimism	—“80% or more the studies reported a positive association between religiousness and greater hope or optimism...” —No published studies have shown the opposite. (p. 215)
Less Depression	—Most studies investigating religion–depression association have found religion associated with less depression. —Of eight clinical trials located, five showed that religious interventions increased the speed of recovery from depression. (p. 216)
Fewer Suicides	—“In studies that correlated suicide with some measure of religious belief or activity (i.e. religiousness) the vast majority found an inverse relationship between religion and suicide.” (p. 217)
Less Anxiety	—“The majority of studies found less anxiety and fear among the religiously involved including 80% of the five prospective cohort studies and 86% of the clinical trials.” (p. 217)
Less Alcohol and Drug Abuse	—76 of 86 studies (88%) “reported significantly lower alcohol use or abuse among more religious subjects” and none reported the opposite. —48 of 52 studies “found significantly less drug abuse among the more religious...” (p. 218) —Significantly for the military most studies of the alcohol-drug-abuse association with religiousness have been conducted among adolescents and college students.
Greater Marital Stability	—“Divorce and separation are significant predictors of poor mental health and suicide (Rossow 1993)...” (p. 219) —Clearly divorce and separation are of major importance to the military. —“More than 90% of studies show greater marital happiness, lower rates of divorce and separation, and greater family stability among the more religious.” (p. 220).
Less Risky Behavior	—Considering a variety of risky from smoking to sexual promiscuity to the wearing of seat belts behaviors, the Handbook reports a general association between religiousness and less risk taking. —It should be noted that avoidance of some risks is more strongly associated with some spiritual traditions than others (e.g., Mormons are much less likely to smoke or drink alcohol because of denomination teaching). (pp. 358–381)
Longevity	—Considering a variety of causes, “When the religious variable was operationalized as religiousness 75% ($n = 39$) of the studies found that those who were more religious survived longer...” (p. 386)

cycle using the 2-⁶² or 10-item version of the Connor Davidson resilience Scale (CD-RISC),⁶³ which take seconds to complete.

While the metrics mentioned above measure spiritual well-being/health, resilience, and risk factors, a comprehensive and valid measure of spiritual fitness is lacking. It is hoped that based upon the definitions established for this and other total force fitness domains that such a metric will be developed for surveillance and measurement of spiritual fitness.

Metrics for Individual Components of Spiritual Fitness

In addition to listing the benefits of developing the spiritual fitness components described above, Table III describes and provides references for several options for validated metrics to assess each of these components.

How Spiritual Fitness Is Being Addressed With Current Programs

Chaplains

The three service branch’s chaplaincies provide help to ensure the right to free exercise of religion, conduct worship services and religious rites, and provide counseling and spiritual guidance to service members, wounded warriors, and/or their families.⁶⁴ The Army’s chaplaincy employs over 2,700 chaplains who represent over 130 different religious organizations; over 700 of these chaplains and chaplain assistants are mobilized or deployed throughout the world.⁶⁵ The U.S. Navy Chaplain Corps has 10 “spiritual fitness divisions”⁶⁴ and serves the Navy, Marine Corps, and Coast Guard both at sea and on land at foreign and domestic bases. Air Force chaplains are both commissioned military officers and ordained clergy from diverse faith

backgrounds, and they serve as advisors to commanders regarding religion, religious accommodation, ethics, and morale.⁶⁶

Identifying and Evaluating Resilience-Building Programs and Practices

Operations Iraqi Freedom and Enduring Freedom are returning thousands of warfighters with physical (brain and body), psychological (mind), and spiritual and moral injuries, many with long-term symptomatic and functional consequences.^{67,68} The current standard of care for post-deployment stress disorders, PTSD, and related conditions is not maximally effective, nor does it fully address the spiritual foundations and overlap of precursors and comorbidities characteristic of these stress disorders.⁶⁹ Service members most at risk for chronic PTSD are among the least likely to seek care;^{68,70} they report mistrust of mental health professionals, concerns about being stigmatized, and doubts about the effectiveness of mental health treatments.⁷¹ Thus, there is a need for resilience-building interventions and training programs that are delivered outside the mental health setting, include a spiritual component, address the whole-person experience of combat-related stress, and that can help pre-empt a disabling downward spiral of acute stress reactions in returning veterans. Just as all equipment that is deployed in combat undergoes a process of restoring to baseline function, so too should the minds and spirits of service members who engage in combat.

In response to these and other needs, the DoD has recently implemented numerous programs, interventions, and policies oriented toward building resilience and preventing and treating combat-related psychopathology. The DCoE is sponsoring several studies of leading resilience-building programs to identify

TABLE III. Spiritual Fitness Components, Related Outcome Variables and Recommended Metrics for Assessment

Component of Spiritual Fitness	Benefits of Component, Including Referenced Evidence Where Appropriate	Options for Metrics
Spiritual Beliefs	—Less death anxiety and death depression⁹³ —Greater stability over time and under pressure —Confidence when encountering conflicting beliefs, including those of the enemy	Glock and Stark's Orthodoxy Index: —4 items, oriented toward Christianity Systems of Belief Inventory-15 —15-item spiritual beliefs inventory consisting of 2 factors: a 10-item factor regarding beliefs, feelings and experiences, and a 5-item factor assessing social support from one's religious community.⁹⁴ Index of Spiritual Orientation —Intended to capture "non-traditional religious group orientations." —Includes belief, salience of religion, purpose in life and mysticism subscales.⁹⁵ Spiritual Involvement and Beliefs Scale —26 items including behaviors as well as beliefs. —Although it includes elements that are not strictly spiritual (e.g., willingness to forgive), it is appropriate as a psychospiritual measure.⁹⁶ Spiritual Connection Questionnaire (SCQ-14) —14-item questionnaire measuring beliefs and experiences of spiritual connection. —Designed to be consistent with both religious and spiritual-but-not-religious spirituality. —Higher scores found to be negatively correlated with "self-enhancement values" and positively correlated with "self-transcendent values."⁹⁷ Duke Religion Index (DUREL) —Contains 5 questions about frequency of organized and private religious practices, experience of connection to the Divine (could be used for transcendence, too) and the extent to which religious beliefs carry over into other aspects of life.¹⁰⁶
Personal Spiritual Values	—Positive relationship of spiritual values to prosocial behavior.⁹⁷ —Strong though indirect evidence of a values-fitness association. —Consistent and predictable behavior.	
Personal Practices	—General health benefits.^{4,98} —Greater ability to manage symptoms of PTSD⁹⁹ —Improved functioning and performance —Enhanced resilience and recovery following combat⁹⁹ —Benefit to blood pressure, immune function, depression, and mortality.¹⁰⁰ —"Strong, consistent, prospective, and often graded reduction (approx. 25% after adjustment for confounders) in risk of mortality in church/service attenders."¹⁰¹ —Better mental health among previously healthy individuals subjected to serious illness or injury.¹⁰² —Ability to change pain perception.¹⁰³ —Potential buffer for distress derived from experiences of ego loss.^{104,105} —Greater acceptance of difficult situations and opportunities for post-traumatic growth leading to spiritual resilience.³ —Construing positive meaning from war experiences involving combat exposure or high perceived threat, associated with better psychological adjustment.^{107,108} —Remorse or self-blaming for combat-related experiences and actions can lead to guilt and shame, and shame linked to decreased empathy, increased focus on internal distress, greater psychopathology, remorse, self-condemning thoughts, and lower well-being.³ —Greater coping ability.¹⁰⁹ —Includes ability to find religious significance.^{89,110}	
Purpose and Meaning		Sense of Coherence Questionnaire (SOC) —Measures the important salutogenetic construct sense of coherence, which consists of the three subdimensions manageability, comprehensibility, and meaningfulness.¹¹¹ —High consistency (Cronbach α for SOC-13 ranges from 0.74 to 0.91) and considerable stability (e.g., 0.54 over a 2-year period).¹¹² —High level of content, face, and construct validity.¹²

(Continued)

TABLE III. Continued

Component of Spiritual Fitness	Benefits of Component, Including Referenced Evidence Where Appropriate	Options for Metrics
Self-awareness: Reflection and Introspection	—Ability to reframe positively the stressors of deployment and recover more quickly from mental and psychological stress.⁷⁴ —Allows leaders to adapt to the external environment, potential adversaries, allies and local populations; to “shift gears” quickly, transitioning quickly from fighting in one moment to relating peacefully with the local community in the next; to access information from a wider variety of channels; and to display greater accuracy and more objectivity in gathering information.⁷⁴ —Improved attention and self-regulation.²³ —Increased efficiency of the executive attentional network leading to better task performance.¹¹³ —Enhanced attentional stability, reduced mean reaction time, improved target detection times, and increased efficiency by reducing task effort.¹¹⁴ —Protection against functional impairments in working memory capacity, which is used in managing cognitive demands and emotion regulation.²⁴ —Increased control over distribution of limited brain resources, which is significant in the dynamic, high-stress, and resource-scarce combat environment.¹¹⁵ —Reduced risk of physical, psychological, and spiritual injury. —Charitable or selfless actions and behaviors. —Well-being. —Feeling of connection/belonging. —Absence of loneliness/isolation. —Leaders who promote a “vision of transcendent service”^{141,117} in their units can transform something mundane “to something vibrant, where individual and collective spirituality are valued and reinforced, and spiritual development becomes a cultural expectation of the group for mission accomplishment for the greater good.”¹¹⁸	Freiburg Mindfulness Inventory (FMI) —Short, 14-item version measures mindfulness as a one-dimensional construct that is associated with regular meditative practice.¹¹⁶ —Internal consistency high (Cronbach $\alpha = 0.86$).²⁵ —Can be used in subjects without previous meditation experience. —FMI correlates well with relevant constructs (self-awareness, dissociation, global severity index, meditation experience in years).¹¹⁶
Transcendence	—Reduced death anxiety.^{56,93,121,122} —Association between “bereavement visits” and healthy faster resolution of grief.^{46–48,53} —Avoidance of anxiety and potential interpersonal conflict produced by conventional stigmatization of such experiences as pathological. —Increased life purpose and satisfaction, a health-promoting attitude. —Decreased frequency of medical symptoms.¹²³	Daily Spiritual Experience Scale (DSES)¹¹⁹ —A 16-item unidimensional instrument designed to measure frequency of positive spiritual experiences. —Assesses the perception of the connection with the transcendent as well as moments of interactions with the transcendent in daily life. —Items focus on experience rather than beliefs or behaviors. —Can be used to measure “vertical” transcendence. —Cronbach’s $\alpha = 0.95$; test–retest reliability $\alpha = 0.92$.^{119,120} Interpersonal Support Evaluation List (ISEL)⁸⁷ —Two domains of the ISEL measure belonging and perceived isolation. —Can measure “horizontal” transcendence. Index of Core Spiritual Experiences (INSPIRIT) —7-item scale “measuring the occurrence of experience that convinces a person God exists and evokes feelings of closeness with God, including the perception that God lives within.”¹²⁴ —Not specific to exceptional experiences, but clearly would include them.¹²⁵ Exceptional Experiences Questionnaire (EEQ): —Measures the frequency and evaluation of exceptional experiences as a multidimensional construct. —Factors: positive spiritual experiences, experiences of ego loss, psychopathological experiences, visionary dream experiences.¹⁰⁵
Exceptional Spiritual Experiences	—Reduced death anxiety.^{56,93,121,122} —Association between “bereavement visits” and healthy faster resolution of grief.^{46–48,53} —Avoidance of anxiety and potential interpersonal conflict produced by conventional stigmatization of such experiences as pathological. —Increased life purpose and satisfaction, a health-promoting attitude. —Decreased frequency of medical symptoms.¹²³	Freiburg Mindfulness Inventory (FMI) —Short, 14-item version measures mindfulness as a one-dimensional construct that is associated with regular meditative practice.¹¹⁶ —Internal consistency high (Cronbach $\alpha = 0.86$).²⁵ —Can be used in subjects without previous meditation experience. —FMI correlates well with relevant constructs (self-awareness, dissociation, global severity index, meditation experience in years).¹¹⁶

TABLE IV. Operationally Relevant Outcomes and Metrics

Operational Outcome	Related Variables	Recommended Metric for Each Variable
Resilience and Recovery From Deployment- and Combat-Related Trauma	Key variable and metric: Resilience	Connor Davidson resilience Scale (CD-RISC) —Distinguishes between those with greater and lesser resilience. —Has been used in military populations. —The two-item version of the Connor-Davidson Resilience Scale (CD-RISC2) takes less than 30 seconds to complete and asks about one's abilities to adapt to change and recover from illness or hardship, and distinguishes between those with greater and lesser resilience.⁶¹ —CD-RISC2 has demonstrated validity, good test-retest reliability, and significant correlation with the full, 25-item version of the CD-RISC.⁶²
	Other related variables and metrics: Post-deployment reintegration Symptoms of depression	Post-Deployment Readjustment Inventory (PDRI)⁶⁰ Patient Health Questionnaire (PHQ-2) —Included in the Post-Deployment Health Assessment and Re-Assessment (PDHA/PDHRA) is the Patient Health Questionnaire (PHQ-2), a 2-item depression instrument with high construct and criterion validity.^{60,61} Veterans RAND 12-Item Health Survey VR-12 —Derived from the SF-36, the gold standard used by the VA to measure health related quality of life.⁶²
Optimized Prevention and/or Resolution of Moral Injury	Well-being Key variable and metric: Risk factors for moral injury and spiritual resilience	Deployment Risk and Resiliency Inventory (DRRI)⁸³ —Created with DoD and Veterans Affairs support to assess key deployment-related risk factors unique to combat temporary warfare that can negatively impact service members health and well-being.⁸⁴ The DRRI scales assess: —Prewar factors such as prior stressors and early life experiences. —Deployment and war-zone factors such as stereotypical warfare experiences, one's sense of preparedness and safety in the combat zone, and exposure to nuclear-biological-chemical agents and consequences of combat. —Postwar factors such as the extent of social support and stressful life events post-deployment.⁸⁵
	Other related variables and metrics: Knowledge about moral injury and its relationship to spirituality and stress. Preparation for exposure to, and handling of, traumatic combat experiences.	Knowledge questionnaire/"test" following training session on this topic. Existence of pre-deployment facilitated discussions with chaplains, including scenario building, role playing, etc.

(Continued)

TABLE IV. Continued

Operational Outcome	Related Variables	Recommended Metric for Each Variable
Cohesive Unit Climate Supportive of Peak Performance	Key variable and metric: Unit cohesion	Platoon Cohesion Index (PCI) ⁸⁶ —Developed for use by company commanders and platoon leaders to assess cohesion in their platoons. —Consists of 20 items that form 3 horizontal, 2 vertical, and 5 organizational bonding scales. —Tested in 44 platoons of light and mechanized infantry from 2 posts. —Moderate to high intrascale, inter- scale, and scale-criterion correlations as well as predictive validity with platoon performance on field training exercises.
	Other related variables and metrics: Unit climate that respects diversity and differing values.	Unit climate surveys
	Purpose and mission clearly articulated by command.	Focus groups Observational research
	Genuine care and concern exhibited by unit members.	Interpersonal Support Evaluation List (ISEL) ⁸⁷ —Provides a global measure of perceived social support across four domains (belonging, self-esteem, appraisal, and tangible help). —Adherence to rules of engagement —Presence of unit training.
Healthy, Mature, and Engaged Spirituality That Fosters Finding Meaning/Purpose and Effective Coping	Ethical behavior and decision making modeled by leadership.	Spiritual Attitudes Inventory (SAI) —Has been tested and used in military populations. ⁸⁹ —Includes 39 questions and takes approximately 3-5 minutes to complete. —Measures the following areas: (1) Religious spiritual practice as measured by the Duke Religion Index (DUREL), ⁸⁸ $\alpha = 0.85$. (2) Religious/spiritual belief as measured by the Negative Religious Coping (NRCOPE) scale, ⁸⁹ $\alpha = 0.73$ to 0.98. (3) Sense of purpose/connection as measured by the Existential Well-Being Scale (EWBS) (a subscale of the Spiritual Well Being Scale (SWBS) ⁹⁰), $\alpha = 0.78$ –0.81. (4) Sense of hope/control as measured by the internal/external subscale of the Multiple Health Locus of Control Scale (MHLC). ⁹¹ $\alpha = 0.60$.
	Key variable and metric: Healthy spirituality	Focus groups and semi-structured interviews
	Other related variables and metrics: Availability of individual and unit spiritual practice opportunities, including perception of freedom of spiritual / religious expression	Institutional records
	Accessibility of chaplain and chaplain-sponsored programs. Positive coping	Coping Self-Efficacy Scale (CSES) ⁹² —Measures perceived self-efficacy for coping with challenges and threats; 3 factors: problem-focused coping, emotion-focused coping thoughts (and ability to get social support) Perception of Unit Support Scale (DRRI-US) ⁸³
	Perception of unit support	

key principles and outcomes for each program. Examples of these projects include an overview of DoD resilience programs;⁷² a systematic review of factors and components of resilience;⁷³ and a report that includes data about existing DoD programs' consistency with research evidence on resilience, a catalog and taxonomy of existing efforts and initiatives to support resilience and psychological health, a framework and toolkit for evaluating them, and preliminary data on some of the most promising programs/interventions.^{74,75}

Comprehensive Soldier Fitness

Comprehensive Soldier Fitness (CSF) is a total force fitness program designed to enhance performance and build resilience in soldiers, families, and Army civilians.⁷⁶ CSF uses individual assessments, self development modules, a variety of training styles (e.g., virtual, classroom, online, and institutional), and resilience trainers who provide self-care skills training to soldiers and their families. One of five dimensions of CSF, the spiritual module is based on the Domain of the Human Spirit (DOTHS) model.⁷⁷ The components of the DOTHS model are spiritual strength (core values and beliefs concerning purpose and meaning); self-awareness (reflection and introspection); social awareness (respect, empathy, compassion, and communication skills); self-motivation (confident belief, expectancy, hope, and optimism); self-regulation (emotion, cognitive, and behavior control); and sense of agency (ownership). The spiritual fitness component of CSF focuses first on individual spiritual development, and then on spiritual leadership through role modeling and establishing an organizational climate supportive of spiritual development.⁷⁷

DISCUSSION

Combat has always presented fighters with complex and difficult spiritual issues. The asymmetrical nature of combat facing American troops today, along with the growing role of religious ideology in those conflicts, makes formal attention to spirituality by military leadership more urgent than ever. Fortunately, there are many existing programs within which new spiritual elements can be incorporated, utilizing existing personnel. Chaplains are primary in this, but chaplaincy work and spiritual support in general need to be better integrated with these programs and staff. For example, some spiritual practices very useful to service members, such as yoga and meditation, may be most usefully located in areas set aside for physical exercise or recreation, and instructors may not be chaplains.

The development of an integrated team approach to troop support is crucial, similar to developments in civilian health care. As has become obvious in the civilian healthcare setting, this integration can only occur when there is full commitment from the leadership. Commanders need to understand why this is crucial to force readiness and troop fitness, and must be given the training and tools to develop and support integrated teams. Especially in the modern, spiritually diverse armed forces, leadership has a crucial role in establishing and maintaining balance so that minority traditions are not disadvantaged.

Spiritual support planning must be evidence based, just as medical and behavioral supports are. The research literature on

spirituality and health is relatively young, but it is extensive and includes data that can support the planning of policies and programs in the armed forces. However, the applicability of those findings to the military population, in combat and postcombat, has not been empirically tested and confirmed. Therefore, new policies and programs must include evaluation research, not only to gauge effectiveness, but also to allow the fine tuning of interventions to the specifics of the military environment.

Programs should begin with the utilization of those instruments currently available that are sufficiently compact to be useful for the monitoring of service members on a regular basis (see Metrics section above) before, during, and after deployment. The usefulness of this monitoring will depend on the availability of chaplains and mental health personnel for referral and training programs to ensure that those personnel are familiar with the instruments in use and can address identified problems appropriately.

In addition to this monitoring, pre-deployment programs should address the likely risk of spiritual distress and moral injury and prepare all new service members rather than waiting for individual crises. Also, leaders need to monitor events in the field that call for proactive interventions. When accidents or errors in combat result in civilian deaths, or when atrocities are reported, it should be assumed that spiritual distress and moral injury are likely results among service members. In these circumstances, programs should be in place for spiritual support.

Increasing diversity in the American population has raised the issue of cultural competence as never before, and spirituality constitutes a major part of that diversity. Military programs must scrupulously avoid discrimination against minorities while providing appropriate services for the large Christian and spiritual-but-not-religious groups in the services. This means that all levels of leadership and support personnel need training.

Chaplains are a valuable resource for such training and for development of programs. This is especially true for those with Clinical Pastoral Education (CPE) training and certification. CPE training is a virtual necessity to the chaplain's ministry in a diverse setting, and it greatly enhances their ability to train and work with other professionals, especially behavioral health professionals. It is essential that chaplains be considered an integral part of the care team, especially since service members have shown a tendency to present their psychological problems to chaplains to avoid the perceived stigma that goes with consulting a mental health professional. The work of chaplains can be optimized by teaming them with psychologists and social science experts in the field of spirituality and health.

Such collaborative relationships require support from leadership, so this should be a high priority for commanders. Training and policy should be implemented to address barriers in leadership, such as silence about spiritual issues, inaccurate views of spirituality and psychospiritual fitness, and inconsistent receptivity to chaplains' pastoral services and advice.

CONCLUSION: BOTTOM LINE FOR THE LINE

The following recommendations are designed to enhance individual and unit spiritual fitness, build resilience, and optimize

force readiness and protection. Each recommendation requires commanders with the training to understand its importance and the skill to support it.

- (1) Implement evidence-informed mental and spiritual fitness training programs, including practical skills training in appropriate mind–body self-management techniques, education about moral injury and its relationship to spirituality and stress, and peer counseling opportunities with returning and retired veterans.
- (2) Organize pre-deployment discussions, facilitated by chaplains and including scenario building and role playing, to prepare service members and their families for exposure to moral and ethical stressors unique to modern unconventional warfare, to “break the ice” on talking about the possibility of loss of a loved one’s life, and to facilitate development of contingency plans in the event of physical, mental, emotional, and/or spiritual injury.
- (3) While in theater, implement unit after action reviews following any potentially traumatic experience and at regular intervals throughout the deployment. The spiritual ramifications of combat trauma do not affect just the individual; they impact the entire unit.
- (4) While in garrison, monitor resilience, assess risk factors that could negatively impact spiritual fitness, and screen for moral trauma and potential problems resulting from spiritual injury.
- (5) Develop a toolbox of resources to recommend when service members screen positive for mental health and spiritual problems or moral injury, including referral to chaplains, chaplain-supported programs, counseling, and/or other resources.

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REFERENCES

1. Department of Defense: Quadrennial Defense Review. Washington, DC, DoD, 2006. Available at <http://www.comw.org/qdr/qdr2006.pdf>; accessed.
2. Joint Forces Command US: The Joint Operating Environment. Washington, DC, Department of Defense, 2008. Available at <https://us.jfcom.mil/sites/J5/j59/default.aspx>; accessed January 4, 2010.
3. Litz BT, Stein N, Delaney E, et al: Moral injury and moral repair in war veterans: a preliminary model and intervention strategy. *Clin Psychol Rev* 2009; 29(8): 695–706.
4. Koenig HG, McCullough M, Larson DB: *Handbook of Religion and Health*. Oxford University Press, New York, 2001.
5. Hufford DJ: *An Analysis of the Field of Spirituality, Religion and Health*. Metanexus Institute, Bryn Mawr, PA, 2005.
6. Rhodes J, Hufford D, Fritts M, Yosick T, Johnson D, Smith M, Boyd O, Campbell M, Hunter C, Dugal M, Bates M, Pinder E, Thom B, Dickens V,

- Page L, Steiner M, Westphal R, Nash W, Fautau D: Results of the Spiritual Fitness Working Group Discussions. Presented at the “Defining Total Fitness for the 21st Century” conference, Uniformed Services University of the Health Sciences (Bethesda, MD), Dec 7, 2009.
7. Rhodes J, Fritts M, Hufford D, Pinder E, Bates M, Herrold R: Spiritual Fitness and Ethical Fitness in the Armed Services. Presented at the Defining Total Fitness for the 21st Century conference. Bethesda, MD, Uniformed Services University of the Health Sciences, December 6, 2009.
8. Mullen M: Chairman of the Joint Chiefs of Staff Instruction (CJCSI): Total Force Fitness Framework, Enclosure B5. Washington, DC, Department of Defense, 2010.
9. Brown L: *The New Shorter Oxford English Dictionary on Historical Principles*, pp 2989–2990. Oxford, UK, Clarendon Press, 1993.
10. Zinnbauer BJ, Pargament KI, Cole B, et al: Religion and spirituality: unfuzzifying the fuzzy. *J Sci Study Relig* 1998; 36: 549–64.
11. Egbert N, Mickley J, Coeling H: A review and application of social scientific measures of religiosity and spirituality: assessing a missing component in health communication research. *Health Commun* 2004; 16(1): 7–27.
12. Larson DB, Swyers JP: *Scientific Research on Spirituality and Health: A Consensus Report*. Rockville, MD, National Institute for Healthcare Research, 1998.
13. Kurs K: Are you religious or are you spiritual? *Voices of a new America. Spirituality and Health International*. 2001; 4: 28–31.
14. Gallup Organization: Gallup Poll Topics: A-Z; Religion. Washington, DC, Gallup, 2001. Available at www.gallup.com/poll/indicators/indreligion4.asp; accessed January 4, 2010.
15. Schmidt LE: *Restless Souls: The Making of American Spirituality*. Harper Collins Publisher, New York, 2005.
16. Fuller RC: *Spiritual but Not Religious: Understanding Unchurched America*. New York, Oxford University Press, 2001.
17. Williams DR, Larson DB: Religion and psychological distress in a community sample. *Soc Sci Med* 1991; 32.
18. Ai AL, Dunkle RE: The role of private prayer in psychological recovery among midlife and aged patients following cardiac surgery (CABG). *Gerontologist* 1998; 38(5): 591–601.
19. Helm H, Hays JC, Flint E, Koenig HG, Blazer DG: Does private religious activity prolong survival? A six-year follow-up study of 3851 older adults. *J Gerontol Med Sci* 2000; 55(7): M400–5.
20. Koenig HG, Pargament KI, Nielsen J. Religious coping and health status in medically ill hospitalized older adults. *J Nerv Ment Dis* 1998; 186(9): 513–21.
21. Kabat-Zinn J, Massion AO, Kristeller J, et al: Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *Am J Psychiatry* 1992; 149(7): 936–43.
22. Astin JA: Stress reduction through mindfulness meditation. Effects on psychological symptomatology, sense of control, and spiritual experiences. *Psychother Psychosom* 1997; 66(2): 97–106.
23. Davidson RJ, Kabat-Zinn J, Schumacher J, et al: Alterations in brain and immune function produced by mindfulness meditation. *Psychosom Med* 2003; 65(4): 564–70.
24. Grossman P, Niemann L, Schmidt S, Walach H: Mindfulness-based stress reduction and health benefits. A meta-analysis. *J Psychosom Res* 2004; 57(1): 35–43.
25. Jha AP, Krompinger J, Baime MJ: Mindfulness training modifies subsystems of attention. *Cogn Affect Behav Neurosci* 2007; 7(2): 109–19.
26. Jha AP, Stanley EA, Kiyonaga A, Wong L, Gelfand L: Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion* 2010; 10(1): 54–64.
27. Miller JJ, Fletcher K, Kabat-Zinn J: Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psychiatry* 1995; 17(3): 192–200.
28. Stanley E: *Mindfulness And Military Effectiveness In Counterinsurgency Operations*. Conference of the Inter-University Seminar of Armed Forces and Society. Chicago, IL, 2007.
29. Sachidananda S: *The Living Gita: The Complete Bhagavad Gita: A Commentary for Modern Readers*. Verses VI.11–13. Yogaville, VA, Integral Yoga Publications, 1997.

30. King W: *Zen and the Way of the Sword: Arming the Samurai Psyche*. Oxford, Oxford University Press, 1993.
31. Harvey P: *An Introduction to Buddhist Ethics*. New York: Cambridge University Press, 2000.
32. Kohlberg L, Power C: Moral development, religious thinking, and the question of a seventh stage. *Zygon* 2005; 16(3): 203–59.
33. Marine Corps USMCO 1730.6D: *Command Religious Programs in the Marine Corps: Joint Publication 1-05, Religious Affairs in Joint Operations*. Washington, DC, Department of Defense, November 13, 2009.
34. Clifford G, Smith M: *Speaking the Ineffable? A Definition of Spirituality that can be Measured*. Appendix A. FY08 PDTW, Chaplain Self-Care While Caring for Others: The Art of Finishing Well. Student Guide, 2008.
35. Stanley E: *Mindfulness-Based Mind Fitness Training (MMFT)*. 2010. Available at <http://www.mind-fitness-training.org/MMFTOverviewNarrative.pdf>; accessed March 1, 2010.
36. Rosen SP: *War and human nature*. Princeton, NJ, Princeton University Press, 2005.
37. Stanley EA: Neuroplasticity, mind fitness, and military effectiveness. In: *Smart Imitates Life: Biologically Inspired Innovation and National Security*. Edited by Drapeau M. Washington, DC, National Defense University Press, 2010.
38. Hobfoll SE, Briggs-Phillips M, Stines LR: Fact or artifact: the relationship of hope to a caravan of resources. In: *Between Stress and Hope: From a Disease-Centered to a Health-Centered Perspective*, pp 81–104. Edited by Jacoby R, Keinan G. Greenwood Publishing Group, Santa Barbara, CA 2003.
39. Schaufeli WBB, Burnout BP: An overview of 25 years of research. In: *Handbook of Work and Health Psychology*, pp 383–425. Edited by Schabracq JAM. Chichester, Wiley, 2002.
40. Brunye T, Riccio G, Sidman J, Darowski A, Diedrich FJ: *Enhancing Warrior Ethos In Initial Entry Training*. Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting, San Francisco, CA, pp 2634–2638, 2006.
41. DeVinne PB (editor): *The American Heritage Dictionary of the English Language*. Second College Edition. Boston, Houghton Mifflin, 1991.
42. Fry LW: Toward a theory of ethical and spiritual well-being, and corporate social responsibility through spiritual leadership. In: *Positive Psychology in Business Ethics and Corporate Responsibility*, pp 47–83. Edited by Giacalone RA, Jurkiewicz CL. 2005, Information Age Publishing, Inc. Charlotte, NC.
43. Fry LW: Toward a theory of spiritual leadership. *Leadersh Q* 2003; 14(6): 693–727.
44. White RA: Dissociation, narrative, and exceptional human experience. In Krippner S, Powers S (Eds.), *Broken images, broken selves: Dissociative narratives in clinical practice* (pp. 88–121). Washington, DC: Brunner-Mazel, 1997.
45. White R, Anderson I: *Psychic Experiences: A Bibliography*. Dix Hills, NY: Parapsychology Sources of Information Center, New York, NY 1990.
46. Davis CF: *The Evidential Force of Religious Experience*. Oxford, UK, Clarendon Press, 1989.
47. Rees D: *Death and Bereavement: The Psychological, Religious and Cultural Interfaces*, Ed 2, London, Whurr Publishers, 2001.
48. Rees D: The hallucinations of widowhood. *British Med J* 1971; 37–41.
49. Haraldsson E: Survey of claimed encounters with the dead. *Omega* 1988; 19(2): 103–13.
50. Hufford DJ: Visionary spiritual experiences and cognitive aspects of spiritual transformation. *Global Spiral*. 2008; 9(5): 1–18.
51. Sadock BJ, Sadock VA (editors): *The Comprehensive Textbook of Psychiatry*. Ed 7. Philadelphia, Lippincott Williams and Williams, 2000.
52. Olson PR, Suddeth JA, Peterson PA, Egelhoff C: Hallucinations of widowhood. *J Am Geriatr Soc* 1985; 33: 543–7.
53. Barbato MC, Blunden K, Reid H, Irwin H, Rodriquez P: Parapsychological phenomena near the time of death. *J Palliat Care* 1999; 15(2): 30–7.
54. Greeley AM: *The Sociology of the Paranormal: A Reconnaissance Vol 3, series 90-023*. Beverly Hills, CA, Sage Publications, 1975.
55. Moody R: *Life After Life*. Atlanta, Mockingbird Books, 1975.
56. van Lommel P, van Wees R, Meyers V, Elfferich I: Near-death experience in survivors of cardiac arrest: a prospective study in the Netherlands. [see comment][erratum appears in *Lancet* 2002 Apr 6;359(9313):1254] *Lancet* 2001; 358(9298): 2039–45.
57. Groth-Marnat G, Summers R: Altered beliefs, attitudes, and behaviors following near-death experiences. *J Humanist Psychol* 1998; 38(3): 110–25.
58. Cohen J: A power primer. *Psychol Bull* 1992; 112: 155–9.
59. Nunnally JC, Bernstein IH: *Psychometric theory*. Ed 3. New York, McGraw-Hill, 1994.
60. Boyd OW: *The USACHPPM–Duke Spiritual Attitudes Inventory: Information and Status Briefing*. USACHPPM, Aberdeen Proving Ground, MD, March 2006.
61. Katz L: *Assessing Readjustment From OIF/OEF Using the Post-Deployment Readjustment Inventory*. International Society for Traumatic Stress Studies Annual Meeting. Chicago, Illinois, 2008.
62. Vaishnavi S, Connor K, Davidson JR: An abbreviated version of the Connor-Davidson Resilience Scale (CD-RISC), the CD-RISC2: psychometric properties and applications in psychopharmacological trials. *Psychiatry Res* 2007; 152(2-3): 293–7.
63. Campbell-Sills L, Stein MB: Psychometric analysis and refinement of the Connor-Davidson Resilience Scale (CD-RISC): validation of a 10-item measure of resilience. *J Trauma Stress* 2007; 20(6): 1019–28.
64. US Navy: *Chaplain Care*. Washington, DC, DoD, August 8, 2008. Available at <http://chaplaincare.navy.mil/index.htm>; accessed February 12, 2010.
65. US Army: *Army Chaplaincy*. Washington, DC, DoD, 2010. Available at <http://www.army.mil/info/organization/chaplaincy/>; accessed February 12, 2010.
66. US AirForce: *United States Air Force Chaplain Corps: What We Do*. Washington, DC, DoD, October 2006.
67. Erbes C, Westermeyer J, Engdahl B, Johnsen E: Post-traumatic stress disorder and service utilization in a sample of service members from Iraq and Afghanistan. *Mil Med* 2007; 172(4): 359–63.
68. Hoge CW, Auchterlonie JL, Milliken CS: Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA* 2006; 295(9): 1023–32.
69. Osuch E, Engel CC Jr: Research on the treatment of trauma spectrum responses: the role of the optimal healing environment and neurobiology. *J Altern Complement Med* 2004; 10(Suppl 1): S211–21.
70. Rogers S: An alternative interpretation of “intensive” PTSD treatment failures. *J Trauma Stress* 1998; 11(4): 769–75.
71. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL: Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med* 2004; 351(1): 13–22.
72. Bowles SV, Bates MJ: Military organizations contributing to resilience building. *Mil Med* 2010 (in press).
73. Meredith LS: *Review of Literature to Identify Evidence-Based Practices that Promote Resilience*. Santa Monica, CA, RAND Corporation, 2009.
74. RAND Corporation: *Center For Military Health Policy: Innovative Practices for Psychological Health and Traumatic Brain Injury*. Santa Monica, CA, 2010. Available at <http://www.rand.org/multi/military/innovative-practices/>; accessed February 15, 2010.
75. Stanley EA, Jha AP: *Mind Fitness And Mental Armor: Enhancing Performance And Building Warrior Resilience*, p 55. Washington, DC, Joint Force Quarterly, 2009.
76. Cornum R: *Comprehensive Soldier Fitness*. Presented at Master Resilience Trainer Course Philadelphia, PA: December 7–17, 2009.
77. Sweeny H: Domain of the human spirit. In: *Forging the Warrior Character*, 2008, pp 23–50. Edited by Snider D, Matthews L. Boston, MA, McGraw Hill.
78. Thomas OC, Wondra EK: *Introduction to Theology*. New York, Morehouse Publishers, 2002.
79. Puchalski CM, Romer AL: Taking a spiritual history allows clinicians to understand patients more fully. *J Palliat Med* 2000; 3(1): 129–37.
80. Kroenke K, Spitzer RL, Williams JB: The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001; 16(9): 606–13.
81. Kroenke K, Spitzer RL, Williams JB, Lowe B: An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics* 2009; 50(6): 613–21.

82. Kazis LE, Miller DR, Skinner KM, et al: Applications of methodologies of the Veterans Health Study in the VA healthcare system: conclusions and summary. *J Ambul Care Manage* 2006; 29(2): 182–8.
83. Vogt DS, Proctor SP, King DW, King LA, Vasterling JJ: Validation of scales from the Deployment Risk and Resilience Inventory in a sample of Operation Iraqi Freedom veterans. *Assessment* 2008; 15(4): 391–403.
84. National Center for PTSD: History of the DRRI. Washington, DC, Department of Veterans Affairs, 2003. Available at <http://www.ptsd.va.gov/professional/pages/assessments/drri-history.asp>; accessed January 2010.
85. National Center for PTSD: Deployment Risk and Resilience Inventory (DRRI) Measures. Washington, DC, Department of Veterans Affairs, 2003. Available at <http://www.ptsd.va.gov/professional/pages/assessments/list-drri-measures.asp>; accessed January 2010.
86. Siebold G, Kelly D: Development of the Platoon Cohesion Index. Alexandria, VA, Army Research Institute For The Behavioral And Social Sciences, 1988.
87. Cohen S, Mermelstein R, Kamarck T, Hoberman H: Measuring the functional components of social support. In: *Social Support: Theory, Research and Applications*, pp 73–94. Edited by Sarason SB. Dordrecht, The Netherlands, Martinus Nijhoff Publishers, 1985.
88. Koenig HG, Meador KG, Parkerson G: Religion index for psychiatric research: a 5-item measure for use in health outcome studies. *Am J Psychiatry* 1997; 154: 885–6.
89. Pargament KI, Koenig HG, Perez LM: The many methods of religious coping: development and initial validation of the RCOPE. *J Clin Psychol* 2000; 56: 519–43.
90. Paloutzian RF, Ellison CW: Loneliness, spiritual well-being and the quality of life. In: *Loneliness: A Sourcebook of Current Theory, Research and Therapy*, pp 224–237. Edited by Peplau LA, Perlman D. New York, Wiley-Interscience, 1982.
91. Wallston KA: The validity of the multidimensional health locus of control scales. *J Health Psychol* 2005; 10(5): 623–31.
92. Chesney MA, Neilands TB, Chambers DB, Taylor JM, Folkman S: A validity and reliability study of the coping self-efficacy scale. *Br J Health Psychol* 2006; 11(Pt 3): 421–37.
93. Alvarado KA, Templer DI, Bresler C, Thomas-Dobson S: The relationship of religious variables to death depression and death anxiety. *J Clin Psychol* 2006; 51(2): 202–4.
94. Holland JC, Kash KM, Passik S, et al: A brief spiritual beliefs inventory for use in quality of life research in life-threatening illness. *Psychooncology* 1998; 7(6): 460–9.
95. Glik DC: The redefinition of the situation: the social construction of spiritual healing experiences. *Sociology of Health and Illness* 1990; 2: 151–168.
96. Hatch R, Burg M, Naberhaus D, Hellmich L: The Spiritual Involvement and Beliefs Scale: development and testing of a new instrument. *J Fam Pract* 1998; 46(6): 476–86.
97. Wheeler P, Hyland M: The development of a scale to measure the experience of spiritual connection and the correlation between this experience and values. *Spirituality and Health International*. 2008; 9(4): 193–217.
98. Koenig H: *Medicine, Religion, and Health: Where Science and Spirituality Meet*. Conshohocken, PA, Templeton Foundation Press, 2008.
99. Dewey L: *War and Redemption: Treatment and Recovery in Combat-Related Post-Traumatic Stress Disorder*. Burlington, VT, Ashgate, 2004.
100. Seeman TE, Dublin LF, Seeman M: Religiosity/spirituality and health: a critical review of the evidence for biological pathways. *Am Psychol* 2003; 58: 53–63.
101. Powell LH, Shahabi L, Thoresen CE: Religion and spirituality: linkages to physical health. *Am Psychol* 2003; 58: 36–52.
102. Koenig HG, Larson DB, Larson SS: Religion and coping with serious medical illness. *Ann Pharmacother* 2001; 35(3): 352–9.
103. Wachholtz A, Pearce M, Koenig H: Exploring the relationship between spirituality, coping, and pain. *J Behav Med* 2007; 30(4): 311–8.
104. Kohls N, Friedl C, Walach H: Häufigkeit und Bewertung von aussergewöhnlichen menschlichen Erfahrungen. Ergebnisse einer Fragebogenstudie zu differentialdiagnostischen Zwecken. [Frequency and valuations of exceptional human experiences. Explorative results of a survey]. In: Belschner W, Galuska J, Walach H, Zundel E (Hrsg.) *Perspektiven Transpersonaler Forschung. Jahresband 1 des DKTP*. Oldenburg: Bibliotheks- und Informationssystem der Universität Oldenburg 2001; 89–116.
105. Kohls N, Walach H: Exceptional experiences and spirituality: a new measurement approach based on frequency and valuation of experiences. *Spirituality and Health International*. 2006; 7: 125–50.
106. Koenig H, Parkerson GR Jr, Meador KG: Religion index for psychiatric research. *Am J Psychiatry* 1997; 154(6): 885–6.
107. Owens G: Posttraumatic stress disorder, guilt, depression, and meaning in life among military veterans. *J Trauma Stress* 2009; 22(6): 654.
108. Schok M: *Meaning as a Mission: Making Sense of War and Peacekeeping*. Eburon–Eburon Academic Publishing, The Netherlands, 2009.
109. Bonura D: *The Army Chaplaincy: Professional Bulletin of the Unit Ministry Team*. ISSN 1542-8907. Washington, DC, 2009; PB 16-09-2.
110. Pargament K, Smith B, Koenig HG, Perez L: Patterns of positive and negative religious coping with major life stressors. *J Sci Study Relig* 1998; 37: 710–24.
111. Antonovsky H, Sagy S: The development of a sense of coherence and its impact on responses to stress situations. *J Soc Psychol* 1986; 126(2): 213–25.
112. Antonovsky A: The structure and properties of the sense of coherence scale. *Soc Sci Med* 1993; 36(6): 725–733.
113. Tang YY, Ma Y, Wang J, Fan Y, Feng S, Lu Q: Short-term meditation training improves attention and self-regulation. *Proc Natl Acad Sci USA* 2007; 104(43): 17152–6.
114. Lutz A, Brefczynski-Lewis J, Johnstone T, Davidson RJ: Regulation of the neural circuitry of emotion by compassion meditation: effects of meditative expertise. *PLoS ONE* 2008; 3(3).
115. Slagter HA, Lutz A, Greischar LL, et al: Mental training affects distribution of limited brain resources. *PLoS Biol* 2007; 5(6): e138.
116. Walach H: Measuring mindfulness—the Freiburg Mindfulness Inventory (FMI). *Pers Individ Dif* 2006; 40: 1543–55.
117. Fry LW: Spiritual leadership as a model for student inner development. *J Leadersh Stud* 2009; 3: 80.
118. Dent E, Higgins ME, Wharff D: Spirituality and leadership: an empirical review of definitions, distinctions, and embedded assumptions. *Leadersh Q* 2005; 16: 625–53.
119. Underwood LG, Teresi JA: The daily spiritual experience scale: development, theoretical description, reliability, exploratory factor analysis, and preliminary construct validity using health-related data. *Ann Behav Med* 2002; 24(1): 22–33.
120. Kalkstein S, Tower RB: The daily spiritual experiences scale and well-being: demographic comparisons and scale validation with older Jewish adults and a diverse internet sample. *J Relig Health* 2009; 48(4): 402–17.
121. Sabom W: Near-death experience: a review from pastoral psychology. *J Relig Health* 1980; 19(2).
122. Neimeyer RA: *Death Anxiety Handbook: Research, Instrumentation, and Application*. Washington, DC, Taylor and Francis, 1994.
123. Kass JD, Friedman R, Leserman J, Zuttermeister PC, et al: Health outcomes and a new index of spiritual experience. *J Sci Study Relig*. Jun 1991 1991; 30(2): 203–211.
124. McBride JL, Arthur G, Brooks R, Pilkington L: The relationship between a patient's spirituality and health experiences. *Fam Med* 1998; 30(2): 122–6.
125. VandeCreek L, Ayres S, Bassham M: Using INSPIRIT to conduct spiritual assessments. *J Pastoral Care* 1995; 49(1): 83–9.

Social Fitness

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ABSTRACT The context of military service has been altered greatly since September 11, 2001. The forward deployment of service members to theaters of conflict, which involves issues of potential trauma exposure and separation from support systems can challenge group performance; however, group cohesion might be a mitigating factor and explain how units perform. This article represents a new way of looking at cohesion. To this end, a social cohesion and social fact framework is introduced and highlighted. Implications for this model are presented.

INTRODUCTION

An extensive review of the literature establishes that the most common operationalization of the concept of “social fitness” is the concept of social cohesion. However the research on the military to date does not allow us to look at group cohesion over vastly different settings and subpopulations within the settings. There are a wide range of intervening variables that can occur between cohesion and performance. The results of the research, however, pose a dilemma for the military. The challenge is whether priority should be placed on the importance of cohesion for productivity/effectiveness/performance, in which case the object should be to develop task cohesion. Or should the focus be on the support of the soldiers and social cohesion? The latter provides more emotional and psychological support for the soldier but might reduce the performance of the unit.

Social cohesion is, in the language of military sociology, a “strength multiplier”: the military strengthening and psychologically protective effect of stable, socially cohesive units is not scientifically speculative, ambiguous, or uncertain. Theoretically, when we destroy social cohesion—in a military setting, by repeatedly moving soldiers from one assignment to the next, by switching their leaders year after year, by depriving them of factors such as unit traditions and domestic stability, by preventing them from getting to know their community and fellow soldiers well—we destroy the ability to face difficult challenges and to accomplish extraordinary things. The consequences are attrition, poor performance, insubordination, sick call behavior, suicide, and disaffection.

A recent study of the first war in Iraq by Wong et al.,¹ which compared American soldiers to Iraqi soldiers, concluded that social cohesion among the Americans was stronger and that

social cohesion as opposed to task cohesion was more predictive of successful unit performance. The study reflects a very widely held belief both within the military and outside in business and sports teams that the group plays a significant and different role than that of the individual. It can be seen in such expressions as “he/she is a real team player” or “go in there and win one for the Gipper.” Both reflect the belief that the group is both different from and more important than the individual. It is also enshrined in the Marine’s motto *Semper Fidelis* (Always Faithful) to voice loyalty and commitment to their Marine comrades in arms. So the idea of putting the interest of the group first, even in a highly individualistic society and culture as the U.S., is a widely held belief and in some ways might be considered a foundation principle of all the military services where it finds its fullest expression and is captured in very significant symbols (the regimental colors, the green beret, etc.).

We are interested in understanding the phenomenon of social cohesion. We know that service members in deeply stressful situations can often make it through successfully, as long as they belong to socially cohesive groups and as long as those with authority over them (who are supposed to be “on their side”) do not betray them—the ancient concept of justice that Shay² translates as “what’s right.” Data from the Vietnam Readjustment Survey suggest that a lack of social cohesion wrought in the minds of veterans who have experienced a betrayal of “what’s right.” Shay² forcefully rejects the nomenclature that characterizes people who suffer from the long-term effects of stress and from a betrayal of “what’s right” as having a “disorder.” What they have, according to Shay,² is an “injury” because they lack social fitness. Stable and cohesive social communities multiply individual strengths and protect people from injury by the hostile world around them.

In contrast to the American experience in the Vietnam War, and quite in contravention to the predictions of many of the Iraq War’s critics, units of the American ground forces fighting the war, the 20 or so U.S. Army and Marine Corps brigades, about 160,000 troops, now shuttling in and out of the country, have managed to maintain a large degree of “social cohesion.” Perhaps more focus on military stress or some structural changes or “social facts” have led to this greater social cohesion.³

In his classic sociology work, Emile Durkheim⁴ established the concept of social facts, which stand apart from the

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individual but act in the background, determining how individuals act and behave. He noted that when we fulfill social roles (soldier, sailor, and pilot) we are carrying out obligations we have incurred that have been defined by custom and law apart from the individual. These he termed social facts. The individual does not create these roles, although they might influence how they are enacted. But even that influence must be within socially defined parameters. If you go beyond the accepted limits you can be removed from the role (dishonorable discharge for example). Social facts are external to the individual. Durkheim⁵ was able to show that even in the most individual of acts, suicide, it is possible to show that suicide rates vary according to social variables, not individual ones. In fact Thorensen and Mehlum⁶ found that often after deployment, suicide rates were higher where leadership and group cohesion were lower or where soldiers were moved away from their units. Since groups have very different suicide rates, and it varies in different time periods, there must be something about social groups that either prevents or fails to prevent individuals from committing suicide. Durkheim⁵ found that when an individual is tightly bound into an integrated social group with a strong sense of solidarity, where the individual accepts the norms and values of the group as their own, suicide rates are lower.⁵ Where a state of normlessness exists (a state Durkheim called *anomie*) suicide rates go up, as was seen in Thorensen and Mehlum.⁶ We also know that suicide rates were higher in the interwar years between the Vietnam War and the Carter administration than during the Vietnam War or the period of 1990–1999, suggesting that the draftee military without a wartime mission lacked the social cohesion of the military at war or the all volunteer army of the 90s and beyond.⁷

Given the importance of the group on such behaviors as suicide, the “fitness” of the group has real significance for society and the military. Durkheim was publishing in 1897, so we can say that there is a very long tradition of scholarship in both sociology and anthropology that supports the importance of the group in human behavior.

Yarvis³ notes that it has been said that soldiers do not give their lives for their country, but they do for the group: their unit, the fellow soldiers in their regiment, company, platoon, or other relatively small discreet military formation. Specific political motivations for a war may come and go, may morph and be stated anew, but it really does not matter. For men (usually) under combat, a bond of friendship and loyalty develops, so intense and formidable, frequently far more intense than filial or sibling bonds, that the soldiers are willing, indeed, they frequently volunteer, to sacrifice their very lives to maintain the greater unit’s continued survival. Military surgeons and soldier memoirs have documented such facts since war has been recorded.³

DEFINING SOCIAL FITNESS

Much attention has been given to the returning service members and their physical and psychological health. Leadership

has called for the development and implementation of strategies for strengthening units through community-based prevention efforts.⁸ The intent of these efforts is to develop strategies to strengthen the capacity of formal and informal networks as mechanisms of social cohesion.

In response, we seek to define social fitness to study performance outcomes in military groups. Nomenclature presents the first problem in moving social cohesion and fitness from an abstract concept to a measurable one. Whereas we can define health fitness, medical fitness, physical fitness and develop biological and other direct markers to determine these in individuals, in the case of social fitness, this is not possible. The concepts of social health and social fitness are often used metaphorically. Furthermore, the concept of social fitness does not lend itself easily to measurement. To accept an accumulation of measures all from individuals’ fitness or health, as measures of group health or fitness, poses very serious epistemological questions.⁹ If social facts (such as social fitness) are something different, and greater than individuals, then the whole is clearly greater than the sum of the parts. Having every service member medically, physically, and even psychological fit may tell you nothing about group fitness. Witness the sports teams that have hugely talented, fit individuals but cannot perform well together as a team. Therefore when considering group fitness, it is important to recognize we are entering a different world than that of individual fitness.

A second problem can be seen by replicating the chart provided by Dr. Wayne Jonas in his introduction (Fig. 1).¹⁰

What the model above suggests is a “language” for examining military relationships. Military leaders cannot learn this language without a common vocabulary and a corresponding conceptual model that provides a roadmap for measuring these variables.

In this article we offer a preliminary model for social fitness that responds to this need.

Depending on what level of group we are talking about, some of the variables shown in the figure will be internal to the group and some will be external. If the group we are concerned

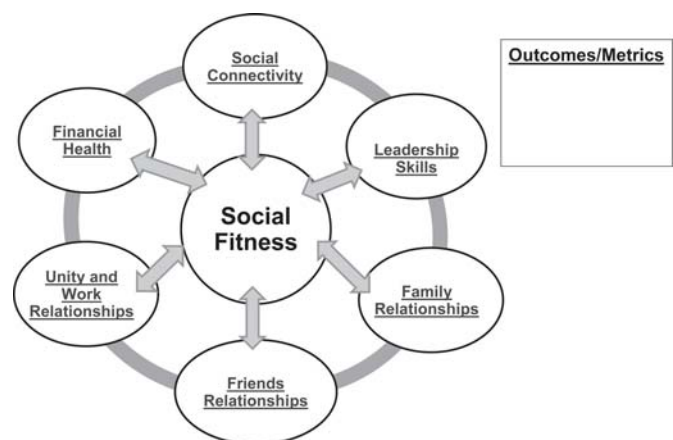


FIGURE 1.

about is the combat ready unit, or the fully deployed unit, then the role of the family, while hugely important, is actually external to the group. Clearly these relationships and their impact on group fitness will be quite different from leadership skills, friend relationships, and work relationships. One could foresee the situation where highly dysfunctional families, for example, could have a detrimental effect on the fitness of the unit but we might also see them having no effect and in fact the unit could act as a support for those in dysfunctional family relationships and therefore this could contribute to greater cohesion in the unit. The model focuses on the production of social cohesion, internal and external, and the relationship of social cohesion to unit and individual performance. The model offers an opportunity to re-conceptualize social fitness by looking at social cohesion as a conceptual anchor for prevention efforts by military leaders and providers.

SOCIAL COHESION AND SOCIAL FITNESS

The renewed interest in “group fitness” by military leaders as part of “social care” has prompted profound changes in America’s military. The 1990s were a new epoch in the size and stationing of America’s forces. In the context of these changes and the recent wars in Afghanistan and Iraq, social scientists have started to ask about the psychological sense of camaraderie, group connectedness, esprit de corps, and sense of mutual support. This article focuses on the dominant way in which “group fitness” has been conceptualized as social cohesion.

Historically, cohesion has been treated by social scientists as the most important variable for the study of small groups.¹¹ A sociological definition of social cohesion is:

“Groups are socially cohesive when group-level conditions are producing positive membership attitudes and behaviors and when group members’ interpersonal interactions are operating to maintain these group-level conditions. Thus, cohesive groups are self-maintaining with respect to the production of strong membership attractions and attachments.”¹²

A definition used by MacCoun et al.¹³ in military research states:

“Social cohesion refers to the nature and quality of the emotional bonds of friendship, liking, caring, and closeness among group members. A group is socially cohesive to the extent that its members like each other, prefer to spend their social time together, enjoy each other’s company, and feel emotionally close to one another.”

But MacCoun et al.¹³ distinguishes social cohesion from task cohesion:

“Task cohesion refers to the shared commitment among members to achieving a goal that requires the collective efforts of the group. A group with high task

cohesion is composed of members who share a common goal and who are motivated to coordinate their efforts as a team to achieve that goal.”

Social cohesion therefore refers to group members liking each other and task cohesion to sharing common goals. Hagstrom and Selvin¹⁴ in a study of small groups identified two factors using factorial analysis: social satisfaction and sociometric cohesion. The first they termed “instrumental” attractiveness of the group (the degree to which group members liked the people) and the second, “intrinsic” attractiveness (the degree to which group members liked the values of the group). With these terms defined we can use military units as the subjects and military communities as a laboratory for conceptual development and study of these concepts.

SOCIAL COHESION OPERATIONALIZED

While the history of studies in social cohesion has been a long one there has not been a high level of cohesion among those using the concept. This occurred partly because the researchers adopted varying definitions of social cohesion but also because of the variance in the ways in which the concept has been used in research. The studies have also varied in what antecedents or causal factors have been derived with regard to social cohesion.

Friedkin¹² has provided an excellent overview of the field. He notes a contemporary approach in which social cohesion is multidimensional or a latent construction with multiple indicators. Part of the problem is that the linkage between individual microlevel analysis and the group macrolevel analysis has proven difficult to measure. At the individual level, cohesion has been measured by individual attitudes toward the group (what do they feel about the group) and by looking at the individuals’ behaviors (participation in the group, withdrawal from the group, etc.). So in this contemporary approach, social cohesion is a measure of the aggregate of individual members’ attitudes and behaviors. It should be noted here that much of this work has been done on voluntary groups where an individual can leave or continue freely so that measuring continuance in the group can be an indicator of commitment or loyalty. This makes such measures of less use in a military setting where much of the group participation is not voluntary. Duration in a group might have a different meaning in the military where it is more likely to be an assigned (nonvoluntary) group membership. Clearly for those who re-enlist this might be a significant measure.

In measuring social cohesion, positive attitudes and feelings toward the group have been thought to contribute to cohesion as have duration of membership, interpersonal ties, turnover rate, absenteeism, proportions of those who participate in group activities, networks, resistance to disruptive forces, cliques, degree of consensus about important issues and or goals, rewards and punishments in the group, satisfaction, density/frequency of interactions, and cohesive subgroups.¹² Research that is more sociological in nature, is likely

to focus on structural features found by such methods as network analysis where the focus is on the patterns, strength, and interconnections of the networks rather than on individual feelings and attitudes.

The problem with much of this work is often the difficulty in knowing which comes first. Do the positive attitudes and beliefs give rise to social cohesion or does the social cohesion itself produce positive attitudes? In the military where trainees are indoctrinated from day one about the importance of the group through the buddy system, which necessitates covering each others' backs, there are social pressures for conformity. So if we ask the soldiers about this they will likely give us the attitudes they have been taught to hold, which includes the strong emphasis on the buddy system.

There is also an assumption that the more personally satisfying inter-relationships a person has in a group the higher their level of satisfaction. But it could be that simply one very satisfying relationship is enough or even just a positive attitude about the leadership suffices to create a positive attitude and therefore social cohesion for the individual.

This article suggests moving from a problem-focused approach to a cohesion-focused approach. In a problem-focused approach, the focus is on the lack of cohesion and where the fissures are in cohesion. A problem-focused approach looks at inter-relationships in a reactionary way, looking at leaders as communicators, staff as providers, and soldiers as doers.

We propose a cohesion-focused model in which the unit and its members are assets. The focus is on opportunity rather than problems. A cohesion-focused model is proactive in that the model calls for improved cohesion at all levels, where leaders and staff enable the building of connections and the focus becomes one of unit results. We see high social cohesion as the ability to demonstrate "a sense of shared responsibility" for the general welfare of the unit and its members and "evidence collective competence" in taking advantage of opportunities that address unit requirements and needs, meeting challenges, solving problems, and confronting situations that threaten the integrity of the community and the safety and well-being of its members.

MEASUREMENT PROBLEMS

As MacCoun et al.¹³ point out, the evidence to date is stronger for task cohesion and group performance than for social cohesion. But even then the correlations are modest. Social cohesion in the military to date has shown no reliable correlation with performance.¹³ Mullen and Copper¹⁵ found in their meta-analysis of 66 cohesion performance correlations, that the correlation was due to task commitment more than group pride. In criticizing the study by Wong et al. on Iraqi soldiers, MacCoun et al.¹³ note the methodological challenges. First Wong et al. based the study on qualitative interviews with soldiers in both the U.S. and Iraqi forces. But since the probes/questions that were used are not given, it is difficult to know whether there was any effect from the questions themselves. Furthermore the soldiers might just be repeating what they have been told

about the importance of the group. Second, individuals are often unable to reliably and validly report on the causes of their behavior. Third, there was no attempt to test other explanations. As MacCoun et al.¹³ suggest, if social cohesion was the important variable they could have done several comparisons to test the hypothesis: they could have compared U.S. groups with high cohesion against U.S. forces with low cohesion against their performance; they could have compared Iraqi forces with high cohesion against Iraqi forces with low social cohesion against performance. If military victory is the evidence for performance then the Iraqi troops were very successful in Kuwait. Was this while their cohesion scores were also low or did their social cohesion change after Kuwait?

Mudrack¹⁶ reviewing the literature in 1989, called the attempts to define group cohesion "a legacy of confusion." While group cohesiveness is taken for granted for effective and efficient performance of a group, he notes that the construct is seldom easy to define and even more difficult to operationalize, measure, or manipulate. He concludes that group cohesion is "a construct that does not lend itself readily to precise definition, consistent measurement, or standard experimental manipulation." Although the group is the focus in these studies, researchers have been forced to measure individuals and to aggregate the data from individuals to study groups.

"Cohesiveness is a property of the group and yet the group as a distinct entity is beyond the grasp of our understanding and measurement."

So what is it about groups that has been thought to be important to cohesion? It has been captured in a variety of terms:¹⁷ stick together, solidarity, harmony, commitment, connectedness, we-ness, tightly coupled, in-group, strong ties. Some have conceptualized cohesion as the field of forces that keep the individuals in a group and others as the resistance to disruptive forces. As Mudrack¹⁶ notes, none of the definitions have been totally satisfactory. But the dilemma is that those definitions that try to define cohesion as group forces have not been able to operationalize cohesion and those who can operationalize it have had to settle for measuring individual attraction. That is, the focus has remained on the individual and not the group. Mudrack¹⁶ concludes "The construct known as group cohesiveness has thus far proven to be, in a very real sense, undefinable." He suggests that a better definition might be to link cohesiveness to the commitment to group tasks. So cohesiveness is defined as "a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its goals and objectives." This is similar to MacCoun et al.'s¹³ conclusion that "military performance depends on whether service members are committed to the same professional goals, not on whether they like one another."

OUTCOMES: COHESION AND PRODUCTIVITY/ PERFORMANCE/EFFECTIVENESS

One of the major interests among scholars looking at cohesiveness is the effect it has on productivity. While on one level

it might seem self-evident that a group that lacks cohesion, particularly task cohesion, is unlikely to be very productive at least with regard to those tasks, determining in research any direct relationship between cohesion and productivity has proven to be challenging.¹⁴ While productive groups tended to be both cohesive and production oriented, the least productive units have also been shown to be cohesive but nonproduction oriented. The results suggest that some intervening variables might also be operating. Langfred¹⁸ in his review of the literature also noted that the cohesiveness–productivity relationship has proven to be inconsistent. In some of the studies (one-third), the more cohesive were more productive but in another third, they were less productive. So clearly some other factor is operating here. He notes “although cohesive groups are often more enjoyable, they are not always more productive.” Even where meta-analyses have shown a positive effect of cohesion on productivity¹² the effect is small but positive. The suggestion is that there may be an optimal level of cohesion and that when this is surpassed it can be counterproductive for performance. Langfred¹⁸ identifies that the intervening variable as “group work norms,” which studies have shown to be related to productivity. Group work norms are expectations about appropriate behavior; task-focus expectations. Strong work norms imply consistent task-focused behavior while weak norms imply a lack of commitment and motivation toward tasks. The concept of group work norms seems very similar to task cohesion, but both are considered as different from social cohesion. So group cohesion could be thought of as necessary for a group but not sufficient to ensure productivity effectiveness. This also explains the results about excess cohesion being nonproductive because if the group norms demand too much conformity the group can control for any deviancy even if the behavior might improve productivity. It might also result in the military in individuals following the group into highly unethical behavior (assault on civilians for example). This is often referred to as “group think.”¹⁵ Some of the most nonproductive groups may have high cohesion and very satisfied group members. Langfred¹⁸ notes that he is not suggesting that high cohesion by itself can lead to nonproductivity but that high cohesion combined with dysfunctional norms can.

Two other variables that Langfred¹⁸ identifies that affect performance are group size and leadership. “Groups with leaders who are better able to coordinate and direct activities of the group, or to better communicate with superiors, for example, will be more effective than groups with less skilled leaders.” Langfred’s¹⁸ own study focused on three infantry companies and 61 work groups in the Danish military and showed that group task norms did moderate the relationship between group cohesiveness and group effectiveness. High cohesiveness combined with task norms were always more effective.

A more recent review by Dyaram and Kamalansabhan¹⁹ in 2005 notes that one of the reasons effectiveness or productivity has been studied in relationship to cohesion is because it

is measured in terms of the whole group. They note that task interdependence, which is a task that requires high levels of interaction, communication, interdependence, coordination, and mutual monitoring among the members also effects cohesion–performance. It also matters what task the group thinks is important.

Chang et al.²⁰ investigated the relationship between group cohesion and group performance but distinguished between task cohesion and task effectiveness and social cohesion and system viability. Their study was interested in whether cohesion would be both an antecedent and a consequence of performance. They found that task cohesion was the sole predictor of self-related performance where social cohesion was the sole predictor of system viability (staying with the group, working with them in the future). Group cohesion was found to be antecedent but not the consequence of group performance. Their conclusion was that “practitioners who are interested in improving group cohesion as a means of improving group performance should consider carefully which dimension of cohesion is more important to the targeted performance measure. For example, if the aim is to reduce turnover rate in the group, then interventions specifically aimed at improving a group’s social cohesion should be implemented. On the other hand, if the goal is to improve a group’s task effectiveness, then task cohesion should be targeted.

Some of the work on cohesion and performance has been done with sports teams. For example Ramzananezhad et al.²¹ showed that task cohesion was positively and significantly correlated with collective efficacy in volley ball, and that social cohesion was not. It is not clear whether sports examples are relevant to the military. Membership in sports teams is usually voluntary so the group dynamics might be expected to be different. The meta-analysis by Mullen and Copper¹⁵ showed that cohesiveness and performance have a highly significant correlation but of small magnitude. But their results also showed it is more significant in small groups, stronger in real groups as opposed to experimental groups, that it is due more to commitment to task than interpersonal attraction or group pride, and that the most direct effect might be from performance to cohesiveness rather than from cohesiveness to performance. They also note cohesiveness did not appear “to enhance the smooth operation of a social system.”

The relationship between cohesion and conflict has also been shown to be complicated. As Stein²² points out, there has been a long held hypothesis that external conflict can increase cohesion within a group. But his review of the literature would suggest some caveats here. It increases internal cohesion under certain conditions. The conflict should pose a threat of some sort, it should impact the whole group, it should involve a solution, and the group probably needs some pre-existing cohesion and a leadership that can enforce cohesion.

In an experimental situation, Zaccaro and McCoy²³ found that groups were more successful when both task and interpersonal (social) cohesion were high and they suggested that where there is high task cohesion, high-ability members will

contribute to problem solving but when interpersonal cohesion is high they are likely to get the “procurement, recognition, and acceptance of high-quality contributions.”²³

In summary, the work on cohesion/performance/productivity/effectiveness has established there is a relationship but that it is mediated by other variables; that task cohesion is more highly related to performance than social cohesion and that cohesion must be considered a multidimensional construct.²⁴

METRICS AND MEASUREMENT TOOLS

Not surprisingly, instruments have been developed to measure cohesion. Piper et al.²⁵ developed a questionnaire focusing on three areas: the other participants in the group, the leader, and the group itself. For each area they used a Likert 7-point scale and about 20 items per subset. From their factor analysis of the group items they identified three group factors: mutual stimulation and effect, commitment to the group, and compatibility of the group. From the participant item analysis they identified three factors: positive qualities, personal compatibility, and significance as a group member. From the leader items they also got three factors: positive qualities, dissatisfaction with the leaders role, and personal compatibility. Within each area they have 2–9 items.

A simple perceived cohesion scale (PCS) was used by Bollen and Hoyle²⁶ and has two factors and only 6 items with a Likert scale of 0–10, with 5 being neutral.

This same scale was adapted by Chin et al.²⁷ to create 6 items with a Likert 7-point scale from strongly disagree to strongly agree.

Carron et al.¹¹ constructed an instrument that consisted of items about group integration (GI): measuring belief, perceptions about what the group believes about its closeness, similarity, and bonding; individual attractions to the group (ATG): reflecting the individuals motivations to stay with the group. They proposed two foci for ATG and GI: beliefs about tasks (collective performance, goals, objectives) (T) and social concerns (S) (relationships). This gives them a conceptual model represented by GI-T; GI-S; ATG-T; ATG-S. The Group Environment Questionnaire (GEQ) they developed with 18 items comprises the two subscales, GI and ATG.

Bahli and Büyükkurt²⁸ also developed scales for four constructs: task cohesion, social cohesion, team building, and group performance.

Ramzananezhad et al.¹⁹ used two instruments in their study: the Collective Efficacy Questionnaire (CEQ) and the Group Environment Questionnaire (GEQ). The CEQ is a 49-item questionnaire with 20 actual scale items. There are 5 subscales: ability, unity, persistence, preparation, and effort. There is 10-point Likert scale 0–9 from extremely confident (9) to not at all confident. The GEQ instrument measures both task cohesion (9 items) and social cohesion (9 items). Its 18 items are scored on a 9-point Likert scale from strongly agree to strongly disagree.

From the above it is clear there are existing measures for social cohesion that have been psychometrically tested. The

authors' choice is dependent on what the objective is and what priority exists. Without knowing those in a particular case, it is not possible to say which instrument is the preferred one. Clearly a predeployment measure will be different than a deployment measure. They may vary by the size of the unit being examined and what services are being examined.

COHESION IN THE SERVICES

Cohesion in the military has been a long-term concern and there is a reasonable body of research on it. As with its use in the social sciences, the use and measurement of the concept of cohesion in military research has evolved.²⁹ MacCoun¹⁷ reviewed 185 research articles over a 50-year span. He notes some writers on the military use cohesion and morale as synonymous. But the former refers to the group, the latter to individuals. Morale is viewed as a more general, diffuse, and inclusive concept. MacCoun¹⁷ has provided the most extensive review of cohesion in the military for a study about sexual orientation in the armed forces. He summarizes some of the variables that have been found empirically to be related to cohesion. The first is propinquity, is the company of assignment. Those who are spatially and temporally located, i.e., in proximity, are more likely to develop an in-group preference for their group. So the assignment predisposes them to social cohesion. A factor that was thought to be important is turnover (and its associated turbulence). It was thought that keeping units together through training and deployment would make them more cohesive. In the Army this resulted in COHORT units (cohesion, operational readiness, and training) but MacCoun¹⁷ notes the results were very mixed and no strong evidence merged to support this concept. Research does support the hypothesis that leadership affects cohesion. Both relations-oriented leadership and task-oriented leadership have been shown to be effective for cohesion. But there is no evidence that supports whether one gives rise to social cohesion and the other task cohesion. Group size has been shown to be inversely related with cohesion. Some have suggested that cohesion can only be said to occur in small units in the services (teams, squads, platoons, companies). Success experience as a group promotes cohesion but the evidence is more in relationship to social cohesion and not task cohesion, although these results possibly reflect a lack of investigation. The evidence for a shared threat effect on cohesion is variable and it seems to depend on a host of other variables. Are they all mutually threatened for example? Perhaps it only promotes cohesion where cohesion existed before the threat. Furthermore such cohesion may be short term (in the heat of the battle). For the variable similarity and/or homogeneity, the results are not very clear. It does not seem to affect task cohesion but may impact social cohesion.

Griffith³⁰ in his study of cohesion in U.S. Army units, studied over 8,000 soldiers in 93 companies who gave ratings to questionnaire items. He found cohesion could be represented by four general dimensions: the quality of instrumental and affective relationships among junior enlisted soldiers, the

quality of relationships between junior enlisted soldiers and their leaders, soldier internalization of Army values, and soldier confidence in weaponry and leaders. Results from the Griffith²⁵ study showed a positive relationship with group cohesion as measured by willingness to stay in the unit, morale, and satisfaction. He also found that soldiers who had not undergone a common introductory training together or were not in a stabilized unit did not score as highly. He used three questionnaires to collect the data before his factor analysis: Combat Readiness Morale Questionnaire, Modified Field Forces Questionnaire, and Company and Squad/Platoon Perceptions Questionnaire.

In an interesting quasi-experimental study of tank crews in the Israeli army, Tziner and Vardi³¹ showed that performance effectiveness was high in the following: low cohesiveness with a command style that emphasizes people orientation and high cohesiveness with emphasis on both task and people orientation. Cohesiveness in this study was measured by the way the individuals chose who was to be assigned with them and who they did not want to be teamed with. In a crew of six, if they all mutually chose each other this was considered high cohesiveness.

Although most of the research on cohesiveness has been on the Army, Boer³² provided a descriptive case study of a Dutch fighter squadron from World War II to demonstrate that the processes of cohesion that have been shown to be important in small groups in the Army, are equally important for operational effectiveness in the Air Force.

As discussed earlier Langfred's¹⁸ study focused on three infantry companies and 61 work groups in the Danish military and showed that group task norms did moderate the relationship between group cohesiveness and group effectiveness. High cohesiveness and task norms were always more effective.

Salo³³ in a study of conscripts in the Finnish army added sociometric analysis to the usual method of questionnaires in cohesion studies. Respondents were asked: who is your best friend in your platoon? In a combat situation (war), who would you choose as your fighting partner from your platoon? In a combat situation, which 6 persons would you choose to be in your squad? In a combat situation (war), who would you choose as your squad leader if no official leader has been named? The sociometric choices were transformed into individual choice status and sociometric group cohesion. Salo²⁸ sees the sociometric method as a way of getting information about the informal social structure that cannot be gotten any other way and as a useful addition to the typical questionnaire based measures of cohesion. Salo's³³ study found a high correlation ($r = 0.71-0.78$) between being chosen a friend, fighting partner, or combat squad member but modest correlations with being chosen as a squad leader ($r = 0.33-0.41$). The correlation between perceived peer cohesion and the pooled sociometric choice status was also modest as was the correlation between individual pooled choice status and average individual performance ratings by the training instructors. The

correlation between individual pooled choice status and conscript-expected personal performance was also low. By incorporating five variables into a model, the results suggested that those conscripts "who are close to their primary group but maintain a distance from their formal, larger organization have higher popularity and choice status in their group."³³ Salo's conclusion in sociometric analysis is a method for studying the quality of group dynamics in a squad or platoon.

Yagil³⁴ studied cohesiveness and unit effectiveness in the Israeli army but also looked at the intervening effects of professionalism, confidence in the commander, commander tenure, morale, motivation, and stress. There were significant correlations between cohesion and unit effectiveness but there were differences between the soldiers and the commanders in their perception of the relationship between cohesion and personal effectiveness. Morale and stress were intervening variables.

The U.S. Army was concerned enough about the importance of cohesion that it contracted the development of the Combat Platoon Cohesion Questionnaire. The Army wished to develop products that would allow small unit leaders to improve their leadership, cohesion, and commitment in their squads, platoons, and companies. Siebold and Kelly³⁵ under this contract developed the Combat Platoon Cohesion Questionnaire (CPCQ). This instrument was tested on 1,000 soldiers from 70 platoons and 5 infantry battalions. The instrument had 79 items and measured cohesion in terms of horizontal bonding among peers, vertical bonding between leaders and their subordinates, and organizational bonding between platoon members and their platoon and the Army. They concluded from their analysis of the items and the scales that it is possible to measure platoon cohesion in a valid, reliable, and meaningful way. They also developed an abbreviated version, the Platoon Cohesion Index (PCI).

On three historical occasions the impact of distinct groups on cohesion has been questioned and debated. The first was over the issue over racially integrated troops. More recently very similar questions have been raised about the impact of sexual orientation and gender. The question of sexual orientation was covered in the work done at the RAND Corporation in the work earlier discussed by MacCoun.¹⁷ In an article published in 1999 by Rosen et al.³⁶ the authors conducted a meta-analysis of the five studies that had been done to that date on gender composition and cohesion. They identified five such studies done in very diverse settings (two garrisons, Haiti, Somalia, and the Persian Gulf). Not only were the settings diverse but the measures of cohesion varied as did the collected variables (although some core items in the measures of cohesion occurred over most of the studies). Also the size of the units ranged from 4 to 200 members. Despite the methodological challenges and using a variety of statistical methods they were able to conduct a meta-analysis. Social cohesion was measured by taking the mean of the individual scores as an aggregate measure. Overall they found a negative group correlation between percentage of women and unit cohesion but there were slightly different

results depending on the different methods in which cohesion was measured. Only the Haiti study did not show the negative correlation and the strongest relationship was in Somalia. Even where the correlations did not reach significance they were in the predicted direction. The authors³⁶ conclude that “negative effects appear common but are by no means universal.” Nor were they universally strong. Demographic variables did not seem to account for the differences found in the major findings. Size of the unit and the mission were examined for their impact but no conclusion could be drawn. Rosen et al.³⁶ did note that the most recent studies (1995) had the least negative effects. They also wondered whether events that occur in theater have an effect but were unable to test this. They conclude future studies should include unit size, support for the mission, level of violence in theater, and effects of leadership policies regarding treatment of gender.

The most extensive report on the importance of cohesion found in preparing this background article was an article prepared on the Marine Corp Infantry. While the article does review a lot of literature it is only partly a review and partly proselytization for cohesion and how to achieve it (as well as a strong critique of a program the author feels has seriously undermined cohesion in the U.S. military by not focusing on stability of the unit). We might close therefore with the exhortation by Major Brendan McBreen:³⁷

“Of all the ideas for improving the combat capabilities of Marine Corps infantry battalions, only one really matters. Improving the stability and cohesion of our units is a prerequisite for all other improvements. The future Marine Corp requires more capable infantry units. Cohesion is the first and most effective answer.”³⁷

“Cohesion’s central requirement is personnel stability. Stability, stress and success build horizontal cohesion in units. Leaders who understand their men build vertical cohesion. Horizontal cohesion between leaders is built on shared experience. Vertical cohesion between leaders is built on clear standards. Organizational cohesion is built on history and traditions. Competence and honesty between the army and its society build societal cohesion.”³⁷

CONCLUSION AND DISCUSSION

In the past, the concept of cohesion as a way of conceptualizing social fitness, posed difficulties in terms of definition and measurement but no more so than any other approach to social fitness. There is a large body of work on cohesion both within the military and external to the military. Numerous instruments have been developed for measuring cohesion and many have been subjected to psychometric testing for reliability and validity and factor analysis to identify what is being measured.

However, the research to date does not provide us with data about group cohesion over vastly different settings and subpopulations within the settings. The active combat unit clearly has quite different demands and needs than a support unit might. Those on base pre- or postdeployment have different challenges and needs from the active combat unit. The fighter pilots will

be different from the service staff but cohesion between both will be necessary for effectiveness. Those who sail the ships are a different group than those who fly off the decks but again they will need cohesion to successfully complete their missions.

Also as we have noted there are a wide range of intervening variables that can occur between cohesion and performance. Some the military can control or can put in place programs that might mitigate against them having too big an impact. Such things as effective leadership can clearly be taught and individuals can be trained in leadership. But other factors such as the family pose a much greater challenge because they are less amenable to manipulation.

The results of the research however pose a dilemma for the military. As noted earlier the challenge is whether priority should be placed on the importance of cohesion for productivity/effectiveness/ performance in which case the objective should be to develop task coherence. Or should the focus be on the support of the soldiers and social cohesion? The latter provides more emotional and psychological support for the soldier but might reduce the performance of the unit. This decision might also be impacted by the time frame. Task coherence is clearly most important in the immediate time frame of combat but social cohesion might return the soldier in better shape stateside in the long term.

An alternative approach will be to conceptualize cohesion as a capacity builder. We propose that this will require a study framework that monitors the effects of unit readiness and cohesion. When looking at unit fitness we will look at core service standards of fitness. A survey designed to do this would be an amalgam of profile characteristics, quality of life measures, unit cohesion measures, program evaluations, and measures of mental, physical, and spiritual fitness according to the Jonas model.¹⁰

A military unit that operates from a cohesion-building perspective, we propose, will identify more with the larger military society, will be more knowledgeable about its capacity to function well with systems internal and external to factors in the model/community, will understand the values of connections, will be committed to addressing unit issues, will be guided by results of unit evaluation, will place more effort on tangible outreach to its members, and will value partnerships with other units and organizations.

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REFERENCES

1. Wong L, Kolditz TA, Millen RA, Potter TM: Why They Fight: Combat Motivation in the Iraq War. Carlisle Barracks, PA, Strategic Studies Institute, U.S. Army War College, 2003.

2. Shay J: *Achilles in Vietnam: Combat Trauma and the Undoing of Character*. New York, Atheneum, 1994.
3. Yarvis J: *Subthreshold PTSD in Veterans with Different Levels of Traumatic Stress: Implications for Prevention and Treatment with Populations with PTSD*. Saarbrücken, Germany, VDM Verlag, Dr. Muller Publishers, 2008.
4. Durkheim É: *The Division of Labor in Society* (translated from French). New York, Free Press of Glencoe, 1964.
5. Durkheim É: *Suicide, a Study in Sociology*. Glencoe, IL, Free Press, 1951.
6. Thoresen S, Mehlum L: *Suicide and Other Violent Death in Former Norwegian Peace-Keeping Personnel. The UNIFIL Follow-Up Study*. Oslo, Norway, The Norwegian Armed Forces Joint Medical Service, 1999.
7. Yarvis J: *Combat Stress Prevention Programs for a Tri-Service World*. Presented at the Association of Military Surgeon's of the United States Conference, Las Vegas, NV, 2000.
8. Bowen GL, Orthner D, Martin J, Mancini JA: *Building Community Capacity: A manual for US Air Force Family Support Centers*. Chapel Hill, NC, A Better Image Printing, 2001.
9. Gross N, Martin WE: On group cohesiveness. *Am J Sociol* 1952; 57: 546–54.
10. Jonas WB: *Getting to Total Force Fitness*. A presentation delivered at Total Force Fitness workshop December 6–9, 2009. Uniformed Services University of the Health Sciences, Bethesda, MD.
11. Carron AV, Widmeyer NW, Brawley LR: The development of an instrument to assess cohesion in sports teams: the Group Environment Questionnaire. *J Sport Psychol* 1985; 7: 244–66.
12. Friedkin NE: Social cohesion. *Annu Rev Sociol* 2004; 30(1): 409–25.
13. MacCoun RJ, Kier E, Belkin A: Does social cohesion determine motivation in combat? *Armed Forces Soc* 2006; 32(4): 646–654.
14. Hagstrom WO, Selvin HC: Two dimensions of cohesiveness in small groups. *Sociometry* 1965; 28: 30–43.
15. Mullen B, Copper C: The relation between group cohesiveness and performance: an integration. *Psychol Bull* 1994; 115(2): 210–27.
16. Mudrack PE: Defining group cohesiveness: a legacy of confusion? *Small Group Behav* 1989; 20(1): 37–49.
17. MacCoun R: *What Is Known About Unit Cohesion and Military Performance. RAND, Sexual Orientation and US Military Personnel Policy: Options and Assessment*. MR-323-OSD. Santa Monica, CA, National Defense Research Institute, 1993.
18. Langfred CW: Is group cohesiveness a double-edged sword? *Small Group Res* 1998; 29(1): 124.
19. Dyaram L, Kamalanabhan TJ: Unearthed: the other side of group cohesiveness. *J Soc Sci* 2005; 10(3): 185–90.
20. Chang A, Bordia P: A multidimensional approach to the group cohesion-group performance relationship. *Small Group Res* 2001; 32(4): 379.
21. Ramzaninezhad R, Keshtan MH, Shahamat MD, Kordshooli SS: The relationship between collective efficacy, group cohesion and team performance in professional volleyball teams. *Braz J Biomotricity* 2009; 3(1): 31–39.
22. Stein AA: Conflict and cohesion: a review of the literature. *J Conflict Resolut* 1976; 20(1): 143.
23. Zaccaro SJ, McCoy MC: The effects of task and interpersonal cohesiveness on performance of a disjunctive group task. *J Appl Soc Psychol* 1988; 18(10): 837–51.
24. Mudrack PE: Group cohesiveness and productivity: a closer look. *Hum Relat* 1989; 42(9): 771.
25. Piper WE, Marrache M, Lacroix R, Richardsen AM, Jones BD: Cohesion as a basic bond in groups. *Hum Relat* 1983; 36(2): 93–109.
26. Bollen KA, Hoyle RH: Perceived cohesion: a conceptual and empirical examination. *Soc Forces* 1990; 69(2): 479–504.
27. Chin WW, Salisbury WD, Gopal A: Perceived cohesion in groups: a confirmatory factor analysis of the dimensions of belonging and morale. Available at <http://academic.udayton.edu/davesalisbury/research/cohesion.html>; accessed November 1, 2009.
28. Bahli B, Buyukkurt MD: Group performance in information systems project groups: an Empirical study. *J Inf Technol Educ* 2005; 4: 97–113.
29. Siebold GL, Kelly DR: *Development of the Combat Platoon Cohesion Questionnaire*. Fort Belvoir Defense Technical Information Center. Available at <http://handle.dtic.mil/100.2/ADA204917>; accessed November 5, 2009.
30. Griffith J: Measurement of group cohesion in U.S. Army units. *Basic Appl Soc Psych* 1988; 9(2): 149–71.
31. Tziner A, Vardi Y: Effects of command style and group cohesiveness on the performance effectiveness of self-selected tank crews. *J Appl Psychol* 1982; 67(6): 769–75.
32. Boer PC: Small unit cohesion: The case of fighter squadron 3-VI.G.IV. *Armed Forces Soc* 2001; 28(1): 33–54.
33. Salo M: *The Relation Between Sociometric Choices and Group Cohesion*. Arlington, VA, U.S. Army Research Institute for the Behavioral and Social Sciences, Force Stabilization Research Unit. Available at <http://purl.access.gpo.gov/GPO/LPS94326>; accessed November 8, 2009.
34. Yagil D: *A Study of Cohesion and Other Factors of Major Influence on Soldiers' and Unit Effectiveness*. Fort Belvoir Defense Technical Information Center. Available at <http://handle.dtic.mil/100.2/ADA299079>; accessed November 8, 2009.
35. Siebold GL: The evolution of the measurement of cohesion. *Mil Psychol* 1999; 11(1): 5.
36. Rosen LN, Bliese PD, Wright KA, Gifford RK: Gender composition and group cohesion in U.S. Army units: a comparison across five studies. *Armed Forces Soc* 1999; 25(3): 365–86.
37. McBreen BB: *Improving Unit Cohesion: The First Step in Improving Marine Corps Infantry Battalion Capabilities*. Available at <http://www.2ndbn5thmar.com/coh/Cohesion%20Research%20McBreen%202002.htm>; accessed November 10, 2009.

Family Fitness

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ABSTRACT The Department of Defense (DoD) is exploring the holistic construct of total force fitness for individual service members. This exploration provides an opportunity to understand fitness concepts in the context of military families. Currently, there are no developed operational definitions or integrated models for the concept of “total family fitness.” This article used the U.S. Navy experience with family programs to begin the discourse of family fitness and identify potential family fitness-related metrics. A proposed definition of family fitness was developed from the conservation of resources theory and a model of family resilience. This article identifies eight dimensions of family functioning: problem solving, communications, family roles, affective responsiveness, affective involvement, behavior control, global health, and spiritual support. Four potential instruments are identified that could provide metrics for these family dimensions.

INTRODUCTION

There is increasing awareness that military children and families are significantly affected by a parent’s combat-related mental health problems and physical injuries, as well as the wear and tear of multiple wartime deployments.^{1,2} Given that over 50% of U.S. service members are parents, a large number of military children and families are at risk and may benefit from targeted preventive services.³ Specific high-risk groups include parents with active symptoms related to post-traumatic stress or other mental health conditions. Psychological injuries and symptoms can interfere with parenting, family functioning, and child adjustment.^{2,4-6} Another high-risk group are the families of the over 31,000 combat-injured service members. Combat and operational injuries, whether psychological or physical, in a military parent are likely to disrupt family roles, sources of care, and instrumental support.^{7,8} These factors underscore the urgent national public health need to provide family-centered, evidence-based prevention services to military children and families who have been affected by multiple wartime separations and parental combat-related psychological and physical injury.

Despite ongoing advances in the availability of trauma-informed resources for consumers and providers (e.g., Sesame Street’s “Talk, Listen, Connect: Helping Families During Military Deployment,” Military OneSource web-based materials), important gaps remain in the provision of evidence-informed interventions and services for children and families of military members and veterans who are contending with combat-related mental health problems, physical injury, and loss. Military families facing these challenges are an identified risk group who could benefit from evidenced-based coping skill building interventions and services adapted for military culture.

The Department of Defense (DoD) is exploring the holistic expansion of the term fitness to encompass the biological, social, spiritual, and psychological domains that constitute “total force fitness” for individual service members. Military family relationships can serve as resource gains or losses in each of the fitness domains for individual service members. However, the military family is more than a social subset of the individual service member. The DoD has dependent and independent relationships to military families. A dependent organizational relationship is one where family resources can only be provided through the service member, such as identification cards and housing allowances. An independent organizational relationship is where resources are established and provided directly to family members without the presence or permission of the service member, such as health care and family service center support. It is this independent relationship that the DoD has with military families that provides an opportunity to understand the concept of family fitness in the context of the military family. Exploring the constructs of family fitness has potential to develop integrated resources and measures that can be used by military families and leaders to enhance the readiness and health of the force.

Family fitness has potential as a universal concept that can be applied to military and nonmilitary families in the U.S. and internationally. Currently, there are no developed operational definitions or integrated models for the concept of “total family fitness.” This article will use the U.S. Navy experience with family programs to begin the discourse of family fitness and identify potential family fitness-related metrics.

PROPOSED OPERATIONAL DEFINITION

We propose a definition of family fitness that is based on conservation of resources theory⁹ and the concept of family resilience.¹⁰ The conservation of resources theory identifies that people who invest in resources and can use those resources during times of demand remain committed and engaged in their life tasks. Walsh defines family resilience as “the capacity to rebound from adversity strengthened and more resourceful (p 4).”¹⁰ Family fitness is the immediate military family’s

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ability to use physical, psychological, social, and spiritual resources to prepare for, adapt to, and grow from military lifestyle demands. The immediate military family is further defined as the Defense Enrollment Eligibility Reporting System (DEERS) authorized dependents of a service member. Immediate family members are often those who live with the service member. The extended military family includes individuals that a service member would describe as having a moral, legal, or kin relationship. The concept of immediate and extended families is intended to capture the wide range of social relationships and networks that constitute a family. Organizationally, military leaders have both obligations and limitations related to family support and programs that are often limited to the immediate military family. The construct of total family fitness focuses on the immediate military family while acknowledging the important influence that the extended military family has on both the immediate military family and the service member.

NAVY FAMILY SUPPORT

All large U.S. military installations have dedicated resources to support military families in the domains of physical activity and health care, social connection and peer activities, spiritual and religious growth, and psychological support. Resources such as commissaries, youth centers, schools, improved family housing, employment support, spouse mentors, and career transitions support are often distinct organizational structures with separate missions, goals, oversight, and funding. These services represent investments by the DoD to create environmental resources that support, foster, and enrich family function. The family psychological fitness domain in particular has had a significant investment in programs and resources over the past 3 years.

The U.S. Navy's experience with family support programs provides a historical and current context for understanding existing resources that would be part of a comprehensive family fitness paradigm. The U.S. Navy family support programs are not necessarily unique or better than those provided by other military services. The discussion of Navy family programs was selected as an example of how one service has systematically invested in developing family-centric resources over time. Initial programs were primarily focused on enhancing communication between service members and the dependent spouse. As the first wave of the all-volunteer force prepared for re-enlistment or second tours, there were more families that needed support resources. Combat and operational demands have steadily increased since 2001 and recent programs have been developed to provide enhanced support and coping skills related to those operational demands.

In 1970, the Navy Family Ombudsman Program was established to improve communication between commands and sailors' spouses.¹¹ The ombudsman is a trained volunteer, appointed by the commanding officer, to disseminate information both up and down the chain of command, including official Department of the Navy and command information,

command climate issues, local quality of life improvement opportunities and provide resource referrals to immediate Navy families. Initially, the ombudsman had little training and functioned as a mentor to first-term spouses, those spouses new to Navy life, and information relay for seasoned spouses. Currently, ombudsmen participate in structured training to develop understanding of critical family resources and role-appropriate crisis intervention skills.

The Naval Chaplains Religious Enrichment Program (CREDO) was developed in 1971 to initially respond to drug abuse issues. CREDO developed into a retreat-based program that supports the Navy and Marine Corps' readiness, retention, recruiting, and quality of life priorities.¹² CREDO continues to provide programs for personal growth, character development, team building, ethical leadership, and workshops on marriage enrichment and spiritual growth. The retreats provide participants the opportunity to develop new perspectives about their relationships with family and friends, the military, and spiritual traditions.

In July 1979, the first Fleet and Family Support Center was established in Norfolk, Virginia to provide programs and services focused on deployment support, crisis response, career support, and counseling for individuals, families, and commands.¹³ The Fleet and Family Support Program (FFSP) provides unified, customer-focused, consistent, and efficient family-centric services to support the Navy mission and readiness. As support grew for the FFSP, there has been an expansion of family-centric resources such as commissaries, youth centers, schools, improved family housing, employment support, spouse mentors, and career transitions.

In 2001, Navy Medicine formalized its support to Navy families by establishing family centered-care as a strategic goal to provide integrated training, services, and research partnerships. Family-centered care is now a priority across the military health system.¹⁴ Navy Medicine's strategic plan for psychological health of service members affected by combat and operational stress included investments in military families to enhance early recognition of stress injuries and family coping skills.

The Department of the Navy's paradigm regarding psychological support for service members and families began to shift in 2007. The Stress Continuum Model (Fig. 1) was developed as a unifying conceptual framework that guides resources and concepts to meet the needs of individual service members, commands, and military families.¹⁵ The Stress Continuum Model is a psychological demands and resource utilization model to facilitate early recognition of stress behaviors and early access to preclinical and clinical service as needed. The Stress Continuum Model is gaining broader use by other military services and was the basis for the Defense Centers of Excellence (DCoE) Resilience Model.

The color-coded heuristic forms the basis of communication strategies, an acknowledging discourse about stress reactions and injury, and a hopeful perspective of recovery from illness. The stress continuum supports fitness and resilience concepts within the context of being ready (green zone). The emphasis

READY (Green)	REACTING (Yellow)	INJURED (Orange)	ILL (Red)
<u>DEFINITION</u> Wellness Flexible Coping Skills Optimal functioning	<u>DEFINITION</u> Mild and transient distress or loss of optimal functioning	<u>DEFINITION</u> More severe and persistent distress or loss of function	<u>DEFINITION</u> Persistent and disabling distress or loss of function
<u>FEATURES</u> Well trained and prepared Fit and focused In control Optimally effective Behaving ethically Having fun	<u>FEATURES</u> Always goes away Low risk for illness Irritable, angry Anxious or sad Physically pumped up or tired Loss of self-control Poor focus Poor sleep Not having fun	<u>CAUSES</u> Life threat Loss Inner conflict Wear and tear <u>FEATURES</u> Panic or rage Loss of control Can't sleep Recurrent nightmares or bad memories Persistent shame, guilt, or blame Loss of moral values & beliefs	<u>TYPES</u> Clinical mental disorders Unhealed stress injuries <u>FEATURES</u> Symptoms and disability persist over many weeks or get worse over time
Unit Leader Responsibility	Individual, Peer, Family Responsibility		Caregiver Responsibility

Department of the Navy, Maritime COSC Doctrine (2010)

FIGURE 1. Stress Continuum Model.

on stress reactions and injuries is an acknowledgment that even the most fit and resilient person will react to stress, will become injured, and has the potential to develop a stress-related illness. The stress continuum model provides a lens for understanding the psychological, social, and spiritual domains of individuals and families from readiness through illness behaviors.

There are four main points in relation to stress behaviors within the family:¹⁶ (1) Withstanding adversity without serious distress or loss of function (staying in green or yellow zones); (2) limiting the severity of distress or functional impairment when these do occur (recognizing and treating orange zone stress injuries); (3) recovering quickly and relatively fully from distress or impairment (staying out of red, returning back to green); and (4) coping effectively with residual and persistent distress or changes in function (actively engaged in treatment and recovery from stress illnesses).

The Fleet and Family Support Program (FFSP) provides services to strengthen personal and family competencies to meet the unique challenges of the military lifestyle from the “green through the orange” zones. In recognition of the increased stress facing today’s Navy families, FFSP has incorporated the concepts of operational stress control’s stress continuum into all programming areas. The FFSPs support individual and family readiness and adaptation to life in the Navy through education and counseling for crisis response, personal and family wellness, career development, finances, spouse employment, and deployment support. Programs and services are currently delivered from 81 sites worldwide, delivering a full portfolio of programs and services.

The most recent family support program was established by Navy Medicine in 2008, Project FOCUS (Families Over Coming Under Stress) is a coping and communication skills-based program designed to address difficulties that military families may experience when facing the challenges of operational deployments, combat stress, and/or injuries. The Project FOCUS pilot program was initiated at Navy and Marine Corps installations with personnel who deployed regularly to Southwest Asia. A limited test of Project FOCUS began in 2010 at selected Army and Air Force installations. FOCUS uses family level techniques to highlight areas of strength and identify areas in need of growth and change to contend with current difficulties. Throughout the intervention, structured activities bridge the gaps in communication among family members that often follow highly stressful experiences. The fundamental idea behind the Stress Continuum Model is that stress responses are expected and the model helps provide tools to work through the stress. The identification of stressors includes developing knowledge about how to intervene early and seeking assistance when necessary.

FOCUS has a foundation in evidence-based interventions that reduce risk and support coping and communication skills across the family system and builds upon a family-centered prevention approach for those affected by challenging circumstances.^{17–21} Family coping and communication skill building supports all members of the family and may serve as a gateway for parents who may be more inclined to seek services for their children than for themselves. Over the past two decades, the field of family intervention science has demonstrated that family factors play an important role in child adjustment. In

particular, effective caregiver–child relationships serve as scaffolds for building adaptive skills such as emotional and behavioral regulation. Family-centered interventions that provide developmental guidance, increase adaptive skills and behaviors in families—particularly those that support parent–child communication, parent–child bonding, and effective family management—reduce problem behaviors and emotional distress in children and support development over time.²²

FOCUS is grounded in three well-established interventions that have demonstrated a positive impact on psychological adjustment and functioning, through rigorous randomized controlled trials, in families and children facing challenging circumstances, including parental depression, parental medical illness and loss, and wartime exposure. The first is a family-centered preventive intervention designed to strengthen children and families in which a parent is depressed.¹⁸ Developed to enhance communication skills and reduce risk by increasing positive interactions between parents and children, as well as increasing understanding of depression for family members, this intervention has shown positive effects in a large-scale efficacy trial and has been adapted for multiple public health settings.^{17,18} The second is a family-centered intervention for medically ill parents and their children, which has demonstrated improvements in psychological adjustment for both parents and their children receiving the intervention over long-term follow-up in a large scale randomized trial and has been adapted for multiple communities.^{19,21} The third is a trauma-focused intervention for children and parents exposed to trauma and loss. This successful evidenced-based program was implemented and evaluated across postwar Bosnia-Herzegovina²⁰ and has been adapted for wide-scale use throughout New York City subsequent to the attack on the World Trade Center. Building on these established interventions, the UCLA-Harvard team worked with military partners to adapt and standardize FOCUS at Marine Corps Base Camp Pendleton to support military children and families affected by high operational tempo, multiple deployment stress, and combat operational psychological and physical injuries.

FOCUS integrates the Stress Continuum Model into family coping and communications training. The model is a measure of severity of physical and psychological injuries that result from exposure to combat and the wear and tear on bodies and minds during a deployment. The Stress Continuum Model aims to destigmatize psychological and physical injuries and improve access to treatment. Family members, although not in combat, also experience the effects of deployment. From the combat and operational stress control (COSC) perspective, deployments provide both the potential for challenges and growth in military families. FOCUS training incorporates the maritime COSC model to reduce the effects of stigma, promote open communication in families about combat and deployment-related physical and psychological injuries, and to help family members understand how the deployment experience has impacted them as individuals and as a family. The fundamental idea behind the Stress Continuum Model is that since stress tends to push indi-

viduals toward the yellow, orange, or even red zones, the goal is to keep families in the green “ready” zone as much as possible, and to return them to that zone as quickly as possible when there is a change in family function related to stress injury or illness. FOCUS is addressing the psychological health and sustenance of families who are in the “yellow to orange” zone.

POTENTIAL FAMILY FITNESS METRICS

The military family is an interdependent group of individuals who have shared experiences that are influenced by world events, national policy, military culture, and one or more parents who have a commitment that requires self and family sacrifice. One of the challenges to the assessment of total family fitness is to identify metrics that have potential for understanding family functioning as a whole versus individual family members. It is important to identify those measures that identify both strengths and vulnerabilities when evaluating potential metrics that contribute to understanding family fitness. In addition to academic and research utility, total family fitness metrics need to provide military leaders a reasonable estimate of family function in relation to its impact on the readiness and retention of service members.

A comprehensive biological, psychological, sociological, and spiritual conceptual model for family fitness does not yet exist. Epstein et al.²³ identified six essential dimensions of healthy family functioning: problem solving, communications, family roles, affective responsiveness, affective involvement, and behavior control. Problem solving is the family’s ability to use active and emotional skills to proceed through a sequence from problem identification through problem resolution and includes the ability to recognize and use diverse resources. Communication refers to the effectiveness and extent that a family’s style of communication includes clear and directive verbal messages. Clear and directive communication is different from authoritarian communication. Family roles are the recurrent behavior patterns needed to fulfill material and emotional family needs and includes the ability to engage social supports. Affective responsiveness is the capacity of family members to display appropriate emotions, both in quality and quantity, to a wide range of stimuli. Affective involvement is the amount of interest, care, and concern family members invest in one another. Behavioral control refers to the flexibility or rigidity for maintaining discipline and standards of behavior. In addition to the six dimensions proposed by Epstein et al. the perception of global health²⁴ and spiritual supports²⁵ are important dimensions for military families. Families that function at high levels within each dimension have fewer stressors and are more likely to effectively manage life problems that do arise.^{23–25} Instruments that measure these eight dimensions of family functioning will provide enhanced assessment and evaluation capabilities with the potential to develop action plans and guide resource decisions. Table I. is an index of the eight family fitness dimensions and potential instruments for assessing the dimensions.

The Family Assessment Device (FAD)²⁶ is recommended as a potential measure for family fitness because it is a valid, reliable

TABLE I. Dimensions of Family Function and Potential Family Fitness Metrics

	The Family Assessment Device (FAD)	Family Sense of Coherence (FSOC) and Family Adaptation Scale (FAS)	Family Crisis Oriented Personal Evaluation Scale (F COPEs)	Self-Report Family Inventory (SFI) Version II
Problem Solving	X	X	X	
Communication	X	X		X
Family Roles	X	X	X	X
Affective Responses	X	X		X
Affective Involvement	X	X		
Behavior Control	X		X	X
Spiritual Support			X	
Global Health				X

instrument that measures overall family functioning in six of the eight dimensions of family functioning. The FAD is a 60-item four-criteria Likert scale ranging from strongly agree to strongly disagree that can be completed by one or more family members. The FAD has robust internal reliability and validity (Cronbach's α ranging from 0.74 to 0.92), good test-retest reliability, low correlations with social desirability, moderate correlations with other self-report measures of family functioning, and evidence of concurrent validity.²⁷ The FAD was used with the Project FOCUS military families and has demonstrated acceptance and utility. In addition to the FAD, there are other instruments that can provide measures related to family functioning and can contribute to understanding military family function in relation to factors that affect readiness and retention.

Family Sense of Coherence (FSOC) and Family Adaptation Scale (FAS) are based on Antonovsky's²⁸ salutogenic model that frames health and disease on a continuum. Whether stress and tension will lead to pathogenesis or growth depends, in part, upon a sense of coherence. Sense of coherence is developed from the availability and use of generalized resistance resources. A generalized resistance resource is any phenomenon—cultural stability, money, social support, cognitive skills, etc.—that is used effectively to decrease the tension created by a stressor. The ability of an individual or family to access and use the resources that comprise the mediators of psychological fitness and the components of total fitness is a significant determinant of overall health and resilience. The FSOC and FAS are jointly developed measures of cognitive orientations that help family members view their families as comprehensible, manageable, and meaningful.²⁸ The combined FSOC and FAS is a 36-item seven-point Likert scale that measures sense of coherence and sense of adaptation within the family. Both scales have good internal consistency (Cronbach's α 0.92 and 0.87, respectively) and good concurrent validity as they measure different concepts and are highly correlated.

Family Crisis Oriented Personal Evaluation Scale (F COPEs)²⁹ was developed from the McCubbin and Patterson Double ABCX family crisis model.³⁰ The letters ABCX represent the stressor event (A), the family's crisis-meeting resources (B), the family's definition or interpretation of the crisis event (C), and the family crises itself (X). The F COPEs has been used in numerous studies with military families.³¹ This

event-centric model emphasizes that no event occurs in isolation and also includes the concept of "pile-up" of stressors. The F COPEs is a 30-item five-point Likert scale that measures a variety of coping behaviors that individuals may use in times of stress. The F COPEs has good internal consistency (Cronbach's α ranging from 0.77 to 0.86) and an overall test-retest reliability of 0.81.³¹

Self-Report Family Inventory (SFI) Version II was based on Beavers Systems Model of family functioning that evaluates two intersecting family domains.³² Family competence ranges from severely dysfunctional to optimal and family relationship style ranges from an internal (centripetal) to external (centrifugal). Family functioning is evaluated in five areas: health/competence, conflict, cohesion, leadership, and expressiveness. Psychologically healthy families have a mixed family style with competent abilities in each of the five areas. The SFI is a 36-item five-point Likert scale that measures a family member's view of overall family competence. The SFI has good internal consistency (Cronbach's α ranging from 0.84 to 0.93) and an overall test-retest reliability of 0.85.³² Clinical validity of the SFI has shown that it can discriminate between groups of psychiatric patients and that it correlates well with other family function measures such as the FAD ($r = 0.77$).

CONCLUSION

Total family fitness is an emerging concept within the Department of Defense that refers to families who are resilient, physically, psychologically, socially, and spiritually within the context of a military lifestyle. Family readiness directly impacts service member readiness and retention and has significant mission implications for military leaders. The military has developed many resources to support service members and their families to competently cope with the stressors of daily living; promote psychological, spiritual, and physical well-being; and support the capacity of service members and their families to manage the competing demands of work life and personal/family life. A historical review of Navy programs was used to highlight the shifting paradigm of family support programs in the military.

Senior military and policy leaders have asked for potential family fitness metrics while research and further concept development is progressing. This article highlighted

four potential metrics that are currently being used with military families. In particular, the use of the Family Assessment Device has demonstrated its potential as a metric for military family functioning as concepts and measures of family fitness are developed and implemented. Family fitness is a concept that can be used to develop and integrate family centric programs and resources, leverage existing resources while reducing unnecessary redundancy, and promoting overall family functioning and health. The concept of total force fitness will not be complete if the fitness of the military family is not included in the overall matrix. Leaders, service members, and families need to effectively leverage the internal and external resources that contribute to quality of life and total health of the entire force.

REFERENCES

1. Bramsen I, van der Ploeg HM, Twisk JWR: Secondary traumatization in Dutch couples of World War II survivors. *J Consult Clin Psychol* 2002; 70: 241–5.
2. Dirkzwager AJE, Bramsen I, Ader H, van der Ploeg HM: Secondary traumatization in partners and parents of Dutch peacekeeping soldiers. *J Fam Psychol* 2005; 19: 217–26.
3. Invisible Wounds: Serving Service Members and Veterans with PTSD and TBI. Washington, DC, National Council on Disability, 2009.
4. Dekel R, Solomon Z: Marital relations among former prisoners of war: contribution of posttraumatic stress disorder, aggression, and sexual satisfaction. *J Fam Psychol* 2006; 20: 709–12.
5. Prigerson HG, Maciejewski PK, Rosenheck RA: Population attributable fractions of psychiatric disorders and behavioral outcomes associated with combat exposure among US men. *Am J Public Health* 2002; 92: 59–63.
6. Riggs DS, Byrne CA, Weathers FW, Litz BT: The quality of the intimate relationships of male Vietnam veterans: problems associated with posttraumatic stress disorder. *J Trauma Stress* 1998; 11: 87–101.
7. Defense Health Board: An achievable vision. Report of the Department of Defense Task Force on Mental Health. Falls Church, VA, Defense Health Board, 2007.
8. Cozza SJ, Chun RS, Polo JA: Military families and children during Operation Iraqi Freedom. *Psychiatr Q* 2005; 76: 371–8.
9. Hobfoll SE: Conservation of resources: a new attempt at conceptualizing stress. *Am Psychol* 1989; 44(3): 513–24.
10. Walsh F: Strengthening Family Resilience, Ed 2. New York, Guilford Press, 2006.
11. OPNAVINST 1750.1F: Navy Family Ombudsman Program: Chief of Naval Operations; 2007.
12. U.S. Navy, Commander Navy Installations Command. CREDO Program. 2010. Available at <https://www.cnic.navy.mil/cnrma/Programs/CREDO/NORFOLK/index.htm>; accessed March 10, 2010.
13. U.S. Navy, Commander Navy Installations Command. Fleet and Family Support Services. 2010. Available at http://www.cnic.navy.mil/CNIC_HQ_Site/WhatWeDo/FleetAndFamilySupportServices/index.htm; accessed March 15, 2010.
14. Institute for Family Centered Care: Current Initiatives and Collaborations, January 31, 2010. Bethesda, MD, Institute for Family Centered Care. Available at <http://www.familycenteredcare.org/services/current.html>; accessed March 15, 2010.
15. Department of the Navy: Combat and Operational Stress Control. MCRP 6-11C, MTTP 1-15M. U.S. Marine Corps. Washington, DC, Department of the Navy, (in press, expected June 2010).
16. Department of the Navy: Combat and Operational Stress Control: The Family Dynamic. Professional Development Training Manual. Washington, DC, Navy Medicine and Navy Chaplain Corps, 2009.
17. Beardslee WR, Wheelock I: Children of parents with affective disorders: empirical findings and clinical implications. In: *Handbook of Depression in Children and Adolescents*. Edited by Reynolds WR, Johnston HF. New York, Plenum Publishers, 1994.
18. Beardslee WR, Gladstone TR, Wright EJ, Cooper AB: A family-based approach to the prevention of depressive symptoms in children at risk: evidence of parental and child change. *Pediatrics* 2003; 112(2): e119–31.
19. Rotheram-Borus MJ, Lee M, Lin YY, Lester P: Six-year intervention outcomes for adolescent children of parents with the human immunodeficiency virus. *Arch Pediatr Adolesc Med* 2004; 158(8): 742–8.
20. Layne CM, Saltzman WR, Poppleton L, et al: Effectiveness of a school-based group psychotherapy program for war-exposed adolescents: a randomized controlled trial. *J Am Acad Child Adolesc Psychiatry* 2008; 47(9): 1048–62.
21. Lester P, Rotheram-Borus MJ, Elia C, Elkavich A, Rice E: TALK: teens and adults learning to communicate. In: *Evidence-Based Treatment Manuals for Children and Adolescents*, pp 170–285. Edited by LeCroy CW. New York, Oxford University Press, 2008.
22. Spoth RL, Kavanagh K, Dishion T: Family-centered preventive intervention science: toward benefits to larger populations of children, youth, and families. *Prev Sci* 2002; 3: 145–52.
23. Epstein NB, Bishop DS, Ryan CE, Miller IW, Keitner GI: The McMaster Model View of Healthy Family Functioning. In: *Normal Family Processes*, pp 138–160. Edited by Walsh F. New York, Guilford Press, 1993.
24. Beavers RW, Hampson RB, Hulgus YF: Commentary. *Fam Process* 1985; 24: 398–404.
25. Olson DH, Russell C, Sprenkle D (editors): *Circumplex Model: Systemic Assessment and Treatment of Families*, Ed 2, New York, Haworth Press, 1989.
26. Epstein NB, Baldwin LM, Bishop DS: The McMaster Family Assessment Device. *J Marital Fam Ther* 1983; 9: 171–80.
27. Miller IW, Epstein NB, Bishop DS, Keitner GI: The McMaster Family Assessment Device: reliability and validity. *J Marital Fam Ther* 1985; 11: 345–56.
28. Antonovsky A, Sourani T: Family sense of coherence and family adaptation. *J Marriage Fam* 1988; 50: 79–92.
29. McCubbin HI, Olson DH, Larsen AS, Corcoran K, Fischer J: Family crisis orientated personal evaluation scales [F COPEs] (1987, 1991). In: *Measures for Clinical Practice: A Sourcebook*, Ed 3, Vol 1, pp 294–7. New York, Free Press, 2000.
30. McCubbin HI, Patterson JM: The Family Stress Process: The double ABCX Model of adjustment and adaptation. In: *Social Stress and the Family: Advances and Developments in Family Stress Theory and Research*, pp 7–37. Edited by McCubbin HI, Sussman MB, Patterson JM. New York, Haworth Press, 1983.
31. Jacob T, Tennenbaum DL: *Family assessment: rationale, methods, and future directions*. New York, Plenum Press, 1988.
32. Beavers R, Hampson RB: The Beavers Systems Model of Family Functioning. *Am J Fam Ther* 2000; 22: 128–43.

Program Evaluation of Total Force Fitness Programs in the Military

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ABSTRACT The Chairman of the Joint Chiefs of Staff has charged the military's medical and research communities to join with the line community in rapidly and efficiently building a framework to promote and measure total force fitness (TFF). The need to identify the elements of promising TFF programs, and to evaluate whether and how they work, has taken on a new urgency, as we witness the heavy toll of combat exposure on our military members and families. We propose a rigorous methodology for conducting program evaluation, including the study of structure, process, and outcomes. The proposed model combines both quantitative and qualitative methods, to assess the effectiveness and replicability of holistic, multidimensional programs as they are implemented. We describe an additional model for the assessment of efficacy through group randomization trials. The result is a comprehensive model that can be used to assess and compare TFF programs.

INTRODUCTION

The concept of total force fitness (TFF), when applied to the military, is defined as follows: A state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions; well-being encompasses physical, mental, social, and spiritual well-being and not merely the absence of disease or infirmity. Total force fitness promotes resilience: the resources to withstand recover and/or grow in the face of stressors and changing demands.

At a time when our all-volunteer force is under extreme stress due to multiple and frequent deployments in two theaters, with short dwell time and heavy enemy engagement, maintaining the health of our fighting force is of critical importance. At the same time, Department of Defense health-care costs are projected to rise at twice the rate of overall U.S. healthcare spending between 2001 and 2011.¹ Still, perhaps the most compelling reason to commit to total force fitness for the military is the moral imperative to safeguard the health of individuals who have volunteered to be put in harm's way in service to their country.

Many warriors enter the military in top physical and mental form; others reflect lifestyle behaviors that include poor sleep hygiene, unhealthy diet, and inattention to spiritual and social support. The military has the unique opportunity to establish standards for millions of Americans and to achieve them through the implementation of total force fitness programs.

If the goal of total force fitness is "universal" health strength and vigor, a single program may be inadequate to meet all service members' and units' fitness needs. It is the nature of human capital that "one size fits all" is not a viable approach. Unlike tanks, aircraft carriers, and mechanized weaponry, human beings are not built to military specifications, and getting them to achieve a standard level of fitness and health is a daunting challenge. Therefore, total force fitness endeavors must also include a method for evaluating and comparing any programs, including the ability to identify which elements work best for which subpopulations and in which environments. Laying out the fundamental contributors to total force fitness, along with standardized metrics to assess progress toward the goal of total force fitness, is insufficient if it does not include the tools for evaluating and comparing the effectiveness of programs according to these dimensions. Only then can policy be set and resources be allocated in the most efficient manner.

In developing this evaluation framework, it is important to consider both the need for rigorous methods and for relevance of results. Rigor is established through the use of valid research methods and design that are accepted by the scientific community. Relevance addresses the more subjective elements of the particular values and needs that the research is intended to meet. Thus, a virtual "evidence house" is necessary in which multiple methods and research designs are included to provide a complete view of the value of the studied program. Unlike the classical "evidence hierarchy," the evidence house recognizes that various research methodologies are necessary and no less valuable when they are properly designed to address matters of relevance, feasibility, and related elements of the "does it work?" question. The relative timing of effectiveness and efficacy research can be determined on a case-by-case basis; where the 80% solution exists, we posit that the mixed methods, continuous process improvement program evaluation might well be the most efficient way to drive toward the 100% goal.²⁻⁴

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While the individual and group metrics defined elsewhere in this journal will allow us to determine outcomes using a rigorously derived toolkit, they do not address evaluation of the structure and process of the programs and therefore consider neither the relevance to particular populations nor the effectiveness of the programs as implemented. The quantitative metrics do not speak to the issue of replicability of the programs nor do they foster continuous quality improvement that comes from a feedback process about the program's operation in real time. Last but not least, the success of any program is highly dependent on contextual factors, those that arise from the unique features of the setting and the implementation. The latter is a significant issue in the military, which permits considerable leeway at both the service level and installation level for implementing programs. What is required therefore is a systematized process, including the collection of both quantitative and qualitative data as programs are developed and implemented, to determine what works to approximate the goals, to understand how and why certain elements contribute to success, and to identify those that act as barriers. Such a standardized process for rigorous data collection, with a robust dataset and the ability to measure how changes in programs lead to changes in achieving the goal, is termed program evaluation.

Another advantage of the proposed program evaluation methodology is that it is sufficiently flexible to allow multiple programs with perceived value to be implemented while being rigorously studied and compared using standardized metrics, and to cycle important information on lessons learned back into the program, thus promoting performance improvement and timely progress toward TFF. That approach accommodates the urgent need for TFF programs now, while ensuring that each iteration yields valuable information on how to improve the program for the next cycle. The mixed methodology we propose is essential to gauge key factors, such as scalability, facilitators and obstacles to success, and midcourse changes that often occur in real-life, real-time implementation; moreover, the mandate to produce total force fitness requires both the assessment of each individual's fitness, using the metrics outlined in the accompanying articles in this journal and the study of group dynamics and interactions that work to either enhance or degrade the effectiveness of a program. By combining the collection of both quantitative and qualitative data in a program evaluation model with group randomized trials to determine efficacy, the necessary information to achieve total force fitness can be obtained.

RELEVANCE TO THE MILITARY

Leadership at all levels of the military recognizes the challenge of total force fitness, to identify its key elements, to describe how they interact, and to select validated and relevant outcome measures to assess achievement in each domain and in totality. Similarly, each of the armed services has performance challenges and goals that require total force fitness of its members. For example, the sustained, asymmetrical warfare against an elusive insurgency, which characterizes Operations

Iraqi Freedom and Enduring Freedom has changed much of the way the Air Force experiences warfare and widened the pool of airmen who experience direct combat conditions. Today, nearly every Air Force career may be exposed to direct enemy engagement. Furthermore, the reliance on the all-volunteer military has required Air Force members to fill roles traditionally filled by members of sister services. Consequently, airmen are increasingly asked to push the boundaries of their traditional roles and training needs—conditions that create risk for physical and mental health problems.^{5,6}

Like the other services, the Air Force is interested in strengthening service members' resilience by ensuring that they have skills to promote physical health and restedness, healthy thinking and stress management, leadership and group cohesion, and organizational commitment. These factors have been identified since World War II to be helpful for enabling troops to continue to perform under adverse conditions.⁷ Efforts are ongoing to develop credible programs that can increase knowledge of these skills; increase confidence and motivation to use them; and results in improved resilience and decreased adverse effects, such as burnout, injuries, mental health distress, and casualties. While there is evidence that psychoeducational briefings can have a positive impact,^{8,9} they may not be sufficient to produce desired outcomes¹⁰ and there is growing support for more comprehensive skills-based training programs. This emphasis on program evaluation is especially important to ensure that the time and energy spent on resiliency-enhancing programs are truly effective rather than just efficient.

The recent TFF workshop acknowledged that TFF is multifactorial, encompassing individual, relational, group, and environmental factors. Developing a construct of total force fitness, in which the interdimensional effects are predictable and measurable, is a complex endeavor; ultimately the need is line driven. Key terms and definitions from the literature must be translated into line and operationally relevant language and the outcomes must be measured using military performance metrics. Program evaluations attach to pragmatic implementations and provide relevant, timely information that is usable by the line.

To generate a model capable of producing meaningful, actionable results, an optimal evaluation framework must provide an understanding of logistics of implementation, environmental conditions, subtle group dynamics, and the other salient features of any program. The only way to do this is to apply mixed methods, including both qualitative and quantitative research.

Herein, we make the case for a standardized program evaluation methodology as the best framework for assessing the real-life effectiveness of programs instituted to promote total force fitness. The power of program evaluations derives from a number of features:

- Its incorporation of both qualitative and quantitative research methods creates a rich tapestry of data.

- Because it is conducted in real-life settings, as opposed to controlled research environments, it can identify and accommodate variations from the intended program and address feasibility factors.
- It can easily be performed repeatedly as program improvements are implemented and can provide a real-time feedback loop, facilitating continuous performance improvement in design and delivery.
- It provides meaningful information in the event that the program intervention proves ineffective in meeting the performance goals.
- Its focus on effectiveness in real-world settings as opposed to efficacy in controlled environments is consonant with the chairman's call for immediate solutions.

We posit that program evaluation should be a required element of all programs being implemented under the rubric of TFF. There are several compelling reasons to make standardized evaluation a requisite. Doing so would ensure that every program yields valuable data that inform future effort. Further, such evaluations produce a catalog of data that enables comparison of programs, populations, and environments.

PROGRAM EVALUATION

Too often there is a disjuncture between the goals of research and the operational goals of the military. The gold standard of research is the randomized controlled trial (RCT), which focuses on efficacy in controlled environments. However, such trials are not always feasible or pragmatic; they may require large numbers of soldiers, and strict adherence to intervention guidelines that may be easily disrupted by unanticipated military operational events. Beyond determination of what works under ideal trial conditions is the need to understand why it works, whether it is practical or affordable in the real world of the line and how best to implement it. In that regard, the standard RCT may be too narrow a design, and the results may yield limited conclusions that only tentatively support a "go/no-go" decision. Properly constructed mixed-methods research can provide more actionable information, both on what not to do again and what to do more of in the future. Depending on the nature of the program and the outcomes of interest, program evaluations may be completed in as short a period as 2–4 months or may extend over a period of years.

Health, education, and training programs have as their ultimate goal preventing or treating disease, changing behavior, attitudes, beliefs, and increasing knowledge and skills. More often than not, trainings target significant and difficult changes in attitudes and risk/protective behavior such as those related to stress and resiliency. Because the stakes are so high, there is a pressing need for accountability to stakeholders, to include assessing effectiveness, documenting implementation challenges and solutions, developing and applying standard metrics, and comparing outcomes across programs, to inform resource allocation.

Toward this end, the Toolkit for the Evaluation of Resilience training programs has been developed by the Samueli Institute in conjunction with a consulting team from RAND Corporation. The toolkit incorporates the theoretical elements outlined below and adds a preliminary set of validated metrics to assess outcomes of interest to assess resilience. It is currently in use in an evaluation being conducted by the Samueli Institute of a skills-based resilience training program in a brigade combat team that has deployed to Afghanistan. As designed, this particular evaluation will be completed over a 2-year period; assessments of structure and process of a discrete training intervention require only a 4- to 6-month period, but quantitative data on resilience and related health outcomes is being collected over a period that begins predeployment and extends to the Post-Deployment Health Reassessment (PDHRA) at 3–6 months postreturn. (As noted below, this longer period of follow-up is desirable to assess whether the training's effects on health are sustained.)

PROGRAM EVALUATION THEORY

Standard program evaluation involves three elements: (i) structural evaluation, (ii) process evaluation, and (iii) outcome evaluation (Fig. 1). This information helps to determine the value of a program and assists those who may wish to expand, change, or replicate it in other environments. Such an approach is based on the discovery of unique factors within a program (leadership, relationships, culture, structure, rewards) that bring about the outcomes.

Process evaluation assesses the extent to which the intervention components are implemented as planned. Summative evaluation measures the extent to which program goals and objectives were achieved and the intermediate and longer-term impact of the program.

DATA COLLECTION TECHNIQUES

Data are collected using multiple methods,¹¹ a strategy that yields higher quality results¹² and that allows for triangulation^{12–14} to increase the reliability and validity of the findings.¹⁴ It will combine both qualitative and quantitative techniques, a combination that has long been recognized as a powerful research strategy, especially for exploratory studies of new programs, such as TFF programs.^{11,12,14}

THE MODEL

We reviewed several classic models of program evaluation. These included the following: Donabedian,¹⁵ Andersen,¹⁶

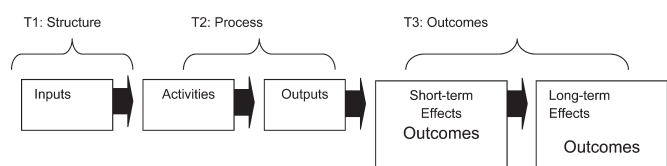


FIGURE 1. Logic model with evaluation components.

Chinman,¹⁷ Green and Kreuter's Precede/Proceed Model,¹⁸ RE/AIM,¹⁹ CDC Self-Guided Protocol for Program Evaluation,²⁰ and Scrimshaw's rapid ethnographic assessment.^{21,22}

We have drawn on this wide body of work to construct our program evaluation toolkit. From Donabedian's model we incorporated the foundations of evaluation, adding Andersen's approach for rigorous measurement and the social/community interaction. From Chinmann's "Getting To Outcomes" model, we took the practical application of evaluation so that practitioners can plan, implement, and evaluate their own programs. From Green's "Precede/Proceed" model we took the logic model and feedback loop, which addresses midcourse corrections better than a linear logic model (Fig. 2). The RE/AIM model added the maintenance and reinforcement components, which are essential in training/education programs. The conceptual and functional frameworks were adapted from the CDC evaluation toolkit because they provide a simple snapshot of evaluation. The RAP model added the qualitative data collection component. Logic models are used extensively throughout; all the models we reviewed contributed essential components to our evaluation model. Finally, Ryan's model added the systems perspective.

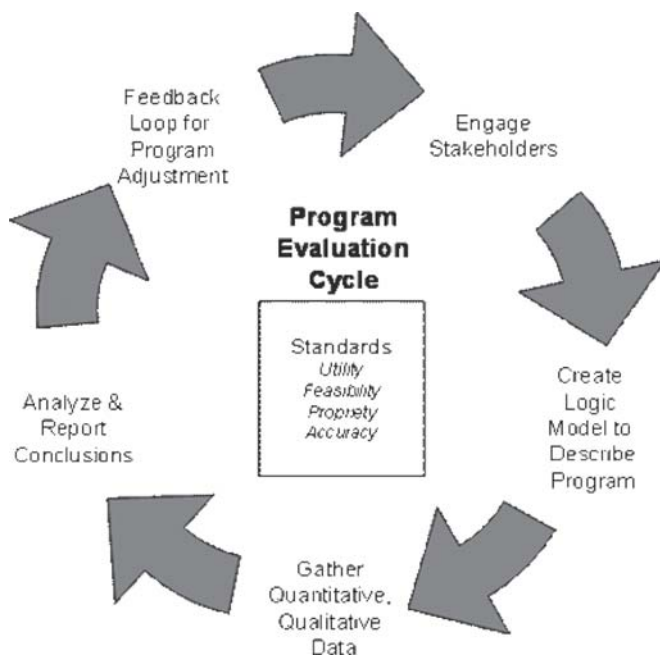


FIGURE 2. The program evaluation cycle.

STEPS IN EVALUATION PRACTICE²⁰

Structural Evaluation

The determination of the structure of the program and its sites requires interviews with key personnel and a review of official descriptions of the program and the environment. It also involves the logic of the program, the goals/milestones, and values.²³ The aim is to get as complete a description of the

program as possible from those who are implementing it. For evaluation of TFF programs we suggest the following components be included:

Organization

- Were the implementation sites optimal? Were the facilities adequate to support the training?
- How was the program organized? Was the per-person time allocation sufficient to convey the concepts and/or skills? Was the schedule feasible and appropriate to the military duty environment?
- Did this training program integrate well with existing programs? Was its design consistent with other military programs? Did it support/enhance institutional principles and culture?
- Was the implementation site properly selected to target the intended population and outcomes stated?
- If there was a needs assessment, did the program's design meet the identified needs?

The Program

- Who did the training? How many trainers were there and were they sufficiently knowledgeable about military life to be credible teachers?
- What was the content of the training program? Did it contain didactic and experiential elements? What skills were trained? Did the principles support the skills, and vice versa?
- Were the training goals clearly stated?

Staff/Participants

- What were their qualifications?
- Were other faculty/staff involved in the program? Was the staff augmented by military?
- What are the affiliations of the staff (e.g., institution, department, community), and how were they selected?
- What are their backgrounds, credentials/certifications?
- Was the staff adequate for the sessions?

Process Evaluation

The primary roles of the process evaluation are to identify deviations from the intended program, barriers that need to be overcome if the program is to work effectively and to assess the impact of midprogram modifications. The secondary goal is to provide a clear description of how the program worked so that successful programs can be replicated, and less successful programs can be improved.

We suggest using a two-stage evaluation, beginning with an initial assessment to identify how the program really operates (the lived program as opposed to the program on paper), followed by a more expansive evaluation to identify factors that may explain the program's success or the actual or potential barriers that interfere with its success.

Process evaluations should also be designed to record important implementation decisions and document change

throughout the history of the program; moreover, consideration should be given to providing timely identification of barriers to the decision makers in a timely fashion, to allow for midcourse corrections if needed. In summary, the process evaluation is conducted to characterize and understand:

- The extent to which the program is being implemented according to plan, including assessment and documentation of the degree of integrity, fidelity, variability in the program implementation, expected or unexpected, planned or unplanned.
- What components of the intervention appear to be responsible for outcomes.
- The relationship between the program context (i.e., setting characteristics) and the program processes (i.e., implementation).
- The quality of staff implementing program and the impact of that quality on the successful delivery.
- Frequency of program sessions, intensity, and duration.
- Size of group receiving program.
- The correlation of the program's design, goals, and outcomes.

Outcome Evaluation

Outcome evaluation involves comparing what the original program objectives were with what has been achieved before and after the program, using both quantitative and qualitative measures. For TFF programs, the metrics presented in the accompanying manuscripts would form the standardized dataset for functional and health outcomes, allowing for comparisons of various programs, based on their relative success in promoting the desired outcomes. Wherever possible this should be done with objective measures such as medical records or survey data on the following types of quantitative outcomes, measured pre- and postprogram:

- Changes in risk or protective behaviors (i.e., healthy sleep patterns, nutrition, stress reduction, use of alcohol).
- Changes in trends in morbidity and mortality (i.e., anxiety, depression, anger management, blood pressure, other health indices and biomarkers).
- Changes in the environment, including policies, formal and informal enforcement of regulations, and influence on social norms and other societal forces (i.e., allocation of down time to practice self-regulation).
- Additional objective metrics relevant to the goals/objectives of the particular program being evaluated, such as those outlined in this journal.

Other important outcomes that are frequently included are changes in beliefs/attitudes/knowledge, which are subjective measures, as opposed to changes in behavior or biomarkers. The purpose of the additional qualitative assessments is to elucidate issues that cannot be answered by the quantitative analyses and to explore additional areas that are difficult to address through quantitative data, including the following,

obtained through interviews with participants, staff, and administrators:

- Participant acceptability and receptivity (satisfaction).
- Participant descriptions of the program, including things they liked or disliked, improvements they suggest.
- Perceived side effects or undesired effects.
- Perceived unmet needs.
- Economic outcomes (cost versus benefits).
- Change in beliefs, attitudes, knowledge about a particular topic.
- Anticipated change in behaviors, expected degree of use and applications.
- Participants' comparisons of the program to others they have learned or experienced.

Once the program evaluation has been completed, the data analyzed and interpreted, the final report should address the overall utility of the program for its intended users and outcomes; the feasibility of the program as designed and implemented (accounting for such elements as acceptance, total resource costs, successful completion, etc.); recommendations for future programs, addressing the weaknesses and strengths of the program, and lessons learned about reparative measures; and a thoughtful, scientific analysis of how the program compared overall to others with similar goals. Both the operational line community and the research community can extract important, pragmatic information from this report.

THE EVIDENCE HOUSE BEYOND PROGRAM EVALUATION

Measuring Efficacy

Program evaluation provides some measure of program coherence and effectiveness; however, as noted above, ideally research should also assess program efficacy. One way this has been done in the Army is through randomized trials in which individuals were randomly assigned to a program of intervention or some other comparison condition (either an active comparison intervention or no intervention at all). Adequate sample sizes and randomization are designed to ensure that differences between the intervention and comparison conditions can be reliably attributed to the intervention. In the military context, fitness-type interventions can be designed to leverage unit-level strengths such as cohesion and leadership. Because programs are typically implemented in existing units, it is often preferable to randomize by intact unit (i.e., conduct a group randomized trial or GRT). The Army's GRTs generally entail randomizing 30 or more groups and conducting analyses that account for pre-existing group-level differences.⁸

The main goal of a GRT and other randomized trials is to establish with some certainty that positive outcomes are caused by the targeted intervention. Research designs are strongest when they measure and evaluate outcomes (such as mental health status) months after the intervention because such designs test for evidence of long-lasting effects. Designs

that assess outcomes immediately after the intervention are weaker because they fail to provide evidence of lasting impact. The strongest GRTs also test an intervention against an active control. That is, the targeted intervention is contrasted to an alternative intervention that is face valid to those undergoing the intervention. Finally, within the context of the military, universally applied programs are more realistic in many cases than targeted interventions that focus only on high-risk individuals.

Importantly, design elements that strengthen the scientific credibility and/or applicability of the research also reduce the effect sizes (e.g., the measurable impact of the intervention). This concept can be understood in the context of the earlier discussion on the need for both rigor and relevance in the evidence house. For example, it may be more difficult to detect changes months after the program implementation; therefore, this design often leads to small effect sizes. Similarly, contrasting an intervention to an active control is often associated with smaller effect sizes than contrasting an intervention to a passive control condition.²⁴ Finally, universally applied programs generally have lower effect sizes than targeted programs.²⁴

For these and other reasons, authors such as Bliese et al.²⁵ have argued that in conducting research on efficacy, focusing on statistical significance is more important than focusing on effect sizes in large-scale universally applied resilience programs. Fundamentally what is important to demonstrate efficacy is that resilience-based programs have a statistically significant probability of improving mental health outcomes and that such programs do not demonstrate harm.

At a theoretical level, it is critical to understand that even seemingly small effect sizes can have meaningful effects when (a) the process is cumulative and (b) when large populations are involved. In terms of a cumulative effect, for instance, we would reject a treatment for the common cold that had a low effect size for preventing the next single exposure to cold virus; however, we would accept a treatment with a low effect size (on a single occasion) if it would lower the risk for the next 10 years of exposure. Intervention programs such as those that would comprise a total force fitness program are often designed to be cumulative—teaching skills that generalize across time and situations—and these effects may be missed in traditional randomized trials that have few follow-up measurement occasions. In terms of populations, the fact that resilience programs are being designed to impact hundreds of thousands of individuals means that even small effect sizes will result in positive outcomes for hundreds if not thousands of service members. Thus, the value of even small effect sizes is compensated for by the magnitude of the institutional benefit.

Despite the fact that GRTs are resource intensive, it is possible to assess the efficacy of an intervention using these techniques.⁸ Such studies demonstrate not only the feasibility of conducting a GRT but also the possibility of demonstrating that interventions designed to leverage the military social context can result in positive effects.

CONCLUSIONS

In tandem with the development and adoption of a toolkit containing the elements and metrics for the military-wide commitment to total force fitness, a rigorous method of evaluation will provide not only a framework to show that total force fitness programs are successful, but also the basis for continuous process improvement. It is vital that such methods be harnessed to deliver TFF programs now when the need is urgent, and that they can yield timely results that are relevant to the line, producing actionable evidence of effectiveness and efficacy and the evaluation of the facilitators and barriers to successful implementation, expansion, and replication. The proposed mixed-methods program evaluation will enable leaders to understand why and how a program was or was not successful to tailor the next effort thoughtfully and on the basis of scientific information. Conducting structural, process, and outcomes evaluation will provide the results required to justify spending precious resources on TFF programs, guide the allocation of resources to those with evidence-based success, and will ultimately yield a catalog of TFF programs suitable for implementation at various locations among troops with a variety of needs. For the assessment of efficacy, group randomization trial design, a comprehensive, scientifically rigorous and operationally meaningful variation on program evaluation has been described. Because universally applied programs may demonstrate small treatment effect sizes, the information obtained through program evaluation, including such things as feasibility, replicability, subjective value ratings, cost analysis, and cultural/environmental fit may be the determining factors in deciding which program(s) to implement. Importantly, the pragmatic methodology, in which programs are studied as they are actually implemented in real-life, brings the research function into closer alignment with the needs of the line and ensures that research lessons can be cycled into practice more efficiently. At a time when stress-related illness and dysfunction are exacting a heavy toll on our military communities, the need for identifying holistic programs that work both in principle and in fact is vital.

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REFERENCES

1. Zoroya G: Military's health care costs booming. *USA Today*, April 22, 2010.
2. Jonas W, Lewith G: Toward standards of evidence for CAM research and practice. In: *Clinical Research in Complementary Therapies*, Ed 2. Edited by Lewith G, Jonas W, Walach H. Littleton, NH, Churchill Livingstone, 2010 (in press).
3. Jonas W: The evidence house: how to build an inclusive base for complementary medicine. *West J Med* 2001; 175(2): 79–80.

4. Jonas W: Building an evidence house: challenges and solutions to research in complementary and alternative medicine. *Forsch Komplementarmed Klass Naturheilkd* 2005; 12(3): 159–67.
5. Gal R, Jones F: A psychological model of combat stress. In: *Textbook of Military Medicine, War Psychiatry*. Edited by Bellamy R, Jenkins D. Falls Church, VA, Office of the Surgeon General, U.S. Department of the Army, 1995.
6. Wilcox V: Burnout in military personnel. In: *Textbook of Military Medicine, Military Psychiatry: Preparing in Peace for War*. Edited by Zajtcuk R, Bellamy R, Jenkins D. Falls Church, VA, Office of the Surgeon General, U.S. Department of the Army, 1994.
7. Manning F: Morale and cohesion in military psychiatry. In: *Textbook of Military Medicine, Military Psychiatry: Preparing in Peace for War*. Edited by Zajtcuk R, Bellamy R, Jenkins D. Falls Church, VA, Office of the Surgeon General, U.S. Department of the Army, 1994.
8. Adler A, Bliese P, McGurk D, Hoge C, Castro C: Battlemind debriefing and battlemind training as early interventions with soldiers returning from Iraq: randomization by platoon. *J Consult Clin Psychol* 2009; 77: 928–40.
9. McKibben E, Britt T, Hoge C, Castro C: Receipt and rated adequacy of stress management training is related to PTSD and other outcomes among Operation Iraqi Freedom veterans. *Mil Psychol* 2009; 21(1): S68–81.
10. Sharpley J, Fear N, Greenberg N, Jones M, Wessely S: Pre-deployment stress briefing: does it have an effect? *Occup Med (Chicago, IL)* 2008; 58(1): 30–4.
11. Henry G, Melvin M: Beyond use: understanding evaluation's influence on attitudes and actions. *Am J Eval* 2003; 24(3): 293–314.
12. Donaldson S, Scriven M: *Evaluating social programs and problems: visions for the new millennium*. Mahwah, NJ, Erlbaum, 2002.
13. Tashakkori A, Teddlie C: *Mixed methodology: combining qualitative and quantitative approaches*. Thousand Oaks, CA, Sage Publications, 1998.
14. Yin R, Bateman P, Moore G: *Case studies and organizational innovation: strengthening the connection*. Washington, DC, Cosmos, 1983.
15. Donabedian A: Promoting quality through evaluating the process of patient care. *Med Care* 1968; 6(3): 181–202.
16. Andersen R: Methods and problems in evaluation of primary health care: does it matter which way we go? Paper presented at Conference on Evaluation of Primary Health Care, Center for Primary Care Research, University of Uppsala, Uppsala, Sweden, October 28–29, 1991.
17. Chinman M, Imm P, Wandersman A: *Getting to outcomes: promoting accountability through methods and tools for planning, implementation, and evaluation*. Santa Monica, CA, RAND Corporation, 2004.
18. Green L, Kreuter M: *Health Program Planning: Precede/Proceed Model*, Ed 4. New York, McGraw Hill, 2005.
19. Glasgow R, Vogt T, Boles S: Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health* 1999; 89(9): 1322–1327.
20. U.S. Department of Health and Human Services: *Introduction to program evaluation for public health programs: a self-study guide*. Atlanta, GA, Centers for Disease Control and Prevention, 2005.
21. Beebe J: *Rapid assessment process: an introduction*. Walnut Creek, CA, AltaMira, 2001.
22. Scrimshaw S, Hurtado E: *RAP: rapid assessment procedures*, Vol 11. Tokyo, United Nations University, 1987.
23. Scriven M: *Evaluation Thesaurus*. Newbury Park, CA, Sage Publication, 1991.
24. Brunwasser SM, Gillham JE, Kim ES: A meta-analytic review of the Penn Resiliency Program's effect on depressive symptoms. *J Consult Clin Psychol* 2009; 77: 1042–54.
25. Bliese PD, Adler AB, Castro CA: Research-based preventive mental health in the military. In: *Deployment Psychology: Evidence-Based Strategies to Promote Mental Health in the Military*. Edited by Adler AB, Bliese PD, Castro CA. Washington, DC, American Psychological Association, (in press).

A Survey of Multidimensional Health and Fitness Indexes

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ABSTRACT This article discusses the findings of a brief assessment of the literature on existing, multidimensional measures of wellness. The aim is not to present an exhaustive list of available metrics purporting to assess wellness, but rather to select several exemplar indexes that can serve as a model for developing an index to assess, in a holistic, multidimensional way, the state of an individual's health and fitness that goes beyond just the absence of disease or injury. Each index review provides an introduction to the index and a more detailed discussion of how the index does or does not address the descriptive criteria outlined within the report. A brief concluding discussion about the utility of these indexes for use in assessing service member total force fitness follows. The four indexes reviewed are: The Wellness Inventory, SaluGenecists Smart Tools, the Global Assessment Tool (GAT), and the TestWell: Holistic Lifestyle Questionnaire.

INTRODUCTION

Charged by Chairman of the Joint Chiefs of Staff, ADM Mike Mullen, to define "total force fitness" and to identify metrics that can measure it, this article discusses the findings of a brief assessment of the literature on existing, multidimensional measures of wellness. The aim of this article is not to present an exhaustive list of available metrics or surveys that purport to assess wellness, fitness, or health in general. Nor is it to assess only metrics used in or developed by the military. Rather, this article's purpose is to select several exemplar indexes from within and outside of the military that can serve as a model for developing an index to assess, in a holistic, multidimensional way, the state of an individual's health and wellness that goes beyond just the absence of disease or injury. To that end, as outlined at the 2009 Total Force Fitness for the 21st Century conference report,¹ any measure of total force fitness should examine physical, psychological, behavioral, medical, environmental, nutritional, spiritual, and social constructs.

Total force fitness is defined by the Uniformed Services University (USU) Consortium for Health and Military Performance (CHAMP) and the Samueli Institute as "a state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions... and is manifest by health, resilience, and human performance optimization."¹ Total force fitness, as defined here, is in line with other multidimensional definitions of wellness.^{2,3} Additionally, this definition underscores the importance of measuring wellness with both salutogenic (positive health) and pathogenic (negative health) factors in mind. Many health/wellness indexes simply assess known risk factors leading to negative health outcomes. However, to truly assess a construct that is as holistic as wellness requires that we determine not only to what extent negative health is present, but also to what extent positive health is present.^{4,5}

METHODS

As this is not intended to be an exhaustive systematic review of the available literature, we employed a more rapid, systematic assessment of the literature intended to quickly scan common databases as a starting point. The methodology proceeds much

as a traditional systematic review except it is less comprehensive. A review team was assembled to explore appropriate search terms and the team agreed upon the following keywords: (biopsychosocial, or multidimensional, or emotion*, or wellness or whole* or lifestyle or psychol*) and (measure* or assessment or survey or instrument or tool). We ran our full keyword searches, as well as more abbreviated searches where warranted, in the following databases: CINAHL, Health and Psychological Indexes Database (HAPI), PsychInfo, Google, and PILOTS. Based on a brief scan of abstracts as well as face validity (i.e., whether the title and brief description appear to support the index as being a multidimensional, wellness measure), the authors selected 261 articles for further review. After a more thorough read of the abstracts, we refined our selection to 22 possible wellness indexes. We pulled all 22 articles (or other relevant web-based information) and constructed a more comprehensive set of inclusion criteria. The criteria were sent to a group of military and civilian experts involved in wellness index development and/or the Total Force Fitness for the 21st Century conference working groups for review and feedback. The inclusion criteria are as follows:

- All indexes/tools must be multidimensional, measuring at least the physical, psychological, and social domains.
- All indexes/tools must be set up with the intention of linking to a behavioral feedback system that individuals can use to improve their health.
- All indexes/tools must be computer-based, interactive, and give "real time" feedback.
- All indexes must be for the health of individuals.
- All indexes must be written in English.

These criteria were chosen to enable us to seek out existing metrics with a multidimensional approach to wellness that provide real-time feedback to users regarding their current state of wellness as well as useful, proactive information to be used to increase positive health behaviors and decrease negative health behaviors. We were also interested in selecting indexes that could be used longitudinally to track the progression of wellness over time. On the basis of these criteria, we were able to more narrowly refine our potential group of indexes from

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TABLE I. Initial Selection of Wellness Indexes

Name	Developer	Number of Items	Online (Y/N)	Feedback (Y/N)
Perceived Wellness Survey	Adams et al.	36	N	N
Optimal Living Profile	Renger et al.	135	N	Y
Health Risk Appraisal	University of Michigan	60	Y	Y
Personal Wellness Profile	Wellsource	75	Y	Y
Wellness Measure	World Economic Forum	20	Y	Y
Wellness Index	WellKom	N/A	Y	Y
Holistic Lifestyle Questionnaire	TestWell	100	Y	Y
SaluGenecists Index	SaluGenecists, Inc.	50–100	Y	Y
HRAII v2	U.S. Army/Fort Lewis	Varies	Y	Y
Global Assessment Tool	U.S. Army	Varies	Y	Y
Wellness Inventory	Travis et al.	120	Y	Y
Gallup Wellbeing Finder	Gallup Press	100	Y	Y

22 to 12. Both authors agreed that these indexes represented the best examples of wellness indexes available through our review. Table I is a list of the initial indexes reviewed.

While many of the indexes listed above fulfilled all of our inclusion criteria, because our aim is to present a brief review of several exemplar indexes, we selected four to present in greater detail below.

Our exemplar indexes will be discussed in relation to a set of descriptive categories that were also vetted by a group of military and civilian experts involved in wellness index development and/or the Total Force Fitness for the 21st Century conference working groups. The descriptive categories are:

- (1) Index development:
 - a. Who developed the index?
 - b. Why was it developed?
 - c. How was the development of the index funded?
 - d. Is it based on research?
 - e. Has it been evaluated for reliability (i.e., criterion related, construct, test–retest) and/or validity (does it measure what it purports to measure)?
 - f. Where is the index being used or where has it been used?
- (2) Index validation:
 - a. Has the index been validated on clinical populations? size?
 - b. Has it been normed for nonclinical populations? size?
 - c. Are there published references about validation/utility?
- (3) Index evolution:
 - a. Year first developed?
 - b. Has it ever been updated?
 - c. How often has it been updated?
 - d. What is the method for updating?
 - e. Has updating improved its reliability or validity?
- (4) Utility for military populations:
 - a. Was the index developed specifically for military populations?
 - b. Has the index ever been used or modified for the military?
 - c. If yes, what branches and how widely?
 - d. If not, can it be?

- (5) Index administration:
 - a. Format (e.g., paper/pencil, computer)?
 - b. How long does it take to complete?
 - c. Can it be filled out and interpreted by a lay individual or is a health professional/educator necessary for administration?
 - d. Does it assess overall health? Can it assess health by subtopic or domain?
- (6) Correspondence with the concept of total force fitness:
 - a. Does the index measure the domains used in the military definition of total fitness?
 - b. Does it use the metrics recommended by the Total Force Fitness working group?
- (7) Index focus:
 - a. Does the index measure pathogenesis (e.g., disease risk factors)?
 - b. Does it measure salutogenesis (e.g., positive health behaviors)?
 - c. Does it measure resiliency factors (e.g., hope, optimism, self-efficacy)?

Each review will provide a brief introduction to the index and then a more detailed discussion around how the index does or does not address the descriptive criteria outlined above. The four wellness indexes we will review are: Wellness Inventory, SaluGenecists Smart Tools, the Global Assessment Tool (GAT), and TestWell: The Holistic Lifestyle Questionnaire. These particular indexes were chosen because they were deemed to be good examples of existing, multidimensional, interactive indexes. We do not mean to imply that these are the only indexes worthy of review. While, as mentioned above, other indexes measuring wellness are in use, both within and outside of the military, these four were particularly comprehensive, user friendly, and/or salutogenically focused and could be considered as potential models for an effective total health and fitness index.

WELLNESS INVENTORY

The Wellness Inventory is a 120-item “whole person” assessment and lifestyle program designed to maximize human potential by helping users gain personal insight into their state of physical, emotional, and spiritual wellness and provide them with guidance and tools to make lasting changes in their

health and well-being. The Wellness Inventory is part of a five-step process in which users complete the assessment, receive personal wellness and satisfaction scores, and identify areas of strength and areas with motivation to change. This is followed by creating a personal wellness plan with simple action steps in areas the user is motivated to change and utilizing an array of tools (e.g., online wellness resource and study centers, a personal wellness journal) designed to help users successfully implement each step. Users are able to continually update their personal wellness plans and monitor progress by retaking the assessment every 6 months. Users receive wellness action steps in regular e-mail reminders, use an edit tool to regularly update action steps, and use a test comparison feature to track progress. Authors of the Wellness Inventory see it as an educational tool as well as an assessment.

In accord with selection criteria, the Wellness Inventory is written in English, measures the wellness of individuals, and is computer-based and interactive, giving immediate feedback linked to creation of an action plan so that the user can improve his/her whole person wellness. It is multidimensional, measuring 12 key aspects of physical, emotional, behavioral, nutritional, spiritual, and social wellness. Specifically, the Wellness Inventory measures: self-responsibility and -love, breathing, sensing, eating, moving, feeling, thinking, playing and working, communicating, intimacy, finding meaning, and transcending. It was chosen as an exemplar because in addition to meeting all the inclusion criteria, it is very comprehensive in nature, is adaptable, and has a strong focus on health rather than disease.

Index Development

The original version of the Wellness Inventory was authored by John W. Travis, MD, MPH, an early pioneer in the field of wellness. While serving with the U.S. Public Health Service's Division of Health Services Research, Dr. Travis was a protégé to Dr. Lewis Robbins, creator of the first Health Risk Appraisal (HRA). In 1975, Dr. Travis gave up the practice of sick care to open up one of the world's first wellness centers, Wellness Resource Center, in Mill Valley, California. The same year he personally created the Wellness Inventory as a way to assist individuals in gaining personal insight into their state of wellness and transforming their awareness into long-term sustainable change. The Wellness Inventory incorporates Dunn's concepts of high-level wellness,³ and Prochaska's Transtheoretical Model (TTM) of behavior change, also known as Stages of Change.⁶ The Wellness Inventory has been used by individuals and groups in a variety of populations and settings across the United States and abroad, including healthcare workers, patients, students, teachers, administrators, and veterans at worksites, schools, colleges, clinics, and hospitals. Today, the online, interactive Wellness Inventory is provided through HealthWorld Online, an Internet network for wellness and healthy living (www.wellpeople.com).

Index Validation

The Wellness Inventory was evaluated with a population of 141 full-time college students and determined to be a psycho-

metrically sound measure for wellness.⁷ It was demonstrated to be internally consistent and reliable. Content validity and internal consistency validity were supported. The Wellness Inventory has not been normed on a clinical population. Currently, the tool is being used in several pilot research studies, one with 600 BlueCare healthcare workers in Australia, another with students at Grand Valley State University, Allendale, Michigan, and a third with teachers and school administrators from a Phoenix, Arizona area school district.

Index Evolution

The Wellness Inventory was first developed in 1975. It has been updated on an ongoing basis since then, most recently in 2009. In 2003, the original author, Dr. Travis, collaborated with HealthWorld Online to create an expanded, online version of the Wellness Inventory, with added functionality and features, including an assessment of the user's satisfaction (motivation) level for each of the 12 dimensions, a wellness action plan feature, a personal journal, resource centers, and a self-study center. This expanded program was designed to be used by individuals and wellness coaches, health and wellness professionals, and organizational consultants. In 2006, HealthWorld Online created the Wellness Inventory Certification Training, a 14-week training for wellness and life coaches, nurses, social workers, and other health and mental health professionals, wellness and fitness professionals, and corporate trainers. The certification training is designed to support implementation of the Wellness Inventory within individual, group, and organizational settings.

The Wellness Inventory is updated by three staff at HealthWorld Online who have intimate knowledge of the tool and the contexts in which it is being used—the president/CEO, the medical director, and the original author. Updating the inventory is a fluid, nonscientific process. By working directly in the field and soliciting and receiving feedback, the three staff become aware when aspects of the tool need to be refined or changed. They bring suggestions for modification to the other staff and work together as a team to update it.

Utility for Military Populations

The Wellness Inventory was not developed for and has not been used by the United States military. However, it is used in a variety of settings as a personal self-care tool to prevent burn-out and support people to live better, healthier lives and could be used similarly with military populations. According to the president/CEO of HealthWorld Online, the survey can easily be modified for military and Veterans Administration (VA) populations and they are currently in conversations with the VA to do so. Several of the Wellness Inventory certified coaches are veterans or spouses of veterans, and one of the primary HealthWorld Online staff also serves as chief neurologist at a VA site. The survey can be used as a stand-alone tool or incorporated into an already existing program. Wellness Inventory administrators think the survey could be quite effective in helping maximize human potential by creating wellness and wholeness in the lives of service members and their families.

Index Administration

The original 1975 Wellness Inventory was a paper/pencil tool and remained in that form for over 25 years. In 2003, the tool was expanded and put online, with added features to help users take action steps toward wellness goals, and to support and engage users by constantly monitoring and reassessing progress. Currently, the Wellness Inventory is 120 items and takes 30–45 minutes to complete. It measures 12 dimensions and overall wellness. For each dimension there are 10 statements, each of which describes a wellness action, skill, belief, attitude, or awareness. If a user is unable to complete the assessment at one sitting, they can save their results and login at a later time to complete it.

Upon survey completion, a user is given immediate feedback. They are given “wellness” and “satisfaction” scores for each of the 12 dimensions of wellness, as well as overall scores. The “wellness” scores show users where they are strong in wellness and where there is room for improvement. The “satisfaction” scores, most importantly, help users identify areas in which they are most motivated to change. A personal wellness plan is created focusing on action steps in the areas an individual is motivated to change. The chosen action steps are small and attainable (e.g., 10 minute walk 3 times/wk. vs. 30 minutes of aerobics/day), based on the philosophy that small doable action steps are most likely to be integrated into a person’s life and maintained over time. In interpreting results, it is helpful, but not mandatory, for users to work with a professional who has gone through the Wellness Inventory certification training.

Correspondence With Total Force Fitness Concept

The multidimensional Wellness Inventory measures six of the eight dimensions determined to comprise military total force fitness at the recent Total Force Fitness for the 21st Century conference—physical, emotional, behavioral, nutritional, spiritual, and social. It does not measure two of the total force fitness domains—medical and environmental. The Wellness Inventory does not use any of the suggested metrics proposed by the Total Force Fitness for the 21st Century report.

Index Focus

The Wellness Inventory has a very strong focus on creating health and wellness (salutogenesis) and maximizing human potential. It does not focus on disease or disease prevention (pathogenesis). As such, the tool measures positive health behaviors and does not include measurement of disease risk factors. Some of the measures it covers, such as satisfaction, meaning, and motivation to change, would be considered factors that contribute to resiliency.

SALUGENESISTS SMART TOOLS

The SaluGenecists index is a predictive risk tool developed by SaluGenecists, Inc. led by Dr. Joseph Pizzorno, ND. Although this index, for the most part, has been used commercially by employers to benchmark the health of their employee population and to demonstrate improved health over time, there is also a version designed for healthcare providers. The index is delivered as a modular assessment covering five elements

of health: financial, relationships, spiritual, physical, and emotional. Upon completion of the index, the user receives a personalized assessment with suggestions for health improvement and risk reduction ranging from targeted life style modifications, nutritional supplements, and diet modifications and suggestions. The employer receives an aggregated report of the general health status of the employee population.

This tool was chosen as an exemplar on the basis of our criteria that it is a multidimensional index, written and delivered in English, online, interactive, it provides detailed feedback to the user, and is longitudinal. The index design enables the system to ask a limited number of initial questions, the answers to which provide smart branching to increasingly targeted, differentiating questions. While the initial list of questions ranges from 50 to 100, their database has over 20,000 potential items that can be targeted to each user based on the initial “smart questions.” By answering the individualized series of questions, the user triggers the system to create a map of his or her unique metabolic and functional needs, ranked by probability, and their potential impact on health.

Index Development

This wellness index, or Smart Tools as they are referred to by the SaluGenecists team, are natural health expert systems that use artificial intelligence to identify each individual’s most important underlying physiological dysfunctions and the steps necessary to remedy them. The tool was developed in response to the demand of consumers and healthcare professionals for an evidence-based index incorporating a highly technical yet user friendly platform that would encourage users to take a more active role in affecting their health and well-being. This wellness index uses the National Health and Nutrition Examination Survey (NHANES) as its norming base and makes extensive use of peer-reviewed scientific evidence and information from the United States 2000 census upon which it bases its feedback. This is accomplished using rigorous probabilistic reasoning algorithms.

Index Validation

At this time it does not appear that this index has been clinically or psychometrically validated and there are no peer-reviewed publications supporting its validity or utility. As mentioned above, the NHANES database and the 2000 United States census are used for norming.

Index Evolution

Developed during the early 2000s, this wellness index is updated periodically (every 6 months) but without regularity. As new scientific health evidence is generated, the scientific team at SaluGenecists, Inc. evaluates it for inclusion into the existing database. Each study receives an “evidence grade” based on the assessment of three reviewers. The level of evidence is graded as follows:

- 1A: Multiple high-level research trials provide a hard statistical finding. Examples of high-level research

trials are double-blind, randomized controlled trials and prospective epidemiological surveys.

- 1B: A single high-level research trial provides a hard statistical finding.
- 2A: Multiple low-level research trials provide a hard statistical finding. Examples of low-level research trials are case series, unblended pilot trials, and retrospective case-controlled studies.
- 2B: A single low-level research trial provides a hard statistical finding.
- 3A: Multiple knowledge workers (KW) and/or senior science staff make an expert judgment based on the results of one or more clinical research findings. These findings can range from in vitro work through animal models to human clinical work.
- 3B: A single KW or senior scientist makes an expert judgment based on the results of one or more clinical research findings.
- 3C: Multiple KW and/or senior scientists make an expert judgment without support of clinical or experimental research.
- 3D: Single KW or senior scientist makes expert judgment without support of clinical or experimental research.

The index currently contains no 3C or 3D level evidence in any active node or link.

Utility for Military Populations

Although the SaluGenecists tool was not developed for, and has not been used within, a military population, the developers report that it is fully customizable and could be easily adapted for use with various populations. Their index items are not based on standardized metrics suggested by domain experts at the Total Force Fitness for the 21st Century conference.

Index Administration

The SaluGenecists' index is designed to create a unique and engaging user experience to enhance user compliance. It can be accessed through the Internet, used in privacy, and completed at a comfortable pace. All information collected is confidential with results tracked over time. When the user logs on to their personalized page they can see, via "dashboard" graphics, their last health assessment score in comparison to any newly updated assessments. This visual gauge provides immediate feedback regarding health status over time. Users also walk away with a personalized report that they can use to make health behavior and life style changes aimed at improving their overall health and wellness. The real-time feedback is comprehensive and includes a total score calculated from the aforementioned financial, relationships, spiritual, physical, and emotional modules, which can also be examined separately if desired.

Correspondence With Total Force Fitness Concept

As reported in the introduction to this report, the military has defined total force fitness as encompassing the following dimensions: physical, psychological, behavioral, medical,

environmental, nutritional, spiritual, and social. This index examines the health (health behaviors and risk factors), financial, relationships, spiritual, physical, and emotional domains. It does not utilize any of the suggested metrics proposed by the Total Force Fitness for the 21st Century report.

Index Focus

This tool is essentially a predictive risk tool. It aims at identifying each individual's "most important underlying physiological dysfunctions" and offers lifestyle, diet, and other health-related behavior modifications to improve overall health and well-being.

GLOBAL ASSESSMENT TOOL (GAT)

The Global Assessment Tool (GAT) is an assessment tool used by the United States Army as a component in its Comprehensive Soldier Fitness (CSF) program, which strives to enhance performance and build resilience among service members, families, and Army civilians, preparing them for the challenges they might face throughout their military career and life. The GAT assesses fitness in four dimensions—emotional, social, spiritual, and family. Upon completion, users receive a rapid assessment of their individual fitness in these four dimensions as well as an individualized profile to guide them through self-development training modules appropriate for their level of performance in each dimension. Users are able to track self-development and growth in these four dimensions over time. By using aggregate scores of the Army population, the Army can determine which aspects of its training are most effective in building emotional, social, spiritual, and family strength.

In accord with our selection criteria, the GAT is written in English, measures the health of individuals, and is computer-based and interactive, giving immediate feedback with the intention of linking to a behavioral feedback system so that the user can improve his/her strength in each domain. Important to mention is that though the GAT is a multidimensional survey, it does not include measurement of the physical domain, one of the selection requirements. The decision was made to still include the survey in this review because the physical health of users is measured elsewhere as part of the CSF program and is included in the service members' training. GAT was chosen as an exemplar because as well as being online, interactive, and linked to a behavioral feedback system, it is based on a holistic prevention and wellness model, was developed specifically for our population of interest (the military), and has been effectively administered to 540,000 service members in the U.S. Army.

Index Development

The Global Assessment Tool was developed by research psychologists in the U.S. Army in collaboration with top psychologists and researchers at the University of Michigan. GAT is an initiative of the chief of staff of the United States Department of the Army and its development was funded from the Army budget. The GAT was developed to measure the emotional, social,

spiritual, and family fitness of service members, families, and Army civilians. The tool is used as part of the Comprehensive Soldier Fitness (CSF) program, which was launched by the Army in October 2009 to invest in the readiness of the force and the quality of life of service members, family members, and Army civilians by giving the same emphasis to psychological, emotional, and mental strength that has previously been given to physical strength. The CSF program takes a holistic approach to fitness by optimizing the five dimensions of strength outlined in the World Health Organization (WHO) definition of health: physical, emotional, social, spiritual, and family. The GAT assists by assessing strength in four of those domains (all but physical), giving feedback to individual users based on their scores, and linking them to self-guided training modules that can build their strength and resiliency in each domain. The Global Assessment Tool is based on principles of positive psychology. According to one of its authors, the majority of its items are taken from or based on published scales used in peer-reviewed literature.

All service members in the U.S. Army are required to take the GAT by May 31, 2010, and then every 2 years or 120 days following a deployment. The Army's plans also call for new service members to take their first GAT during basic combat training. As of April 2010, approximately 540,000 of the Army's 1.1 million service members have completed the GAT. GAT is also voluntarily used by U.S. Army family members. As of March 2010, more than 1,300 family members Army-wide have completed the survey.

Index Validation

The original GAT included over 300 items that were pilot tested with 10,000 Army soldiers. Through factor analysis, items were discarded until approximately 105 remained. The index has been found to have a normal distribution, skewed slightly to the right, with service members in the U.S. Army. The GAT has been evaluated for reliability through an acceptable Cronbach's α and through factor analysis was found to divide into one large factor and four subfactors, suggesting reliability. It has not been tested for predictive validity or used or normed in any clinical populations.

Index Evolution

The GAT was originally developed in 2009. It has been modified for use by families by removing service member-focused language and addressing the family members specifically. There is also a version specific to initial entry training service members and a version in development that will be used by Army civilians. All versions measure strength in the same four domains (emotional, social, spiritual, and family) and provide online self-development modules to improve user's knowledge and skill set in the four dimensions of strength.

Only recently developed, the GAT has not had a whole-scale review for updating purposes though authors and administrators regularly look at the tool to see whether there are items that should be added or deleted. For future updates, authors, administrators, and top experts in each of the domains

covered by GAT will meet to review items and discuss how they perform. Authors do not anticipate frequent or large-scale changes since analysis so far indicates a normal distribution among users.

Utility for Military Populations

The GAT was developed specifically for the United States Army. It can be modified for other military branches. Currently, the Coast Guard and Navy are looking at GAT and the CSF program to determine whether they would fit with their needs and purposes.

Index Administration

The GAT is administered via computer, taking an average of 13 minutes to complete. Users fill it out and are immediately provided with an individualized profile comprised of four scores corresponding to emotional, social, spiritual, and family fitness. No overall score is given. Users are also given feedback based on their scores, which guides them through self-development training modules appropriate for their level of performance in each dimension.

Correspondence With Total Force Fitness Concept

The GAT measures three of the eight dimensions determined to comprise military total fitness—psychological, social, and spiritual. It does not include measurement of the five remaining total fitness domains—physical, medical, nutritional, behavioral, and environmental—although the physical, medical, and nutritional domains are measured elsewhere as part of the Army's CSF program and incorporated into the service members' training. The GAT does not include the standardized tools recommended by Total Force Fitness working groups to measure psychological, social, or spiritual fitness. However, it does measure some of the components recommended as indicators within the domains, such as family support as an indicator of social fitness and relational connection to humanity as a measure of spiritual fitness.

Index Focus

The Army's CSF program is a preventive model, aiming to enhance resilience and coping skills that will enable service members, families, and Army civilians to grow and thrive throughout their Army career and life. As such, the GAT's focus is on salutogenesis and resiliency. It aims to measure the positive aspects of people and what is "right" with them and in their lives rather than what is "wrong."

TESTWELL: THE HOLISTIC LIFESTYLE QUESTIONNAIRE

TestWell (The Holistic Lifestyle Questionnaire) is an online wellness assessment application designed for health professionals and wellness administrators. It is currently managed by the National Wellness Institute, Inc. This 100-question index is based on the six-dimensional model of wellness as conceived by Dr. Bill Hettler over 25 years ago. According

to information from his website, Dr. Bill Hettler has been a driving force in health promotion and wellness for more than 20 years. As a pioneer, he defined (and defended with zeal) the wellness concept as it emerged. In 1975, he cofounded the National Wellness Institute and guided it to the dominant position it holds today. Dr. Hettler's original six dimensions of health assessed by this index include, social, intellectual, occupational, emotional, physical, and spiritual. A newly revised version of the assessment now also includes nutrition, self-care, environmental, and sexuality dimensions. TestWell assessment tools are designed to help individual users become more aware of these different areas and to help them identify the areas that need improvement and better understand that creating a balance within 10 specified domains of health will lead to a greater sense of wellness. Examples of the TestWell tools and reports can be accessed via the Web at www.testwell.org. Attempts by the authors to contact TestWell for additional information were not successful.

The Holistic Lifestyle Questionnaire has been customized for four different populations: teen, college, adult, and older adult. Each domain assessed consists of 10 sections. Each section represents a dimension of wellness. The sections are: physical activity, nutrition, self-care, safety, social and environmental wellness, emotional wellness and sexuality, emotional management, occupational wellness, intellectual wellness, and spirituality and values. The Holistic Lifestyle Questionnaire meets all of our inclusion criteria. It has been chosen as an exemplar index due to the fact that it is very comprehensive and holistic, can be used longitudinally to track multidimensional aspects of health and wellness over time, and has a particularly interactive platform with immediate feedback in the form of individual and/or group reports.

Index Development

The Holistic Lifestyle Questionnaire is one part of a larger package of assessment tools offered by TestWell.org. According to information provided on their website, this tool is part of an online application consisting of a group of wellness assessments. The assessment tools can be used individually or together to create an assessment package designed to fit the needs of the client. They consists of the following:

- Holistic Lifestyle Questionnaire (HLQ) is a 50- or 100-question assessment encompassing the full spectrum of wellness categories and designed as an educational and awareness tool. Based on the six-dimensional model of wellness as conceived by Dr. Bill Hettler over 25 years ago, this multidimensional model emphasizes the importance creating balance in one's life.
- Health Risk Assessment (HRA) is an assessment that uses statistics from the Center for Disease Control to calculate the user's top health risks. The assessment reports the user's appraised and achievable health age and provides suggestions for reducing risk and achieving a healthier lifestyle.

- Custom Questions (CQ) is an assessment created by the administrator and can include a variety of questions in a flexible choice of formats: one-line text box, check box, radio button, drop-down combo box, list box, or memo. The assessment can include basic validation and individualized help and can be tied to the other assessments via a unique, computer-generated identification number.
- Topic for Personal Growth (TPG) is a short assessment that asks the user to checkmark any of the listed topics about which he or she would like more information. The user is provided with a list of custom resources, and the administrator is given popularity counts for each of the topics.

Their website outlines the primary consumers of their product as professional wellness consultants, high school counselors, university health and wellness educators, and large corporations looking to enhance their employee wellness programs.

Index Validation

At the time of this report there was no information available regarding the validation of Holistic Lifestyle Questionnaire, but information from TestWell.org indicates that their Health Risk Assessment utilizes information from the Centers for Disease Control and Prevention (CDC) to calculate a health risk profile based on information gathered from the user. As with all of the indexes reported on here, the questionnaire appeared to have very good face validity. We were unable to gather any published documents regarding the validity or utility of this index.

Index Evolution

As has been previously mentioned, the original work upon which this tool was developed is more than 25 years old. It has been expanded from the original 6 dimensions of wellness to the 10 dimensions of wellness described above. As of the writing of this report there was no additional information available regarding updating procedures.

Utility for Military Populations

This index was not developed for, nor has it ever been utilized on a military population.

Index Administration

Individuals can take the assessment from any location in the world with an Internet connection. After completing the wellness inventory, the user is immediately taken to a screen displaying the results of his or her assessment. The results and scores are categorized by section and a chart is displayed, so that the relative strengths and weaknesses of the user's wellness status are shown. The report also includes a list of recommended resources as well as a 10-step behavior change guide that can be used by the individual as a guideline for making long-term positive modifications to targeted behaviors.

TestWell can also provide additional group reports, among them:

- (1) Overall group analysis.
- (2) Scores broken down by demographics.
- (3) Demographic distribution.
- (4) Reports comparing the results of two or more groups.

The administrator can also export all data to a standard ASCII file and use this data in a spreadsheet or database for further analysis.

Correspondence With Total Force Fitness Concept

This index does measure all of the wellness constructs deemed important at the Total Force Fitness conference as well as several other dimensions not targeted; namely, safety, sexuality and emotional awareness, intellectual wellness, and occupational wellness. It does not, however, utilize the specific metrics suggested by domain experts at the conference.

Index Focus

The focus of the questions that make up this index are delivered from a positive perspective. For example, questions such as, "I take action to minimize my exposure to tobacco smoke," and "I express my feelings of anger in ways that are not hurtful to others" exemplify the approach to information gathering within the 10 dimensions of health. The dimensions of emotional management, and sexuality and value measure factors that we would define as resiliency factors such as positive affect, self-efficacy, and positive emotion. There is much less emphasis on pathogenic risk factor assessments.

CONCLUSION

Armed with a definition of "total force fitness" as, "A state in which the individual, family, and organization can sustain optimal well-being and performance under all conditions... and is manifest by health, resilience, and human performance optimization,"¹ the authors of this article took to the literature databases and the Internet to determine to what extent, and in what form, measures of a holistic, multidimensional approach to "fitness" exist. The goal was to look for exemplar indexes upon which to model an interactive measure of service member total fitness that would be easy to administer (preferably online), would utilize multiple dimensions of fitness or wellness (including physical, psychological, and social), would present feedback in real time, would link to a behavioral feedback system used to improve health, and would have the capacity to be longitudinal in nature. Using a methodology of quickly assessing common databases for relevant reports, the authors uncovered 11 potential indexes. Most of the 11 indexes met the majority of the inclusion criteria defined above. In the interest of space and time constraints, four exemplar indexes were reviewed: the Wellness Inventory, SaluGenecists Smart Tools, the U.S. Army Global Assessment Tool, and the TestWell Holistic Lifestyle

Questionnaire. Although all four of these indexes offer unique perspectives to the measurement of wellness, none were an exact fit to our definition and none were based on the list of suggested, standardized metrics proposed by domain experts convened at the Total Force Fitness for the 21st Century conference. This is not entirely surprising given the plethora of definitions and dimensions of what constitutes wellness.⁸ What we did discover, however, are four multidimensional, interesting, well-developed models with potential to inform the development of a total fitness assessment tool customizable for military and other populations. From this brief review we would not attempt to pinpoint any one of these indexes as the best or only index upon which to model a service member total fitness metric and delivery platform. Some of the indexes were more obviously evidence based whereas others were more theoretically derived. All display high face validity, that is, at face value they appear to measure constructs associated with and related to overall health and wellness, but none have a history of peer-reviewed publications to bolster their overall validity or utility. We are encouraged, however, to discover several user-friendly, high-tech, holistically modeled assessment tools with the capacity to deliver immediate health and wellness feedback that can be used over time to assess wellness and improve health.

A best next step would be a more thorough review of the four targeted indexes presented in this article as well as a continued review of other potential indexes not uncovered by this approach. On-site demonstrations with the index developers would greatly enhance this review and inform relevant partners working to develop and deliver such an index to the military.

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REFERENCES

1. Institute for Alternative Futures: Total Fitness for the 21st Century. Conference Report. December 30, 2009.
2. Adams T, Bezner J, Steinhardt M: The conceptualization and measurement of perceived wellness: integrating balance across and within dimensions. *Am J Health Promot* 1997; 11: 208–18.
3. Dunn HL: High Level Wellness. Arlington, VA, Beatty Press, 1961.
4. Becker C, Moore J, Whetstone L, et al: Validity evidence for the slautogenic wellness promotion scale (SWPA). *Am J Health Behav* 2009; 33(4): 455–65.
5. Breslow L: From disease prevention to health promotion. *JAMA* 1999; 281: 1030–3.
6. Prochaska J: Systems of Psychotherapy: A Transtheoretical Analysis. Homewood, IL, Dorsey Press, 1979.
7. Palombi BJ: Psychometric properties of wellness instruments. *J Couns Dev* 1992; 71(2): 221–5.
8. Roscoe L: Wellness: a review of theory and measurement for counselors. *J Couns Dev* 2009; 87(2): 216–27.

Lessons Unlearned, Education Forfeited: Military Hygiene Enters the 21st Century

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ABSTRACT Obtaining and maintaining a military force hearty enough for the trials of campaign and combat is the concern of military hygiene. It has been a challenge for governments and commanders for centuries. Empirical practices in recruiting, training, and maintaining service members gave way to more scientific, evidenced-based practices of the 18th century, and the research-driven, laboratory-proven methods of the late 19th century. As science made military medicine predictable, it widened the intellectual and professional gap between commander and medical officer, weakening trust and hindering communication. It also distanced the medical officer from the more mundane health and fitness concerns of service members by transforming military hygiene into military preventive medicine. Medical misadventures consequent to this state of affairs continue into the 21st century and will remain until a philosophical and educational shift in the value of military hygiene occurs.

INTRODUCTION

For efficiency and success, a military organization must be composed of individuals fit enough to withstand the rigors of a sustained campaign and combat action. It is a simple concept to understand; in fact it is intuitive. Achieving that goal through the application of medical science in a military environment has been, and continues to be, a challenge for both line and medical officers. Not because the knowledge, experience, and materials do not exist to obtain and maintain such an organization, but because the lessons of history go unlearned. This article presents a short review of Western military establishment efforts to obtain and maintain a fit force. It focuses on the importance of science to those efforts and the imperative of sound line and medical officer education and communication.

FITNESS BEFORE SCIENCE

The Romans recruited their soldiers from the young men of the northern provinces who engaged in the more manly trades: blacksmiths, carpenters, wagon makers, and hunters. These fellows were considered healthier, stronger, quicker to learn, and easier to train. Basic training consisted of weapons exercises, military drill, ditch digging, felling trees, and marching with equipment.¹ The armies of Imperial Rome were some of the most mobile known to history. The legionary carried 50 (U.S.) pounds as he marched along smooth Roman roads. That weight was decreased to 44 pounds as the enemy was approached, and the Roman soldier engaged in combat carrying only 33 pounds of equipment.² On campaign the legionary carried 3 days worth of iron rations: bacon fat, cheese, hardtack, and sour wine. But the garrison military diet, consisting of protein, carbohydrates, and fat, was quite nutritious, depending on time of year and location of garrison. The Roman army also had an organized, well-trained medical service, which cared for the physical, if not the psychological trauma of battle, and

military hospitals existed in some garrisons later in the empire. The Romans obtained and maintained their army in a systematic manner entirely on the basis of empirical evidence.¹

From the fall of Rome to the Renaissance, European armies came and went, but none were organized, trained, or maintained on the scale or in the detail of those of Imperial Rome. As the modern nation-state began to emerge in the late 15th century and with it the continuing development of gunpowder weapons, standing armies were created on the continent. Through the 16th and 17th centuries the organizational structure—recruiting, training, paying, and supplying—of these armies became more complex. The development of the *tercio*—a military formation of about 1,750 pikemen and arquebusiers organized by companies—by the Spanish army improved tactical efficiency and strength. Later Dutch military reforms increased tactical strength and flexibility once again through routine drill, an established chain of command, and the development of company grade officers. The Swedish army under Gustavus Adolphus II pioneered the idea of a combined arms approach on the battlefield. Standing European armies were living, breathing organisms of the state. They cost money to train and maintain, and therefore the loss of soldiers through injury or illness was a financial loss to the state. Keeping losses to a minimum catalyzed the establishment of formal military medical services, created new responsibilities for a commander, and a new relationship between commanders and the physicians and surgeons serving a force whether on land or sea began to develop.

EMPIRICALLY BASED FITNESS

The opinion of the military physician and military surgeon began to matter. Those opinions reflected the scientific progress, numerous military ventures, and the medical experiences of European colonial expansion of the 17th century. Disease causation as proposed by Thomas Sydenham and John Locke was based upon the relative potencies of contagion, miasmas generated from the decomposition of organic matter, and

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the epidemic constitution of the atmosphere. During their voyages, soldiers and sailors contracted new fevers and developed what are now defined as dietary deficiency diseases. Efforts to prevent these diseases increased during the 18th century and, while empirical, some preventive modalities were evidenced based.

Aboard the HMS Salisbury during the War of Austrian Succession, James Lind conducted the first case-control study using oranges and lemons in the treatment of scurvy.³ Although he proved the value of citrus fruit as a treatment and preventive for the disease, it would take another 50 years before his findings were implemented by the Royal Navy. Disease rates were also found to decline if sailors were made to change their clothes regularly and wear shoes aboard ship, sensible suggestions that were implemented.

Smallpox inoculation—rubbing smallpox scabs into a small incision hopefully to induce a mild case of the disease—was another evidence-based intervention, which gained acceptance in the 18th century. From midcentury the British Army in North America practiced voluntary inoculation in the face of epidemics, but when smallpox threatened to destroy our army at Morristown in the winter of 1777, General Washington ordered that the entire army be inoculated. It was a bold move considering the dangers of inoculation, and to ensure this modality did not generate a smallpox outbreak, soldiers were segregated from nonimmunes and others who were sick.

Segregating those with similar maladies was found to be beneficial later in our war for independence by James Tilton. He designed smaller, well-ventilated hospitals and found less hospital transmission of camp fevers that we recognize today as typhus, streptococcal infections, and respiratory disease. The 18th century also saw a concerted effort on the part of medical officers to educate line commanders. John Pringle, MD, who first defined jail, ship, and hospital fevers as all one disease, what we know today as epidemic typhus, wrote the first English military medicine text in 1752. “My chief intention,” he stated, “was to collect materials for tracing the remoter causes of military distempers, in order that whatever depended upon those in command, and was consistent with the service, might be fairly stated so as to suggest... measures for preventing or palliating such causes in any future campaign.”⁴ Pringle’s text and the good relationship the medical establishment had with line officers had a positive effect on soldier health during the Seven Years’ War, in which smallpox, scurvy, and dysentery were the main disease threats.

This desire to educate line officers concerning soldier health continued in 1764 with the publication of Richard Brocklesby’s *Oeconomical and Medical Observations*⁵ and Donald Monro’s *An Account of the Diseases which were most Frequent in the British Hospitals in Germany* with advice on military hospitals and soldier health. Monro’s book included specific instructions concerning clothing and diet in various climates, treating cold injury and avoiding heat injury on campaign, and maintaining cleanliness aboard troopships.⁶

Organizational, operational, and logistical requirements of the service, directed by line officers not physicians, determine who is recruited, the type and style of uniform, the soldier’s load, the rations eaten, and the health measures employed. The 18th century British soldier was recruited from the country yeomanry and the sweepings of jails. He was well fed for the era and trussed up in a tight fitting wool uniform, which constricted his respirations and circulation, and altogether weighed close to 80 pounds.⁷

His American counterpart was a volunteer who came to the war dressed as he was carrying his own firearms. General Washington, although he tried throughout the war, never had a uniformly clad army or one that was regularly or adequately fed by the government. However, he was devoted to preserving the health of his command. In early 1778 he selected a like-minded German officer, Baron Friedrich von Steuben, to train the provincial army then wintering at Valley Forge. Commissioned a major general, von Steuben did a superb job especially in training officers to attend to health issues. Later he produced the first health regulations for an American army.⁸

The following year Dr. Benjamin Rush published *Directions for Preserving the Health of Soldiers*. His text, like Brocklesby’s and Monro’s, was addressed to line officers and provided sound epidemiological observations. Increased transmission of airborne diseases occurs in crowded tents. Young, immunologically naïve soldiers brought together from different parts of the country had more illness than older, previously exposed soldiers. Southern troops had a greater incidence of malaria and other parasitic diseases than did their northern neighbors. Also Rush specifically noted the role and authority of the line officers in preventing disease and ensuring health with the advice and support of their medical officer.⁹

Medical science began to positively impact army and soldier fitness in the 18th century. However, the line-medical officer relationship always suffered from a lack of consensus in, and predictability of, that science in the medical advice offered. Inoculating with smallpox might preclude an outbreak, but it might generate the epidemic one wished to avoid; changing camps frequently might reduce disease, but maybe not if carriers of typhoid, diphtheria, or meningitis were in the ranks; and citrus juice might prevent scurvy if the vitamin C had not been destroyed in preserving it.

Some early 19th century medical officers, such as Army Surgeon General Joseph Lovell, systematically employed the current science to improve soldier fitness. Surgeons maintained meteorological records, investigated the relationship of disease incidence to climate and weather, and provided recommendations on the health of forts and barracks on the basis of these descriptive epidemiologic studies. Lovell advocated placing recruiting and disciplining practices within the domain of the medical officer.¹⁰ His reports to the secretary of war concerning proper diet, exclusion of strong spirits, proper clothing and quarters, policing of camps, and his recommendation for the senior surgeon of an army or district to function

as medical director and inspector of hospitals demonstrate a concerted effort to improve soldier fitness on a broad scope.¹¹

Scientific predictability, however, remained elusive for military physicians of the early and mid-19th century. During this era, John Dalton introduced atomic theory; Friedrich Woehler established organic chemistry, Justus von Liebig began studying the chemical components of food, and Claude Bernard established physiology as a science. Furthermore, Britain and America were embracing a more humanitarian approach to social problems. The wretched working conditions of industrial factories were exposed, poverty became associated with disease, as did filth and immorality, and a growing public consciousness and responsibility for these issues arose.

SCIENCE-BASED FITNESS

Before the new science or social consciousness could impact the military, the Crimean War intervened and proved to be a powerful catalyst for change in the British Army Medical Service. The 18th century line-medical relationship had vanished, concern for the common soldier was nonexistent, the supply system failed miserably, and evacuation was inadequate. Cholera, malaria, dysentery, and scurvy soon inundated the ranks compounding the supply and transport problems, overcrowding the hospitals, and increasing the mortality rates.

The British minister of war dispatched Florence Nightingale and the English Sanitary Commission to re-establish order and efficiency. In 1857, a royal commission was appointed to inquire about the sanitary condition of the British army and prepared a new edition of the Queen's hospital regulations.¹² The new regulations made the medical officer an advisor to the commanding officer "in all matters affecting the health of troops whether as regards garrisons, stations, camps and barracks, or diet, clothing, drills, duties, or exercises." The commission also recommended the establishment of an Army medical school in which "the specialties of military medicine, surgery, hygiene, and sanitary science" could be taught to new medical officers.¹² To assist with this educational task, Edmund A. Parkes wrote *Practical Hygiene*, a text book that addressed the medical officer's duties and responsibilities in recruiting, feeding, clothing, training, and quartering the soldier, based on science and experience.

The time between the work of the royal commission and Parkes' text and the beginning of the American Civil War was too short to impact the U.S. Army Medical Department. Medical care at First Bull Run was as disastrous as the battle. This led to the creation of the U.S. Sanitary Commission, a civilian directed organization with semiofficial government status and plenty of political clout, which they used to have William Hammond inserted as surgeon general. Hammond's tenure would be short—he and Secretary of War Stanton never got along, but his ideas for the administration, education, and operational employment of the department make him one of the U.S. Army's finest surgeons general. In the spring of 1862, he ordered the establishment of an army medical museum,

directed a medical history of the war be prepared, and planned for a postgraduate army medical school. The following year he published *A Treatise on Hygiene* and had it issued to medical officers. In it he defined the parameters of the military physical examination, temperament, heredity, and the impact of age, etc., on recruits and reasons for their rejection.¹³

In the 40 years following the Civil War, a wide range of technical sciences developed that changed the organization and operations of our military and naval forces. Likewise, physiology, bacteriology, and immunology began to redefine the practice of surgery, medicine, and public health. In both the military and in medicine, these new sciences created a specialized body of knowledge that required specific and continued education. While this fostered a new sense of professionalism, it also broadened the intellectual gap between line and medical officers. The expanse of that gap became apparent in our war with Spain in 1898. Yellow fever terrorized our army on Cuba, but malaria brought it to its knees. Simultaneously typhoid fever ravaged state volunteers in mobilization camps where sanitation and hygiene discipline had been ignored by troops, commanders, and regimental surgeons alike.¹⁴

In the aftermath, the Dodge Commission investigated why the army and its medical department had not covered themselves with glory. Many recommendations were forthcoming regarding medical personnel, supplies, reporting, etc., and Surgeon General George M. Sternberg added an additional responsibility: education of the line officer concerning soldier health. This revival of 18th century thought was supported in full by Edward Munson's comprehensive text, *Military Hygiene*, in 1901 as he noted it was meant as "a practical guide to officers of the line."¹⁵ In it he discussed rations, clothing, equipment and weight, marching, camps, etc. Four years later courses in sanitation and hygiene, taught by medical corps officers, were begun at West Point, and in 1914 a textbook was published for the cadets.¹⁶ In 1908, Captain Munson was detailed to the School of the Line at Fort Leavenworth where he worked with Major John Morrison to integrate soldier health into the military art curriculum and educate the commander about his sanitary assets, responsibilities, and the value of his medical staff.¹⁷ The beneficial results of their efforts—as well as medical advances, such as water chlorination, typhoid immunization, and the Lyster bag, which prevented diseases common to soldiers—were seen during the expedition to Mexico in 1916 and continued as we deployed soldiers to the war torn fields of France the following year.

World War I was a watershed in military and military medical history, the first industrial war. The use of automatic weapons, heavy artillery, submarines, aircraft, and chemical weapons became routine and lethal, and medical science achieved a tremendous amount of predictability. Medical examinations were now more efficient at filtering out recruits mentally and physically unfit for service, typhoid immunization, and camp sanitation and hygiene became standard practices. The First World War was also a laboratory for learning

about the performance, endurance, and resilience of soldiers on the modern battlefield.

Trench warfare and the climate of the Western Front resulted in a new appreciation of cold injuries. Additional clothing increased the soldier's load and the diagnosis of trenchfoot was added to the lexicon. The threat of chlorine gas brought more protective equipment, increasing the soldier's load and risk of overuse injuries once again. Weaponry and tactics could generate thousands of casualties in a single day creating a never ending collage of horrors from which there was no escape. What we call post-traumatic stress disorder was first noticed by British, French, and German armies early in the war. The French established immediate forward treatment of psychiatric casualties with the expectation that they would return to the trenches and were therapeutically quite successful, boasting a 91% return to duty rate.¹⁸ The British labeled these cases as "shell shock" and began treating them in forward areas with rest and hypnosis, but ignored expectancy.¹⁹ By the time Surgeon General William C. Gorgas sent Thomas Salmon, MD to study British and French methods of dealing with war neurosis in 1917, the treatment imperatives of proximity, immediacy, and expectancy had been established. Salmon incorporated the best parts of French and British therapy into three levels of psychiatry at the front—through division psychiatrists, at neurologic hospitals, and at base hospitals.²⁰

MILITARY HYGIENE VERSUS PREVENTIVE MEDICINE

In the immediate postwar years, military hygiene as an integrated line to medical education process at Leavenworth continued, but was significantly reduced as the course was cut from 2 years to 1. Moreover, during the interwar years the term military hygiene faded away to be replaced by military preventive medicine, a term with a more modern and scientific ring. Science was developing preventive and treatment modalities that tremendously affected soldier fitness. The causes of dietary deficiency diseases—beri-beri, pellagra, ricketts—were being worked out and a new player known as a vitamin was being described, work that would improve the nutritional value of future military rations. German scientists developed an effective synthetic antimalarial (Atabrine) and the first safe, efficient, and practical antimicrobial agent (Prontosil) that would be followed rapidly by more efficient second and third generation sulfa drugs. In 1937, a safe and effective yellow fever vaccine was produced and a year later a fairly effective epidemic louse-borne typhus vaccine, and the National Institutes of Health established the requirements and standards for tetanus toxoid and cholera and plague vaccines, both produced in the 1920s. By 1939, the United States had the means in its medical arsenal to preclude most of the mobilization and operational infectious disease threats it would encounter in World War II. In fact, the medical science of the interwar years gave physicians something they had never had before: an ability to intervene in the infectious diseases they encountered.

Specialization blossomed during this era; the American Medical Association (AMA) gained power and prestige. Medical corps officers began to identify with these organizations, exchange knowledge, and work with civilian colleagues more routinely than in the past. By the time the Axis Powers declared war on the U.S., the Division of Medical Sciences of the National Research Council in conjunction with its military liaisons created seven primary committees to answer the military's burgeoning number of questions across the whole field of medicine. COL James S. Simmons, Chief, Preventive Medicine Division for the Surgeon General, established the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army. Consisting of distinguished civilian scientists and medical department officers, the board—known today as the Armed Forces Epidemiological Board—worked in coordination with their respective research facilities to solve major disease problems affecting the army.

However, military preventive medicine was not military hygiene. COL George Dunham, MC, USA wrote *Military Preventive Medicine*, but it was never intended as a guide for line officers as Munson's had been. No discussion of rations, clothing, equipment weight, marching, or hot and cold climates was included.²¹ Modern medicine, which had improved the general fitness of the armed forces through rational recruiting standards, immunizations, and the sulfa drugs, only broadened the educational and social gap between line and medical officers. This, to some extent, disengaged the medical officer from critical staff planning and the mundane health problems of an army on campaign. From this situation, lessons from the First World War notwithstanding, occurred some of the more memorable blunders affecting performance, endurance, and resilience during World War II.

LESSONS UNLEARNED

As General MacArthur went on the offensive in the Southwest Pacific area following the Battle of Midway in summer 1942, the power of the malaria parasite was given low priority. The capture of Dutch Indonesia in 1942 gave Japan control of the world's largest supplies of chinchona. The U.S. armed forces reserved quinine for treatment only, but had no appropriate dosing schedule for Atabrine and no malaria discipline on the fighting line. On Guadalcanal, 12–23% of the 1st Marine Division was ineffective from malaria between August and November.²² At the same time on New Guinea, the inadequately trained, poorly supplied, and poorly led 32nd Infantry Division was being pummeled by mosquitoes, the Japanese, and dysentery until LTG Robert Eichelberger assumed command. Eichelberger instilled leadership and discipline, straightened out logistics problems, and by January 1943 had helped the Australians beat the Japanese. However, the heavy toll of *Plasmodium falciparum* and *vivax* malaria on Allied forces had to stop.²³ In March 1943, MacArthur put tropical disease control on his agenda by establishing a combined advisory committee, which reported directly to him, under the direction of COL Neil Fairly. Their recommendations received

not only MacArthur's support but also that of Army Chief of Staff George C. Marshall. Antimalarial education, research, and development became energized. Army schools of malariaology were established. Educational programs defining the dangers of mosquito exposure and methods of protection were intensified. New repellents and a new pyrethrum bug bomb began making their way to the South Pacific in mid 1943, and by early 1944 a new and versatile insecticide called DDT was also going to the front. Vector control teams expanded their operations as more territory was secured. Through COL Fairley's research, Atabrine doses were standardized and issued under supervision to troops weekly. Malaria control in the Pacific, however, did not really begin until mid 1944. A lack of American campaign experience with malaria provides a comforting alibi for these misadventures; not so for fighting in the cold.

The army gained valuable experience in cold weather operations during the Indian Wars and it learned of the debilitating effect of wet and cold on feet encased in leather boots from the British in World War I. But in March 1943 the 7th Infantry Division began the Attu Island Campaign without properly insulated, wind-proofed, and water-proofed clothing or footgear. In 3 weeks of combat, the 7th sustained 3,829 casualties, 31% of which were due to the cold, a rate identical to the rate of wounded in action. Commanders had ignored the quartermaster recommendations to wear special clothing and footgear and officers and enlisted were poorly trained to fight in cold, wet climates. Foot hygiene was not enforced and often wet clothing was discarded rather than dried out. Colonel Dunham's book had not discussed cold injuries or their prevention for medical officers. *The Medical Department Soldier's Handbook* did not mention trench foot and *The Guide to Therapy for Medical Officers* not only excluded trench foot but advised troops to lace shoes snugly, which only decreased distal circulation. It would take two more severely cold, wet winters in Italy and France to convince the U.S. army to pay attention to the problem.

The soldier's load went unaddressed by line or medical officers as well. In the 1920s, a British commission studied how soldiers were loaded down over the centuries. They concluded that on a training road march the soldier's load should not be in excess of 40–45 pounds, roughly one-third of the soldier's body weight, and noted a soldier cannot be trained to efficiently carry more than this weight.²⁴ However, on June 6, 1944, American infantrymen struggled ashore carrying 80 pounds. Some became slow moving targets on the beach, others did not make it out of the surf.

Psychiatrists and psychiatry were also ignored early in the war. Some officers still contended that a psychiatric diagnosis was the coward's ticket to the rear. But as psych casualty rates rose after the battles of Faïd and Kasserine Pass, in mid February 1943, the interwar neglect of military psychiatry was highlighted, and the notion that proper leadership, high morale, and appropriate soldier selection could prevent such injuries was proven untrue. This led to Captain Frederick

Hanson being deployed to Major General George S. Patton's II Corps in late February. Hanson re-educated both line and medical officers of the value of proximity, immediacy, and expediency in treating traumatic psychiatric injury. Hanson returned 30% of cases to duty in 30 hours and during the battles of Maknassy and El Guettar, 70% of the 494 casualties were back in combat within 48 hours.²⁵

In the generation after World War II the explosion of oral medications—antibiotics, antihypertensives, and psychotropic agents, as well as newer and better vaccines—only marginalized the importance of military hygiene. The idea of pill as cure all and medical officer as scientist only widened the intellectual gap between line and medical officers. The Department of Military Hygiene at the U.S. Military Academy went away and in the late 1960s military physicians were replaced by medical service corps officers at the U.S. Command and General Staff Course.

In Vietnam, we had to relearn lessons from the trenches of the First World War.

Wet feet wrapped in wet socks and boots for a prolonged period could destroy the combat effectiveness of a unit. Granted it was warm water and called paddy foot, but the result was the same and so was the prevention. Malaria was a major problem for the First Air Cavalry early on in the northern jungle highlands. The unit experienced the same rates that so concerned General MacArthur a generation earlier, about 1,000 cases/1,000 soldiers/year and it was worse in the battalions, the real population at risk. (R. J. T. Joy, personal communication) It was Guadalcanal all over again because malaria discipline was not enforced.

And battle fatigue? Well, a 1-year rotation policy, the intermittent nature of guerilla warfare, and the rapid ramping up of division psychiatric assets combined to keep rates low. That same rotation policy, however, took soldiers home as individuals not units. Furthermore, they could be home in hours to days not weeks as in earlier wars and, therefore, the therapeutic catharsis achieved through informal group therapy with one's combat buddies was never obtained. By the late 1970s, post-Vietnam syndrome was a diagnosis and the rates were burgeoning. In the early 1980s, the concept of chronic post-traumatic stress disorder²⁶ became accepted, and it took only 20 more years to deploy combat stress teams to the battlefield.

EDUCATION FORFEITED

Victories in military hygiene are slow to come, but not because the factors that influence the performance, endurance, and resistance of service members are unknown. Over the past century many have been described and studied and a number of effective interventions developed to improve them. Victories in military hygiene are slow to come because many lessons observed go unlearned by both line and medical officers. The physical injury and mental fatigue generated in the overloaded soldier was revisited by S. L. A. Marshall in *The Soldier's Load and the Mobility of a Nation* in 1950. But

33 years later soldiers and marines in Grenada²⁷ contended with heavier loads than Marshall had warned against and in an article in the *Washington Post* in February 2009 the travails of the continually overloaded infantryman in Afghanistan were described.²⁸

In September 2003, Marines in Liberia sustained 69 cases of *Plasmodium falciparum* malaria, 4 of them with cerebral symptoms, and 44% of the landed force were affected because malaria discipline was completely ignored by line and medical officers.^{29,30} In fact, medical officers reviewing the problem considered requiring unit commanders to directly observe people taking antimalarial medication impractical or unnecessary. Moreover, the criminal neglect of line and medical officers was passed on to the troops.^{29,30} Military medical history unlearned, education forfeited.

CONCLUSION

Correcting such ignorance and neglect can be done, but it will be a three-phased challenge. First, what knowledge, already available and valid concerning performance, endurance, and resilience factors must be assessed.

Second, the determination of what new research will broaden our knowledge. We know overloading the soldier is detrimental to performance and endurance. How do we stop commanders from doing it? We know battle fatigue is a natural reaction to an unnatural and often bizarre situation that can lead to chronic PTSD. But how much exposure is needed? Is there a dose-response curve? Can the stress control mechanism be reset? We know repetitive deployments are bad, but how bad are they? What have we learned from the deployment experience of the 10th Mountain Division in the 1990s or as peacekeepers in the Balkans? What have we learned from other armies addressing the same problem?

Third, the philosophy of line to medical education and communication that existed just a century ago must be resurrected. Medical science must be continually translated into strategic, operational, and tactical terms that a commander can understand. The role of the line staff surgeon must be energized, and, most importantly, the theory and practice of military hygiene as an educational imperative for line and medical officers must be re-established for the 21st century and beyond.

REFERENCES

1. Davis RW: Service in the Roman Army, pp 3–6, 15, 209, 222–5. Edinburgh, Edinburgh University Press, 1989.
2. Marshall SLA: The Soldier's Load and the Mobility of a Nation, p 27. Quantico, VA, Marine Corps Assn., 1950.
3. Lind J: A Treatise on the Scurvy, Ed 3. London, Crowder S., 1772. Reprint: Birmingham, AL, Classics of Medicine Library, 1980.
4. Pringle J: Observations on the Diseases of the Army in Camp and Garrison, pp vi–vii. London, A. Millar, 1753.
5. Brocklesby R: Oeconomical and Medical Observations. London, T. Becket, 1764.
6. Monro D: An Account of the Diseases which were most Frequent in the British Hospitals in Germany, pp 309–354. London, A. Millar, 1764.
7. Lothian NV: The load carried by the soldier. JRAMC 1921; 37: 451–3.
8. Steuben FW Baron von: Revolutionary War Drill Manual, pp 81, 87, 88, 118–20. Boston, Thomas and Andrews, 1794. Reprint: New York, Dover Pubs, 1984.
9. Rush B: Directions for Preserving the Health of Soldiers: Recommended to the Consideration of the Officers of the United States Army. Lancaster, John Dunlap, 1778.
10. Lovell J to Calhoun J and Hemphill WE: November 27, 1818, Hemphill, Calhoun Papers, v3, p 306.
11. Office of the Surgeon General: Reports of the Surgeon General, 1818–1819. Bethesda, MD, National Library of Medicine, 1819.
12. Parkes EA: A Manual of Practical Hygiene, Ed 2, p vii. London, Churchill and Sons, 1867.
13. Hammond WA: A Treatise on Hygiene. Philadelphia, PA, Lippincott, 1863. San Francisco, Norman, Reprint, 1991.
14. Reed W, Shakespeare E, Vaughn VC: Abstract of Report on the Origin and Spread of Typhoid Fever in U.S. Military Camps During the Spanish War in 1898, 176, 178. Washington, DC, U.S. Government Printing Office, 1900.
15. Munson EL: Military Hygiene. Quote in preface. New York, William Wood, 1901.
16. Keefer FR: A Text-book of Military Hygiene and Sanitation. Philadelphia, PA, WB Saunders, 1914.
17. Morrison JF, Munson EL: A Study in the Troop Leading and Management of the Sanitary Service in War. Leavenworth, KS, Ketcheson Printing, 1910.
18. Jones E, Wessely S: Shell Shock to PTSD, p 25. New York, Psychology Press, 2005.
19. Myers CS: A contribution to the study of shell shock. Lancet 1915; 1: 316–20.
20. Salmon TW, Fenton N (editors): The Medical Department of the United States in the World War, v10, Neuropsychiatry, pp 497–547. Washington, DC, U.S. Government Printing Office, 1929.
21. Dunham GC: Military Preventive Medicine. Harrisburg, PA, Military Service Publishing Co., 1930.
22. Frank RB: Guadalcanal, pp 51, 259–260. New York, Penguin Books, 1992.
23. Joy RJT: Malaria in American troops in the South and Southwest Pacific in World War II. Med Hist 1999; 43: 192–207.
24. Lothian NV: The load carried by the soldier. JRAMC 1922; 38: 21.
25. Mullins WS(editor): Neuropsychiatry in World War II, vII, Overseas Theaters, pp 1–10. Wash., D. C., OTSG, 1973.
26. Silsby HD, Jones FD: The Etiologies of Vietnam Post-traumatic Stress Syndrome. Milit Med 1985; 156: 6.
27. Dubik JM, Fullerton TD: Soldier Overloading in Grenada. Mil Rev 1894; 67: 38–47.
28. Tyson AS: "Weight of Combat Gear is Taking Toll," Washington Post, 1 Feb 2009, pA3.
29. Brown D: "Failed Sageguards Are Blamed for Marines' Malaria Outbreak," Washington Post, 10 Sep 2003, A16.
30. Brown D: "Malaria Outbreak Blamed on Troops," Washington Post, 18 Oct 2003, A20.

The Principal Challenge of Realizing Total Force Fitness: Changing Our Readiness Culture

BG Michael Rounds, USA (Ret.)

ABSTRACT The Chairman of the Joint Chiefs of Staff (CJCS) has directed the development of an instruction issued under his signature that outlines guidance on the establishment of total force fitness programs across the military. The key element of the instruction is a framework that portrays the essential elements of total force fitness. Individual elements of the framework are, in many cases, adequately covered by programs in one or more of the services. The concept of establishing programs that integrate more than one fitness domain when addressing the needs of our warriors, their families, their organizations, and communities is a break from normal operations associated with an organization involved in preparing for or executing combat operations. In essence, the CJCS has fundamentally challenged the military to shift from the current course of fitness efforts to embrace a new paradigm associated with the readiness of our organizations to deploy. The directed change will be difficult to implement during a time of conflict, but it is necessary to establish an accurate reflection of the fitness of our warriors and their surrounding environment.

THE PRINCIPAL CHALLENGE OF IMPLEMENTING TOTAL FORCE FITNESS—CHANGING OUR READINESS CULTURE(S)

“So in this total fitness, total health, how do you get at the integration of the spiritual, the mental, the social, the physical, etc.? What does it mean to us and what does it mean for families? It is a readiness issue because, if you are not successful in that, you are not ready to carry out your mission individually, as a unit, etc.”

Chairman of the Joint Chiefs of Staff, ADM Mike Mullen, December 9, 2009

When the CJCS directed a total force fitness integration effort he fundamentally challenged the military to shift from the current course of fitness efforts to injecting a new paradigm when determining our readiness. Traditional fitness has largely been defined in the military by our capacity to manage physical challenges. Under current standards, an organization's readiness (fitness) is tied to the access of adequate manpower, availability of equipment, the maintenance levels of that equipment, and the ability of manned and equipped units to execute essential tasks (training levels). The measure of readiness is accomplished by putting units through exercises to demonstrate their ability to execute these essential tasks. In the military's current deployment cycle, these assessments are called mission rehearsal exercises (MREs) and are the primary validation that an organization is ready for the next operational mission. The CJCS, however, is concerned that the current assessment strategy is limited in scope, and that 21st century challenges merit a more comprehensive readiness assessment.

The chairman has challenged us to do a better job at understanding and taking care of our most valuable resource—our warriors and their families. After 9 years of conflict, the military is under considerable, sustained stress. This stress is

having an increasingly significant impact on the readiness of the force. To continue to be fully prepared to execute our central mission, to fight and win the country's wars, the culture of how we understand, maintain, and assess the fitness of the force needs to be adjusted. It is no longer sufficient to simply assess an organization's manning, equipping, maintenance, and training levels. A holistic, integrated approach is necessary for us to assess and sustain the optimal well-being of our warriors and their families for the current conflict and well into the future.

But change, especially prescribed change, is inevitably hard. Cultural change can best be described as a form of organizational transformation that is a fundamental shift from current practices. This change usually involves adjusting basic values, norms, and beliefs in an organization to improve organizational performance. The establishment of a common total force fitness paradigm across the military will be a significant shift away from the current approach and will require each service to adjust its readiness assessment process (and mindset).

As previously mentioned, fitness in the military has been traditionally defined by the ability to perform necessary physical tasks. The new total force fitness model advocated by the CJCS is reflected below (Fig. 1):

Per the Total Force Fitness model, the mind domains of behavioral, psychological, spiritual, and social are ideally in relative balance with the body domains of physical, environmental, medical, and nutritional. Equally important is the balance the warrior feels surrounding him/her in the environment defined by his/her family, organization, and community (Fig. 2).

Currently, services and commands have programs that deal with the domains individually and many programs or processes that aim to establish and maintain balance in families, organizations, and communities. The challenge is establishing a holistic integration process across the fitness domains. While there are nascent attempts to address this integration issue, there is no comprehensive effort within our military to establish a total force fitness assessment or supporting

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FIGURE 1. The total force fitness model.



FIGURE 2. Mind and body domains important for total force fitness.

metrics. Through the development of a total force fitness instruction under his signature, the chairman has started the integration process and initiated a change to our fitness assessment culture. In his words integration is a “leadership issue” and as the senior military leader he is also “the lead integrator.”

To achieve the CJCS vision of integrated “Total Force Fitness” will require a significant shift in how the military defines and manages fitness/readiness. How we manage the fitness of the force will require a shift away from dealing with a single mind/body domain at a time to the difficult task of establishing cross-domain fitness programs. While the new total force fitness framework is common to all services, combatant commands and support agencies, the processes to attain total force fitness may vary depending on location/mission.

Key Aspects or Considerations in Achieving the Cultural Shift Across the Military to a Mindset of Total Force Fitness

Families Are Central to the Total Force Fitness Equation—How Our Families Are Taken Care of Is a Fundamental Readiness Issue

A service member cannot be fully prepared to execute his/her mission unless they are comfortable that the needs of their family are being addressed. The definition of what constitutes a family should be considered. A service member who does not have the traditional family support structure may look to replace the structure within the unit/organization. During periods of increased or peak stress, such as an injury, service member access/communication with their family, however it is defined, needs to be a strong consideration.

A Community Is the Supporting Environment That Surrounds Each Military Organization

In most cases communities can be seen as concentric circles around an organization with military members working or operating largely within their organization but, along with their families, dependent upon the support of the surrounding community. The immediate community circle that encompasses multiple organizations consists, in most cases, of the military installation and the comprehensive soldier and family support structure associated with each installation. The outer circle is the infrastructure that has grown up around the installation to, ideally, meet the needs of the service members and their families and supplement the services provided by the military installation.

Establishing a Stigma-Free Environment Across Our Military

Individual balance issues in one or more of the domains will often require a prompt, dynamic (integrated) response. Individuals should feel comfortable that necessary treatment is supported by all echelons of their leadership. A stigma-free environment is critical to getting or keeping our warriors in balance and those who are willing to seek assistance.

Organizational Fitness Programs Must Be Adequately Resourced

Available resources to execute all aspects of our mission will continue to be constrained. Installation fitness programs have traditionally been at risk in a fiscally constrained environment. Leaders at all levels need to establish metrics to determine the comprehensive cost associated with every effort to reduce support to total fitness programs.

Total Force Fitness Programs Should Be Prevention Centric

Establishing resilience in our warriors, families, organizations, and communities is a critical component of achieving total force fitness.

Clear and Open Lines of Communication Across the Total Force Fitness Community Are Essential

Much of the great work that is being done in individual fitness domains is not being effectively shared across domains even

where there is a clear relationship between efforts. Service and command total force fitness programs should be established with information sharing as a primary goal. Within the Department of Defense, a Human Performance Resource Center is being established with a mission to provide a bridge on fitness domain issues between the experts and the field and to provide the information in a format that is understandable and useful to our warriors.

Total Force Fitness for Our Warriors and Their Families Should Be Considered a Lifetime Commitment

There is a responsibility, at a minimum, to ensure that warriors are fully ready to be discharged when they have completed their service. They should be engaged during the separation process where a holistic separation suitability evaluation is conducted. Our commitment to validate their readiness to transition back to public life is the right thing to do for our service members as well as a realistic expectation of society.

The Culture of How We Execute Personnel Management Needs To Be Aligned With Our Focus on Ensuring That Individuals and Organizations Are Totally Fit

An individual's resilience is enhanced by extended dwell opportunities. At a minimum, each warrior should have a 12-month dwell between operational deployments. Tracking systems have to be sophisticated enough to ensure that individuals who are being reassigned shortly after a deployment are not pushed to a unit in the final stages of reset.

Total Force Fitness Programs/Approaches Need to Be Inclusive and Innovative

All of the stakeholders identified in the total force fitness diagram need to be involved in the shaping of local programs.

Stakeholder engagement is important to ensure that all equities are addressed and that the program design is adequate for the local situation. In some instances new or better ways to take advantage of resources or capabilities that are already available should be leveraged. An example is the chaplain corps. Chaplains are the focal point for managing spiritual fitness. At the same time, they have unique insights into the balance of individuals, families, organizations, and the community. Properly utilized and not jeopardizing any privacy concerns, their insights could be invaluable as leaders proactively manage their total fitness programs across multiple domains.

Extending Total Force Fitness Across the Entire Force Is Critical

Particularly challenging will be providing the same total force fitness programs to the reserve component that are emerging throughout the infrastructure of the services. As these programs mature, there should be consideration for how they can be made as universally available to the reserve component as they are to the active component warrior. A considerable impediment that needs to be addressed will be the physical separation of many reserve component service members and their families from traditional installation-based total force fitness.

In conclusion, establishing total force fitness across the military will not be easy. It is not an exact science and will require patience, resolve, and flexibility throughout the process. Optimally, it is a collaborative effort where best practices are rapidly shared and integrated by commands as appropriate. Ultimately we should see a new paradigm emerge that reflects the true or holistic readiness of our organizations. An accurate reflection of the fitness of our warriors and their surrounding environment will be the primary benchmark for both important resource and deployment decisions.



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