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Perspective

The SP Corps Brings Four Vital Specialties to the Soldier

Brigadier General Daniel F. Perugini

I am afforded the opportunity to re-introduce you to the proud heritage and modern capabilities of our great Army Medical Specialist Corps (SP). Our modern day SPs are comprised of four separate and distinct health care specialties, giving our Army Medical Department (AMEDD) the distinctive skills to “conserve the fighting strength”. They are the Occupational Therapists, Physical Therapists, Dietitians, and Physician Assistants. These highly-skilled and talented professionals employ their medical talents from battalion aid station to fixed-facility medical centers. Each of these specialties brings unique knowledge and expertise to their respective roles in the all-important AMEDD health care continuum.

Occupational therapy has been a part of the Army Medical Specialist Corps since its inception in April 1947. Since that time, our Army Occupational Therapists (OTs) have served globally in both combat and humanitarian operations. Their distinctive skill sets include neuromusculoskeletal evaluation with emphasis on upper extremity evaluation and treatment, traditional rehabilitation, psychiatry (particularly Combat Stress Control), and Ergonomics. I am proud to say that our OTs are human performance experts and dedicated leaders. Their innovative programs and services serve to optimize Soldier performance and readiness now and well into the next century.

Did you know that the first physical therapy unit was assigned to Fort Sam Houston, Texas, in 1919? Fort Sam was also the site of the first formal training program for physical therapists. Today, our PTs continue to lead in physical therapy education, practice, and research. In addition to a professional Doctor of Physical Therapy program (ranked as being in the top 5% in the country), the Army has two advanced clinical residency programs – orthopedic physical therapy and sports medicine. Our PTs plan and supervise physical therapy programs through patient self-referral or referral from other health care professionals on the battlefield or in the clinic.

Our dietitians have been providing nutritional support to Soldiers since World War I under the framework of the American Red Cross. However, it was not until 16 April 1947 when President Harry S. Truman signed public Law 80-36 that dietitians became part of the Regular Army. To date, Army dietitians have served with distinction in every military conflict, playing key roles in the full spectrum of global humanitarian and peacekeeping missions. Today’s exciting practice of dietetics in the Army focuses on Soldier readiness and enhanced performance. Dietitians are intimately involved in health promotion and wellness programs throughout the command. Whether the call is for mobilization or war, we can depend on our dietitians to manage the medical food preparation and service for patients and staff. Clinical expertise focuses on the more traditional roles of nutritional assessment, medical nutrition therapy, and patient counseling. Today’s Army dieticians belong to a dynamic organization that maximizes readiness through comprehensive nutrition management operations including high quality medical nutrition therapy, health promotion, and food service.

Ensuring Soldier readiness and force sustainment through leadership, training, and quality health care; “From the line, For the Line” is the mission of the Army Physician Assistant (PA). AMEDD “Team Players” since July 1973, when the first PAs graduated from the Medical Field Services School PA program at Fort Sam Houston, Texas, PAs have provided troop medical care across the full spectrum of Army operations, while providing garrison and community health care to Soldiers, family members and all eligible beneficiaries. Today, there are over 400 active duty Army PAs serving in all echelons of care, from combat maneuver and special operations to specialty clinics and services at Army Medical Centers. They provide a myriad of specialty care including orthopedics, emergency medicine, occupational health, cardiac perfusion, and aviation medicine. Let there be no doubt that our Army PAs are leaders within the Army healthcare system, delivering world wide services to the nation and its Armed Forces-anytime, anywhere.

This edition of the Journal showcases our SP Corps specialties and their invaluable contributions to the AMEDD. The articles that follow emphasize quality care for the Soldier and our ability to meet the changing requirements of hospital and battlefield medicine. I feel they are of particular interest and importance in view of today’s rapid operational tempo and unique medical situations.

• *Continuing Medical Education Needs of Physician Assistants in Combat* details the results of a survey given to U.S. Army PAs during a trauma symposium in Qatar, assessing the combat medical readiness of PAs in Operations *Enduring Freedom and Iraqi Freedom.* This is of greater interest due to the PA's unique position in the battlefield environment and the requirement for them to maintain multiple combat medical-specific proficiencies.

• *Physical Therapists in the U.S. Army Combat Health Support System: Part I – History and Rationale for Army Transformation* and *Part II – Recommendations for Employment* is a two-part article detailing the contributions of U.S. Army physical therapists. Part I contains a review of the published papers and military correspondence concerning the impact of deployed physical therapists in combat operations. Part II analyzes possible course of action for the future deployment of physical therapy assets to support the battlefield and recommends the most advantageous employment strategies.

• A little-known role of the U.S. Army occupational therapist is to serve with other AMEDD specialties in Army Combat Stress Control (CSC) units and perform the full range of CSC operations. *The Role of the Occupational Therapist in CSC Operations* details their role in the management phases of combat stress casualties, enabling the affected Soldier to function in daily activities

• *Nutrition Therapy for Soldiers with Eating Disorders* explores various eating disorders, how they may be accurately diagnosed, and the complex and multifaceted role of the dietitian in their effective treatment.

• *Injury Prevention in the Army: An Ergonomics-Based Approach* provides a task analysis of a specific occupational hazard; in this case, work-related musculoskeletal disorders, to illustrate how the use of ergonomics can assist in the prevention of injury to Soldiers in certain military specialties.

• *Occupational Therapy in the Management of Lateral Epicondylitis* explores current medical literature on the use of physical agent modalities (ultrasound, iontophoresis, heat, cold) in the effective treatment of lateral epicondylitis or "tennis elbow." A case study offers an outline of patient diagnosis and rehabilitative measures and details the effectiveness of a comprehensive treatment plan.

• *Conservative Management of Back Pain: A Literature Update* presents a critical literature review of evidence-based, conservative clinical practice guidelines for lower back pain developed and published by a Veterans Health Administration and Department of Defense working group.

• *Recombinant Factor VIIa and its Clinical Applications* provides a comprehensive overview of the current multiple uses for factor VIIa and its potential use for hemorrhage control on the battlefield. It also discusses the limitations and situational applications of this possible universal hemostatic agent.

The supplementary articles in this edition deal with issues relating to the AMEDD's role in current military operations and our strategies for providing even higher-quality health care for the Soldier, regardless of location or battlefield situation.

• *The Theater Army Medical Laboratory/Area Medical Laboratory Concept; Lessons Learned and Prescription for Change* reports on the deployment of the 520th Theater Army Medical Laboratory in support of Operation *Iraqi Freedom.* The successful operation of this unit confirmed our ability to provide far forward analytical capabilities for chemical and biological detection. The author also points to future changes that must be made to ensure the theater commander can accurately evaluate potential adversarial chemical and biological threats.

• *Evaluating Redeployment Concerns: Potential Asbestos Exposure* describes the deployment of a team from the William Beaumont Army Medical Center Preventive Medicine Service to investigate a reported asbestos exposure by a missile battery returning from Qatar. It emphasizes the importance of a multidisciplinary response to concerns of hazardous materials exposure to active duty Soldiers in remote locations.

From the Chief, Army Medical Specialist Corps

Colonel Rebecca S. Hooper

As I meet and greet the nearly 1,100 officers in the Army Medical Specialist Corps (SP), I often ask them, "who has ever had to explain what the 'S' on your collar stands for?" Without exception, everyone has! In an attempt to let everyone in the Army Medical Department (AMEDD) and in the larger Army know what the SP Corps does and who SP officers are, we undertook this project, a special edition of the *AMEDD Journal.* This Journal is a tremendous opportunity for us to market the SP Corps and to showcase the research, clinical contributions, and leadership activities accomplished by SPs around the AMEDD.

Just who are the members of the SP Corps? Occupational Therapists (OTs), Physical Therapists (PTs), Dietitians, and Physician Assistants (PAs) serve the AMEDD and the Army in literally every unit from the TOE to the TDA and from staff to command positions. The SP Corps officially celebrated it's 57th anniversary on April 16th of this year, but OTs, PTs, and dietitians have been serving the needs of the Army for much longer than that.

In fact, the genesis of each of our professions can be traced to roots in the Army. Hospital "dietists" served as far back as the Spanish-American War. Reconstruction Aides (later to become OTs and PTs) and Dietitians served in World War I. During World War II, these professionals served as civilian employees of the Army receiving "relative rank" in 1942 and finally attaining commissioned status in 1944. The PA profession was born during the Vietnam era.

President Harry S. Truman signed the bill that formally established the Women's Medical Specialist Corps (WMSC) in 1947. In 1955, the name of the corps changed to the Army Medical Specialist Corps after a law was passed that permitted men to be commissioned as OTs, PTs, and Dietitians. The most recent change to the SP Corps occurred in February of 1992 when PAs (previously warrant officers), were commissioned as officers and became the fourth section of the Corps.

The early pioneers in both the WMSC and the SP charted a course of excellence in education, clinical practice, research, administration, and leadership that we strive to maintain today. Our entry-level education programs rank among the best in the country. Advancements in clinical practice and contributions in research are frequently attributed to Army OTs, PTs, Dietitians, and PAs. The SP officers are educators, clinicians, administrators, and leaders in every corner of the AMEDD. And as you will see as you read through this edition of the *AMEDD Journal*, SP officers are world-class health care providers successfully contributing to the body of medical knowledge in useful and meaningful ways.

So just what does the "S" stand for? After you read the articles in this Journal, I'm sure you will agree that the "S" worn proudly on the collars of SP officers stands for the superb professional contributions from some of the premier leaders in the AMEDD today. I am confident in our future as evidenced by our past and demonstrated in our present. The SP Corps, standing relevant and ready, will continue to serve the AMEDD and the Army with pride and distinction for a long time to come.

Acknowledgement: My sincere thanks go to MAJ Rachel Evans, Physical Therapist, assigned to the United States Army Institute of Environmental Medicine. Major Evans currently serves on the Editorial Board of the AMEDD Journal and graciously accepted my request to act as the project officer for this special edition. Her sound judgment, outstanding organizational skills, and attention to detail are the reasons this project was such a success.

Continuing Medical Education Needs of Physician Assistants in Combat

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Introduction

The Army Medical Department (AMEDD) is charged with ensuring that deploying medical personnel are trained, experienced, equipped, and capable of supporting the medical needs of the deployed forces under any contingency and environment. Training must fulfill the requirement of preparing Army medical personnel to deliver world-class health care not only in fixed facilities but also in a fluid, field environment, and often under hostile and austere conditions. Army Physician Assistants (PAs), because of their unique position on the battlefield environment, must be proficient in a multitude of skills to include first line care of trauma patients, disease and nonbattle injury (DNBI) management, field sick-call, patient evacuation, and preventive medicine just to name a few. While the interservice PA training program (IPAP) is the primary source of training all components of Army PAs, a majority of readiness training and contingency skills development occurs after initial training through various course offerings and training experiences. Thus, it is critical for the Army to continually assess and reassess the educational needs of PAs, particularly during deployments to assure that they are receiving adequate preparation for deployment and combat missions.

This article discusses one such assessment conducted during a continuing medical education (CME) event in Qatar during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). In Dec 03, the Army Central Command Surgeon's Office conducted a CME trauma/operations symposium for PAs in the combat theaters of Southwest Asia. The conference was held December 7-9, 2003 in Camp As-Sayliyah, Qatar. The CME presentations on various deployment and combat related topics were approved by the American Academy of PAs for Category I CME credit. This event presented a unique opportunity to survey the CME needs of PAs who were currently deployed in OIF and OEF. Since it is not known how prevalent combat medical readiness training is for PAs, and the differences that may exist for active duty (AD) and reserve component (RC) PAs, this survey was intended to learn more about the educational status and needs of Army PAs for combat and deployed missions. The survey sought to collect information regarding; demographics, delineation of current duty activities, prior training in various topic areas, attendance at career and post-initial training courses, relevance of conference topic content, and available technology as training delivery platforms.

Army PAs are all graduates of accredited PA programs and nationally certified. They are either AD or members of one of the two RC: U.S. Army Reserve (USAR), or Army National Guard (ARNG). Basic PA professional education and requirements for certification with the National Commission on Certification of Physician Assistants are the same for PAs from all components. The Army PA Training Program started in 1972 and was replaced in 1996 with the IPAP which now trains PAs for the Army, Navy, Air Force, and Coast Guard. All IPAP students have previous military experience in various fields and compete for a training seat in order to participate in the program. Most AD PAs receive their training through the IPAP program as do many of the USAR and ARNG PAs. However, the USAR and ARNG also assess PAs from civilian PA programs who may have no prior military background. The differences in military experience are significant when examining the preparation of all Army PAs for deployment and/or combat missions.

In addition to entry-level professional training, the Army provides career military and medical education. Several Army courses prepare PAs for deployment and combat missions. These courses have topics that directly and indirectly bear on medical requirements during deployment. Course offerings include the combat casualty care course (C4), a 9-day course offered at Camp Bullis in San Antonio, TX. The C4 aims to provide a basic understanding of medical operations for various medical, paraprofessional, and allied health officers during deployment and combat for all three services. The Advanced Trauma Life Support (ATLS) course is incorporated into the C4 training, although PAs are also able to take this course independently through other organizations and training opportunities. The AMEDD also offers emergency medicine (EM) training in one of three modalities – a correspondence course, a resident short course, and a 1-year internship. The PA EM Correspondence Course is available to all medical providers through the Nonresident Instruction Branch

(AMEDD Center and School) and is offered free of charge. The PA EM Short Course is a 2-week program available to AD PAs that is conducted at one of two PA EM Residency Programs at Madigan Army Medical Center, Fort Lewis WA, and Brooke Army Medical Center, Fort Sam Houston, TX. This program trains approximately 25 students annually. The yearlong residency is offered through competitive selection through the Long Term Health Education Training program and trains approximately 6-8 PAs per year.

The AMEDD also conducts an Emergency War Surgery Course and the Management of Burns and Multiple Trauma Course. The former is primarily intended for physicians only while the latter trains physicians, PAs, Physical Therapists, Occupational Therapists, and nurses on AD. Additionally, an Army skill badge, the Expert Field Medical Badge (EFMB) is awarded to Army medical personnel who complete testing on combat skills. The EFMB testing is conducted at numerous active and reserve Army installations annually and serves as a train-up and testing for various medical professionals in a variety of medical and combat skills.

While most military medical training is presented through these existing courses, some training is also conducted by the units themselves. Generally, the Division Surgeons will arrange for special training on combat medical topics for the medical staff in their divisions. This training is often conducted just before deployment using instructors and curriculum from various sources. Training is also conducted by units once they are in the combat theater, either just before actual operations begin or during ongoing operation phases. This training is dependent on the resourcefulness, funding, and availability of assets within each unit or installation; as such is difficult to assess.

Methods

An anonymous survey was conducted of the attendees at the Qatar PA Trauma Symposium. The PAs were required to turn in the survey in order to receive their CME certificates. Surveys were then analyzed by Service Provisioning System Software and the open-ended items were collected in a word document. Of 72 surveys collected, 56 were from Army PAs, with the remainder from physicians, medics, or other allied health professionals in attendance. The survey consisted of several sections, to include demographics on gender, service component, type of unit, daily duties, prior training experiences, satisfaction with course content, and available technology. The PAs were asked to list the percentage of time they spent in various typical deployment activities. A picture of typical duties is important to use in judging educational needs. Additionally, each class presentation was graded on relevancy to the PA mission, which allowed the classes to be ranked in terms of importance to their combat mission. Finally, PAs listed what educational platforms were available at their location. This information will help in determining what format to send future CME and training.

Results

Table 1 shows the results of surveys collected from 55 of the 56 PAs attending the conference, distributed by gender, service component, and type of unit. The gender distribution approximates the current ratio of male and female PAs in the Army. The relatively high number of USAR and ARNG PAs (34.5%) gives evidence of the "Army of One" which now heavily depends upon RC Soldiers for operations. Most PAs were assigned to maneuver units (Armor, Infantry, and Field Artillery) but were also present in Area Support Medical and Forward Support Battalions (ASMB, FSB). The PAs in the other category were primarily assigned to a special project conducting post-deployment health assessment surveys of Soldiers as they departed the theater.

	Frequency	Percent
Gender		
Male	44	80
Female	11	20
Component		
AD	36	65.5
USAR	7	12.7
ARNG	12	21.8
Unit Type		
IN	10	18.2
ASMB	10	18.2
FA	9	16.4
FSB	7	12.7
AR	6	10.7
Other	12	21.8

Table 1. PA Frequency and Percent Distribution by Gender, Component, and Unit Type

Duties for PAs were reported by percentage of time performed during the week. The PAs spent the most amount of time with sick call, (35.0%), screening for acute injury, and illness. This time is consistent with traditionally large amount of DNBI encountered during military deployments. Combat related trauma (5.3%) and performing medical coverage of unit missions (11.8%) accounted for the next highest percentage

(17.1%) of duties performed. Trauma care needs reflects the ongoing daily hostilities and casualties in OIF and OEF. Care of acute trauma, minor illness, and injury patients is the primary mission of forward combat medical care where Army PAs and medics are assigned, therefore, training in this area is significant not only for medical staff but all Soldiers. Medical instruction to medics and combat lifesavers, a critical mission for PAs, also occupied a significant category of time (12.2%). The unit PA is primarily responsible for clinical instruction of the enlisted medics, assuring that they maintain critical lifesaving skills and can triage minor illness and injury. Additionally, Combat Lifesaver instruction is also provided to Soldiers so they can provide immediate aid to their fellow Soldiers while awaiting medical help. Finally, PAs reported spending 16.5% of their time in administrative duties. These administrative duties are consistent with Army PA duties as medical platoon leaders and as staff advisor to commanders on medical issues. The combined duties for the PAs underscore the importance of currency in trauma skills and knowledge for Army PAs.

Next, assessment of course content was evaluated in relation to current duties. The course subjects were selected by the PA who organized the CME event based on his extensive knowledge of operations, and estimate of need. Survey feedback ranked the relevancy of subjects in the following order: diarrhea, thoracic trauma, abdominal trauma, head and facial trauma, endemic diseases, musculoskeletal trauma, spinal trauma, airway management, airway evaluation, hemorrhage and shock, patient assessment, airway adjuncts, and airway anatomy and physiology. Trauma subjects reflected the need to respond to casualties of hostile fire while the inclusion of epidemiological disease subjects on diarrhea and endemic disease highlighted the importance of preventive medicine and DNBI during operations.

Prior medical training in the C4, ATLS, War Surgery Course, EM PA Short Course, EM PA Correspondence Course, and the Management of Burns and Multiple Trauma Course and attainment of the EFMB was assessed. Differences between RC and AD show a disparity in availability and may indicate less preparedness for combat and military medicine (Table 2). While PA attendance of ATLS was similar between AD and RC PAs (69.4% vs 63.2%), a substantially lower percentage of the RC PAs had completed or attended the EFMB, the PA EM Correspondence Course or EM Short Course, and/or the C4. This is significant, as ATLS does not contain the combat related trauma skills covered in the military courses.

The final series of items on the survey instrument asked PAs what educational platforms were available at their duty location. Responses indicated that many of the traditional platforms were readily available to a large number of PAs. Almost all PAs had a computer (92.6%). The computer gave them e-mail access (77.8%) as well as internet access (77.8%), but they had a limited ability to download large files (57.4%). There appeared to be a trend to use DVD (85.2%) over VCR (35.2%) players, illustrating how technology has kept pace even on the battlefield. These findings represent a maturing theater and can be predicted to improve as the Army establishes itself in the theater of operations. However, it is significant that less than a year after commencing operations, significant educational platforms exist for PAs to obtain and provide training.

Course	**AD**	**%**	**RC**	**%**
Advanced Trauma Life Support	25	69.4	12	63.2
Expert Field Medical Badge	25	69.4	1	5.3
EM PA Correspondence Course	14	38.9	4	21.1
Division Train-up Course	9	25	0	0
Combat Casualty Care Course	8	22.2	2	10.5
Theater Combat Trauma Course	6	16.7	1	5.3
EM PA Short Course	4	11.1	0	0
Burn Course	2	5.6	1	5.3
Emergency War Surgery	0	0	1	5.3

Table 2. Frequency and Percent Distribution of Course Attendance by Component

Conclusions

The Army PAs deployed in Iraq, Kuwait, and Afghanistan for OIF and OEF, consistently spend the most amount of time conducting sick call. This includes the management of patients with acute illness, injury, and DNBI. This reinforces the need for a broad range of medical education topics that would parallel patient problems prior to deployment. The exception to this is the need to increase education on preventive medicine. Topics in endemic disease need to be tailored to the region of deployment and are most valuable when they include timely epidemiological data for infectious diseases in the area of operations. For example, of the PAs who attended the diarrhea class, all commented that the epidemiological-based treatment information would affect their treatment plans.

A number of courses are available to Army PAs that can provide preparation for the combat mission, but they are not being fully utilized whether due to time away from station, seat availability, and/or funding is unknown. The C4, burn, and war surgery courses are examples of courses that offer wartime skills. The war surgery course should be evaluated to see if inclusion of other health care providers would be beneficial in order to improve the continuum of care provided to Soldiers on the battlefield. Additionally, USAR and ARNG PAs have less participation than AD PAs. This most likely reflects differences in funding for PAs on AD versus those in the RC. For example, the PA EM Correspondence Course is available at no charge to all PAs and there was a high completion rate of PAs from all components (37.0%). High completion of the correspondence courses also supports the use of distance learning as an educational method for future courses.

Just in time training is a common educational method in industry to prepare workers for changing job requirements. Most providers, AD or RC, do not encounter the special deployment or combat medical problems as part of their everyday garrison or civilian practice. Training reviews are necessary for subjects like chemical and biological agents, radiation injuries, and high yield explosives. Tropical diseases and preventive medicine topics are also subjects to include as a pre-deployment review. Future CME should focus on military medical related topics. This need is evidenced in the large number of pre-deployment courses being conducted by division surgeon offices. Methods to disperse this education to RC providers will need to be devised.

A variety of educational platforms are available to PAs in the theater of operations. Ongoing medical education can be projected into the combat zone. Various educational media formats are available, especially computer-based programs on DVD and CD. These are durable media that are easily mailed and passed between units. Further, these platforms can accommodate the current distance learning media being produced by Army and civilian educational programs. The Army Medical Specialist Corps has developed distance learning products in the past and these findings will reinforce their efforts to provide relevant and timely education to PAs.

Increasing attendance at existing Army courses must be explored, especially for PAs in the USAR and ARNG. The RC PAs lack the last minute combat medical training that is available to deploying units. This disadvantages them in their transition from civilian medical practice to battlefield medicine. It is apparent that USAR and ARNG PAs have attended less courses that would prepare them for their deployed and combat missions. The RC PAs spend the majority of their practice in a civilian setting. They have fewer opportunities for training that includes military medical skills and knowledge. Future efforts must be directed toward finding better methods and opportunities to prepare and train PAs for the unique challenges of deployment and combat medicine.

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Physical Therapists in Combat Health Support: History and Rationale for Army Transformation (Part I)

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The profession of physical therapy has its origins in the Army when "reconstruction aides" were utilized to rehabilitate injured Soldiers in World War I. Physical therapists (PTs) in the military took on a larger role as orthopedic physician extenders during the Vietnam War. The PTs also deployed during the Gulf War from 1990-1991. Since the end of the Gulf War, PTs have deployed in support of a number of support and stability operations (SASO), including Bosnia and Kosovo. In 1999, the U.S. Army Special Operations Command (USASOC) received authorizations for a PT in each active component Special Forces Group, Ranger Battalion, and Special Operations Aviation unit. Despite historical data demonstrating the effectiveness of PTs deployed across the spectrum of military operations, many AMEDD and Department of the Army leaders remain unaware of the contributions PTs can make outside the traditional hospital setting. This article will review and discuss the unique qualifications PTs possess as specialists in musculoskeletal medicine, as well as the implications of data from published papers, after action reports, and official military correspondence on the role and impact of deployed PTs. A rationale for the utilization of PTs in operational units is presented.

Introduction

Musculoskeletal injuries – those involving the muscles and joints of the spine and extremities – are a common problem in the military.[1] In fact, musculoskeletal conditions and injuries account for as much as 28% of hospitalizations in the Army.[2] These injuries lead to many lost hours of manpower and have a significant impact on training and operational readiness. This leads to significant costs – not only in dollars, but also in mission accomplishment. For example, it has been reported that sports related injuries result in an average of 29,435 lost duty days each year.[3] Moreover, in 1998, over 2,000 recruits – approximately 6% of those in basic training – were unable to complete training due to injury, the overwhelming majority being musculoskeletal in nature.[4] Data from recent deployments and training exercises also show that many injuries are orthopedic in nature, ranging from sprains and strains to fractures and other soft tissue injuries.[5] The PTs are typically consulted to manage the care of orthopedic patients not requiring surgical intervention. Those that do require surgery eventually require rehabilitation under the direction of a PT to return them to full duty.

In light of these considerable rates of orthopedic injuries, and the unique capabilities of Army PTs, PTs should be utilized in as many arenas as possible. Based on recent data and historical evidence, a PT should be employed as a vital member of the Soldier health care team at the maneuver unit level.

The purpose of this article is threefold: First, the authors present evidence demonstrating the expertise of PTs in managing nonsurgical orthopedic conditions. Second, the authors provide a historical context demonstrating PTs' value as physician extenders and force multipliers in combat and SASO missions. Third, the authors examine recent examples of PTs playing a vital role in the elite Special Operations Forces (SOF) Enhanced Physical Readiness Initiative.

PTs: Vital Team Members in Musculoskeletal Medicine

Physical therapists are specialists in nonsurgical musculoskeletal and orthopedic medicine. Recent research studies provide data indicating that PTs are effective musculoskeletal providers, with high-levels of patient satisfaction and low costs to the health care system.[6] Furthermore, studies have shown that only 18% of recent medical school graduates are proficient at basic orthopedic medicine.[7] Many Army PTs are board certified specialists in orthopedics or sports medicine, and many are Certified Strength and Conditioning Specialists. These credentials make PTs especially well suited to diagnose and treat the high incidence of orthopedic injuries that exist in the Army.

In addition to operating an entry-level graduate program in physical therapy ranked among the top 5% in the country, the Army also operates two advanced clinical residency programs for PTs – one in sports medicine and one in orthopedics. Both programs lead to advanced clinical doctoral degrees with specialization in managing complex musculoskeletal injuries.

The PTs have been practicing as physician extenders in the Army for more than 30 years.[8] As physician extenders in the military, PTs are able to order radiographs and other diagnostic tests and prescribe some medications.[9] In fact, a recent study at West Point showed that PTs were comparable to orthopedic surgeons in using magnetic resonance imaging to confirm a clinical diagnosis. The study found a diagnostic accuracy of 74.5% between clinical exam and magnetic resonance imaging findings for PTs and 80.8% diagnostic accuracy for orthopedic surgeons. The PTs examining patients without a physician referral showed a 90.9% clinical diagnostic accuracy. Conversely, nonorthopedic specialists only had a diagnostic accuracy of 35.4%.[10] Furthermore, there does not appear to be any risk to patients accessing PTs without a physician referral. Over a 40-month observation period at 18 military medical facilities, 27,762 patients accessed PTs without a physician referral. No adverse events resulting from the PT's diagnosis or management were reported.[11]

However, it is the ability of the PT to treat patients with orthopedic injuries and quickly return them to duty that makes the PT a crucial member of the military health care team. Moreover, PTs play a vital role in injury prevention and health promotion. Having a PT interacting with Soldiers at the unit level could potentially decrease injury rates and improve operational readiness and unit cohesion. For example, a study examining the impact of a PT working with the 2d Ranger battalion revealed that the 2d battalion had a 95% personnel readiness status versus an 88% personnel readiness status for the other two Ranger battalions without PT intervention. The 2d Ranger battalion also had 48 more Rangers available to deploy during the study. The two Ranger battalions without a PT were 2.3 times more likely to have Rangers unable to deploy. The 2d battalion also had the fewest average number of profile days compared to the other two Ranger battalions.[12]

Historical Context: PTs in Major Theater War and SASO

In addition to being specialists in nonsurgical orthopedic medicine in a traditional setting, PTs have repeatedly demonstrated their value as force multipliers in combat and peacekeeping missions. The origin of physical therapy in the U.S. dates to utilization of "reconstruction aides" in military hospitals during World War I. The PTs served in every theater of operation in World War II and also served during the Korean War.[13] Physical therapy proved effective for a variety of conditions, but proved to be most valuable in treating patients with orthopedic conditions and peripheral nerve injuries.[14] However, PTs assumed an increased role as physician extenders in Vietnam when orthopedic surgeons were unable to manage high volumes of nonsurgical cases in addition to the overwhelming number of surgical cases they faced.[15]

Major Barbara Gray was the first PT to serve in Vietnam, volunteering for duty from her clinic at Fort Belvoir, VA. Arriving in March of 1966, she served in the 17th Field Hospital in Saigon. In addition to her clinical duties, MAJ Gray also served as a consultant to other hospitals throughout the command. Due to the considerable contributions she made in rehabilitating injured Soldiers, especially those with soft tissue injuries to the extremities, 10 additional PTs were assigned to serve in evacuation and field hospitals in Vietnam in the Spring of 1967. The senior PT had the additional duty as consultant to the 44th Medical Brigade. As consultant, this PT constantly assessed facilities and workloads while also determining assignments for incoming officers and enlisted Soldiers to hospitals requiring their services.

The value of PTs in Vietnam did not go unrecognized, as many physicians requested additional physical therapy personnel and services throughout the country. In addition, commanders were so pleased with the service provided by PTs that they ensured adequate space and equipment could be procured within the various hospital clinics.[16]

Orthopedic surgeons were especially pleased with the work of PTs and occupational therapists during the Vietnam War, noting that rehabilitation was an important part of a wounded Soldier's recovery. In fact, PTs and occupational therapists were deemed essential in any decision regarding the rehabilitation of an orthopedic patient. It was noted that these "innovative, interested, intelligent individuals were of immense value to both the patient and physician."[17]

A physiatrist assigned to the 93d Evacuation Hospital also noted the importance of early intervention physical therapy in the management of wounds to prevent contractures, weakness, and disability. The physical therapy clinic averaged 1,800 patient visits per month, which included treatment on the inpatient wards. Despite extensive soft tissue injury, early physical therapy emphasizing stretching and strengthening led to successful rehabilitation with the Soldier frequently returning to duty.[18]

Between 1966 and 1973, 43 PTs served in three of the four combat zones in Vietnam. These PTs treated Soldiers, civilians, and prisoners of war from all allied nations participating in the war, in addition to U.S. Soldiers wounded in combat. Besides direct patient care and consultant roles, PTs serving in Vietnam developed instructional courses to train the Vietnamese in basic bedside physical therapy techniques and compiled an illustrated basic course text that was translated into Vietnamese to assist the Vietnamese nationals in continuing physical therapy services at the 2,700 bed hospital in Cong Hoa.[19]

The PTs on duty in Vietnam provided an invaluable service to the medical brigade, the Army, the physical therapy profession, and most importantly, the patients they treated.

Providing care for everything from joint injuries, post-surgical rehabilitation, burns and other wounds, PTs restored flexibility, strength, and function to thousands of patients. These PTs provided proof of the value of early intervention physical therapy in improving the prognosis, outcome, morale and return to duty status of Soldiers. More importantly, PTs in Vietnam richly contributed to the body of knowledge related to combat medicine. Major Gray noted "physical therapy has finally been recognized as a necessity for early treatment of combat wounds and has received full status as a medical team member with the 44th Medical Brigade."[20] She concluded that physical therapy "administered to the patients after surgery by trained PT personnel would restore patients to duty more quickly."[21]

During Operation Desert Shield and Desert Storm (ODSS), 3,726 (34%) of the overall injuries were musculoskeletal in nature.[22] An Army National Guard mechanized infantry unit activated for ODSS, reported 727 orthopedic injuries during their deployment. Of these, 602 (94%) were nonemergent, with only 138 (22%) requiring a minor or operative procedure or referral to a specialist beyond the brigade level.[23] Travis and Cosio found that 52% of patients evacuated to Madigan Army Medical Center (MRMC) from ODSS had at least one orthopedic diagnosis. However, the evacuation diagnosis was not substantiated in 40% of these cases, and 38% of the cases were exacerbations of pre-existing conditions. Physical training and job-related injuries accounted for 30% of these cases. Low back pain was the most frequent pre-existing condition (26%) that resulted in medical evacuation to MAMC. Travis and Cosio reported a very high percentage of orthopedic patients were immediately returned to duty after evaluation at MAMC, with some patients requesting return to duty upon arrival at MAMC. Other patients felt their injury never warranted medical evacuation out of the theater, but once placed in the evacuation system, found it impossible to return to duty. Travis and Cosio concluded that a lack of orthopedic expertise at battalion and brigade level were a primary reason for the excessive evacuations and could pose a considerable risk to future operations in sustained combat.[24] Had a PT been deployed at the brigade level to assist with musculoskeletal evaluation and treatment, it is possible many of these needless evacuations for routine orthopedic conditions could have been avoided.

Furthermore, Wasserman et al found that 25% of total health care visits were nontraumatic orthopedic conditions, and musculoskeletal injuries were the most common specific indication for Soldiers seeking health care during ODSS. They concluded that increased prevention to decrease orthopedic problems and unintended injuries might substantially reduce outpatient visits in future deployments.[25] In addition to direct access patient care, PTs can also provide these injury prevention and health promotion measures.

A total of five PTs deployed to Southwest Asia in support of ODSS.[26] One of the PTs treated 233 patients. Each patient only required an average of three visits, with 90% of these patients returning to duty without requiring any further intervention.[27] Comparatively, it required 21 days to evacuate more than 1,177 soft tissue injuries during ODSS for an estimated replacement cost of $836,885.[28] Once again, if PTs had been deployed further forward on the battlefield to assist the Soldier health care team in managing these injuries, it is likely the number of evacuations and overall replacement costs could have been much lower.

The PTs have routinely been deployed in Bosnia and Kosovo, as well as humanitarian operations in El Salvador, Ethiopia, Thailand, and Sri Lanka. The PTs deployed on these missions provided musculoskeletal evaluations, developed field-expedient rehabilitation programs, and provided injury prevention programs.[29] In addition, PTs have served as subject matter experts to assist host nations in underdeveloped countries in implementing comprehensive rehabilitation programs and establishing training programs for PTs.[30]

During the initial IFOR/SFOR deployment in Bosnia, 17% of all patients at the 21st Combat Support Hospital (CASH) were seen by the PT, the vast majority being orthopedic in nature. Of these, 78% were returned to duty without restrictions while 20% required a temporary duty restriction. Perhaps most importantly, only 2% of the patients seen by the PT required quarters, medical evacuation, or overnight hospitalization. In addition to direct patient care, the PT established a multidisciplinary wellness program for deployed Soldiers and traveled to remote military compounds to evaluate and treat Soldiers unable to be transported to the hospital.[31]

Experiences of PTs deployed to Kosovo are similar to those from Bosnia. Of all Soldiers entering the 67th CSH, 26% were evaluated and treated by the PT. The physical therapy clinic was the second busiest clinic after the emergency department. Once again, the PT was active in injury prevention and conducted site visits to host nation hospitals, outlying bases, and facilities for allied forces.[32]

It is interesting to note that the initial response of other providers to PTs deployed in the Balkans was somewhat skeptical. An initial informal survey in 1995 found that only 46% of providers felt physical therapy was needed in the field, while 21% felt it was not needed and 31% had not given it any thought. However, at the conclusion of the deployment, 90% felt PT was necessary, while none felt it was not needed.[33]

Six PTs initially deployed with CSHs in support of

Operation Iraqi Freedom. Once again, nonoperative orthopaedic injuries were very prevalent which lead to the request for and approval of four additional PTs being sent into the theater of operations in Jan 04. A PT also deployed with the Stryker Brigade Combat Team that arrived in Iraq in Jan 04.

PTs in SOF

The 2d Ranger Battalion incurred a casualty rate of 35% during Operation Just Cause in Panama, with 217 Rangers sustaining 281 injures. Of these, 90% occurred during the initial airborne insertion, and the majority of these injuries were musculoskeletal and nonsurgical in nature. Most of these injuries were to the lower extremity, particularly the ankle. Closed fractures and ankle sprains caused three times as many Rangers to be forced out of duty than did gun shot wounds or open fractures. The authors reporting these statistics concluded that medical personnel not only need advanced trauma life support skills, but also knowledge in musculoskeletal medicine.[34] As mentioned previously, Creedon showed that a PT working directly with a Ranger battalion resulted in shorter profile duration and improved deployability rates when compared to Ranger battalions without PT intervention.[35]

As a result of the demonstrated success of PTs serving as musculoskeletal specialists, the most elite forces in the U.S. Army have been requesting and receiving PTs to support the SOF Enhanced Physical Readiness Initiative. In 1999, the USASOC validated a manpower requirement for a PT in each Ranger Battalion, active component Special Forces Group, 160th Special Operations Aviation Battalion, and the Special Warfare Training Group.[36] Perhaps what is most interesting about this is the fact that the USASOC elected to delete one platoon leader authorization in exchange for each PT. These elite forces recognized the value that PTs bring to the SOF health care team. As specialists in orthopedics and sports medicine, they establish comprehensive programs to expedite recovery from injury and offer a quicker return of the Soldier to duty. The USASOC recognizes that having a PT providing care forward on the battlefield to treat musculoskeletal injuries means the Soldier is more likely to remain with his unit and decreases the need for costly medical evacuations. In addition to providing direct patient care, PTs serve as a consultant to the battalion commander for health promotion and injury prevention. With good reason, USASOC considers the PT a force multiplier.

It did not take long for the impact of this decision to be recognized. The PT assigned to the 3d Ranger Battalion that deployed to Afghanistan in Oct 01 treated approximately 142 patients, most of these sustained from the initial airborne insertion.[37] In addition to serving as the battalion PT, MAJ David Meyer served in the expanded role as a secondary triage officer, assisting the battalion surgeon and other medical personnel in determining the most appropriate care for injured Soldiers. Besides his physical therapy training and experience, he received additional training as an emergency medical technician as well as in cast application procedures. Major Meyer played a vital role in maintaining operational readiness of the Rangers during the initial phases of Operation Enduring Freedom. In addition to MAJ Meyer, PTs assigned to each Ranger Battalion have successfully deployed to Afghanistan and Iraq in support of the Global War on Terror.

Conclusion

Clearly, PTs have proven to be effective in a variety of operational environments from the Corps level (CSH) to a specialized battalion of light infantry Soldiers. Programs that enhance physical rehabilitation and injury prevention are a common concept within collegiate, Olympic, and professional sports programs. In fact, an Army PT is an important team member supporting the World-Class Athlete Program for the military. Athletes have benefited from rehabilitation programs designed by PTs in conjunction with other members of the health care team.[38] Army PTs possess many credentials making them uniquely qualified to manage the plethora of orthopedic injuries that persist in the military. Historically, PTs have excelled when deployed in support of combat or SASO missions. Finally, the most elite Soldiers in the Army have recognized the value of PTs as force multipliers. As a result, PTs are being incorporated at the unit level across all aspects of USASOC.

The physical demands and performance expectations of a Soldier are very similar to an athlete. Subsequently, Soldiers should be afforded no less in their medical care and recovery from injuries sustained in defense of their country.[39] Clearly, PTs have special skills that can serve a vital role to the Army and its Soldiers. The PTs' versatility as a physician extender, musculoskeletal specialist, injury prevention consultant, and secondary triage officer clearly demonstrates their force multiplier capabilities.

Many aspects of the Army are currently being restructured and reorganized. As the Stryker Brigade Combat Team and Future Force evolve, our leaders must look to the past to understand the important role PTs have played in maintaining the fighting strength of the Army, and look in the direction of the USASOC by incorporating a PT into maneuver units of the future. These initiatives would not only save money in training Soldiers, but in maintaining the Soldier as an investment in the future.

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Physical Therapists in Combat Health Support: Recommendations for Employment (Part II)

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As described in Part I of this article, physical therapists (PTs) in the Army make a unique contribution to the military health care team. Their proven ability to independently manage musculoskeletal conditions, thereby allowing physicians and surgeons to focus their efforts on more complicated or surgical cases, also decreases lost duty days due to injury; reduces costs due to evacuation requirements; and increases return to duty rates. Currently, a PT is allocated to echelon III in the Combat Health Support (CHS) system. This article examines the factors governing employment of PTs and recommends the optimal strategy for their employment within the CHS system in support of Army divisions. After examining the relevant factors, the authors recommend assigning a PT to echelon II in the CHS system. Under this model, each forward and main support medical company supporting maneuver brigades and divisional troops, would have a PT organic to the unit. Such a model would optimize the capabilities of PTs to enhance unit readiness, while minimizing cost. Several implementation strategies for utilization of PTs within echelon II are also discussed.

Introduction

As described in Part I of this article, Army PTs make a unique contribution to the military health care team. The purpose of Part II of the article is to examine the relevant factors and recommend the optimal employment strategy of PTs within the CHS system. This refers to PT allocation in order to provide musculoskeletal health care, as well as soft tissue wound and burn care to Soldiers within the combat organizations (battalion, brigade, division) in addition to fixed facility hospitals. The PTs are currently allocated to echelon III within the CHS system. Specifically, one PT is allocated to each Combat Support Hospital (CSH). Consequently, the authors attempt to address how to better utilize PTs within the CHS system to maximize their unique contribution to the military health care team in order to increase unit readiness.

Facts

There are a number of facts directly impacting this analysis. First, the current budgeted end strength for PTs in the Army is 196.[1] With the present cap on military personnel strength, any increase in PT end strength requires a reduction elsewhere. At the unit level, allocation of PTs to established units will require the unit to relinquish an equivalent number of positions from their Modified Table of Distribution and Equipment (MTOE). In other words, to assign a PT to a forward support medical company (FSMC), one officer position from the unit must be eliminated.

Under the present CHS model, Soldiers do not have access to a PT below echelon III, which is located at Corps level 225 km to 265 km from the front line of troops.[2] As such, many Soldiers that might benefit from PT diagnosis and treatment to improve function are either evacuated away from their unit or go without these services. This not only impedes unit readiness, but it also greatly increases costs due to unnecessary evacuation.

Fixed facility PT allocation now operates under a population-based model. This model accounts for a general military population (active duty personnel, active duty family members, military retirees, and military retiree family members) and allocates one PT per 7,500 beneficiaries.[3] Considering the fact that the individuals encountered in the CHS system primarily consist of active duty Soldiers in physically demanding jobs, the authors recommend changing the ratio to one PT per 3,000 beneficiaries in the CHS system. This is also consistent with a recent request by recently retired Physical Therapy Branch Chief, COL Charles Scoville, to allocate PTs down to populations of 3,000 active duty Soldiers.[4]

In order to place a PT at different echelons of the CHS system, the authors undertook a detailed look at the number of units within each supported level. At echelon I within the current Army divisions, there are 261 combat arms, combat support, and combat service support battalions.[5] Likewise, 261 PTs would be allocated to support echelon I level CHS. Allocation of a PT to echelon II would require 43 PTs.[6] Utilizing a PT at the division level on the division surgeon's staff as an advisor for injury prevention would require 10 PTs. Finally, the current model employing PTs at echelon III requires 37 PTs.[7]

In order to discuss population-based PT allocation within

Army maneuver units, one needs to establish the population of the maneuver units. Battalions are the units located within echelon I level of the CHS system. They range in size from 231 personnel in some aviation battalions to 760 personnel in mechanized infantry battalions. The average battalion consists of 500 to 600 personnel. Brigades, which are located within echelon II level of the CHS system, range from 2,500 personnel in a light infantry brigade to 4,000 personnel in an armor brigade. The average brigade consists of 3,000 to 3,500 personnel. Finally, divisions supported with echelon III level care by CSHs, range from 11,991 personnel in a light infantry division to 17,056 personnel in an armor division. The average division strength is approximately 15,673 personnel.[8]

Assumptions

Several assumptions impact this article. First, the authors assume that the officer position eliminated from the supported maneuver unit may be taken from the overall unit rather than being limited to the organic medical unit. For example, at the brigade level, or echelon II CHS, the position for the PT may be taken from any element within the brigade and would not be just limited to the FSMC. This decision would be left to commanders and the Total Army Analysis (TAA) process. Second, the authors assume that any recommendation for additional military PTs cannot exceed 30% of the current budgeted end strength. This assumption is based upon feasibility, believing that if requests for additional authorizations exceed a 30% increase over current end strength, the risk of rejection is too great based upon financial and personnel considerations. Finally, the authors assume that one CSH will be allocated per division. According to the current Field Manual 8-55, CSH allocation is based upon "100% of the projected beds required in the combat zone."[9] Since it is impossible to determine the specific bed requirement for such a generalized situation, the authors assume allocation of one CSH per division. This is a conservative estimate that still allows comparison of the various courses of action generated and is more consistent with casualty rates from recent conflicts.[10]

Courses of Action

The authors present and examine numerous courses of action for this analysis. Each course of action (COA) refers to the level of PT assignment and whether or not it requires an increase in PT budgeted end strength. The authors present the following COAs for this analysis:

COA A: Echelon I with increase in budgeted end strength

COA B: Echelon I without increase in budgeted end strength

COA C: Echelon I and II with increase in budgeted end strength

COA D: Echelon I and II without increase in budgeted end strength

COA E: Echelon II with increase in budgeted end strength

COA F: Echelon II without increase in budgeted end strength

COA G: Echelon II and Division Staff with increase in budgeted end strength

COA H: Echelon II and Division Staff without increase in budgeted end strength

COA I: Division Staff with increase in budgeted end strength

COA J: Division Staff without increase in budgeted end strength

COA K: Echelon III with increase in budgeted end strength

COA L: Echelon III with increase in budgeted end strength to account for CSH in the active component only

COA M: Echelon III without increase in budgeted end strength (current doctrine)

Screening Criteria

The first screening criterion titled, "PT end strength" arises from the authors' assumptions. This criterion states that any COA recommending additional military PTs may not exceed 30% of the current budgeted end strength.

The next screening criterion titled "Fixed facility military PT allocation" addresses maintenance of active duty military PTs in the fixed facility hospitals. Regardless of the COA selected, fixed facility hospitals should continue to be staffed with military PTs due to the need for military institutional knowledge and use of the fixed facilities for exposure to a wide variety of pathology, in-patient care experience, additional training, and mentoring of younger PTs by more experienced active duty PTs. Forward employment of military PTs to maneuver units may reduce but not eliminate the current staffing needs in fixed facility hospitals. Even with the current structure, many large fixed facilities already employ some contract or general schedule (GS) PTs. If PTs are employed further forward within the CHS system, this may reduce the workload at the fixed facility. In this case, however, the authors recommend maintaining military positions within the fixed facility hospitals, since the fixed facilities must remain not only first class treatment facilities, but must also serve as a training and mentoring base for the active duty PTs. Operational assignments to maneuver units will require PTs to function independently. Therefore, PTs may need these positions in order to alternate between operational and fixed facility assignments for the purpose of maintaining a more comprehensive skill set.

The final screening criterion titled, "Primary direct care role" emphasizes the direct patient care role of PTs. Since the primary role of PTs involves a direct patient care role as orthopedic physician extenders, each COA must involve PTs primarily in direct patient care. Injury prevention, ergonomic evaluation and consultation, and other consulting roles may be provided as additional duties of PTs serving primarily in direct patient care.

Screened-Out COAs

All COAs (COAs A, B, C, and D) allocating PTs to echelon I level CHS fail "PT end strength" due to additional PT allocation exceeding the current U.S. Army PT end strength by more than 133%. In other words, allocating PTs to echelon I level CHS within all divisions would require an additional 261 PTs alone, and the current budgeted end strength is only 196 PTs.

Any COAs recommending additional PT allocation without an increase in budgeted end strength (COAs B, D, F, H, J, and M) fails "Fixed facility military PT allocation" because this would require reassignment of military PTs in fixed facilities to the operational maneuver unit openings without military PTs to fill the vacated positions in the fixed facilities. Without an increase in budgeted end strength, the fixed facilities will have to attempt to either backfill vacated military positions with contract or GS providers, or any shortfall in workload coverage will be absorbed through referral to local civilian physical therapy clinics as a short-term solution. In the long-term, however, the absence of military PTs would reduce the capability of the fixed facilities to serve as mentoring and training bases for active duty PTs. Although COA M fails to meet the screening criterion in this instance, the authors keep it in consideration because it is the current doctrine for employment of PTs in the CHS system.[11] In other words, COA M is the "do nothing" COA and continues to allocate PTs to the CHS system as conducted by current doctrine.

Finally, COAs that involve PTs solely in an advisory or consultation role on the division staff (COA I and J) fail "Primary direct access/care role." These COAs place the PT on the staff of the division surgeon only and involve primarily advising and consulting rather than provision of direct patient care.

Surviving COA

The surviving COAs are E, G, K, L, and M. COA E allocates PTs to echelon II and includes an increase in budgeted end strength. COA G allocates PTs to echelon II as well as to a division staff position under the division surgeon and includes an increase in budgeted end strength. COA K allocates PTs to echelon III (consistent with current doctrine) but also includes an increase in budgeted end strength to provide sufficient active duty PTs to backfill vacant positions in fixed facilities when a fixed facility PT deploys with a CSH. COA L is similar to COA K except it calls for an increase in budgeted end strength just sufficient to account for each CSH in the active component, which is 12, and does not make provision for covering active duty PT positions vacated when active component PTs deploy with reserve CSHs. There are 25 CSHs in the reserve component.[12] COA M continues to allocate PTs to echelon III without an increase in budgeted end strength.

Evaluation Criteria

The authors apply several evaluation criteria to compare the surviving courses of action. The first evaluation criterion titled, "PT access" refers to the lowest echelon within the CHS allocated PTs. Each COA allocates PTs to echelon I, II, or III. The benchmark for comparison is III, which is the current doctrine. For the purpose of this analysis, assigning PTs lower than echelon III is an advantage because it provides more Soldiers greater access to a PT that is evaluating and treating as far forward as possible.

The second evaluation criterion titled "Workload/ Demand" represents the projected daily workload that could be managed by a PT. Based upon historical data, musculoskeletal complaints, for which PTs are ideally suited to manage, have been reported as 46% of sick call visits within an active duty infantry brigade.[13] This equates to a daily average of 26 patients and is the maximum number of patients that a single PT could consistently and effectively manage on a daily basis. As such, this workload level is the benchmark. Fewer than 26 patients per day is an advantage in that the PT will have more time to spend per patient. More than 26 patients per day might overwhelm the PT, and such a workload could not be maintained consistently.

The third evaluation criterion titled "Population-based data" establishes the benchmark for the PT to population ratio. The value currently utilized for the allocation of PTs in fixed facility hospitals is one PT per 7,500 beneficiaries. Fewer beneficiaries per PT is considered an advantage. This will ensure adequate provision of musculoskeletal care by PTs.

The final evaluation criterion titled "Cost in terms of budgeted end strength" delineates the total number of personnel required in exchange for PTs to the designated units according to the respective COA. The authors utilize a benchmark of 29, since it is the average cost in added PT end strength for all surviving COAs. Fewer than 29 is an advantage, since lower cost in terms of PT end strength corresponds to fewer personnel that maneuver units must relinquish in order to have a PT.

Analysis of COA

Table 1 displays the raw data for the evaluation criteria as they pertain to each COA.

COA	Level of PT Access Echelon	Workload/ Demand	Population Base	Cost (Added End Strength)
E	II	26	3,000-3,500	43
G	II	26	3,000-3,500	53
K	III	78	15,673	37
L	III	78	15,673	12
M	III	78	15,673	0

Table 1. COA Evaluation Criteria Data

COA E allocating PTs to echelon II with a corresponding increase in budgeted end strength possesses several advantages. Access to PTs at echelon II is superior to the established benchmark of echelon III. The workload or demand meets the benchmark of 26 patients per day. Furthermore, the population-base of one PT per 3,000-3,500 beneficiaries is more advantageous than the established benchmark of one PT to 7,500 beneficiaries. The one disadvantage of this course of action is cost. It requires an addition of 43 PTs to the current budgeted end strength. This also means that the gaining units will have to relinquish 43 positions Army-wide to accommodate the new PT positions.

COA G, which allocates PTs to echelon II and to each division staff under the division surgeon with a corresponding increase in budgeted end strength, shares many of the same advantages as COA E. Similarly, access to PTs at echelon II is superior to the established benchmark of echelon III. The workload or demand meets the benchmark of 26 patients per day, and the population-base of one PT per 3,000-3,500 beneficiaries is more advantageous than the established benchmark of one PT to 7,500 beneficiaries. The one disadvantage of this course of action is also cost. It requires an addition of 53 PTs to the current budgeted end strength, which is at greater cost than COA E in which PTs are only assigned to echelon II but not division staff. Additionally gaining units must relinquish 53 positions Army-wide to accommodate the new PT positions.

COA K, allocating PTs to echelon III with a corresponding increase in budgeted end strength, possesses the advantage of meeting the benchmark of echelon III for PT access. There are several major disadvantages associated with this COA, however. First, if all of the Soldiers with musculoskeletal complaints appropriate for PTs to manage arrived at echelon III for care, the daily workload for the PT would average 78 patients, which is well beyond the capability of one PT to manage.[14] Furthermore, the population-base of one PT per 15,673 beneficiaries is significantly greater than the established benchmark of one PT per 7,500 beneficiaries. Finally, COA K requires 37 additional PTs added to end strength, which exceeds the established benchmark of 29.

COA L is very similar to COA K in that it allocates PTs to echelon III yet it only increases the budgeted end strength by 12 PTs, which is sufficient to account for the active component CSHs only. It also possesses the advantages of meeting the benchmark of echelon III for PT access and at very low cost. This COA requires only 12 additional PTs added to end strength. There are major disadvantages associated with this COA, though. First, if all of the Soldiers with musculoskeletal complaints appropriate for PTs to manage arrived at echelon III for care, the daily workload for the PT would average 78 patients, which is well beyond the capability of one PT to manage.[15] Second, the population-base of one PT per 15,673 beneficiaries is significantly greater than the established benchmark of one PT per 7,500 beneficiaries.

COA M, allocating PTs to echelon III without an increase in budgeted end strength (current doctrine), has the primary advantage of being a "no cost" solution. Obviously, this falls well below the benchmark of 29 additional PTs. Additionally, it meets but does not improve upon the benchmark of Echelon III access to a PT. Its major disadvantages are in the workload/ demand and population-base criteria, which is similar to COA K. If all Soldiers with musculoskeletal complaints appropriate for PTs to manage arrived at echelon III for care, the daily workload for the PT would average 78 patients.[16] Again, this is well beyond the capability of one PT to manage. Additionally, the population-base of one PT per 15,673 beneficiaries is significantly greater than the established benchmark of one PT per 7,500 beneficiaries.

Comparison of COA

In terms of "PT access," COA E and G tie for first with access at echelon II, while COA K, L, and M tie for last with access at echelon III. COA E and G also tie for first in terms of "Workload/Demand," each meeting the benchmark of 26 patients per day. COAs K, L, and M on the other hand, tie for last in "Workload/Demand" with a workload of 78 patients per day. Additionally, COA E and G again tie for first in the criterion of "Population-based data," and at one PT for every 3,000 to 3,500 beneficiaries, are both far superior to the benchmark of one PT for every 7,500 beneficiaries. COAs K, L, and M are vastly inferior to the one PT to 7,500 beneficiary benchmark of the "Population-based data" criterion, tying for last among the five COAs with a ratio of one PT per 15,673 beneficiaries. In comparing the "Cost in terms of budgeted end strength," however, COA M ranks first with the lowest cost, requiring no additional PTs. COA L ranks second with a cost of 12 additional PTs. COA K ranks third with a cost of 37 additional PTs. COA E ranks fourth in this area at a cost of 43 additional PTs, and COA G ranks last with a cost of 53 additional PTs.

Utilizing a relative value decision matrix with ordinal rankings, the authors apply the following weighting to the evaluation criteria: "PT access" slightly favored over "Workload/Demand" and "Population-base" but favored over "Cost"; "Workload/Demand" equal to "Population-base"; and "Population-base" slightly favored over "Cost." The decision matrix and weighting of criteria are provided in Table 2.

Decision Matrix PT HSS Allocation

Weight	3.46	1.86	1.86	1.00	Total
Criteria / COA	Access to PT	Workload/ Demand	Population Base	Cost	
E	1	1	1	4	11.175
G	1	1	1	5	12.175
K	2	2	2	3	17.350
L	2	2	2	2	16.350
M	2	2	2	1	15.350

Relative Values Matrix
Less is better
Consistency Ratio = 99.62

Importance Values for PT HSS Allocation*

	Workload/ Demand	Population Base	Cost
Access to PT	2	2	3
Workload/ Demand		1	2
Population Base			2

Legend of Importance Factors	*This table and Legend of Important Factors is used solely for calculation of the weights for the criteria in the decision maxtrix. They are not used directly in the matrix itself.
1-Equal, 3-Favored, 2-Slightly Favored, 4-Strongly Favored	

Table 2. Relative Value Decision Matrix

Recommendation

Considering the factors of access, workload, population-based data, and cost, the authors recommend selecting COA E, allocating a PT to each of the echelon II level CHS system assets in the division area (Table 2). This COA would also increase PT budgeted end strength by 43 PTs. Implementing this COA will ensure that each brigade, as well as the troops in the division area, have increased access to PT diagnosis and treatment for musculoskeletal injuries, soft tissue wounds and burns. Utilizing this COA will provide better access to PTs at the most appropriate workload level and population base. Finally, the benefits of implementing this COA come at moderate cost, and, based upon the evidence presented in Part I of this article, the authors believe that the cost of this COA will easily be recovered in patient evacuation savings, shorter profile duration, and higher return to duty rates at lower echelons of care. In other words, when in a deployed setting, the brigades should receive a significant return on their investment in the physical therapy position via reduction in the number of Soldiers evacuated for musculoskeletal injuries.

Implementation Recommendations

Having concluded that the optimal COA allocates PTs to echelon II level CHS and increases the budgeted end strength by 43 PTs, how might this be implemented? In an optimal situation, each FSMC would already have a medic with specialized training in physical therapy (91WN9) that could assist the PT. In the absence of a medic with this specialized training, the PT may increase the capability to diagnose and treat more patients by cross-training a medic (91W) from the FSMC to perform the role of a physical therapy technician. Additionally, MTOE changes must also be scrutinized and approved through the TAA process prior to implementation. This could take several years. With emphasis from the Physical Therapy Branch Chief, Army Medical Specialist Corps Chief, and the Army Surgeon General, this process might be shortened.

Operationally, the authors believe this COA may be enhanced in several ways. First, when the units are in garrison at their home duty station, the PTs should be located at a brigade level troop medical clinic (TMC) or consolidated at a TMC designated to service all of the brigades in the division. Second, when the units are deployed (field training, operational assignment, or war), the PT should be located at the FSMC in the brigade support area (BSA). From this location, they may enhance access by visiting each battalion aid station within the brigade weekly to assist the battalion physician and physician's assistant with local management of musculoskeletal injuries as much as the operational situation permits. Third, in a high intensity operational situation or mass casualty situation, the PT should remain in the BSA to assist in orthopedic triage, evaluation and treatment of minor musculoskeletal injuries, and soft tissue wound and burn evaluation and treatment as discussed in Part I of this article. Finally, units could capitalize on additional capabilities of the PT by assigning them the additional duty of injury prevention and ergonomic intervention advisor/consultant.

Under the authors' recommended COA in the new Striker brigades, of which two are currently fielded and six total are expected at the end of fielding, PTs at echelon II will work similarly to the current force. A PT would be assigned to each Brigade Support Battalion (BSB) in the Brigade Support Medical Company (BSMC). Likewise, in the Future Force, a PT should be allocated to the Unit of Action within the BSMC of the BSB.

Conclusion

As discussed, PTs have much to contribute as a member of the military health care team. Assigning PTs to echelon II in the CHS system and increasing the budgeted end strength by only 43 additional PTs will likely result in significantly lower Soldier profile duration, increase return to duty rates, and reduce unnecessary patient evacuation for musculoskeletal injuries in deployed settings, thereby reducing overall costs and enhancing unit readiness. Once assigned to echelon II level CHS units, a number of implementation strategies may enhance the utilization of PTs for maximum benefit to the supported units. Table 3 below summarizes the recommendations and benefits for the selected COA.

References

1. COL Charles Scoville, Chief, Physical Therapist Branch and Assistant Chief, Army Medical Specialist Corps, electronic mail to author. March 10, 2003.

COA recommendations	**Benefit**	**Cost**
Add 43 PTs to end strength	*Increased musculoskeletal evaluation and treatment capability in CHS system *Free orthopedic surgeons and physicians to focus on surgical and more serious injuries/illness *Improves access to PTs *Meets workload and population-based benchmarks *Add another orthopedic triage officer at echelon II in the CHS system *Reduce unneccessary evacuation *Increase return to duty rates *Decrease profile duration	*43 officer positions relinquished across the Army at the brigade level to make room for one PT in each unit
PT technician (Medic 91WN9) at echelon II facilities	*Increase musculoskeletal workload capability of PT	*No additional cost to unit. Medics already assigned at echelon II. Only need one at each facility with additional skill identifier (N9) to serve as physical therapy technician
Cross-train Medic (91W) to serve as PT technician in lieu of 91WN9 at each echelon II facility	*Increase musculoskeletal workload capability of PT	*No additional cost to unit. Cost would only be in terms of time required of the PT to cross-train the medic to function as a physical therapy technician
PTs make weekly visits down to battalion aid stations to assist in nonemergent musculoskeletal injury evaluation and treatment	*Enhances access to PTs by providing access down to echelon I *Reduce unnecessary evacuation *Increase return to duty rates *Decrease profile duration	*No additional cost. The PTs may receive transportation from the battalion medics from the brigade (FSMC) to the unit during routine resupply operations

Table 3. COA Summary

2. United States Army Command and General Staff College. *ST 101-6, Combat Service Support Battle Book:* Fort Leavenworth, Kansas: Government Printing Office. July 2002.

3. COL Charles Scoville, Chief, Physical Therapist Branch and Assistant Chief, Army Medical Specialist Corps, electronic mail and unpublished paper titled "Population-Based Physical Therapy Staffing Requirement." This also includes two enlisted physical therapy technicians, and one receptionist as support staff for the first 7,500 in the population. The technicians and support staff do not increase in a linear fashion, however and the second 7,500 population block only adds one technician to make three technicians to assist the two physical therapists. Electronic mail received November 10, 2002.

4. COL Charles Scoville, Chief, Physical Therapist Branch and Assistant Chief, Army Medical Specialist Corps, electronic mail to author. February 26, 2003.

5. Mr R. Varney, Requirements Documentation Directorate, Combat Arms Branch. Telephonic interview. January 2003.

6. Mr M. Johnson, Requirements Documentation Directorate, Combat Support Branch. Telephonic interview. January 2003.

7. Ms Carrie Brunson, Operations, Force Structure Office. Under the Medical Re-engineering Initiative, the Army will possess 12 active CSHs and 25 Reserve CSHs. Telephonic interview. March 13, 2003. Currently, however, these slots are PROFIS, and the PT positions left vacant in the fixed facilities from active duty PTs deploying with the CSHs are not automatically backfilled. Furthermore, there is no change in the budgeted end strength.

8. Powerpoint presentation from Office of the Chief, Army Reserve, Office of Force Development. All of the unit personnel strength authorizations for this paragraph were derived from this presentation of various division types and their component brigades and battalions. (undate)

9. United .States. Department of the Army. *FM 8-55, Planning for Health Service Support*: Washington, DC: Government Printing Office; September 1994:p 5-34, para 5-21(e).

10. Casualty rates associated with Operations Desert Storm, Enduring Freedom, Anaconda, and Iraqi Freedom. (undate)

11. Uunited States Department of the Army. *FM 8-55, Planning for Health Service Support*: Washington, DC: Government Printing Office; September 1994: p 5-34, para.5-21(c).

12. Ms Carrie Brunson, Operations, Force Structure Office. Under the Medical Reengineering Initiative, the Army will possess12 active CSHs and 25 Reserve CSHs. Telephonic interview. March 13, 2003.

13. MAJ Hobbs, Carol and CPT Maggart, Timothy. Presentation to Fort Benning Leadership based upon data collected from an active duty infantry brigade (3d Brigade, 3d Infantry Division). The presentation was titled, "Injury Prevention: A Commander's Guide To Success," March 7, 1997.

14. Based upon historical data at the brigade level and extrapolated for all three brigades within a division. From MAJ Hobbs, Carol and CPT Maggart, Timothy. Presentation to Fort Benning Leadership based upon data collected from an active duty infantry brigade and a basic training brigade. The presentation was titled, "Injury Prevention: A Commander's Guide to Success." March 7, 1997.

15. Ibid.

16. Ibid.

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The Role of the Occupational Therapist in CSC Operations

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The role of the occupational therapist (OT) in Army Combat Stress Control (CSC) is to evaluate the occupational performance of Soldiers adversely affected by combat stress reactions and to implement interventions to enhance performance. The OT employs unique core occupational therapy skills as well as shared mental health skills to support the six functional mission areas of CSC: Consultation, Reconstitution support, Combat neuropsychiatric triage, Stabilization, Restoration, and Reconditioning. The Army Field Manual 8-51, "Combat Stress Control in a Theater of Operations," describes duties of the OT but gives little detail as to how the OT performs these duties in support of the six CSC mission areas. This article reviews the foundations of occupational therapy in mental health practice, identifies the skills used by OT, and describes the OT's role in each of the six functional mission areas.

Introduction

Occupational therapy is one of five professions utilized in Army CSC units. The other professions are: nursing, psychiatry, psychology, and social work. Current Army doctrine organizes CSC unit members into a "prevention" section and a "restoration" team, with the OT assigned to the latter. Despite this bipartite unit arrangement, "the priority role for all CSC personnel is the prevention of battle fatigue and other stress-related casualties. This is as true for the restoration team as it is for the prevention section."[1] As such, regardless of their alignment under the restoration team, OTs are called upon to perform the full spectrum of CSC operations.

It is well-established that combat stress can adversely affect a Soldier's ability to function. Because of this, CSC units have been fielded to minimizing the functional impairment associated with combat stress. The OTs are well suited to the task of supporting CSC operations. The objective of the occupational therapy profession is to enable people's ability to function within their daily life activities that support participation in their various life roles. *"Occupational performance"* is the term used by OTs to describe function. "Occupational performance is defined as the ability to carry out activities of daily life, including activities in the areas of occupation: activities of daily living (ADL) (also called basic activities of daily living [BADL] and personal activities of daily living [PADL]), instrumental activities of daily living (IADL), education, work, play, leisure, and social participation."[2] In practice, the profession focuses on "supporting function and performance in daily life activities and the many factors that influence performance (for example, performance skills, performance patterns, context, activity demands, client factors) that are addressed during the intervention process."[2] Given this professional focus, *the role of the OT in CSC is to evaluate Soldier's occupational performance and to implement interventions to enhance performance*.

In CSC, the OT must apply his professional expertise across six functional mission areas: (1) *consultation* to unit commanders and staff, (2) *reconstitution support* to attired units, (3) *combat neuropsychiatric triage*, (4) *stabilization* of severely disturbed casualties, (5) *restoration* of combat stress casualties, and (6) *reconditioning* of combat stress casualties.[1] Unfortunately, current Army doctrine is inexplicit as to how OTs support these mission areas. While Army doctrinal manuals offer a duty description and list numerous tasks an OT might perform, it is not clear how the OT applies his various skills across each of the six CSC functional mission areas. The purpose of this article is to describe the authors' views of how OTs fit into the full spectrum of CSC missions. A brief review of the foundations of occupational therapy is offered, followed by a description of the skills used by OTs to carry out their duties and how these skills can be applied in each of the six CSC mission areas (Table 1).

The Foundations of Occupational Therapy

As a therapeutic medium, occupational therapy is the process of facilitating function by developing skills, supporting capabilities and perceptions through engagement in a meaningful occupation. The OT uses the term "occupation" to refer to the purposeful everyday tasks and activities that "occupy" one's time (for example, dressing, meal preparation, participation in educational activities, job performance, participation in play and leisure pursuits, and participation is social activities). "Engagement in occupation includes both the subjective (emotional or psychological) aspects of performance and the objective (physically observable) aspects of performance."[2] It is because of these two aspects of

Occupational Therapists' Skills	CSC Mission Areas					
	Triage	**Stabilization**	**Restoration**	**Reconditioning**	**Reconstitution**	**Consultation**
Unique Core Occupational Therapy Skills						
Perform task analysis	X	X	X	X	X	X
Assess occupational performance	X	X	X	X	X	X
Structure therapeutic environment		X	X	X		
Engage casualties in therapeutic occupation		X	X	X	X	
Match Soldier to tasks and job	X	X	X	X	X	X
Shared Mental Health Skills						
Provide consultation	X	X	X	X	X	X
Provide education	X	X	X	X	X	X
Conduct unit survey interviews					X	X
Conduct critical event debriefings			X	X	X	X
Provide supportive counseling	X	X	X	X	X	X
Interview casualties	X	X	X	X	X	X
Evaluate mental status	X	X	X	X	X	X
Triage casualties	X	X	X	X	X	X
Restrain casualties		X				
Report casualty response to medications & activity		X	X	X	X	

Table 1. Skills Employed by OTs in the Six CSC Mission Areas

performance that engagement in occupation has therapeutic potential for the remediation of both psychological and physical conditions.

The conception of using occupation as a therapeutic medium arose from the moral treatment movement of the 18th and 19th centuries. The moral treatment movement was based on the premise that engagement in normal activities in a normal environment could change the abnormal behavior of psychiatric patients and restore them to normal functioning. Kielhofner suggests that the profession of occupational therapy developed from the moral treatment movement based on the following core constructs: (1) Health is linked to engagement in occupation. (2) A healthful, balanced lifestyle is maintained by habits developed and sustained from engagement in daily occupations. (3) The mind and body are inextricably linked. (4) Idleness has a negative impact on health. (5) Engagement in occupation can regenerate lost function.[3]

While these core constructs are still germane to the profession, over time, the profession's focus has shifted. The profession is no longer centered solely on the use of occupation as a therapeutic medium. The profession now focuses "on occupation and daily life activities and the application of an intervention process that facilitates engagement in occupation to support participation in life."[2] In current OT practice, in addition to using occupation as a therapeutic medium, OTs may also utilize other interventions such as the therapeutic use of self, consultation, and education (Table 2).[2]

While other professions on the CSC team concentrate on psychiatric pathology and the remission of that pathology, in contrast, the OT addresses occupational performance, regardless of pathology. The OT's attention toward occupation and function, rather than pathology, offers a unique perspective and makes the OT a distinctive and valuable member of the CSC team.

Therapeutic Use of Self — A practitioner's planned use of his or her personality, insights, perceptions, and judgments as part of the therapeutic process. *Examples:* Counseling Soldiers to reassure normalcy and to restore confidence Counseling Soldiers to help deal with loss and grief
Therapeutic Use of Occupations and Activities — Selected for specific clients to meet therapeutic goals. **Occupation-Based Activities** — *Purpose*: Allows clients to engage in actual occupations that are part of their own context and that match their goals. *Examples:* Perform personal hygiene Apply personal camouflage Don chemical protective over-garments Maintain personal equipment **Purposeful Activity** — *Purpose*: Allows the client to engage in goal-directed behaviors or activities within a therapeutically designed context that lead to an occupation or occupations. *Examples:* Practice common and collective Soldier tasks Engage in work projects Role play methods of assertive communication Engage in sports activities **Preparatory Methods** — *Purpose*: Prepares the client for occupational performance. *Examples:* Exercise Biofeedback
Consultation Process — A type of intervention in which practitioners use their knowledge and expertise to collaborate with the client. The collaborative process involves identifying the problem, creating possible solutions, trying solutions, and altering them as necessary for greater effectiveness. *Examples:* Advising leaders on activities to enhance unit cohesion Advising a Soldier on resolving interpersonal conflict
Education Process — An intervention that involves the imparting of knowledge information about an occupation and activity and that does not result in the actual performance of the occupation/activity. *Examples:* Educating Soldiers and leaders normal stress reactions Educating Soldiers on methods for stress reduction

Table 2. Types of Occupational Therapy Interventions (Adapted from American OT Association [2002])

Clinical Skills Used by OTs in CSC

To carry out their duties in CSC, OTs employ core occupational therapy practice skills that are unique to the profession, as well as shared mental health clinical practice skills. Core occupational therapy skills include: (1) Analysis of jobs and job tasks for underlying requisites; (required sub-tasks, performance standards, equipment used, the social and physical work environment, occupational hazards). (2) Assessment of Occupational performance (functional abilities) as it relates to specific tasks and jobs; (interpersonal/social-interactive skills, task performance skills, underlying physical functional capacity). (3) Configuration of a therapeutic, structured environment, in which skills can be developed. (4) Analysis, selection, and application of occupations (activities) as therapeutic media. (5) The ability to match the individual to tasks they can successfully perform. If a Solider is not able to return to duty in their primary military occupational specialty

(MOS), the therapist is able to identify vocations in which the Soldier may be able to function, and thereby make an informed recommendation for MOS reclassification.

In addition to these unique, core occupational therapy skills, OTs also utilize practice skills that are shared with other mental health professions. Some of these shared skills include: (1) Consultation on CSC and mental health issues. (2) Education on CSC preventive mental health topics. (3) Conducting unit survey interviews. (4) Debriefing groups of Soldiers following critical (traumatic) events. (5) Supportive counseling using active listening and the therapeutic use of self. (6) Interviewing stress casualties. (7) Evaluating the mental status of stress casualties. (8) Performing combat neuropsychiatric triage. (9) Restraining agitated casualties. (10) Observing and reporting casualty response to medication and activity.

The OT applies these skills at the micro-level with the patient and at the macro-level with the unit in order to enhance occupational performance across the full spectrum of CSC mission areas. Table 1 identifies the skills that are used by OTs in each of the CSC mission areas. The following description of how OTs fit into the six CSC missions is provided, progressing from the micro-level with the individual client (triage, stabilization, restoration, and reconditioning) to the macro-level with the organization (reconstitution and consultation).

The OT Role in Combat Neuropsychiatric Triage

Combat neuropsychiatric triage is the process of sorting combat stress casualties based upon where they should be managed. The OT's role in neuropsychiatric triage is to assess the casualty's occupational performance ability within his MOS and match that to the ability of the parties in the CSC management continuum to supervise the Soldier, given the present tactical situation.

Combat neuropsychiatric triage should not be confused with surgical triage. In surgical triage, casualties are sorted into the categories of *Immediate*, *Minimal*, *Delayed*, or *Expectant*, based upon how quickly they should receive care. The higher the casualty's priority, the more quickly he is seen. In contrast, in combat neuropsychiatric triage, casualties are sorted into the categories of *Duty*, *Rest*, *Hold*, or *Refer*, based upon how closely to their unit they should be managed.[1] The more functional the Soldier, the closer he is kept to his unit. For example, Soldiers classified as *Duty* or *Rest* return to their units while Soldiers classified as *Hold* or *Refer* are managed in CSC or other medical units. The OTs are especially well suited to function in this role. The OT habitually assess client's functional ability in relation to specific job demands. The OT's ability to accurately assess Soldier's capacity to meet occupational demands is essential to the process of sorting casualties for optimal management.

The OT Role in Stabilization

Stabilization refers to the initial management of those few combat stress casualties with severe behavioral disturbances or Soldiers with true psychiatric pathology. For forward-deployed CSC units, initial emergency CSC stabilization amounts to restraining and holding these casualties while awaiting evacuation. However, "full stabilization in CSC also includes adequate evaluation of return to duty potential. This requires assessment of mental status and performance capability over time without excessive drug effects or limitations on activities."[1] The role of the OT in *initial emergency CSC stabilization* is to assist with the physical restraint of the agitated casualty. The OT's role in *full stabilization* is to assess the patient's occupational performance abilities and provide opportunities for engagement in appropriate short-term therapeutic occupations. This is essentially the same role the OT plays on the acute-care in-patient psychiatric ward.[4,5]

In the acute psychiatric treatment setting, the OT structures a supportive, therapeutic environment and engages patients in a variety of occupations. This is done for both assessment and intervention. In assessment, the therapist has the patient engage in occupation to determine baseline functional abilities and deficits. By doing so, the therapist also assists with the physician's diagnostic process by observing and reporting on the patient's task performance and interaction skills. As therapy, occupations are matched to the patient's interests, functional abilities and desired goals in order to give the patient that "just-right challenge." That is, the challenge is just within his functional ability. When the patient successfully meets the challenge, it results in a therapeutic effect (for example, enhanced belief in skills, self-esteem, role competence, etc). Additionally, through observations made of patients engaged in occupation, the OT can also help determine the effectiveness of medications and report any observed side effects to the prescribing physician. Finally, by engaging the patient in occupation, the therapist is better able to assess the patient's potential for return to work. By observing the patient's functional ability while engaged in productive activity, the therapist can make informed recommendations on return to duty status versus MOS reclassification.

The OT Role in Restoration

Restoration is the term used to describe the early management of combat stress casualties. It encompasses the rehabilitative measures taken in the first 72 hours of intervention.[1] The OT's unique role in the restoration mission is to assess the Soldier's occupational performance abilities and to restore his confidence in his ability to function. This is done through the therapeutic use of self, engagement in therapeutic occupation, and through consultation and education on occupational performance (Tables 2 and 3).[2]

Potential Therapeutic Occupations by Area of Occupation
ADL: Bathing/showering; Personal hygiene and grooming; Dressing; Eating; Sleep/rest.
Instrumental ADL: Supervising subordinates during activity; Radio communications procedures; Physical training; Uniform and personnel; equipment maintenance; Kitchen police; Personal protection procedures.
Educational activities: Common and collective Soldier task training; Combative training; Life-skills training.
Work/productive activities: Site maintenance and improvement; Vehicle and equipment maintenance; Work projects at collocated units; Battle drills, patrolling and small unit actions rehearsal.
Leisure/recreational activities: Games; Exercise; Sports; Expressive/creative arts; Crafts.
Social participatory activities: Games; Sports; Meals; Parties, celebrations; Ceremonies; Outings.

Table 3. Examples of Therapeutic Occupations Utilized in CSC

There are four primary treatment methods used to accomplish the restoration mission: (1) provide the Soldier with *rest* and respite from the stress of war, (2) offer *reassurance* that the Soldier is not "crazy" and that the symptoms he has experienced are normal reactions to a stressful situation, (3) provide *replenishment* of physiologic needs such as hydration and food, (4) initiate the *restoration* of confidence through engagement in meaningful activity and supportive counselling.[1] The OT utilizes shared mental health skills to provide the first three of these interventions. In the process of reassurance, the OT (and other members of the team) structures a therapeutic environment in the form of a military setting rather than the appearance of a ward setting. The OT also uses active listening and the therapeutic use of self when debriefing Soldiers on their experiences leading to becoming a combat stress casualty. The OT also provides supportive counseling and psycho-educational interventions (for example, stress management) as needed.

The OT employs core occupational therapy skills in the fourth restoration treatment method, the restoration of confidence through the engagement in therapeutic occupation. In the treatment of the combat stress casualty, the OT assesses the casualty's occupational performance abilities and matches these abilities to appropriate therapeutic occupations that support the casualty's "Soldier" identity. This encourages the Soldier's sense of obligation and duty. The OT selects activities that will provide the casualty with a challenge but that afford success. The OT employs successful engagement in occupation to demonstrate to the Soldier that he is still capable and competent. This realization plays the dominant role in the restoration of the Soldier's functional abilities, sense of confidence, and ability to return to duty.

The OT Role in Reconditioning

Reconditioning is the term used to describe those extended rehabilitative measures employed in the 2 to 4 weeks beyond the initial 3 days of restoration.[1] It is usually more intensive and structured, although the principles of CSC continue to be utilized. The OT functions in much the same way as in the restoration mission. However, with a potential extended period of stay, the OT must focus on preventing atrophy of the casualties' adaptive habit patterns and skills (for example, routine preventive maintenance, checks and services of equipment, reflexive battle drills, patrolling skills, etc). The role of the OT in reconditioning is to assess casualties' occupational performance abilities; to engage casualties in therapeutic occupation to prevent casualty decent into a sick role; to maintain or restore adaptive habits and skills; to restore casualties' sense of skills and confidence in the efficacy of those skills; and to return combat stress casualties to a level of occupational performance that is acceptable to their commands and enables them to function effectively. As in restoration, the OT continues to employ ADL, structured military and work activities, recreational activities, and social participatory activities as therapeutic media. The OT also engages the casualties in various psycho-educational activities to develop specific occupational performance skills.

Not all casualties will be able to return to full duty. The OT must evaluate these casualties to determine their current occupational performance abilities, and make recommendations for potential MOS reclassification. Throughout this process, OTs employ the therapeutic use of self when interacting with casualties, providing supportive counseling and participating in critical event debriefings.

The OT Role in Reconstitution Support

Reconstitution is the process of restoring a unit to combat effectiveness following attrition from combat losses. The OT's role in reconstitution support is to assess the occupational performance of Soldiers, to provide consultation to unit commanders, perform critical event debriefings, and to recommend activities to build unit cohesion and Soldier's confidence. The CSC team supports reconstitution through a five-phase process: (I) Preparation and deployment; (II) Reduction of human physical/physiologic and cognitive stressors; (III) After-action debriefing; (IV) Rebuilding unit cohesion, and (V) Performing final CSC requirements for reconstitution support. [1]

Phase I - Preparation and Deployment. In the preparation and deployment phase, the OT gathers information about the unit to be reconstituted and familiarizes himself with the unit and its chain of command. A unique function of the OT in this phase is to observe the occupational behavior of veteran Soldiers to assess for occupational performance deficits resulting from their combat experience. The OTs apply their unique skill of task analysis, along with their experience of observing occupational behavior, to determine if Soldiers have been adversely affected. If Soldiers are found to have occupational performance deficits, OTs can advise commanders on activities to enhance the Soldiers' performance skills.

Phase II - Reduction of Human Physical/Physiologic and Cognitive Stressors. The second phase of reconstitution support is similar to the CSC mission of restoration. The OT and other CSC team members support unit leaders in providing rest, replenishment of the physiologic needs (sleep, fluids, hot food, hygiene), reassuring Soldiers that their experienced combat stress reactions are normal, and maintaining or restoring the combat survivors confidence in their ability to function effectively in battle. As was done in phase I, the OT continues to assess for occupational performance deficits due to combat exposure. The OT can then advise on methods for improvement.

Phase III - After-Action Debriefing. In this phase of reconstitution support, the OT serves as a consultant to unit leaders to assist in the after-action debriefing process. From these debriefings conducted by unit leaders, CSC team members can determine which groups need further critical event debriefings from CSC personnel. The OT is one of the CSC team members who would conduct such debriefings. Part of the critical event debriefing process includes educating Soldiers on managing the stress associated with experiencing traumatic events. With their unique focus on using activity as a therapeutic medium, the OT can advise on engagement in various activities for their effect on moderating Soldiers stress responses.

Phase IV - Rebuilding Unit Cohesion. The OT is especially useful in rebuilding unit cohesion. The OT can advise unit leadership on the types of cooperative group activities that will contribute to developing unit cohesion. Some of these activities may be directly related to combat skills (such as practicing patrolling procedures or small unit movement tactics), while others may be recreational in nature (such as team sports activities). Still other cooperative group tasks such as construction projects may be recommended to foster unit cohesion. Additionally, the OT serves as a consultant to assist with developing unit member's Soldier identity and individual values which foster unit cohesion (courage, competence, candor, commitment, duty, honor, country).

Phase V - Performing Final CSC Requirements for Reconstitution Support. This final phase of reconstitution support involves continued assistance in unit cohesion development, building unit confidence, and bringing closure to unit reconstitution support. In this phase, the OT continues to serve as a consultant to leaders to facilitate building unit cohesion and Soldier's confidence in their leaders and themselves through engagement in purposeful activities (for example, battle drills, sports, social/recreational activities).

The OT Role in CSC Consultation

The OT's role in CSC consultation is to serve as a consultant to Soldiers and leaders on actions they can take to minimize the negative impact of combat stress reactions on occupational performance. The role of consultant is not a new one for an OT.[6] Occupational therapists serve as consultants in areas of practice as diverse as community mental health, community health, preventive mental health, and employee health promotion.[7-15] Consultation in CSC is a natural extension of consultation in these other areas of practice. For the OT, consultation on CSC involves three functions: (1) advising Soldiers on ways to deal with stress or other factors that may adversely impact upon their occupational performance, (2) advising leaders on ways to train their Soldiers to prevent the negative impact of stress on mission performance, and (3) advising leaders on managing Soldiers affected by combat or operational stress.

Advising Soldiers on Enhancing Occupational Performance

The OT may serve as a consultant to individual Soldiers on ways to enhance their occupational performance abilities. The OT works with the Soldier in a collaborative relationship, much as a coach of sport psychology works with an athlete. He helps the Soldier to pinpoint occupational performance problems, identify causes to these difficulties, and generate and implement solutions to these impediments to resolve performance deficits. In providing this occupational performance counseling, the therapist employs the therapeutic use-of-self to establish rapport and to provide emotional support. The therapist then educates the Soldier on the knowledge and skills needed to overcome the performance problem. For example, if the Soldier is having problems performing due to anxiety, the OT may educate the Soldier on methods of stress management or help him to develop relaxation skills. The therapist may educate the Soldier on employing mental imagery, positive thinking or cognitive reframing to enhance performance. The overall goal of this intervention is to give the

Soldier effective resources to make him mentally tough and better able to do the things he needs to do.

Advising Leaders on Prevention

The responsibility for training Soldiers to function effectively in combat rests solely on the shoulders of commanders. The OT is a resource for commanders for information and advice on how to best prepare Soldiers for the stress of war. The OT model called the Model of Human Occupation (MOHO) has been previously described as a framework to guide OT's prevention and management of combat stress casualties.[16] As such, the MOHO can be used as a cognitive framework for therapist's consultation efforts to help leaders enhance their Soldiers' occupational performance. Based on the MOHO and historical knowledge of CSC, the OT consultant educates and advises leaders on:

- Developing a social and cultural environment to develop the warrior ethos and enhance horizontal and vertical unit cohesion.

- The importance of developing and sustaining Soldiers' role identities.

- Conducting values clarification exercises to bring Soldiers' personal convictions and values in line with those of the Army.

- The need to develop the will to fight and expectation to win our nation's battles.

- Developing a Soldier's sense of importance and enjoyment and satisfaction in his duties.

- Developing battle-focused physical training programs that are structured to meet the combat demands of a Soldier's MOS.

- The importance of developing in Soldiers ingrained habits that support optimal occupational performance even when sleep deprived.

- Developing training events to instill in Soldiers this sense of efficacy of their skills.

- Activities that develop psychological fitness and mental toughness.

- The expected normal combat and operational stress reactions that Soldiers may experience.

- The importance of maintaining physiologic homeostasis and its relationship to successful occupational performance.

Table 4 summarizes preventative consultation objectives in keeping with the MOHO.

Advising Leaders on Casualty Management

Combat stress reactions cannot be entirely eliminated. Therefore, leaders, chaplains, and members of the military medical community must all be educated on the early management of combat stress casualties to minimize unnecessary evacuation and ensure appropriate management of these Soldiers. It is the aim of Army CSC doctrine to manage Soldiers as close to their units as possible, within their units if the tactical situation permits.[1] For this reason, another function of the OT consultant is to advise leaders on how to manage Soldiers affected by combat stress. The OT may be called upon to assess a Soldier's occupational performance ability to advise the commander on his ability to perform his duties. For those Soldiers triaged as *Rest* cases, the OT can advise leaders on the types of activities in which to engage Soldiers in order to restore their confidence in their ability to serve effectively. For those Soldiers that have lost combat effectiveness due to the stress of combat, implementing the previously described immediate interventions of rest, replenishment, reassurance, and restoration of confidence can prevent the loss of a valued Soldier and rapidly return the Soldier to duty. Table 4 summarizes casualty management consultation objectives in keeping with the MOHO.

Summary

In summary, the role of the OT in CSC is to evaluate the Soldier's occupational performance and to implement interventions to enhance performance. Occupational therapists support all six of the CSC functional mission areas by applying unique, core occupational therapy skills as well as shared mental health skills. With a focus on occupational performance, the OT offers a distinct clinical perspective compared to other members of the team. As the sole team member to utilize "occupation" as a therapeutic medium, the OT also brings to the team a unique intervention that is invaluable in restoring the confidence of combat stressed Soldiers and thereby enabling them to return to duty. By applying expertise in occupational performance across the continuum of mission areas, the OT provides a distinctive contribution to the CSC team to minimize the impact of combat stress reactions on Soldier's mission performance.

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MOHO Subsystems	Preventative Leader Actions	Casualty Management Interventions
Mind-brain-body-performance subsystem	Soldiers are rested, fed, and hydrated, physically conditioned, mentally tough, preventive medicine measures implemented	Replenish physiologic needs, maintain physical conditioning, afford opportunity for catharsis and psychological decompression, alleviate stress symptoms
Habituation subsystem Habits	Develop habituated combat skills and coping skills	Engage in activities which develop or support habituated adaptive skills, develop new coping skills
Internalized roles	Develop supportive identity as citizen, Soldier, unit member, inculcate warrior ethos, develop family support for Solider role, no role conflicts	Keep close to unit, support identification with warrior ethos and prevent decline into a sick role by keeping close to unit in a military environment
Volition subsystem Personal causation	Instill the will to fight and expectancy to win, develop sense of competence and confidence	Re-inculcate the will to fight and expectancy to win, engage in activities that restore sense of competence and confidence
Values	Develop values concordant with unit and nation, personal convictions support national goals, sense of obligation to peers, unit and nation	Remind of duty, responsibility and importance to peers and unit, develop expectation of rapid return to duty
Interests	Develop sense of importance, enjoyment and satisfaction in duties	Engage in therapeutic activities consistent with interests, engage recalcitrant cases in distasteful activities
Environment	Develop cohesive unit social environment, inoculate to environmental combat stressors	Maintain in military environment, gradually increase environmental stressors

Table 4. Use of the Model of Human Occupation in CSC Consultation (Adapted from Gerardi [1996])

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Nutrition Therapy for Soldiers with Eating Disorders

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Introduction

According to the American Dietetic Association, it is estimated that more than 5 million Americans suffer from eating disorders. Five percent of females and 1% of males have anorexia nervosa (AN), bulimia nervosa (BN), or binge eating disorder (BED). Over the past 10 years, research studies conducted on military personnel suggest that the prevalence of eating disorders is considered significantly higher for both male and female active duty Soldiers than in the general population. Eating disorders exist in all services and among all ranks.

Soldiers and Athletes: A Population at Risk?

Studies recognize that sports and occupations that place a high value on physical performance, leanness, high achievement, and perfectionism can increase the risk of the participant developing an eating disorder. The rigorous physical and emotional demands placed on Soldiers, coupled with stringent height and weight standards are believed to play a role in increasing the risk of disordered eating.

Navy Captain Peggy McNulty's study titled "A Comparative Analysis of the Prevalence and Contributing Factors of Eating Disordered Behaviors Among Active Duty Army, Navy, and Air Force Service Women in the Health Care Arena" found that eating disorders exist in the female military population, regardless of service or rank. The rate of BN was 8.1% in surveyed females, compared to 2% of the general population, while the rate of AN was comparable to the civilian population. The percentage of eating disorders not otherwise specified (EDNOS) was a startling 62.8% of those surveyed, as opposed to 3% - 35% in the general population.

Weight reduction techniques in preparation for the biannual weigh in seemed to trigger disordered eating patterns. "Diet and exercise were the most common techniques used; however, a number of Soldiers used drugs (6.2%), saunas (5.2%), and bulimia (2.7%) to lose weight."[1]

McNulty's work brought to light that men were struggling with eating disorders as well. Her study, "Prevalence and Contributing Factors of Eating Disorder Behaviors in Active Duty Navy Men" surveyed a population of 4,800 Navy men targeted from hospitals, clinics, and ships at sea. Through anonymous surveys, the study revealed a prevalence of 2.5% for AN, 6.8% for BN, and 40.8% for EDNOS among all active duty men, regardless of rank/rate, job assignment, or age. Correlation was also made between the use of vomiting, fasting, laxatives, and diuretics during periods of body measurement and fitness testing. Even more disturbing, year round use of these methods existed in many of those surveyed.[2]

Warning Signs

The military lifestyle can be stressful. Frequent moves, changing jobs, separation from family and friends, as well as the demand for perfection, can have an impact of the progression of an eating disorder. For supervisors, recognizing the warning signs of an eating disorder may be the key to early treatment and/or prevention.

For AN, symptoms may include rapid loss of weight, anxiety or irritability, and social withdrawal. Unusual eating habits such as ritualized cutting or chopping of food or eating foods one at a time in a prescribed order might also accompany these symptoms. Individuals with AN may also increase their consumption of coffee, tea, and diet sodas in an effort to avoid calorie dense foods.

Warning signs for BN could include eating large amounts of food without gaining weight. Coworkers might also notice frequent trips to the bathroom or "disappearing" after meals. People with bulimia often have an increased focus on food, weight, and body size. They may also increase exercise to a point that is unhealthy, refuse to take rest days, or recuperate when injured.

Supervisors and peers should pay attention to Soldiers who report feeling "fat" or dissatisfied with their body. Other signs may include increased talk of diet and weight, or use of diet drugs, laxatives, and diuretics.

If allowed to progress, an eating disorder can compromise job performance and readiness. Without treatment, it is estimated that 20% of people with serious eating disorders die. Mortality rates decrease to 2% - 3% if treatment is available. Recovery is difficult, and only about 60% of patients are successful in stopping the eating disorder behavior.[3]

Diagnostic Criteria

Diagnostic criteria for eating disorders can be found in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR). Each diagnosis is based on psychological, behavioral, and physiological characteristics. Currently, the DSM-IV-10 contains criteria for AN, BN, and EDNOS, which includes BED. It should be understood, however, that a patient could only be diagnosed with one classification of eating disorder. As a result, EDNOS accounts for the majority of the population with eating disorders, since behavior usually follows a continuum rather than a static disease state.

Anorexia Nervosa

The AN is characterized by a refusal to maintain one's body weight at or above a minimally normal weight for age and height. Examples include: weight loss leading to maintenance of body weight less than 85% expected or failure to make expected weight gain during a period of growth leading to body weight less than 85% of that expected. The person will experience intense fear of gaining weight or becoming fat, even though underweight.

Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight are also symptoms of the disease. Females with AN may suffer from amenorrhea (the absence of at least three consecutive menstrual cycles).

There are two subtypes of AN:

- *Restricting Type*. During the current episode of AN, the person has not regularly engaged in binge eating or purging behavior.

- *Binge Eating/Purging Type.* During the current episode, the person has regularly engaged in binge eating and purging behavior.

Bulimia Nervosa

The BN is characterized by recurrent episodes of binge eating. An episode of binge eating is characterized by the following: Eating within a discreet period of time (within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances. The person feels a lack of control over eating during the episode (a feeling that one cannot stop eating or control what or how much one is eating).

There are two subtypes of BN:

- *Purging Type*. During the current episode, the person has regularly engaged in recurrent inappropriate compensatory behavior in order to prevent weight gain. These behaviors include self-induced vomiting, misuse of laxatives, diuretics, enemas, or other medications, fasting, or excessive exercise. In order to be diagnosed with purging type BN, the binge eating and inappropriate compensatory behaviors both occur, on average, at least twice a week for 3 months.

- *Non-Purging Type*. During the current episode, the person has used other inappropriate compensatory behaviors, such as fasting or excessive exercise, but has not regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.

Eating Disorder Not Otherwise Specified

This category is for disorders of eating that do not meet the criteria for any specific eating disorder. For example, a female might meet all of the criteria for AN, except that she has regular menses. Or, all of the criteria for AN are met except that despite significant weight loss, the individual's current weight is in the normal range.[4]

Lesser Known Eating Disorders and Related Problems
Anorexia Athletica (compulsive exercising)

Although not a formal diagnosis, this behavior is often associated with AN, BN, or obsessive-compulsive disorder. The individual with anorexia athletica repeatedly exercises beyond the requirements for good health, may be a fanatic about weight and diet, and is rarely if ever satisfied with athletic achievements.

Muscle Dysmorphia (bigorexia)

Often called "bigorexia," this disorder is the opposite of AN. The person obsesses about being small and undeveloped, rather than too large. They worry that they are too small and that their muscles are inadequate. People with muscle dysmorphia may spend hours in the gym, abuse supplements or steroids in order to become larger, and withdraw from social situations in order to pursue their fitness goals.

Orthorexia Nervosa

Also not an official eating disorder diagnosis, but useful in describing a "pathological fixation" on eating "proper," "pure," or "superior" foods. People with orthorexia nervosa feel superior to others who eat "improper" foods. These foods might include nonorganic or "junk" foods and items found in regular grocery stores as opposed to health food stores. They tend to obsess about what to eat, how much to eat, and how the food is prepared.

Night Eating Syndrome

A person with night eating syndrome will consume most of the day's calories late in the day, or at night. They are usually distressed about the amount of food eaten at night. Although it has not been proven, it is believed that strict dieting during the day may contribute to developing night eating syndrome. The cycle of night eating often continues because the person wakes up full after a night of eating and eats little or nothing throughout the day. There are also reported cases of people eating while sleeping. It is unclear whether or not this is an eating disorder or a sleep disorder.[5]

Treatment of Soldiers with Eating Disorders

Once diagnosed, treatment of an active duty Soldier may prove difficult. The Soldier may have been placed on an exercise restriction or a strict meal plan. With multidisciplinary treatment, Soldiers with an eating disorder may have multiple appointments requiring frequent absences from duty. Command involvement is essential for recovery, ensuring that appointments are kept and goals are met. If a Soldier is not allowed to pursue care from a multidisciplinary team, treatment is usually ineffective.

A military treatment team consisting of a physician, dietitian, and therapist might also be beneficial, considering that the stress and pressures of military life are unique. However, it should be noted that active duty members deserve to seek help without the fear of military separation and loss of employment. If the Soldier is unable to establish trust in their treatment team, the outcome may not be successful.

Multidisciplinary Treatment Approach

Although eating disorders are classified as psychiatric diagnoses, they have nutritional as well as medical implications that require a multidisciplinary team approach in treatment. The team typically consists of a psychologist, medical doctor, Registered Dietitian (RD), and nursing disciplines. Dental exams should also be performed, specifically in cases of bulimia. Each team member should have special training in the treatment of eating disorders to ensure high quality medical care and to improve outcomes.

The RD's Role in the Treatment Team

Since weight management is often an essential component in treating an individual with an eating disorder, the RD is an integral member of the treatment team. However, due to the complex nature of the disease, a dietitian should never attempt to treat an eating disorder without the supervision of a medical doctor and an appropriately trained and licensed therapist.

The dietitian supports and guides change regarding food, exercise, and weight while educating about normal versus abnormal food intake, hunger, and metabolism. He or she acts as a guide in developing a healthy relationship with food. The dietitian continuously reveals to the patient how food, weight, and body image behaviors often act as a means of expression or protection. With specialized training, the dietitian may work with the patient to repair damaged self and body images. He or she should always reinforce the goals of team treatment and the roles of each member.[6]

With new patients, it is crucial to obtain a detailed history during the first few appointments. The dietitian should ask questions regarding weight history, eating habits, exercise routine, and food attitudes. These questions may provide information to direct the course of treatment. For example, exercise abuse and avoidance of dairy products may lead to bone density testing. Individuals with eating disorders often experience medical problems related to their specific disease state. For example, periods of starvation increase the risk of bone loss and patients with bulimia may suffer from gastrointestinal damage. The table on the following page illustrates the medical consequences related to AN and BN.

Patient relationships with the treatment team can influence outcomes. The dietitian should establish a patient relationship that is nonjudgmental, enabling the person to talk about and resolve food issues. With a solid foundation of trust, the patient may also open up about medical concerns, as well as areas for the mental health team to address.

The dietitian can use education tools to help patients understand the physiological responses to starvation and re-feeding. This can help alleviate some of the stress as the patient's eating habits begin to change. Tools include education materials on the function of nutrients in the body, food models to illustrate portion sizes, and charts or information on healthy body weight. These education materials will help guide a patient toward normal eating by challenging eating disordered thoughts and behaviors.

The dietitian can assist individuals in separating food and weight-related behaviors from emotions and psychological issues. Working with a treatment team, individuals learn to separate fear and anxiety from feelings of "being fat" or "too full." For example, an individual with bulimia may binge eat in response to stress or emotional pain, rather than address the uncomfortable feelings. The dietitian's role is to help the

Medical Consequences of Anorexia Nervosa	
Heart Muscle Shrinkage	Amenorrhea
Bradycardia	Brain Changes
Irregular Heart Beat	Ovarian Cysts
Hypotension	Renal Function Changes
Electrolyte Imbalance	Lanugo Hair
Congestive Heart Failure	Skeletal Muscle Loss
Anemia	Leukopenia
Gastric Problems: Delayed Gastric Emptying, Bowel Irritation, Constipation	Metabolic Abnormality: Hypercholesterolemia, Hypercarotenemia, Low Plasma Zinc
Decreased Hormone Levels: Thyroid, Estrogen, Follicle Stimulating Hormone	Emotional and Social Changes: Depression, Liability, Social Withdrawal

Medical Consequences of Bulimia Nervosa	
Obesity Fluid and Electrolyte Abnormalities: Dehydration, Hypochloremia, Hypokalemia, Muscle Weakness, Fatigue, Cardiac Arrhythmia, Seizures	Gastrointestinal Changes: Reflux, Esophagitis, Gastritis, Hiatal Hernia, Large Bowel Atony, Gastric Dilation

patient recognize the difference between emotional and physiologic hunger. The patient should be encouraged to eat adequate amounts of food when hungry and use other coping mechanisms in response to emotional distress. For those with anorexia, treatment may include training the individual to correctly identify physiologic hunger, respond by consuming appropriate amounts of food, and retrain the body to correctly respond to internal cues.

Gradual change is optimal; setbacks are normal. The dietitian should work with the patient to change food behaviors slowly until intake is normalized. Food journals are often incorporated to monitor caloric intake in relation to weight. The patient's food journal can provide reassurance and logic for weight lost or gained. Often, it can take months for an individual with an eating disorder to trust that weight will not rapidly change when normal food intake resumes. Increasing or decreasing weight too quickly can reinforce the concept that the patient is unable to control food intake and their environment. With a food journal, the patient has a permanent record of how eating affects body size.

Through medical nutrition therapy, the dietitian guides the patient in learning to maintain a weight that is healthful without resorting to abnormal eating behaviors. Emphasis is placed on hunger and satiety cues to determine a natural body weight. The patient is taught to identify physiologic hunger, eat until satisfied, and stop when full.

They are also taught to honor cravings for different tastes, textures, and types of foods. The dietitian works with the patient to eliminate thoughts or feelings associated with "good" or "bad" food choices. It may take months or years of treatment before a patient is able to eat appropriately and instinctively.

Patient Screening

Patient screening is the most important step in beginning the treatment process. Dietitians should obtain the most detailed diet, medical, and exercise history possible in order to assess treatment needs.

Anthropometric Data

Current anthropometric measurements and weight history are essential for effective treatment. The dietitian must measure the current height and weight and obtain a weight history from the patient. Usual body weight, weight gains, and losses over time, as well as highest and lowest adult weight, are important factors to determine a safe weight range for the patient to work toward. If a patient identifies an ideal body weight that is lower than any previous healthy weight that they have been able to maintain without disordered eating, this might be unrealistic.

Medical History and Dietary Supplement Use

Review of the current medical situation, past medical history, and supplement use is essential. Vital signs may provide insight as to whether or not the patient is at their optimal weight. Low blood pressure and decreased heart rate are often indications that an individual's health is declining. The medical history can reveal diagnoses such as depression or obsessive-compulsive disorder that may require prescription drug therapy. Thorough dietary supplement questioning may disclose the use of herbal laxatives, stimulants, and diuretics. It is important to detect the use of enemas, saunas, or other methods to decrease water weight. For an individual suffering from bulimia, irregular heart rate may indicate electrolyte imbalances that need to be corrected. Individuals with eating disorders who do not consume enough calories may ingest mega doses of vitamins to "preserve their health."

Eating Habits/Food Rituals

After obtaining a complete medical and dietary supplement history, the dietitian must investigate individual eating habits. Food rituals must be eliminated as part of the treatment process. For example, a patient who will not eat a sandwich with the crust on may cut wider and wider margins around the sandwich to decrease calories. Another might freeze foods or over-season them to destroy the taste. Food fears are common. For example, a patient may fear foods made with fat, or liquids such as juices or milk, which contain calories. The patient might mask these fears by saying they do not like or refuse to eat certain foods. High fat or high calorie foods that individuals with eating disorders tend to avoid are mayonnaise, bread products, peanut butter, and meat.

People with eating disorders may choose restrictive forms of vegetarianism to justify their limited diet. Restriction of protein foods should be addressed immediately. Starvation increases breakdown of lean body mass and protein is essential to preserve muscle tissue. Vegetarians should be educated on the use of beans, tofu, dairy products, and other alternate protein sources.

Patients with eating disorders sometimes develop strict rules to regulate food intake, such as not eating after a certain time each day or unless exercise has been performed for a set length of time. They may also engage in obsessive counting of calories, repeatedly adding the total for the day before allowing any new food intake. These rituals can become compulsive and hinder performance at work or school. It is essential that the dietitian work with the interdisciplinary treatment team, particularly the licensed therapist, to decrease and eventually eliminate these rituals.

Physical Activity

Exercise routine or history is another vital piece of information for the dietitian to use in assessing caloric requirements. It is important to know how often the individual exercises as well as the intensity and duration. To determine if exercise is being abused, the dietitian should assess how activity affects food intake and social relationships. Exercise abuse can occur when the patient refuses to take rest days, works out in spite of injury or illness, and withdraws from friends and family in order to exercise more. If the dietitian discovers this, he or she should report it to the treatment team so that exercise time can be regulated as part of the recovery process.

Food Journal

Food journals are an essential component of treatment. However, most individuals suffering from an eating disorder resist recording their food consumption. A journal should be as detailed as possible, noting the date and time of meal consumed, portion sizes, and brand of food (if available). For some, it may be necessary to ask for a numeric percentage of food consumed. For example, an individual may prepare a bowl of cereal and then only eat 25%. It is essential to analyze and discuss food journal entries in a nonjudgmental manner. Comments on the quantity and/or choice of food should be well thought-out in order to avoid diminishing patient trust. This is especially important when working with a patient who binge eats. The patient may experience a sense of shame when the journal is reviewed and require reassurance. Referral to the licensed therapist may be beneficial.

Ongoing Medical Nutrition Therapy

It is important that patients continue to work with the entire treatment team for optimal medical care. As part of the team, the RD is responsible for monitoring caloric intake and its affect on body weight. He or she works very closely with the medical team who monitor vital signs, electrolyte fluctuations, and weight changes. The dietitian reinforces that food is necessary for good health and encourages the patient to maintain a steady dietary intake. Weight charts can be used to encourage and reassure patients visually that weight fluctuation is normal and that overeating occasionally will not always lead to weight gain.

Follow-up appointments should address specific goals. If weight gain is the goal, food journals are monitored to ensure that intake is sufficient. If this goal is not achieved, recommendations to increase food intake are often made based on the exchange system to help control the rate of weight gain. The dietary exchange system is most commonly used to break food items into units to ensure balance of protein, carbohydrate, and fat. Calcium exchanges are also used to monitor adequate intake.

At follow-up appointments, the dietitian should frequently inquire about supplement intake, purging behaviors, and actual food consumption. Behavior can change from appointment to appointment. For example, a patient who has recently begun to eat normal amounts of food at meals may feel overwhelmed and begin purging to avoid weight gain. Individuals may not voluntarily provide this information if not asked. Treatment is an ongoing process and must be tailored to the individual, as each situation is unique.

Summary

Eating disorders are complex, psychiatric illnesses, with serious medical and nutritional complications. The RD plays a key role in the recovery process. The multidisciplinary approach to treatment is paramount to ensure the safety of the patient and to promote full recovery. The role of the dietitian is multifaceted. The dietitian leads change associated with eating and food perception. He or she promotes adequate intake to maintain a healthful body weight while eliminating eating disordered behaviors such as restriction of calories or binge/purge eating. Continuous monitoring and support are necessary for long-term change.

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Recombinant Factor VIIa and its Clinical Applications

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More than 13 years ago, the Food and Drug Administration (FDA) approved the use of recombinant human coagulation factor VIIa (rFVIIa) for hemorrhage control in hemophilia A and B patients. Since that time, it has been administered in multiple situations other than those associated with hemophilia to achieve hemostasis. The rFVIIa is now being studied for its role in hemorrhage control of trauma patients with normal clotting factors. The U.S. military shares this interest and has been reviewing this pharmaceutical for possible future applications as a lifesaving tool for its front line troops.

Introduction

The pharmaceutical rFVIIa was approved by the FDA over 13 years ago as a hemostatic agent for use in hemophilia A and B patients. This medication has proven to be an important addition in the treatment of these hemophiliacs. Not only has rFVIIa been useful during bleeding episodes but it has also allowed these individuals to successfully receive high-risk surgical procedures where bleeding sequela would have probably led to mortality.

This medication has also been administered in many situations other than those associated with hemophilia A and B. This off-shelf use has grown in frequency and new applications are continually being described. The rFVIIa is now being studied for use in trauma patients who have normal clotting factors. This use has interested the U.S. military. The medication is now being reviewed for a possible future role as a lifesaving tool for front line troops.

To fully understand the clinical applications of this medication, a review of the clotting cascade should be completed. This review will make clearer the reasons why many consider rFVIIa a universal homeostatic agent.

The Clotting Cascade

At a glance, the clotting cascade follows this sequence: (1) formation of prothrombin activator; (2) prothrombin activator converts prothrombin (factor II) into the enzyme thrombin; (3) thrombin converts soluble fibrinogen (factor I) to insoluble fibrin, the structural basis for clot formation and our final goal of homeostasis. The initial formation of prothrombin activator occurs through both intrinsic and extrinsic pathways of blood clotting.

Intrinsic Pathway

The intrinsic pathway is concerned with homeostasis due to damage within (intrinsic) blood vessels. When veins or arteries are damaged through some traumatic event, a protein called tissue factor (TF or factor III) is released. The TF is also known as thromboplastin and is found on the subsurface of the endothelial cells, which line these blood vessels. The TF is also located in cellular monocytes that circulate within the blood. The release of TF initiates clotting. This protein activates factor VII (FVIIa). Factor VII is normally found in circulating blood. Tissue factor and FVIIa then react with calcium ions and platelet phospholipids to activate factors IX and X. Factor X, now activated (FXa), produces small amounts of thrombin. This thrombin activates platelets and cleaves FV and FVIII. Factor VIIIa combines with FIXa, which activates X at a 50-100 fold increased rate than its formation after the TF and VIIa complex. Factor Xa with FVa and the proper membrane surface form together prothrombinase complex. Prothrombinase is then responsible for prothrombin production. This completes the intrinsic pathway of the clotting mechanism.

Extrinsic Pathway

The extrinsic pathway contains fewer steps than the intrinsic pathway. With fewer steps to proceed through, time is lessened with this cascade. When tissue is damaged outside the vascular system, the release of TF occurs, as seen in the intrinsic pathway. This TF is found on the surface of all cells of the body. Higher concentrations of this protein are located on the surface of intestinal, lung, and brain cells. The TF protein then converts FVII into an activated form. Activated factor VII then combines with FX, activating it. Factor Xa then reacts with FV and calcium ions to produce prothrombin activator. This completes the extrinsic pathway.

Common Pathway

The intrinsic and extrinsic pathways then converge into a common pathway. This pathway uses the prothrombin activator, with the addition of more calcium ions to convert prothrombin to thrombin. The thrombin next activates factors

VIII, V, XI, and platelets. These platelets change morphology to expose negatively charged phospholipids. These lipids, along with FVIII and FXI, become a template for the production of large quantities of thrombin.

In the final steps, thrombin, in the presence of calcium ions, converts soluble fibrinogen to insoluble fibrin. Thrombin also activates FXIII to stabilize the fibrin clot. Another effect of thrombin is to act as a positive feedback mechanism thus accelerating the production of more prothrombin activator.

How Does rFVIIa Work?

The rFVIIa works by supporting the normal pathway of the clotting cascade. Although we will now describe this reaction, the specific mechanism of this pharmaceutical and its results are not yet fully understood.

When TF is released from the sub-endothelial level of a blood vessel (intrinsic pathway) that has been injured, rFVIIa binds with it to begin the production of thrombin and fibrin deposition through the normal clotting cascade. In addition, thrombin affects platelets, inflammatory cells, and endothelium, all of which aid in the processes of homeostasis and inflammation.

It is also stipulated that the increased levels of rFVIIa compensate for decreased levels of platelets by stimulating additional nearby platelets to activate, which in turn, enhances platelet aggregation. This is proposed because increased levels of rFVIIa have shown to activate higher levels of FIX and FX, which then induce a thrombin burst. This burst facilitates a decreased time to fibrin clot, by activating platelets, which circumvents part of the intrinsic pathway of coagulation.

Lastly, it has been postulated that the fibrin plug formed by rFVIIa is stronger and more persistent than one that would be constructed in a heavily transfused patient. These individuals may have less effective thrombin due to the storage and age of the blood product given, thus forming a weaker plug.

The rFVIIa also promotes the extrinsic pathway of the clotting cascade. This is done in the presence of TF where it again binds to and begins the clotting mechanism. The start of this pathway also includes the activation of FIX and FX. This again induces a thrombin burst and the faster and stronger formation of fibrin clots at the site of injury.

The rFVIIa is structurally similar to FVIIa. This medication is derived from using the human gene for FVII, which is cloned by placing it in baby hamster kidney cells (BHK cells). The rFVII is then removed in its single-chain form and grown on a media, which contains newborn calf serum. Using autocatalysis, it is developed into a two-chain form. A purifying process to remove all possible contaminants is then undertaken. The final product is supplied in a single-use vial as a white sterile powder ready for reconstitution. This pharmaceutical is a vitamin K dependent glycoprotien consisting of 406 amino acid residues. The vials come in the following volumes: 1.2 mg, 2.4 mg, and 4.8 mg.[1]

This pharmaceutical is expensive. Approximate costs for the three volume vials are as follows: 1.2 mg ($1,764.00), 2.4 mg ($3,500.00), and 4.8 mg ($7,000.00).

The rFVIIa must be kept refrigerated at 2-8^{O}C / 36-46^{O}F. Its pregnancy category is C and is contraindicated in patients with known hypersensitivity to mouse, hamster, or bovine proteins. Lastly, the package insert suggests dosing at 35-70 mcg/kg with evaluation for repeat dosage in 2.5 hours.

Shelf Use

The FDA-approved rFVIIa for use in the treatment of uncontrolled bleeding in individuals diagnosed with hemophilia A or B. These hemophiliacs have inhibitory antibodies against FVIII and FIX, which limits generation of thrombin. Platelets are able to increase production of thrombin when increased FVIIa is present. Normally FVII is found at 0.2 nM concentrations in the blood. When this is increased to 150 nM, thrombin generation appears at the level equal to those without any factor deficiencies. The rFVIIa has been used in patients with Hemophilia A or B during bleeding episodes, intracrainial bleeds, joint bleeding, in the treatment of deep vein thrombosis, and liver disease.[2-14] It has also been useful in the management of those patients during surgical procedures. Some of these procedures include orthopedic surgeries, elective surgery to correct retroperitoneal fibrosis and hydronephrosis, synovectomy, surgical treatment for gastric cancer, emergency placement of a central line, cataract surgery, and for the formation of a spinal epidural hematoma.[15-28]

In hemophiliacs, the early use of this pharmaceutical by home administration has now been reported.[29-32] These reports demonstrate its safety, efficacy, and cost-effectiveness when used in this role.

Other Uses

Although designed specifically for the treatment of hemophilia A and B, rFVIIa has also been used many times in medical settings outside of this arena. This off label use has been increasing for a variety of conditions.

Some documented off label uses include the correction of hemostatic abnormalities related to liver disease platelet defects such as Glanzmanns thrombastenia, Bernard-Soulter syndrome and type III von Willebrand's disease, reversal of oral anticoagulants, in Sever thrombocytopenia, and in dental extractions in cirrhotic patients.[33-44] It has also been shown to have a use in treating intercranial hemorrhaging and severe uremic bleeding.[45-48] In surgical procedures when the repeated use of blood products has failed to acquire reasonable hemostasis, rFVIIa again has proven its effectiveness. Some of these surgical procedures include interabdominal cases, orthopedic cases, liver transplants, in patients following bone marrow transplants, and bleeding associated with acute renal failure.[49-58] This pharmaceutical has also been administered with success during heart procedures. These include intractable bleeding related to valvular repair, closure of atrial septal defect, De Vega's procedure, transposition of the great vessels, in support of bleeding abnormalities in patients with left ventricular assist devices, and during a transected aortic repair (author's own experience).[59-63] In addition and not surprising, rFVIIa has been used in patients with antibodies against FVII.[50, 64-67]

Adverse reactions identified after the administration of this pharmaceutical as of February 2001 include: 16 decreased therapeutic responses, 17 cardiovascular events of which seven were myocardial infarctions, six cerebrovascular events, six cases of venous thrombosis/thrombophlebitis, and one disseminated intravascular coagulation event. Seventeen of these patients died from reactions to this medication. It was also determined that eight individuals who were identified in this data may not have had a side effect caused by the administration of this medication. These responses were the total from an estimated 171,790 doses sold.[68]

Use in Trauma Patients

In the past, rFVIIa has also been administered with success in trauma patients who were in hemorrhagic shock. Case reports concerning a 24-year-old female suffering from six stab wounds and a 19-year-old Israeli Soldier who was shot in the inferior vena cava have cultivated much attention.[69,70] This interest led to studies using swine that received deliberate traumatic liver injuries.[71,72] The reports generated from these studies demonstrated a decrease in mortality in the first hour (golden hour) and prolonged survival rates, compared to placebo groups, when rFVIIa was used. The data also demonstrated its safe use in swine. The information did support possible future uses in trauma patients when hemostasis cannot be achieved in preparation for surgical intervention. There is some concern of thrombotic events when trauma patients suffering blunt injuries or fractures are administered this medication. Additional studies need to be conducted to determine safe use in these types of insults.

rFVIIa and the Military

The U.S. military is also looking closely at the use of rFVIIa for a role in support of its combat forces. Studies have reported that from 50% to 70% of the trauma patients in urban settings who died, did so as a result of uncontrolled hemorrhage. These numbers are higher, from 80 % to 90%, when studying combat deaths related to the Vietnam War.[71] Much of these injuries were torso in nature and at locations where direct pressure could not be administered in hopes of achieving hemostasis. Data is currently being collected to identify protocols for rFVIIa use to include when to administer and at what dose regiment. A Standard Operating Procedure, on the following page, by the U.S. Army Institute of Surgical Research, Fort Sam Houston, TX, was included to outline their views in rFVIIa administration, and suggests an initial dosing of 120 mcg/kg intravenous bolus.

If studies continue to be positive, the military may wish to have this lifesaving product carried by its front line providers. Unfortunately, the price of this medication is an issue, along with the need for temperature control, as is typical for many medications used during field operations.[73] Discussions are ongoing between the manufacturer and the U.S. Army in an attempt to rectify some of these concerns. I have been told that our forces do have this product in some of the Level 3 medical facilities located in Iraq, however, I am not aware of its clinical use there. Lastly, the FDA is considering the approval of a prospective human trial. With use of this medication being considered in multiple clinical settings, it is not surprising that some are looking at rFVIIa as a universal hemostatic agent.[40,62,74,75]

Conclusion

The role of rFVIIa has varied greatly since its approved use by the FDA 13 years ago. The initial use was for hemorrhage in hemophilia A and B patients. Since that time it has been found to be safe and effective in multiple situations gaining a status in some circles as a universal hemostatic agent. The next step for this medication may go beyond its current off label use as a pharmaceutical administered as a "bail out" when multiple transfusions of blood products have failed to achieve acceptable hemostasis. A protocol, which might eliminate the initial infusion of multiple blood products before rFVIIa is used, could be imagined. This would decrease the percentage of reactions and transmitted viruses associated with repeated transfusions. Also, it would circumvent depletion of bloodstocks by some of the bigger trauma cases. As research and dialogue continues over the use of this medication, it is important for all providers to understand its limitations and situational applications.

Standard Operating Procedure for Use of Recombinant Factor VIIa

1. **Background**: Recombinant factor VIIa is FDA approved for use during critical bleeds or surgery in hemophilic patients with inhibitors to FVIII or FIX. Recently, FVIIa has been shown to decrease transfusion requirements in humans with life-threatening hemorrhage including patients with hypothermia (30-33 degrees centigrade, pH 6.99-7.2) In the forward surgical setting, rFVIIa should be considered for administration in patients that require damage control maneuvers in the presence of poorly controlled hemorrhage.

2. **Mechanism**: Recombinant factor VIIa is activated in combination with tissue factor at sites of endothelial injury. High doses of FVIIa result in the accelerated generation of thrombin. The resulting clots are stronger and more resistant to fibrinolysis than normal clots. The potential effectiveness of rFVIIa degrades with time in the patient with poorly controlled hemorrhage due to platelet and coagulation factor consumption. These patients may require clotting factors and platelet supplementation prior to administration of FVIIa. In the forward surgical setting this supplementation is available by the administration of fresh whole blood.

3. **Guidelines for administration in the forward surgery setting**:

a. Consider use in patients undergoing damage control procedures, those with coagulopathic bleeding, difficult to control bleeding associated with hypothermia or significant pelvic hemorrhage.

b. Consider administration of 2 units of fresh whole blood before giving rFVIIa in patients with possible depletion of clotting factors and/or platelets.

c. Dose is 120 ug/kg intravenous push.

d. Consider re-dosing at 20-60 minutes if hemorrhage continues.

e. Consider administration of 2 units of fresh whole blood if bleeding not controlled with the initial dose of rFVIIa. This should serve to replenish the platelets and fibrinogen in the coagulopathic patient.

f. Application of fibrin sealant to site of hemorrhage may be useful after hemorrhage is controlled due to the relatively short half-life of rFVIIa (2 hours).

4. **Storage:**

a. Refrigeration at 4 degrees centigrade (range 2-8 degrees centigrade).

b. Reconstitution is with sterile water for injection at room temperature.

c. The reconstituted solution may be used up to 3 hours after reconstitution.

5. **Contraindications**: The use in patients with known atherosclerotic disease is a relative contraindicated.

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Injury Prevention in the Army: An Ergonomics-Based Approach

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Introduction

In the military, the term "musculoskeletal disorders" is often linked to acute injuries often arising from physical training (running, marching, push-ups), recreational/sport activities, or other off-duty activities. While these cases account for a large proportion of musculoskeletal disorders, there is another set of musculoskeletal disorders that account for significant costs and burden to the military. "Work-related musculoskeletal disorders" (WMSDs) include problems that affect the low back and upper extremities and are associated with work activities/exposures. Specifically, WMSDs include injuries or illnesses of the muscles, tendons, ligaments, nerves, joints, and supporting blood vessels in either the upper extremities or back. Data from both civilian and military populations have indicated that WMSDs are leading sources of lost duty/work, ambulatory care, and disability.[1-5] For the military, WMSDs also have a major impact on troop readiness.[6] Given the public health challenge presented by WMSDs, much effort has been put forth by professionals from a range of fields including medical and occupational health and safety to identify risk factors and develop prevention strategies. Within the U.S. Army, an ergonomics-based focus that integrates policymaking, research and training/education has been used to prevent and reduce the impact from WMSDs. The following describes this approach and provides examples of how ergonomics can help in efforts to enhance musculoskeletal health among Soldiers.

Risk Factors for WMSDs

Before discussing the efforts towards enhancing musculoskeletal health in the Army, it is critical that key risk factors for WMSDs are understood. In the past few decades, a body of research has consistently identified several risk factors for work-related low back and upper extremity disorders.[7,8] Risk factors have been categorized as individual characteristics (age, gender, body mass index), health behaviors (exercise frequency, physical fitness, smoking status), occupational psychosocial (job satisfaction, social support), work organizational (job demands, perceived job control) and ergonomic factors (posture, force, repetition). More recently, intervention efforts have placed a particular emphasis on ergonomic and psychosocial factors.

Ergonomics is the study of human physical capabilities and perceptual characteristics and the application of that knowledge to the analysis and design of work space, work tasks, displays, tools, and equipment.[9] Essentially, ergonomics is fitting the workplace to the worker to eliminate or reduce physical/biomechanical risk factors.

Based on various job analysis techniques and assessment methods, studies of WMSDs have identified primary ergonomic risk factors to include repetition, awkward postures, duration, mechanical compression, forceful exertions, and whole body vibration.[7,10,11] For example, Bongers et al in a study of helicopter pilots and aircrew, found that heavy physical work, including bent or twisted posture and whole body vibration, was associated with back pain (Odds Ratio [OR] = 8.0, 95% CI 4.5-14.3).[10] Bystrom and collegues examined work-related hand and wrist tendonitis among automobile assembly line workers, found an association with several ergonomic risk factors to include frequent hand and finger movements, wrist position and forceful gripping (OR = 2.5, 95% CI 1.0-6.2).[11] Another study conducted by Silverstein et al found an increased risk (OR 2.8) for WMSDs among jobs that are highly repetitive (a cycle time less than 30 seconds or more than 50% of the time doing the same type of cycle) when compared to jobs requiring low repetition.[12]

"Occupational psychosocial factors" represent a broad set of variables that are associated with the experience and/or perception of stress on the job. More recently, epidemiological studies on WMSDs have increased their focus on task and/or organizational-level work processes that may result in stress. These "work organization" factors have conceptualized as relating to scheduling (work-rest schedules, hours of work, shift work); job design (task complexity, required skill/effort); interpersonal (relationships with supervisors, coworkers); career concerns (job security, growth opportunities); management style (for example, participatory management practices, teamwork); and organizational characteristics (climate, culture).[13] While it is unclear how these factors interact with ergonomic factors in impacting the development, exacerbation, and/or maintenance of WMSDs, there is a growing recognition of the need to simultaneously address both sets of factors in prevention efforts.[14,15]

Case-Study: Task Analysis of a WMSD High Risk Occupation

To exemplify how identifying ergonomic/biomechanical exposures can assist with reducing injuries and generating solutions for future prevention, the following case study is given.

Background

Parachute packers represent one high-risk group for WMSD because the task requirements (layout, folding, packing) involve high repetition, forceful exertions, and awkward postures. A breakdown of the specific subtasks involved is listed in the table on the following page.

The parachute-packing task consists of 28 steps (elements), encompassed in four main subtasks (secure chute to tension device, layout chute, fold chute, pack chute) with most of the time spent on the final subtask (pack chute). One operator, with an average packing time of about 17 minutes, usually completes the entire task.

Task Analysis

The main aim of task analysis is to provide a complete description of the task that must be performed to achieve system goals.[16] A task analysis of the parachute-packing task is detailed below. The analysis employs two previously validated task data collection methods, Rapid Upper Limb Assessment (RULA), Ovako Working Posture Analyzing System (OWAS), and one task simulation method, walk-through/observation.[17,18]

The RULA is a survey method developed to assess the exposure of individual workers to risk factors associated with WMSDs, primarily of the upper limb.[17] The RULA uses diagrams of body postures (upper limb, neck, and trunk) and three scoring tables to evaluate risk factors (number of movements, static muscle work, force and work postures). To provide a method that is quick to use, the tool divides the body into two groups, group A that includes the upper arm, lower arm and wrist while group B includes the neck, trunk, and legs. The range of motion (ROM) for each body part is divided into sections numbered so that a score of 1 is given to the ROM or working posture where the risk factors present are minimal and higher numbers (2-4) are given to ROM with more extreme postures. An additional score of one (1) or two (2) is added to each score if the posture meets certain criteria (if shoulder is raised, if upper arm is abducted, if arm is working across midline of body, if arm is out to side of body, if wrist is bent from midline, if wrist is twisted in midrange, or if wrist is twisted near end of twisting range). A muscle use and force score is calculated for each of groups A and B (to include additional load caused by excessive static muscle work, repetitive motions and the requirement to exert force or maintain an external load while working) and added to each of the above scores to produce a final score for each group (score A + muscle use and force scores for group A = score C; score B + muscle use and force scores for group B = score D). Finally, scores C and D are incorporated into a single grand score of 1-7, based upon estimated risk of injury due to musculoskeletal loading.

The OWAS is useful for identifying and evaluating postural demands of work tasks.[18] The method is based on work sampling (fixed-interval or dynamic/random-interval), which provides the frequency of, and time spent in specific postures. The scoring system uses a one digit number (1-4) to code the posture at each joint of interest: Back, is coded as 1 if straight, 2 if bent, 3 if straight and twisted, 4 if bent and twisted; Upper limb, coded 1 if both limbs on or below shoulder level, 2 if one limb on or above shoulder level, 3 if both limbs above shoulder level; Lower limb category ranges from 1-7 such that a code of 1 given if loading occurs on both limbs and both limbs are straight to 7 if both limbs hanging free; Head and neck coded as 1 if straight, 2 if bent forward greater than 30 degrees, 3 if bent to either side greater than 30 degrees, 4 if bend backwards greater than 30 degrees, 5 if twisted greater than 45 degrees. Additionally, there is a load category that allows assessment of the amount of weight lifted or the strength required performing a task; a code of 1, 2, or 3 is assigned (1 is used if the load is less than 10 kg, 2 if between 10-20 kg, 3 if load exceeds 20 kg). The time of the activity is generally recorded for given postures. Results are generated by calculating the percentage of time spent in each posture and an action level 1-4 is determined (1= none, 2= soon, 3= very soon, 4= immediate) for each posture from a table, based on frequency of each posture. According to the developers, postures falling in action category 1 are acceptable, and require no further action, while postures in category 4 are extremely harmful, requiring immediate action to change the posture.

Walk-throughs are generally used to describe components of tasks.[19] Typically, walk-throughs require personnel to demonstrate the task without actually performing it, while explaining necessary details of the task such as how it is done, why and how given materials, equipment, or controls are used. Walk-throughs can take place in real time (with very little comment from the observer or they can be paced to permit more information or clarification from the observer) or simulated. Kirwan and Ainsworth have identified four ways of recording data from walk-through sessions: data sheets, written comments, audio/video recording, and data logging.[19]

Task Analysis Methods Employed and Results

The RULA was used to analyze a parachute packer's

Time*	Subtasks and Elements of Packing a Reserve Parachute
00:00	1. Secure chute to tension device
00:03	a. Attach straps from top of chute to head of table
00:25	2. Lay out chute
00:28	a. Untangle suspension lines
00:45	b. Adjust tension on parachute system
00:58	c. Fold doors
01:43	d. Stabilize chute assembly
01:48	e. Place suspension lines in line holder
01:53	f. Arrange folds
02:25	3. Fold chute
02:28	a. Fold chute along horizontal axis
03:38	b. Position pilot chute
03:43	c. Disconnect chute from tension device
03:58	d. Stow reserve suspension lines
06:33	e. Fold chute along vertical axis
06:38	f. Remove line holder
07:40	4. Pack chute
07:43	a. Compress chute
08:00	b. Reassemble pack
09:00	c. Secure side flaps of pack
09:50	d. Pull end flaps to pack center
10:00	e. Tuck canopy inside pack
10:40	f. Pack pilot chute:
10:40	- Fold pilot chute
10:50	- Compress pilot chute
11:00	- Insert pilot chute into pack
11:20	- Pack pilot chute suspension lines
11:45	g. Tuck parachute canopy into pack
12:50	h. Pull top flap to pack center
13:10	i. Rework canopy
13:30	j. Insert pin
14:30	k. Sign work log
15:30	l. Hookup pack opening mechanism

*Times approximated using a 17-minute video clip of the reserve parachute-packing task.

Table. Steps Involved in Packing a Reserve Parachute

exposure to risk factors associated with work-related upper limb disorders. In order to become familiar with the parachute-packing task and to select the tasks and postures for assessment, the entire task (all 28 steps) was observed during several cycles using a 17-minute video clip of the task. The final subtask (pack chute) was selected for the assessment as this subtask entails the majority of the steps (operator spent the greatest amount of time completing this step) and postures were held for the greatest amount of work cycle (this subtask had the highest exposure to risk factors). Assessments were made of each posture in the work cycle (Steps 4a–4k in table), and only the right side of the operator was assessed, as it was obvious after observing the operator that the right side dominates the task, while the left side acted as a support. The final score assigned for the RULA assessment was seven (investigation and changes are required immediately) with a corresponding action category of 4 (investigate posture and change immediately). The task exposes the packer to forceful and awkward postures (frequent twisting, bending, and rotating) of the wrist, hand, and trunk to compress the chute and pack and tuck chute into pack. The packer is observed to exert a great amount of force and whole body movements to tuck the parachute canopy into the pack and insert the pin.

The OWAS was used to identify potentially hazardous postures (twisted, awkward), frequency of posture, and duration of time spent in each posture. The entire task was analyzed using a 17-minute video clip of the task. A total of 36 observations were made using a fixed-interval sampling of 30 second intervals. The observations demonstrated that the percentage of back, upper limb, and neck exposure during task performance was high: 75% of the time the back was bent, twisted or both, whereas the neck was in a bent position for 70% of the task. Although the percentage of exposure for the upper limbs was 30%, this did not account for the forceful use of the wrist and hand when tucking and compressing the chute. The packer could be heard pounding the chute in an attempt to compress, tuck, and insert it in the cover; these required elevation of the shoulder most of the time and forceful use of the hand. The action category for the postures was assigned using criteria for Case 2 (Static and Dynamic Postures). The action category assigned for the back and head/neck postures (>80 bent for the back and >50 bent forward for the neck) was very soon ("the duration of the posture is distinctly harmful, action to change the posture should be taken as soon as possible").

The walk-through observation was used as a tool in addition to clarifying and describing the task, to evaluate the work environmental factors of the parachute packing area. The data (written comments of the task requirements and the environmental factors observed) were recorded while observing a 17-minute video clip of the entire task. Several potential risk factors for WMSDs were identified: (1) The steps of the task (see table) are fast-paced, with no breaks/pause between steps or subtasks. (2) The packer completes the entire task in a standing position; associated with this problem is the finding that the flooring is made of hard tiles and the working surface (tabletop) is too low and nonadjustable. Prolonged standing on unbuffered surfaces may be a potential source for leg fatigue and low back strain. In addition, the low table height may place the worker at increased risk for low back disorders due to the excessive trunk flexion and side bending required completing the task from its current work level. (3) The temperature in the work area and the clothing worn by the packer (battle dress uniform and headgear) are hot. The packer and other Soldiers appeared to be compensating for the heat conditions by removing their battle dress uniform tops while in the work area. Improper clothing and hot working environments may potentially contribute to heat stress and strain.

Solutions

The proposed solutions are listed in two categories: (1) Engineering controls changes in the physical work environment (equipment or worker) to minimize or eliminate risk factors. (2) Administrative controls (administrative intervention) (for example, policy changes) to minimize or eliminate risk factors.

Engineering Controls. (1) Change the work area layout. This involves a change in either the height of the table (such as replacing the table with one that is adjustable) or the worker level (such as the use of stools, which may not be feasible in this task since the task is highly dynamic). (2) Provide anti-fatigue mats in work area and or provide appropriate footwear for support during prolonged periods of standing. May also minimize the need for prolonged standing by incorporating work/rest cycles. (3) Increase ventilation in work area (fans, windows, air conditioning) and allow use of lightweight clothing such as the physical fitness uniform. (4) Incorporate the use of mechanical aids for all or some subtasks, particularly the "pack chute" subtask.

Administrative Controls. (1) Incorporate work/rest schedules, allowing for breaks between work cycles. (2) Rotate jobs to allow periods for the musculoskeletal system to rest and recover.

An Integrated Approach to Targeting Ergonomics

The U.S. Army Center for Health Promotion and Preventive Medicine Ergonomics program serves as the Department of the Army (DA) consultant on ergonomics and provides installation level services to include consultation and training. The goal of the program is to support military readiness by creating a culture that focuses on identifying, controlling, and eliminating ergonomic stressors in the work environment that affect the performance of our military and civilian DA employees.

The Army Ergonomics Program (AEP) targets ergonomics through interrelated efforts that form the basis for an integrated AEP strategy (see figure on page 44). This strategy aims to reduce/eliminate WMSDs on individual and installation levels, and is summarized in the following.

- Top Down - the AEP has had major involvement in the writing and implementation of Department of Defense (DOD) policies (DOD Instruction 6055.1, 6055.5). These efforts have involved several key offices and groups, to include Deputy Under Secretary of Defense (Environmental Security), Assistant Deputy Under Secretary of Defense (Environmental Readiness and Safety), Assistant Secretary of the Army (Installation, Occupational and Environmental Health), and DOD Ergonomics Working Group.

- Applied Research - the AEP has implemented a number

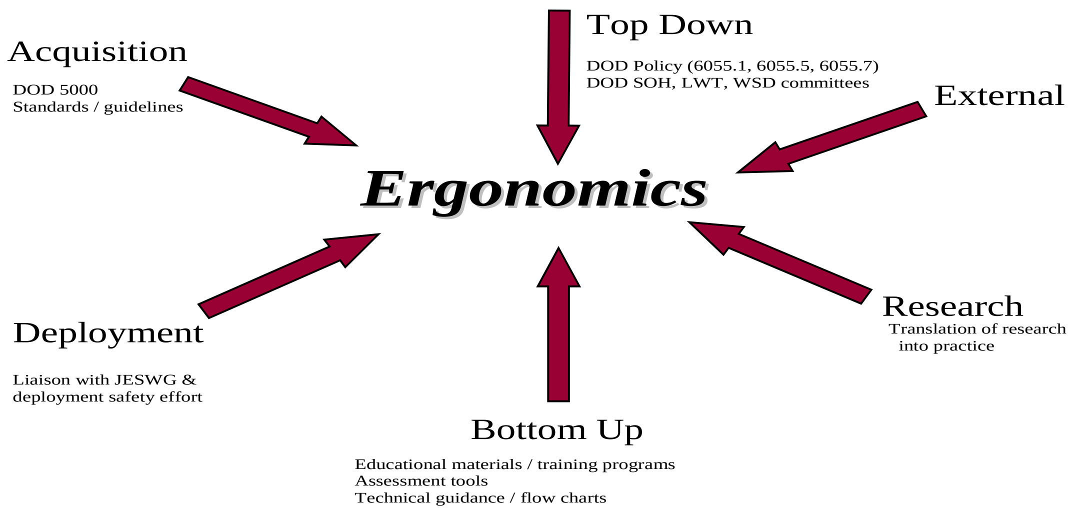

Fig. Army ergonomics strategy summary.

of initiatives from the research work done at several agencies, to include the U.S. Army Research Institute of Environmental Medicine and Department of Veterans Affairs, to military populations to reduce ergonomic-related injuries. Current initiatives include the Safe Patient Handling program at Walter Reed Army Medical Center, which translates research studies on safe patient handling for reducing nursing risk of injuries from patient movement/transfers into practice. Other recent initiatives involve development of a powered hand tool to reduce WMSD risk among DOD workforce performing repetitive hand tasks; load carriage initiative that involve training Soldiers optimal rucksack fitting and loading principles for musculoskeletal injury risk reduction and optimized Soldier performance and military occupational specialty study to identify ergonomic high-risk work tasks and implement engineering controls to eliminate/reduce WMSD risk early in military career.

- Bottom Up - the AEP is routinely involved in providing training, tools, and assessments at installations and assisting installations in establishing ergonomics programs. The AEP offers a 40-hour course in ergonomics that is attended widely by a variety of disciplines within the DA and DOD to include engineers, occupational medicine physicians, purchasing/ logistics personnel, and line supervisors. Recently, AEP, the Army Medical Specialty Corps, and the Uniformed Services University of the Health Science's (USUHS) Department of Preventive Medicine/Biometrics and Department of Medical/ Clinical Psychology created a specialty emphasis track within the Masters of Public Health (MPH) program at USUHS. This specialty track involves courses in occupational ergonomics, human factors and safety engineering, and work analysis methods in addition to MPH core courses in epidemiology and biostatistics.

- Acquisition - the AEP provides support to the Army material acquisition process at different levels to include performing musculoskeletal health hazard assessments. The AEP's role in health hazard assessments serves to enhance Soldier performance and readiness by identifying and minimizing potential ergonomic health hazards related to tactical equipment use in garrison and field operations.

- Deployment - the AEP is working to support injury prevention efforts in deployed environments by collaborating with therapists and other health personnel to provide consultation to identify and control potential ergonomic problems.

Program Elements

Work-related musculoskeletal disorders/injury prevention efforts at Army installations should involve ergonomics. AR 40-5 (Preventive Medicine) and AR 385-10 (The Army Safety Program) provide guidance for implementing an Ergonomics Program. Installations that have implemented successful ergonomics programs have seen measurable results in terms of protecting the workforce, increasing productivity and quality, decreasing workers' compensation expenditures, increasing readiness, and reducing absenteeism and employee turnover. Five critical program elements must be accomplished to successfully implement an ergonomics program at an Army installation [20]:

- *Worksite Analysis*. Conduct an organized and guided analysis of all worksites.

- *Hazard Prevention and Control*. Assess job hazards and provide corrective solutions when necessary.

- *Health Care Management*. Establish and implement a written plan for systematic evaluation, treatment, and follow-up of workers with symptoms of WMSDs.

- *Education and Training*. Organize a program of education and training on aspects of ergonomics applicable to your installation.

- *Ergonomics Program Evaluation*. Assess the effectiveness of the ergonomics program using a variety of evaluation methods at least annually.

Summary

The WRMD present significant burdens to the Army and military in general. Strategies that reduce/eliminate these burdens protect the health of our active duty Army Soldiers, allow resources to be allocated to other areas, generate cost savings, and enhance troop readiness. One critical part of any prevention effort for WMSDs must address ergonomic factors. Within the Army, the AEP uses an ergonomics-based approach that incorporates policy, research, application, and education/ training to mitigate WMSDs. Through this integrated program, the AEP has presented a viable approach for protecting the musculoskeletal health of our active duty Army Soldiers and DOD civilians. The AEP plans to push forward with greater implementation at installations Army-wide.

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Occupational Therapy in the Management of Lateral Epicondylitis

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Introduction

Many things that happen within the walls of a rehabilitation clinic are based on anecdotal evidence and support. Often, therapeutic techniques and methods have scant research to support their validity. Some methods are simply "hand-me-down" recipes of a therapist's predecessor, who has "just always done it that way." This type of passed-on knowledge is being challenged in the current health care marketplace, and rightfully so.

While it is understood that no harm is intended, or for that matter usually inflicted upon the recipient of care, it is no longer acceptable to just avoid harm; rather, it must be proven that the services provided are, in fact, facilitating progress toward recovery. The profession of occupational therapy (OT) is responsible to advance the science of OT, and individual therapists are accountable to patients; therefore, both the profession and the individual therapists must begin to answer the questions that prove the methods legitimate, resource-worthy (cost, time, staff), and effective.

An area of pronounced disconnect between what is done in the clinic and what is supported by quality literature is the therapeutic use of physical agent modalities (PAMs). The clinical use of PAMs is also controversial because of the suggestion that using them veers too far away from the roots and scope of OT.[1] The PAMs are only to be used as an adjunct to therapeutic engagement in occupation, and may enhance clinical practice if used to improve a patient's performance within a given occupational role.

Each day, thousands of patients receive ultrasound, iontophoresis, heat, cold, paraffin, electrical muscle stimulation, and fluidotherapy. It is the right of each patient to *ask* if his treatment is effective, and it is the responsibility of the therapist to *answer*. Evidence-based practice is more than a health care trend: it is the standard. It is ethical. It is necessary. It is important. It is job security.

This article seeks to explore the literature of the use of PAMs in treating lateral epicondylitis. First, a brief background on lateral epicondylitis will be given. Second, a patient will be introduced, and his course of rehabilitation will be outlined. The treatment options and the clinical reasoning used to drive the planning of his rehabilitation will be examined; this will include reviewing the literature for substantiating evidence on the use of PAMs to treat lateral epicondylitis.

Lateral Epicondylitis: A Starting Point

Lateral epicondylitis, also known as tennis elbow, is typically a work-related, repetitive strain, or idiopathic condition. In 1873, Runge first defined it as pain at the origin of the wrist extensors from the lateral epicondyle of the humerus.[2] There is widespread consensus about the presenting symptoms of tennis elbow; "the most important single diagnostic finding of lateral epicondylitis is the location and reproducibility of the pain."[2] The patient may be easily diagnosed, but both the treatment and cause of the condition are subject of much study and debate.

There are mixed theories regarding the pathophysiology of tennis elbow. For many people, the condition is believed to be one of inflammation and scar formation that causes premature degeneration of the common extensor tendon.[2,3] Others, however, purport that the term epicondylitis erroneously implies that the condition is inflammatory, stating that when tissue specimens from surgery are examined in pathology, no acute or chronic inflammation is found.[4-6] As a third alternative explanation for the etiology of epicondylitis, a 1995 study (Boyer and Hastings) suggested that epicondylitis could be related to ingesting antibiotics containing fluoroquinolone.

In a well-designed study of the histopathology of chronic lateral epicondylitis, it was concluded that the process of epicondylitis is degenerative and not inflammatory.[7] In this study, 11 tissue samples from patients who underwent surgical correction of refractory lateral epicondylitis were compared with a control group of 12 cadaveric specimens. The results of this study showed that none of the 11 surgical samples had inflammatory cells or subtendinous granulation. The value of having the 12 control cadaveric specimens was that it was demonstrated that a definitive pathologic tissue changes. Reagan et al suggest that failed treatment programs are the result of treating an inflammatory process rather than a degenerative one.[7] The pathophysiology of tennis elbow is unclear.

Patient Background

Staff Sergeant John Walker was a 32-year-old, right hand dominant white male. He was on active duty and was stationed in Colorado, attached to the 7th Infantry Division. He had been in the Army for close to 15 years. He was referred to OT from the Troop Medical Clinic for right elbow pain. His goal was to "get rid of the pain in my arm so I can work without it hurting again."

Staff Sergeant Walker was a smoker with no relevant past medical history. He reported his pain to be 7/10 on a visual anologue scale when using the arm, and 4/10 at rest. Pain had been present for 6 weeks, progressively worsening. Patient had no recall of trauma, and reported sensation to be normal. No visible or measurable edema at, or distal to, the elbow. No abnormal valgus/varus posture. Patient was able to actively move all upper extremity joints through full range of motion. Pain was reproduced with palpation of lateral epicondyle and while resisting wrist and middle finger extension (elbow extended).

The location of pain was directly over the lateral epicondyle. Patient reported minimal to no pain with palpation over Archade of Frohse with no other radial nerve irritation symptoms. Sensation was found to be intact using the Semmes Weinstein Monofilaments. He could discriminate light touch. Right grip strength with dynamometer was 100 lbs with elbow flexed and 65 lbs with elbow extended. Patient reported pain while gripping in both positions. Left grip strength was 145 lbs with elbow flexed and extended; no pain reported. Dexterity was normal for gender and age, as assessed by the Moberg Pick-up test. During this test, scapular destabilization was noted, as a compensatory movement pattern to avoid full elbow extension.

Staff Sergeant Walker reported a typical occupational pattern for military Soldiers: always engaged in something physical. He was a high school graduate. His military occupational specialty (MOS) was as a 63M, Bradley mechanic. He worked 10-hour days as the sergeant in charge of his motor pool. He was required to supervise junior enlisted Soldiers and enjoyed working alongside them. His work tasks required the following: frequent lifting of vehicle parts greater than 50 lbs; use of wrenches and many other hand tools which required both gross motor and fine motor control and dexterity, as well as strength; work in hard-to-access areas within the vehicles; stooping, bending, and prolonged standing for extended periods of time; reaching, lifting, carrying of medium to large objects; and overhead work. His MOS was demanding, and when his unit was in the field, all these tasks were performed in the elements and with limited access to laborsaving devices.

At the time of initial evaluation, he was having difficulty participating in all work tasks secondary to pain and the decrease of strength that was resulting from pain. He complained of pain for normal reaching tasks, driving, carrying groceries, mowing the lawn, walking his dog, and picking up his children. Additionally, he had stopped participating in his hobbies of archery hunting, bowling, and carpentry for home repairs/improvement; he was diagnosed with right, humeral lateral epicondylitis.

Treatment Options: Engineering the Best Plan

Ultrasound, phonophoresis, iontophoresis, electrical stimulation, manipulation, soft tissue mobilization, neural tension, frictional massage, stretching, icing, splinting, laser, acupuncture, extracorporeal shock wave therapy…there are over 40 treatment options suggested in the literature for the treatment of lateral epicondylitis.[3,4] These nonoperative treatment options are poorly researched; a sound scientific rationale for the treatment choices is missing.

The most common and widely used treatment of tennis elbow is the counterforce brace, which is based on a mechanical view.[3] The brace is set distal to the common origin of the wrist extensors and is used to create a new origin of pull, thereby relieving the stress of the extensor's origin at the lateral epicondyle. In addition to the brace at the elbow, therapists also splint the wrist in neutral or slight extension to decrease the passive stress on the extensors caused by active wrist flexion. In either proposed pathoetiological scenario, inflammatory or degenerative, this nonelectrical treatment strategy makes sense: it rests the involved area, allowing for healing of damaged (and possibly inflamed) tissues.

In a systematic review of the use of ultrasound therapy for the treatment of musculoskeletal disorders, 38 studies were reviewed.[8] Specifically, this review analyzed studies related to five diagnostic categories, one of which was lateral epicondylitis. Several deficiencies were found in all 38 studies, including small study sizes, lack of long-term follow-up exams, poor statistical power, and no control group. There were six studies reviewed on the efficacy of ultrasound in treating lateral epicondylitis. Three of these studies were assigned a high validity score, but only one study on lateral epicondylitis reported statistically significant and clinically relevant results in favor of ultrasound. This review underscored the need for quality clinical trials of ultrasound therapy, citing that there is "little evidence to support the use of ultrasound therapy in the treatment of musculoskeletal disorders."[p 269]

In a meta-analysis searching for scientific evidence for the treatment of acute lateral humeral epicondylitis, 78 articles regarding the treatment options were scrutinized.[9] Of the 78 articles found, only 18 studies utilized control groups. These 18 studies were the ones examined by the researchers. They categorized the treatment options into ultrasound, ionization, nonsteroidal anti-inflammatory drugs (NSAIDs), steroid injection, and other treatments (physical manipulation, manipulation with forearm straps, and anti-inflammatory topical creams, electromagnetic fields, and placebo). Only one study revealed a significant therapeutic effect; it concluded that ultrasound was better than sham ultrasound. Each study was given a percent score, from 0 to %, based on acceptable study design evaluations. The study that showed ultrasound as an effective treatment earned a score of 44%. Another study, that received a score of 73%, demonstrated that there was no significant difference between ultrasound with phonophoresis and placebo ultrasound or between phonophoresis with or without friction massage.

This meta-analysis offered substantial wisdom in critically analyzing the literature as related to the treatment of lateral epicondylitis: it warned that all studies possibly made type 2 errors, which is failure to capture a treatment effect. In other words, there *could have been* a difference based on the intervention, but the study was not sensitive enough to determine it. Most of the randomized and controlled trials were poorly designed so results must be interpreted with caution.

After considering the research related to the treatment of lateral epicondylitis, including the use of PAMs, a treatment plan for SSG Walker was designed. In order to improve patient compliance and administrative and therapeutic control, SSG Walker was given a daily treatment schedule. He reported to the OT clinic every morning after the cardiovascular portion of physical training (PT). This allowed him to take part in platoon runs, but eliminated his participation in muscle building exercises of push-ups, pull-ups, and other in-gym circuit weight training. He was placed on a physical profile for 30 days to restrict push-ups and pull-ups, as well as limit his lifting to 30 lbs. He was given a counterforce armband and instructed on proper wear and care at the initial appointment. Additionally, he was given a wrist control splint to wear during sleep to limit prolonged postures of wrist flexion.

During his daily OT sessions, SSG Walker received ultrasound therapy: pulsed (1:4) at 1.0 MHz at an intensity of 1.5 w/cm^2 for 8 minutes. His ultrasound was given by the Certified OT Assistant, who used a coupling medium to apply the ultrasound directly to the lateral epicondyle. Following each ultrasound treatment, SSG Walker stretched the wrist extensors by actively flexing the digits and wrist (elbow flexed). He continued these stretches while extending the elbow to a tolerable position, using pain as his guide. He was never passively stretched. Following each 1-hour OT session, SSG Walker massaged his elbow for 10 minutes with ice that was frozen in a Dixie cup. He also did this at home 2-3 times each day.

During the initial sessions when he was primarily receiving ultrasound and stretching very gently, the occupational therapist registered (OTR) taught him about proper lifting and activity modification. He was also educated on soft-tissue healing and the importance of rest and a healthy lifestyle. He admitted to working through the pain in order to "get the job done." This was SSG Walker's approach to all tasks, including his carpentry home-improvement hobby. He was asked to keep an activity log for 10 days to track his activities and his pain. After 10 days, he reviewed this log with the OTR and discovered a pattern of pain that worsened after extended periods of repetitive and high-demand (physical) tasks. The initial 10 treatments were primarily a period of controlled rest for his painful upper extremities.

Other treatments included education and practice with force regulation. Staff Sergeant Walker applied excessive force in operating the tools of his trade. The quality of his movement was initially poor, because of pain that was inhibiting him from correctly performing the tasks. He described holding his arm in awkward postures in order to reach work areas inside vehicles. He was educated on principles of joint protection and activity balance.

Toward the end of the second full week of therapy, he reported being pain-free at rest. He then began to complete a series of isometric exercises with his elbow positioned in 90 degrees of flexion. He progressed to isometrics with elbow extended. He then began to progress through isotonic exercises in the same fashion (from elbow at 90 degrees of flexion to full extension). He was also given radial nerve gliding exercises to complete.

He engaged in a Valpar toolbox activity to practice force regulation and force control. During this activity, he was educated on postural control, namely scapular stabilization since this was the most obvious of his abnormal, compensatory movement patterns. He required intermittent verbal and physical feedback for cueing to eliminate scapular destabilizing movements.

After his re-evaluation at 3 weeks, he had completed a full course of ultrasound. therapy: 15 sessions. He had been pain free at rest and had progressed to isotonic exercises and was able to participate in a simulated bowling activity using a 3 lbs bowling ball. He was then advanced to a Baltimore Theraputic Equipment (BTE) program of exercises. These were designed to address the issues of avoiding sustained awkward postures and torque to increase his work tolerance and maintain muscular strength and to address issues of work pace. His recovery was staged so that, eventually, he was able to engage in overhead, job simulation activities with full supervision.

work tasks in the OT clinic. He shelved rehabilitation supplies, swept the pediatric treatment area and waiting room, and hung bulletin board announcements. He reported minimal to no pain during these activities. This helped SSG Walker transition from the patient role to the role of a healthy Soldier tasked to the hospital unit. He was encouraged to help, to the best of his pain-free ability, with clinic maintenance tasks.

Also, during this last week, he worked on mock archery shooting. He brought in his bow from home. He reported that he realized how much less force he needed to apply to "draw" the bow into position than he previously used. He seemed pleased to share his hobby with the OT staff and the other patients. He also was introduced to a new hobby of painting. The painting was affixed to a mirror with the supplies at medium range. He was able to work on fine motor control and upper extremity muscle endurance through these paintings. Contrary to most of his MOS duties and hobbies, painting challenged SSG Walker to use very little force, and train his muscles to respond accordingly.

After 6 weeks of daily treatment, he was re-evaluated. His grip strength in the affected limb had risen by 30 lbs to 95 lbs with elbow extended; and grip increased to by 25 lbs to 125 lbs with elbow flexed. He was no longer tender to palpation, although symptoms could be provoked with forced wrist flexion and elbow extension. His pain was reported at 2 out of 10 with overhead activity, and 0 pain at rest. Staff Sergeant Walker's response to OT intervention was favorable. He was instructed to return to OT for another follow-up in 6 weeks. During this time away from OT, the OTR referred him to the Wellness Center for an evaluation. He was enrolled in the smoking cessation class, back-health education, and healthy living classes.

Clinical Reasoning: Guiding Model of Practice/Frame of Reference

More important than the question of "what?" to do with a patient, is the logical, but occasionally disregarded, question of "why?" In this portion of the article, explanations for the treatment plan will be covered, including the clinical reasoning used to structure intervention.

The model of human occupation (MOHO) was the model that served as the foundation for assessment and intervention. All three subsystems of the MOHO, volitional, habituation, and performance, were examined. Additionally, under the guidance of this model, the environment of the patient's performance was considered. This model is compatible with the biomechanical frame of reference which guided the therapist in assessment of movement, pain, strength, endurance, sensation, and manual dexterity. It drove the decision process for activity planning and pacing, splinting, tolerance to task and endurance training, and modalities selected.

The location and severity of the pain, the age and general health of the patient, and the occupational demands and occupational performance abilities were considered. A top-down, client centered approach was used in the overall engineering of the care plan. The treatment sessions were appropriate and meaningful, based on the patient's occupational history and interests.[10] The patient's pain and physical capacity to participate was the guide for therapeutic activities and exercises that were used to prepare him to perform his functional occupations for work, home, and leisure tasks. "Active occupation was the primary modality of OT, designed to stimulate function and to lead to improved function."[10] The therapist facilitated and guided the process in collaboration with the patient, who experienced personal gratification for his involvement in his own treatment and recovery.

Staff Sergeant Walker was seen daily for command and control issues; in other words, so the OTR could have her eyes and hands on him. When a Soldier is with his unit for regular PT, he is likely to engage in the training regardless of what his profile limits. Also, a daily interaction allows for frequent check-ups and readjustments to care. A less evident motive for daily contact was to establish a rapport with the patient. He was an excellent example of a patient invested in his own rehabilitative care. He learned about his condition and about his MOS tasks that posed at-risk factors.

He was given the counterforce brace in spite of the literature's questionable evidence base for such a treatment.[11] Despite the flaws in the studies to support counterforce bracing, an overall consensus in the literature seems to be positive. Also, the mechanical explanations for use of the counterforce brace makes sense, and should be examined before discarding a viable conservative treatment option. It was further reasoned that, if for no other reason, the armband served as a physical and proprioceptive reminder to the patient, and as a visual reminder to his squad members in the motor pool. The nighttime wrist control splint, which positioned the wrist in 20 degrees of extension, was issued because the patient reported a sleeping posture of wrist and digit flexion. This treatment is not defined in the literature, but has been anecdotally reported as successful; and like the reasons for the counterforce brace, made sense from a mechanical and anatomical perspective.

In selecting a PAM to use with this patient, ultrasound and iontophoresis were the two considered because of their access in the treatment clinic. To ensure a safe and effective selection, the biophysical properties of the modality and the proposed mechanism of pain modulation were considered, as well as the precautions and contraindications.[12] The studies reviewed for the effectiveness of iontophoresis presented mixed pictures. Bertolucci demonstrated that iontophoresis was more effective than placebo in treating shoulder tendonitis, but the results may not be indicated for the treatment of lateral epicondylitis (which may or may not be an inflammatory condition).[13] In another study, a case study, iontophoresis was paired with phonophoresis.[14] This combination seemed to irritate and exacerbate the patient's elbow pain. In this particular case study, the patient's pain did resolve; however, it was proposed that it could have been a result of the effects of the other treatments given to the patient, to include transcutaneous electrical nerve stimulation, forearm epicondyle sleeve, and cryotherapy. This study was flawed because of its lack of control for co-interventions and therefore could not serve as evidence for the use of iontophoresis.

The third study reviewed on ionotophoresis evaluated the difference in two NSAIDs used, sodium salicylate versus sodium diclofenac. There were two groups of 20 patients each. Each one received iontophoresis with the corresponding drug of that group. Both groups experienced a decrease in pain over the course of daily treatment for 3 weeks. The only other treatment during this time was rest. Unfortunately, they didn't use a control group of no treatment or a placebo group, so the results are questionable. This study was not considered as evidence to select iontophoresis to treat SSG Walker. It would have been an obstacle to get permission to access either of the drugs used in this study, as dexamethasone was the corticosteroid used in the OT clinic.

Despite over six decades of therapeutic use, the effectiveness of ultrasound remains questionable when used to treat musculoskeletal disorders.[15a] One glaring limit in the research on the use of ultrasound is the lack of reported effective dosage, "there is little scientific basis for dosage selection in clinical practice."[15b, p 1348] Therefore, the ultrasound treatment was designed after the success reported in Binder's and Davidson's study.[16,17] Both of these studies demonstrated that ultrasound therapy was superior to placebo treatment for pain level and grip strength, and lifting. The dosage was 1:4 pulsed, 1.0 MHz, 1.5 W/cm^{2}.

Ultrasound was indicated because SSG Walker was experiencing decreased performance in his occupational role as a Soldier, at home with his home management tasks, and at his leisure pursuits. Ultrasound has been indicated to decrease inflammation or facilitate tissue repair, and given the research, lateral epicondylitis may be the result of either inflammation or tissue degeneration. A consensus on the pathoetiology of lateral epicondylitis is needed in order to select a best treatment course. The patient did not have any contraindications to use ultrasound.

Staff Sergeant Walker used ice massage following each hour of treatment for pain control.[18] He became independent in this modality and reported continuing to utilize this inexpensive and easy to replicate modality at home. Additionally, this is a modality that is "field expedient" and could be accessed while deployed on training exercises.

Modalities were not used as a stand-alone treatment. The ultrasound used was initially paired with rest, splinting, controlled motion, and patient education.[19] This treatment modality was an adjunct to care that served to decrease painful movements so the patient could participate in a therapy program aimed to return to duty (RTD) a viable Soldier.

Clinical observation and activity analysis were powerful in deciding on the rehabilitative course for this Soldier. After SSG Walker's problems were discerned and his motor patterns evaluated, functional goals were established. These goals were written through collaboration with the patient.

Many imbalances were prominent. Because of the noticeable imbalance of force between extensors and flexors during work, some treatment time was used to teach him about force regulation. Another notable area of imbalance in the patient's life was between work and rest. Under the volitional subsystem in the MOHO, his motivation and personal causation was examined. Staff Sergeant Walker accurately described himself as a "hard charger." He was motivated to get back to his hobbies and was driven to RTD. His tendency to be "all work and no play" was addressed through the activity log and education about life balance.

The environment was considered as a vital component to address in therapy because of its influence on occupational performance. The OTR did not do a work site evaluation in this particular case but had done one in the past for another patient. The information gained through that work site analysis was utilized. Changing the work environment was not supported by the command, based on budgetary constraints; therefore, it was the responsibility of the OT staff to educate the patient how to better interact within the environment. This was done from day one, until the final day of therapy. The BTE program was designed to give SSG Walker a workout program to ensure controlled exposure to risk factors of overuse, torque, repetition, and prolonged awkward postures. He was guided through the proper response to each of these risk factors. It was a rehabilitative goal to increase his tolerance to tasks to better match the task demands of his MOS. This program best addressed the performance subsystem within MOHO. His abilities to regulate force, interface with tools and objects, and maintain endurance without pain were improved by the computer feedback and the therapist's feedback during the BTE activities.

The habituation subsystem of the MOHO was the hardest to influence, as was expected. His habits and role patterns were engrained. He did attend the Healthy Living and Smoking

Cessation classes at the Mountain Post Wellness Center, but was unable to sustain a nonsmoking lifestyle. Based on the education he received in OT, he reported modifying home maintenance tasks of mowing/grooming the lawn, carrying groceries, lifting the children, personal car care, and even walking his dog on a leash. He received education in his role as motor pool sergeant by the lieutenant in the OT clinic. She spoke with him about delegating the more manual, repetitive tasks to his subordinate Soldiers, and enforcing a "smarter" work-to-rest schedule in the motor pool. She educated him on task variability and planning. He did report success in changing his organization of the motor pool's work schedule.

Conclusions

This article demonstrates the effectiveness of a well-rounded and thoughtfully coordinated treatment plan. The use of PAMs served as an adjunct to traditional OT modalities, with the principle modality being active occupational engagement. The powerful illustration of the effectiveness in OT lies in the unique treatment sessions, designed specifically for SSG Walker. The research reviewed in designing a treatment plan demonstrated that there are few effectiveness studies on the sole use of ultrasound or iontophoresis in treating lateral epicondylitis. What is needed is not replication of the same studies, but new studies that demonstrate that using PAMs, in conjunction with active occupational engagement and progressive, graded exposure to risk factors through well-designed activities, is far better than using PAMs in isolation, or in rehabilitation plans without PAMs. Until the research debt is paid with quality, occupation-focused studies, today's therapists must be committed to offering patients the best care based on, and perhaps occasionally in spite of, what existing studies suggest. Good clinical reasoning starts with a heart for the safety and improved health of the patient, and with a mind of discernment towards what the published research advocates.

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Conservative Management of Back Pain: A Literature Update

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Introduction

Most adults suffer from low back pain (LBP) at some time in their lifetime. The resulting medical costs and work-related productivity losses make LBP one of the most expensive ailments to our society today.[1] In the military, LBP is one of the largest detriments to Soldier health and mission readiness. Back disorders are among the most common causes of hospitalization, ambulatory medical visits, and restricted duty days in the U.S. Armed Forces.[2] The high cost, along with the lack of consistency of medical treatment for LBP, has resulted in the creation and implementation of clinical practice guidelines (CPG) for the management and treatment of LBP around the world.

In 1998, a team of 21 primary care, occupational health, physical medicine physicians, physical therapists, and orthopedic surgeons from the Veterans Health Administration (VHA) and Department of Defense (DOD) reviewed the available literature and previously published LBP CPGs to create the *VHA/DOD CPG for the Management of LBP or Sciatica in the Primary Care Setting* (VHA/DOD LBP CPG).[3] The stated purpose of this guideline was to "promote evidence-based management of persons with LBP or sciatica and thereby improve clinical outcomes." The guideline also stated that it "will be updated as further research results become available and end-user feedback is obtained from the field trials in both the VHA and DOD health care systems."[3] As of this writing, no such update has been published.

In 1993, the Cochrane Collaboration was founded to produce and disseminate systematic reviews of health care interventions and promote the search for evidence in the form of clinical trials and other studies of interventions.[4] The Collaboration's major product, the Cochrane Database of Systematic Reviews, arguably represents the single largest collaborative pool of evidence on health care interventions ever created. The Cochrane Collaboration Back Review Group (BRG) was established in 1998, and 1 year later it published it's first systematic review on LBP.[5] Between 1999 and 2003, the Cochrane Collaboration BRG published 22 back and neck pain related reviews and 11 protocols for future reviews. Since the VHA/DOD LBP CPG was written in 1998, no information from the Cochrane Database of Systematic Reviews was included in the CPG's construction.

The purpose of this article is to present best-practice, evidenced-based conservative treatment and management guidance of LBP and sciatica by: (1) Reviewing the VHA/DOD LBP CPG. (2) Presenting a relevant literature update primarily from the Cochrane Database of Systematic Reviews.

Summary of the VHA/DOD CPG for the Management of LBP or Sciatica in the Primary Care Setting

The VHA/DOD LBP CPG team used the *Agency for Health Care Policy and Research (AHCPR) Guideline for Acute Lower Back Problems in Adults*, current literature through 1998, and expert opinion to create an algorithm CPG to help primary care providers and specialists provide evidenced-based, cost-effective management, and treatment of LBP or sciatica in adults.[6] Each box of the CPG has a link to an annotation describing the evidence and recommendations of the panel (Figures 1 thru 3). The strength of the evidence is provided at the end of the annotation and is based on the AHCPR guideline as follows:

- **A** **Strong** research-based evidence (multiple relevant and high-quality scientific studies)
- **B** **Moderate** research-based evidence (one relevant, high-quality scientific study or multiple adequate scientific studies)
- **C** **Limited** research-based evidence (at least one adequate scientific study)
- **D** **Panel** interpretation of information that did not meet inclusion criteria as research-based evidence[6]

History and Physical Examination: VHA/DOD LBP CPG (Figure 1)

Box 1 reminds providers that this guideline is only to be used in people over age 17. The annotation states: "Children are unique from adults and commonly have an identifiable organic etiology for LBP. Strength of Evidence (SE)=B." Boxs 2 and 3 pertain to the history and physical examination. In the expanded annotations, the VHA/DOD LBP CPG states: "*The initial assessment of the patient with LBP is focused on identifying medical history responses and or physical examination findings that suggest "red flag" conditions. "Red flag" conditions include fractures, tumor, infection, cauda equina syndrome,*

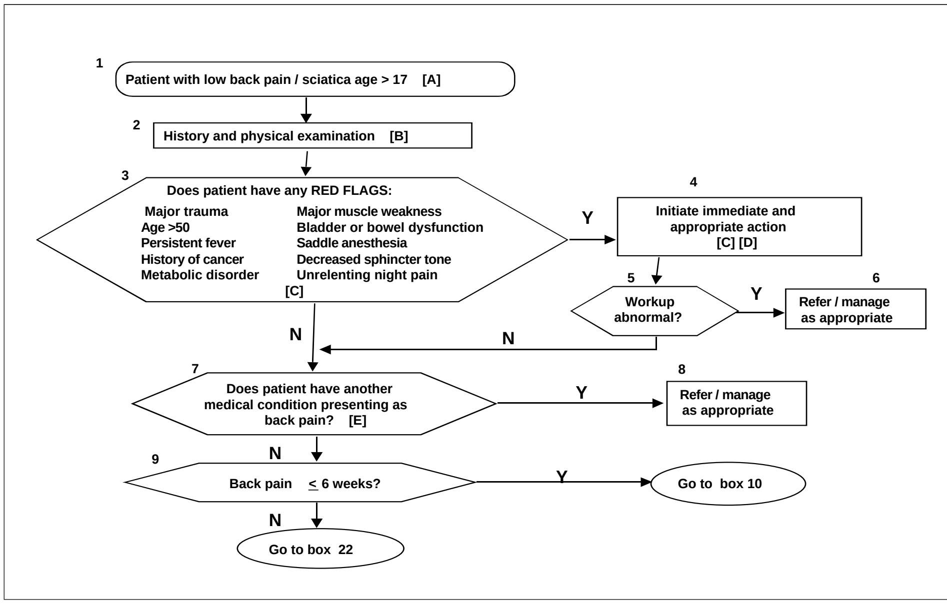

Fig 1. Management of LBP or sciatica in the primary care setting screening.

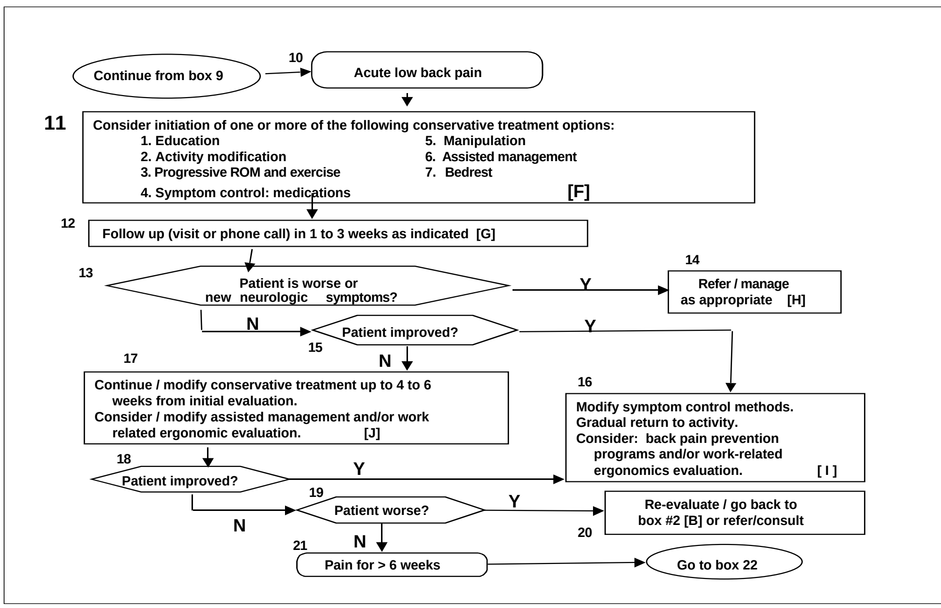

Fig 2. Management of LBP or sciatica in the primary care setting acute phase.

The CPG reports that because over 90% of all clinically significant lower extremity radiculopathies due to disc herniation involve the L_5 or S_1 nerve root, the primary care neurological examination for patients with leg symptoms can safely be limited to a few tests including: (1) Strength of ankle dorsiflexion and great toe extension (L_5) and ankle plantar flexion ($S1_1$). (2) Ankle reflexes (S_1). (3) Light touch sensation in the medial (L_4), dorsal (L_5), and lateral (S_1) aspects of the foot. (4) The straight leg raising test (SE=B).

abdominal aortic aneurysm, or a significant herniated nucleus pulposus."

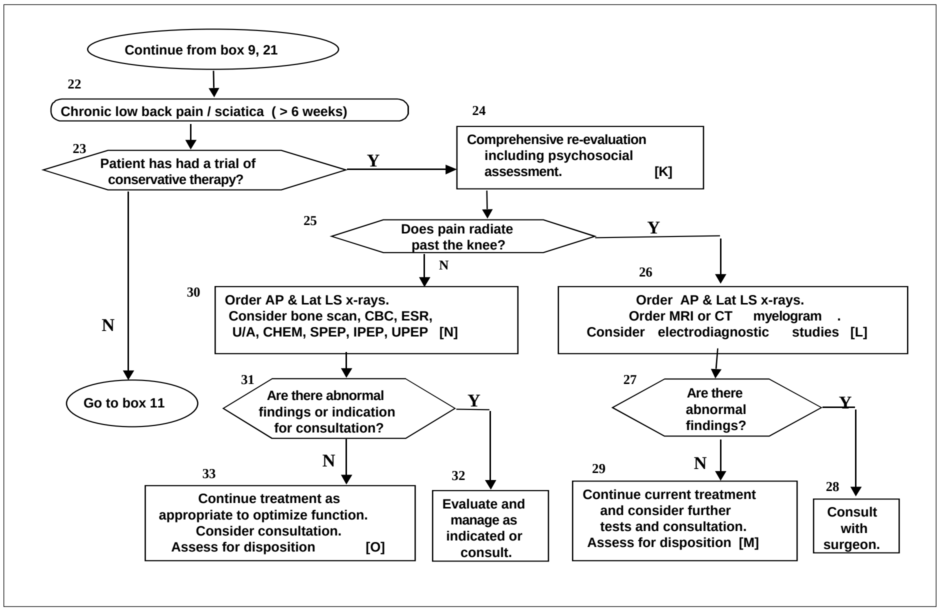

Fig 3. Management of LBP or sciatica in the primary care setting chronic phase.

However, if symptoms have not improved with 6 weeks of conservative treatment, (chronic LBP), the CPG recommends further workup including appropriate imaging (Figure 3, Boxes 26 and 30).

History and Physical Examination: Literature Update

Recent literature continues to recommend similar diagnostic strategies and neurologic evaluation as the VHA/DOD LBP CPG. In a review of primary care evaluation of LBP, Deyo et al reported that because 85% of patients cannot be given a precise pathoanatomical diagnosis, and nonspecific terms such as strain or sprain have never been anatomically or histologically characterized, patients without identifiable spinal pathology should be said to have "idiopathic LBP."[7] Recognizing the increasing understanding of the importance of psychosocial factors in LBP, Deyo et al purports that initial evaluation should focus on answering three questions: (1) Is there any underlying systemic disease? (2) Is there neurologic impairment that might require surgical evaluation? (3) Is there any social or psychological distress amplifying or prolonging pain?[7,8]

Recent literature also supports an imaging strategy similar to the one recommended by the CPG. Specifically: "*For adults younger than 50 years of age with no signs or symptoms of systemic disease, symptomatic therapy without imaging is appropriate. For patients 50 years of age and older or those whose finding suggest systemic disease, plain radiography, and simple laboratory tests can almost completely rule out underlying systemic diseases. Advanced imaging should be reserved for patients who are considering surgery or those in whom systemic disease is strongly suspected.*"[8]

Jarvik et al found that rapid magnetic resonance imaging (MRI) and radiographs resulted in nearly identical outcomes, including pain, disability, and health care costs, for primary care patients with LBP.[9] However, because patients for whom rapid MRI was substituted for plain radiographs had a higher incidence of spine operations, the authors recommend that rapid MRI not be the first imaging test for primary care patients with back pain.

Conservative Treatment

Once it is determined that patients with LBP and/or sciatica don't have any red flags, the VHA/DOD LBP CPG recommends primary care providers institute one or more of the following conservative treatment measures (Figure 2, Box 11):

Education: VHA/DOD LBP CPG. The VHA/DOD LBP CPG states: "Failure to receive an explanation of the problem was the most frequently cited source of patient dissatisfaction among 140 patients with low back problems. Patients who felt they did not receive an adequate explanation wanted more diagnostic tests (and) were less satisfied with their visit…. Evidence indicates that being positive (by giving patients a firm diagnosis and confidently telling them the problem will be better in a few days) in your consultation improves patient's outcome. Therefore, the panel recommends that the patient be given an accurate nonpathoanatomical diagnosis of LBP, but be told confidently that the examination findings suggest no serious pathology."

Education: Literature Update. Recent reviews on the treatment and management of LBP in primary care continue to recommend giving nonpathoanatomical diagnoses and reassurance to patients.[7,8] *To investigate the effectiveness of education on treating LBP, the Cochrane Collaboration review titled, Back Schools for Non-Specific LBP, was published in May 99. Last updated May 03, the review included 15 randomized controlled trials (RCTs) that met their quality criteria. The review concluded "there is moderate evidence that back schools are more effective than other treatments for chronic LBP and moderate evidence that back schools in an occupational setting are effective." The review warned, however, that the positive effects of back schools have been shown only in the short-term and only with chronic back pain. Furthermore, there is not enough data to determine which type of back school is effective to what type of patients or to make any conclusions about cost-effectiveness.*[10]

Activity Modification: VHA/DOD LBP CPG. The VHA/DOD LBP CPG sites very little evidence to make specific recommendations regarding activity modification for patients with LBP. However, because patients very often seek these recommendations from health care providers, the panel wanted to include some guidance-based mostly on expert opinion. The CPG states:

- Activity modifications are aimed at allowing the patient with acute LBP to achieve a tolerable comfort level while continuing adequate physical activity to avoid debilitation. Patients with acute LBP can be advised to limit, temporarily, any heavy lifting, prolonged sitting, and bending or twisting the back since these activities have been shown to increase mechanical stress on the spine. (SE=D)

- Nonphysical factors, such as emotional distress, low work satisfaction, and fear of pain may also affect an individual's symptoms and response to treatment. Activity goals can help keep attention focused on the expected return to full functional status and emphasize physical conditioning to improve activity tolerance. (SE=C)

Activity Modification: Literature Update. Evidence-based activity modification recommendations for patients with LBP remain very slim. The Cochrane Collaboration published a review on advice to stay active as a single treatment for LBP and sciatica in 2002. The review included four RCTs that met their quality criteria and compared, (1) staying active versus bed rest and (2) staying active versus other treatment. Although results were heterogeneous, the review concluded "Advice to stay active as a single intervention, compared with bed rest or exercises, may have little beneficial effect for patients with acute, simple LBP and may not be better or worse than prolonged best rest for patients with sciatica." However, because the review found no evidence that advice to stay active is harmful for either acute LBP or sciatica, and prolonged bed rest may have harmful effects, the authors concluded that it is reasonable to advise people with acute LBP and sciatica to stay active.[11]

Progressive Range of Motion (ROM) and Exercise: VHA/DOD LBP CPG. Regarding recommending progressive ROM and exercise, the VHA/DOD LBP CPG states:

- Until the patient returns to normal activity, aerobic (endurance) conditioning exercise such as walking, stationary biking, swimming, and even light jogging may be recommended to help avoid debilitation due to inactivity. (SE=C)

- Specific trunk muscle conditioning exercises are helpful; especially those for back extensor muscles for patients with persistent symptoms. (SE=C)

- There is evidence that patients improve faster when exercise repetitions are determined by quotas rather than guided by the patient's pain experience. (SE=C)

Progressive ROM and Exercise: Literature Update. The Cochrane Collaboration first published a review on exercise therapy for LBP in 2000. Updated in 2003, the review included 39 RCTs on specific exercises including back and abdominal strengthening, stretching, flexion, extension, static, dynamic, and aerobic exercises. Contradictory to the CPG, the review found strong evidence that exercise therapy is not more effective than inactive treatment or other active treatments for acute LBP. Similarly, the review stated that flexion and extension exercises are not effective in the treatment of acute LBP. For the treatment of chronic LBP, the review found mixed evidence that exercise therapy is more effective than other treatments. The review concluded that there is strong evidence that exercise therapy is more effective than the usual care by general practitioners and equally effective as conventional physical therapy (consisting of hot packs, massage, traction, mobilization, shortwave diathermy, ultrasound, stretching, flexibility and coordination exercises, and electrotherapy) for chronic LBP. Overall, the review concluded that exercises might be useful only in the treatment of chronic LBP if they aim at improving return to normal daily activities and work.[12]

Symptom Control/Medications: VHA/DOD LBP CPG. Since decreasing pain is usually a patient's first concern, the VHA/DOD LBP CPG makes recommendations both for oral and injectable medications. The CPG states:

- Acetaminophen is reasonably safe and is acceptable for treating patients with acute low back problems. (SE=C).

• Non-steroidal anti-inflammatory drugs (NSAIDs) are acceptable for treating LBP; various types of NSAIDs are equally effective for LBP. (SE=B)

• Muscle relaxants are an effective treatment option for patients with acute LBP. (SE=B)

• Opioids appear to be no more effective in relieving LBP symptoms than safer analgesics, such as acetaminophen, aspirin, or other NSAIDs. (SE=C)

• Oral steroids are not recommended for the treatment of acute LBP. (SE=C)

• Trigger point and ligamentous injections are not recommended for the treatment of acute LBP. (SE=C)

• Facet joint injections are invasive and not recommended with acute LBP. (SE=C)

• There is limited evidence to support the use of epidural steroid injections for acute LBP with nerve root pain and radicular neurologic deficit. (SE=C)

Symptom Control/Medications: Literature Update. Recent reviews continue to support the recommendations of the VHA/DOD LBP CPG.[13-15] The Cochrane Collaboration published reviews on NSAIDs for LBP, muscle relaxants for nonspecific LBP, and injection therapy for sub-acute and chronic benign LBP.[13-15] The review on NSAIDs was updated in November of 2002 and included 51 quality trials. The review reported "NSAIDs are slightly effective for short-term global improvement" and those different NSAIDs are equally effective for acute LBP. Additionally, they found that NSAIDs paired with muscle relaxants or with B vitamins are no more effective than NSAIDs alone. The review could not make any conclusions about the effectiveness of NSAIDs on chronic LBP because the four studies that reported outcomes specifically on chronic LBP made heterogeneous comparisons.[13]

The use of muscle relaxants for LBP continues to be a source of controversy for medical providers, likely, in part, due to the controversy over beliefs about muscle spasm in the pathophysiology of LBP. Additionally, there are many different types of "muscle relaxant" drugs with differing effects and mechanisms of action. Most broadly, they can be divided into antispasmodics and antispasticity medications. Antispasmodics can be subclassified into benzodiazepines and nonbenzodiazepines. The Cochrane Collaboration review on muscle relaxants for nonspecific LBP was updated in Feb 03 and reviewed the effect of all types of drugs classified as muscle relaxants. From 30 RCTs the review found strong evidence that any of the studied muscle relaxants are more effective than placebo for patients with acute and chronic LBP on short-term pain relief and that different muscle relaxants are equally effective. However, the high incidence of side effects including drowsiness and dizziness led the authors to conclude that "muscle relaxants must be used with caution and it must be left to the discretion of the physician to weigh the pros and cons."[14]

Therapeutic injections for LBP are another therapy that remains controversial. The Cochrane Collaboration review on injection therapy for sub-acute and chronic benign LBP aimed to examine the effectiveness of facet joint injections, epidural injections, and local injections (into tenderpoints, triggerpoints, and acupuncture points as well as sclerosing agent injections into ligaments) on treating LBP. The review was updated May 03 and included 21 RCTs. The authors reported a significant lack of convincing evidence regarding the effectiveness of all injections for treating LBP. Furthermore, the authors questioned the rationale of injecting a short-acting anesthetic for prolonged pain relief. The review concluded: *"Facet joint, epidural, and local injection therapy has not yet shown to be effective, nor has it been shown to be ineffective. Because of the tendency toward positive results favoring injection therapy and the minor side effects reported by the reviewed studies, there is at the moment no justification for abandoning injection therapy in patients with LBP."*[15]

Manipulation: VHA/DOD LBP CPG. Regarding spinal manipulation for LBP, the VHA/DOD LBP CPG states: *"Within the first 6 weeks of the onset of acute or recurrent LBP, manipulation provides better short-term improvement in pain and activity levels and higher patient satisfaction than the treatments to which it has been compared (SE=B). Furthermore, the risks of manipulation for LBP are very low, provided patients are selected and assessed properly and the manipulation is done by a trained therapist or practitioner."*

Additionally, the CPG states, "selected patients with a nonprogressvie radiculopathy may benefit from a trial of manipulation." However, in the presence of severe or progressive neurological deficits, the CPG recommends that providers perform an appropriate diagnostic assessment before beginning manipulative therapy.

Manipulation: Literature Update. Literature reviews performed after the publication of the VHA/DOD LBP CPG have drawn less encouraging conclusions regarding the effectiveness of manipulation. The Cochrane Collaboration BRG has published a protocol for a review on the effectiveness of spinal manipulation, but has not yet performed the review.[16]

The most recent review, *Spinal Manipulative Therapy for LBP: A Meta-Analysis of Effectiveness Relative to Other Therapies*, was published in Jun 03 and reviewed 39 RCTs. The review found that for patients with acute and chronic LBP, manipulation was only more effective than sham therapy or therapies judged to be ineffective (such as spinal traction, corset, bed rest, topical gel, and diathermy). No difference was found between spinal manipulative therapy and general practitioner care, analgesics, physical therapy, exercises, or back school. The review concluded, "spinal manipulative therapy is probably more effective than a placebo, but its effectiveness compared with other advocated therapies is substantially less than previous reviews and meta-analyses have suggested."[17]

Assisted Management: VHA/DOD LBP CPG. The VHA/DOD LBP CPG does not give any specific guidance or rules when primary care providers should refer LBP patients to physical therapists or other conservative spinal care professionals. The CPG merely states: "In certain cases where patients' symptoms are moderate to severe, or when duty obligations require a rapid return to full functional status, assisted management may be indicated." Although in the military LBP is often managed by physical therapists, and physical therapist provide the majority of interventions discussed elsewhere (education, exercise, manipulation), the CPG seems to infer that assisted management is nearly synonymous with physical therapy. The VHA/DOD LBP CPG further divides assisted management into transcutaneous electrical nerve stimulation (TENS), shoe insoles and shoe lifts, lumbar corsets and back belts, traction, biofeedback, acupuncture, and physical agents and modalities (ice, heat, massage, ultrasound, cutaneous laser treatments, and electrical stimulation except TENS). Regarding physical agents and modalities, the CPG reports that no well-designed RCT supports their use as treatments for acute LBP. However, because some patients with acute LBP appear to have temporary symptomatic relief, providers may recommend self-administered home programs of heat or cold. More specifically the VHA/DOD LBP CPG states:

- The benefit of using physical agents and modalities in the treatment of acute LBP has not been proven to justify cost. (SE=C)

- TENS is not recommended for treating patients with acute LBP. (SE= C)

- Shoe insoles may be effective in selected patients with acute LBP. (SE=B)

- Lumbar corsets and low back belts have not proven beneficial in acute LBP. (SE=D)

- Spinal traction is not recommended in treating patients with acute LBP. (SE=C)

- Biofeedback is not recommended in treating patients with acute LBP. (SE=C)

- Acupuncture is not recommended in treating patients with acute LBP. (SE=D)

Assisted Management: Literature Update. To date, the Cochrane Collaboration BRG has performed systematic reviews on a minority of the VHA/DOD LBP CPG's assisted management therapies. Several other reviews have been planned by the BRG, and may be available shortly after this articles publication.[16,18,19] Massage for LBP: A Systematic Review within the Framework of the Cochrane Collaboration Back Review Group was published in Sep 02. Although massage is most often used as an adjunct treatment for LBP, only eight RTCs that looked at massage separately were included. The review found that "massage might be beneficial for patients with sub-acute and chronic nonspecific LBP, especially if combined with exercise and delivered by the licensed therapist." Furthermore, and contrary to current belief, the review found that massage may have long-lasting beneficial effects (at least 1 year) on LBP and that acupuncture massage is more effective than classic massage.[20]

A Cochrane review on TENS for chronic LBP was updated in May 03. The review aimed to not only determine the effectiveness of TENS in the treatment of chronic LBP, but also to determine the most effective method of administering TENS including, frequency, intensity, application techniques, duration of treatment, and site of application. The review found a significant lack of quality RCTs evaluating TENS resulting in the inclusion of only five trials. Consistent with the recommendation of the VHA/DOD LBP CPG for acute LBP, this review found no evidence to support the use of TENS in the treatment of chronic LBP. Furthermore, because of the heterogeneity of included studies, the evidence provides no data on the optimal application of TENS.[21]

Lumbar Supports for Prevention and Treatment of LBP: A Systematic Review within the Framework of the Cochrane Collaboration Back Review Group was published in Feb 01 and updated in Feb 03. The review included five randomized and two nonrandomized preventive trials and six randomized therapeutic trials. Regarding prevention of LBP, results showed that there was "moderate evidence that lumbar supports are not effective in preventing LBP and that lumbar supports are not more effective than other types of prevention for LBP." This finding is consistent with the recommendations of both the VHA/DOD LBP CPG and the National Institute for Occupational Safety and Health. Regarding the treatment of LBP, the results showed conflicting evidence of the effectiveness of lumbar supports and it remains unclear whether lumbar supports are more effective than other interventions for the treatment of LBP. Based on these findings the review does not recommend lumbar supports for the primary prevention or treatment of LBP.[22]

The Cochrane Collaboration's review on acupuncture for LBP was updated in Feb 03 and included 11 RCTs. In addition to evaluating the effectiveness of acupuncture, the review aimed to perform subgroup analysis of acute versus chronic LBP and for LBP with radiation versus without radiation. Results indicated, "there was no evidence that acupuncture is more effective than no treatment, there was moderate evidence that acupuncture is not more effective than trigger point injection or TENS, and there was limited evidence that acupuncture is not more effective than placebo or sham acupuncture for the treatment of chronic LBP." Because most studies contained mixed subject groups, subgroup analysis could not be performed.[5]

Bed Rest: VHA/DOD LBP CPG. One of the strongest recommendations that the VHA/DOD LBP CPG makes regarding the conservative treatment of LBP is against using bed rest for simple back pain (SE=A). The CPG states: *"The aim is to minimize bed rest and use symptomatic measures to control pain so patients can return to normal activity as soon as possible. Some patients initially may be confined to bed as a consequence of their pain but this should not be considered a treatment. For acute or recurrent LBP with or without referred leg pain, bed rest for 2 to 7 days is worse than a placebo or ordinary activity."*

Bed Rest: Literature Update. The Cochrane Collaboration review on bed rest for acute LBP and sciatica, updated in Feb 02, supports the recommendation of the VHA/DOD LBP CPG. From nine RCTs, the review concluded, "bed rest is not effective in the treatment of LBP, and might have small harmful effects on acute LBP." Furthermore, based on the strength of evidence, the review stated "no further research on the role of bed rest in the treatment of acute LBP is needed."[23]

Chronic Phase of LBP and Sciatica: VHA/DOD LBP CPG (Figure 3)

The VHA/DOD LBP CPG recommends the implementation of the above conservative treatment options along with regular re-evaluation until patients have had symptoms for greater than 6 weeks. Once patients have been treated conservatively for 6 weeks and they have not had a substantial improvement in their symptoms, they enter into the "Chronic Phase" of the algorithm. At this point, the CPG recommends a "comprehensive re-evaluation including psychosocial assessment and physical examination" (Box 24). The "comprehensive re-evaluation" should include imaging, laboratory tests, and electrodiagnostic studies depending on whether pain radiates past the knee (Boxes 25, 26, and 30). The VHA/DOD LBP CPG states, *"Patients who have persistent radicular pain, a correlative imaging study, and a motor/reflex tingling, are candidates for a surgical intervention" (SE=B).*

For the psychosocial assessment portion of the "comprehensive re-evaluation" the CPG suggests providers consider using one or more of the following screens: (1) Waddell's signs and symptoms of inappropriate or nonorganic distress. (2) The Oswestry Questionnaire. (3) Fear Avoidance Behavior Questionnaire. (4) Modified Work APGAR Score for Job Task Satisfaction. (5) DSM-IV Screening Checklist for Depression. (6) Zung's Self-Rating Depression Scale. (7) CAGE Screening Checklist for Possibility of Alcohol Abuse.

Emphasizing the importance of psychosocial factors in chronic LBP, the VHA/DOD LBP CPG states: *"Patients with chronic LBP present complex problems, and often a patho-anatomic cause is not apparent. Unlike acute pain, chronic pain often is not associated with ongoing tissue injury, serves no biological usefulness, and may not be accompanied by the autonomic response of sympathetic over activity. Vegetative signs, such as sleep disturbance, appetite disturbance, and irritability appear. Pain can be reinforced or perpetuated by social and psychological factors. Back pain can affect employment, income, family, and social roles, producing psychological distress that increases pain and disability."*

Therefore, the CPG concludes: "social, economic, and psychological factors are *more important* than physical factors in affecting the symptoms, response to treatment, and long-term outcomes of patients with chronic low back problems."

The VHA/DOD LBP CPG algorithm ends by suggesting that, if surgical intervention is not warranted, providers consider a referral to a nonsurgical back specialist such as a provider from physiatry, neurology, occupational medicine, rheumatology, or primary care sports medicine. Finally, "for active duty personnel who have not improved after 4 to 6 months of treatment, also consider referral to the Medical Evaluation Board for possible reclassification or discharge from service."

Psychosocial-Based Treatment Literature Update. Although the VHA/DOD LBP CPG portrays the growing correlational evidence of psychosocial factors and chronic LBP, at the time of it's writing, very little was known about the association of psychosocial factors with acute LBP or about the effectiveness of psychosocial-based treatment on LBP. Recently, the Cochrane Collaboration BRG has published several reviews concerning psychosocial treatment for LBP.[24-26]

Behavioral treatment of LBP focuses primarily on the reduction of disability through the modification of environmental contingencies and cognitive processes. Behavioral treatment for Chronic LBP: A Systematic Review within the Framework of the Cochrane Back Review Group was published in Oct 00. The review included 20 RCTs, which provide strong evidence that "behavioral treatment of patients with chronic LBP has a positive effect on pain intensity, generic functional status, and behavioral outcomes when compared with waiting-list controls or no treatment." It remains unclear, however, if a specific type of behavioral treatment is superior to another or which patients benefit most from behavioral treatment.[24]

Two Cochrane Collaboration reviews were performed on the effect of multidisciplinary biopsychosocial rehabilitation (MDBPSR) on LBP- one on chronic LBP and one on sub-acute LBP among working age adults. There is no consistent definition of MDBPSR, but the approach usually addresses physical, psychological, and social/occupational factors involved in pain syndromes. Both Cochrane Collaboration reviews required that MDBPSR programs include both a physical dimension and at least a psychological or social/ occupational dimension. The review on chronic LBP included 10 RCTs while only two trials could be included in the review on sub-acute LBP. The reviews found both a statistically and clinically positive effect of intensive MDBPSR programs on pain and function in both patients with sub-acute and chronic LBP. In addition, less intensive programs were no better than control nonmultidisciplinary programs on chronic LBP.[25,26]

Discussion

As a whole, the VHA/DOD CPG for the Management of LBP or Sciatica in the Primary Care Setting is still consistent with current evidence. Recent reviews and literature on the primary care management of LBP support the VHA/DOD LBP CPG in recommending providers focus on "red flags," indicative of underlying systemic disease or neurologic compromise that may require surgical intervention. In the absence of "red flags," current literature continues to support a conservative imaging strategy and nonspecific diagnostic labels, such as "idiopathic LBP."[7-9]

Regarding the conservative treatment of LBP and sciatica, data from the Cochrane Database of Systematic Review supports the VHA/DOD LBP CPG except for its recommendations on injections, exercise therapy, and spinal manipulation.[12,15,17] Positive and reassuring educational strategies and back schools are still recommended.[10] Advising LBP patients to stay active within the limits of pain continues to be recommended.[11] Prescription of NSAIDs, acetaminophen, and muscle relaxants are still recommended.[13,14] Prolonged bed rest is still strongly discouraged.[23] The use of TENS, lumbar supports, and acupuncture continue to be not recommended.[5,21,22] The use of facet, trigger point, and ligament injections are controversial. The VHA/DOD LBP CPG recommends against their use, but the Cochrane review reports no evidence to abandon them.[15] The VHA/DOD LBP CPG recommends the use of both general aerobic exercise and specific truck muscle conditioning exercises for the treatment of LBP and sciatica. The Cochrane Collaboration review on exercise therapy, however, found mixed evidence and supported the use of exercise therapy only in the treatment of chronic LBP when aimed at improving return to normal daily activities and work.[12] Likewise, the VHA/DOD LBP CPG recommends spinal manipulation for patients with acute LBP and possibly even for those with a nonprogressive radiculopathy. The most recent review of spinal manipulative therapy, however, found spinal manipulation for both acute and chronic LBP was only more effective than sham and ineffective treatments, and it was not more effective than general practitioner care, analgesics, physical therapy, exercises, or back school.[17]

The VHA/DOD LBP CPG describes the importance of psychosocial factors in chronic LBP and disability, and there is now evidence supporting both behavioral and multidisciplinary biopsychosocial *treatment* for sub-acute and chronic LBP.[24-26] Because psychosocial factors are among the most important determinants of chronic LBP, many researchers are now exploring the relationship of psychosocial factors and acute LBP, especially as risk factors for chronic LBP and future disability. In New Zealand, this concept has led to the development of "yellow flags" in their national LBP guidelines.[27] Whereas "red flags" indicate the need for more rigorous biomedical investigation to rule out serious pathology, "yellow flags" are indications for further investigation of cognitive, behavioral, or social aspects of acute LBP.[28] Although the idea of using tools such as "yellow flags" shows promise, it is still in its infancy, and little is known about the reliability, validity, and usefulness of such tools.[29]

Overall findings of both the VHA/DOD LBP CPG and the Cochrane Collaboration reviews on LBP is that very few conservative treatments of LBP are very effective. This general finding, together with the classic assumption that "90% of LBP spontaneously resolves within 4 to 6 weeks," leads to the CPG's implication that most nonspecific LBP and sciatica can be effectively and efficiently managed initially with minimal intervention and in primary care. Although data from the Cochrane Database of Systematic Review supports most of the recommendations of the VHA/DOD LBP CPG, the timing and vigor of LBP intervention still is the subject of much debate.

Recent epidemiological evidence shows that LBP is actually more accurately viewed as a chronic condition characterized by a fluctuating pattern of acute exacerbations rather than acute and self-limiting.[30] Additionally, several recent studies support the efficacy and cost-effectiveness of early physical therapy intervention.[31-34] One such study, retrospectively, analyzed 3,867 patients with LBP less than 3 weeks. The patients were treated with a "sports medicine approach" emphasizing conditioning exercises, manual therapy, and education. Results showed that earlier referral to physical therapy was associated with fewer physician visits, fewer restricted workdays, fewer days away from work, and shorter case duration.[34]

Another trend in current LBP research concerns the development of a classification system for LBP that would allow interventions to be more effectively paired with specific dysfunctions. Some researchers purport that "lumping" LBP in one homogenous group may explain the general lack of literature support for most conservative LBP treatments.[33,35] They argue that although we have not successfully classified LBP into reliable and valid pathoanatomical subgroups, it is unlikely that all LBP is homogenous. During research, if a specific intervention is effective in treating only a subgroup of LBP patients, the positive result may be diluted to nonsignificance when lumped in with the results of the other LBP subjects. Our failure to classify LBP based on pathoanatomy has lead many clinicians and some researchers to develop classification systems based on symptoms and clinical findings.[33,35] Fritz et al compared treatment of one such classification system to treatment based on AHCPR clinical practice guideline recommendations in patients with acute LBP.[33] Patients treated by the AHCPR CPG recommendations were all given the same interventions including advice to remain active, low-stress aerobic exercise, and general muscle reconditioning exercises. Patients treated by the classification system were divided into one of four treatment groups based on their symptoms and clinical findings: mobilization, specific exercise, immobilization, or lumbar traction. After 4 weeks, the group treated by the classification-based approach had less disability, higher patient satisfaction, and more returned to work than the patients treated by the guideline recommendations. Although this classification system shows promise, a great deal of research is still needed to validate this or other classification systems and it will likely be many years before providers and researchers can agree on the best classification system for LBP.

Conclusions

Recommendations of the *VHA/DOD CPG for the Management of LBP or Sciatica in the Primary Care Setting* are still generally consistent with current literature. Since the guideline's publication, there is an increased awareness of the importance of psychosocial factors in LBP, and growing evidence of the effectiveness of psychosocial-based treatment on patients with sub-acute and chronic LBP.

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Evaluating Redeployment Concerns: Potential Asbestos Exposure

The Army ensures its superiority through technologically advanced equipment, coordination, and strategy in the field. In response to health, safety, and environmental concerns, the Army uses similarly advanced technology and coordination to ensure the welfare of our Soldiers. Popular media commonly display images of our advantages in weapons technology, but the Army's medical organizations are equally deserving of attention. A multidisciplinary response is imperative in responding appropriately to exposure concerns among active duty Soldiers in remote locations. The following case study is an example of how various medical organizations collaborated to support the Department of the Army's deployment health mission.[1-3] This study describes a successful international and interdisciplinary collaboration, in which asbestos exposure concerns of a Patriot Missile Battery (PMB) stationed in Qatar were effectively evaluated and managed.

In Jul 03, the Preventive Medicine Service (PMS) at William Beaumont Army Medical Center (WBAMC) was contacted by the Commander of a PMB on Fort Bliss regarding the potential exposure to asbestos of his Soldiers while they were deployed in Qatar. According to written statements on Post-Deployment Health Assessments (DD Form 2796), this battery was stationed for approximately 1 month in what was believed to be a newly built landfill lined with asbestos or in an actual asbestos dump area. A thin layer of dirt covered this alleged asbestos landfill/dump, but there were many areas where the suspected white asbestos was exposed. Soldiers stated that Qatari military officials and local workers informed them that this was a former asbestos dump. Occupational Safety and Health Administration regulations pertain to any asbestos exposure to workers greater than the permissible exposure limit of 0.1 fiber/cubic centimeter.[4] Based on statements in the DD Form 2796, WBAMC – PMS offered individual counseling regarding the likelihood of an exposure and the pathology of asbestos-related diseases, baseline chest x-rays and an SF 600 encounter in a Subjective/Objective/Assessment/Plan format. In addition, WBAMC Industrial Hygiene (IH) contacted U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) for a consultation and possible referral.

Within 2 weeks after initially contacting USACHPPM, personnel from the Kuwait-based, the 804th Medical Brigade (MED BDE) - Force Health Protection and 200th MED DET, visited the former Patriot Missile site in Qatar. A five-person team walked the approximately 8-acre site and observed no asbestos containing materials and found no other hazardous materials. This field team also evaluated areas adjacent to the former Patriot Missile site consisting of a solid waste facility to the west, undeveloped land to the east and south, and undeveloped land and a storm water facility to the north. The solid waste facility was organized and showed no evidence of burning of wastes to reduce volume. There was no evidence of oil and hazardous waste at the landfill site, to include asbestos containing materials. According to the team leader, this facility was well maintained, its employees appeared to be professional, and employees were not required to wear personal protective equipment In addition, management at the local industrial plant provided a letter stating that hazardous materials are not dumped within the solid waste facility/landfill adjacent to the former PMB. A copy of this report was emailed to WBAMC – PMS on 6 Aug 03.[5]

In late Aug 03, WBAMC – PMS provided a briefing to the Soldiers concerned about potential exposure to asbestos. At this initial briefing, the findings from the on-site inspection were summarized and presented to the unit. General questions about asbestos and its health concerns were addressed while emphasizing that there was likely no exposure. Soldiers expressed additional concerns involving environmental exposure from naturally occurring asbestos and concerns that the location of the survey was not identical to the deployment site. Some Soldiers stated Qatari national employees of the landfill had advised them that the entire area was unsafe due to asbestos.

In early Sep 03, WBAMC – PMS/IH met with Soldiers and reviewed dozens of photographs of the area taken by Soldiers. Photographs showed the site location including workplace and living environmental conditions. Based on these photographs, there was no evidence of an encampment within a landfill or dump. Rather, these photographs showed what appeared to be relatively undisturbed open field areas in the desert in which earth-moving equipment was used to create earthen berms and roads. Whitish areas on the surface appeared to be mineral deposits of halite or gypsum, which are common to this area. Global Positioning System measurements confirmed the location of the inspection to be identical to the camp.

In early Dec 03, WBAMC – PMS/IH contacted the Geology Department at the University of Texas at El Paso (UTEP). Geologic authorities expressed that it was unlikely natural deposits of asbestos occur in Qatar. The following week, at the request of WBAMC – PMS/IH, the United Arab Emirates University conducted a literature review of the Qatari geology in Sheikh Zaid Library and emailed a geologic map of Qatar (Figure 1), which confirmed there are no asbestos-containing geologic formations in Qatar. This map shows sedimentary deposits and formations throughout the country and not ultramafic, metamorphic rocks that are known to contain asbestos minerals. In addition, Qatar University Geologic experts provided a statement that the closest naturally occurring asbestos deposits occur in the mountain ranges of Iran and Iraq located across the Persian Gulf hundreds of miles from the PMB site (Figure 2).

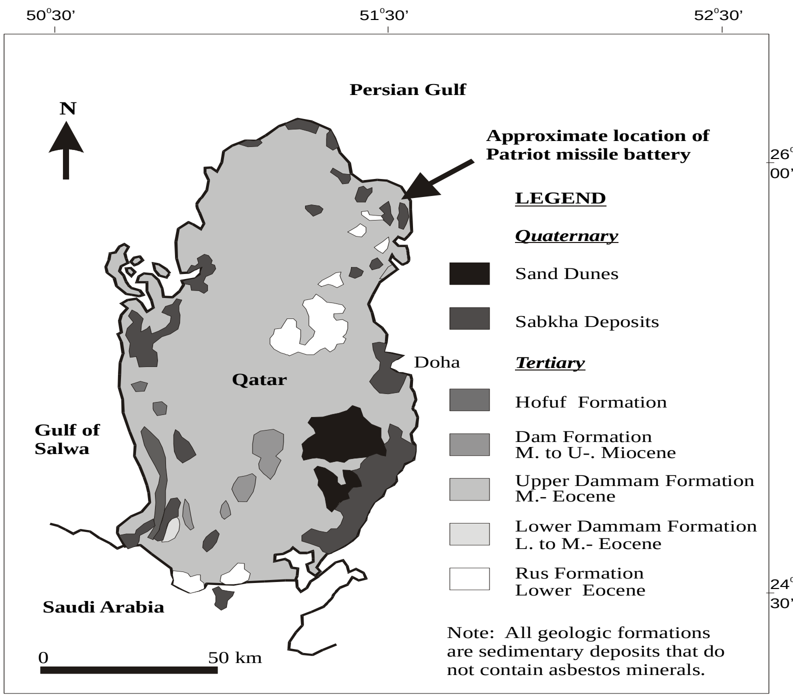

Fig 1. Geologic Map of Qatar.[6] (Note: No asbestos occurs in these deposits)

Fig 2. Regional map of Persian Gulf showing Qatar and adjacent countries.[7]

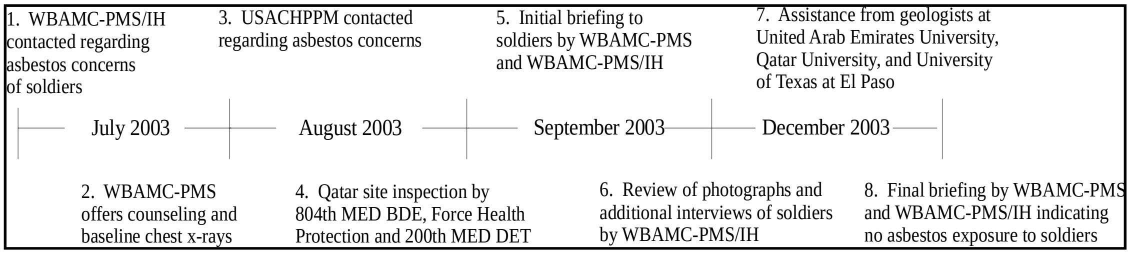

Fig 3. Timeline showing relative sequence of events in addressing asbestos concerns.
(Note: Abbreviations are defined in text)

Based on the collective information gathered during this investigation, the PMS and IH Section at WBAMC concluded that there was no asbestos exposure to the PMB in Qatar. This case study demonstrates collaboration between members of different medical affiliations (PMS-WBAMC, IH-WBAMC, USACHPPM, Force Health Protection, 804th MED BDE), and academic institutions (Qatar University, United Arab Emirates University, UTEP) in addressing overseas asbestos concerns of our redeploying Soldiers. This collaboration was both effective and efficient so that Soldiers' concerns were quickly allayed. A summary of events is presented in the timeline in Figure 3.

A valuable lesson in this case study was how quickly a field team was assembled and dispatched to the site in Qatar, thus demonstrating the Army's rapid response of a continental United States referral to outside continental United States Preventive Medicine assets. This case demonstrates effective implementation of advanced investigative technologies, interagency, and international coordination and a successful strategy to address health and safety concerns of U.S. Army Soldiers.

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The TAML/AML Concept; Lessons Learned/Prescription for Change

COL Ronald L. Shippee, MS, USA†

At 1045 AM, 22 Mar 03, a 29 member team from the 520th Theater Army Medical Laboratory (TAML) crossed the Kuwait/Iraq demilitarized zone, traversed 150 miles of rough terrain, set up laboratory operations and provided confirmation level analysis for chemical and biological warfare agents in support of the Iraqi Freedom campaign. This was the first time the TAML has been deployed to a high threat, combat environment since the unit was formed in 1995. While the success of the operation proved that a robust confirmation laboratory could be fielded and operated in an austere and harsh environment, the future development of the concept will require significant changes in how the unit is structured and supported. This article will provide suggested changes that the authors feels will be required in the command and control (C^2) support along with funding and staffing to ensure this valuable theater asset remains robust and relevant to contemporary theater operations.

Background

The 520th TAML was designed and fielded in 1995 in response to the growing threat of chemical and biological agent exposure during combat operations. The Army medical planners recognized that while technological advances fielded on platforms such as the M93A1 Fox NBCRS (FOX) and Biological Identification and Detection System (BIDS) were advancing, the analytical capability remained at the *detection* level. These systems, while extremely sensitive, lack specificity. The systems provide critical detection information for immediate tactical decisions. The TAML was designed to support theater *confirmation* analytical capability to provide the theater commander a timely and definitive chemical and biological threat intelligence documented by appropriate chain of custody to support operational level decision planning.

Over the past 8 years, the TAML table of organization and equipment (TOE) has undergone minor modified table of organization and equipment (MTOE) changes to its original structure. Currently, Force Development, Office of The Surgeon General is in the process of converting the TAML MTOE to individual Area Medical Laboratory (AML) TOEs. This effort will essentially divide the equipment, analytical resources, and enlisted personnel of the current TAML equally between two separate AMLs (1st AML and 9th AML). An additional Department of the Army command select position; officer support staff and Sergeant Major positions will be filled for the additional AML.

This article will provide suggested changes that the author feels would best support the proper utilization of the complex and extremely valuable assets that the AMLs provide to the warfighter. These suggestions are based both on garrison operations as well as lessons learned from the recent deployment of the TAML to the Iraq theater of operations.

Scope

The underlying factor driving the recommendations of this article concerns the required analytical capabilities of an AML. The very nature of the organization dictates that the capabilities, both in terms of equipment and subject matter experts, are complex and time sensitive. The field of chemical and biological assessment and confirmation is a rapidly expanding field of study. Furthermore, the threat, in terms of potential adversaries acquiring the offensive capabilities and scientific advances, particularly in the field of molecular biology, dictate that the AML must have a robust capability that can be rapidly adjusted in response to scientific advancements and the threat. The operational relevance of the information provided by an AML depends on the fielding of the appropriate equipment and trained individuals to operate the equipment as well as to interpret the results. Intimately linked to the technical requirements is the ability of the organization to deploy to the theater of operation and operate in austere environments.

While garrison operations and periodic field training exercises have uncovered a number of changes that are needed to keep the AML concept viable, the recent deployment to a combat environment has both reinforced these needed changes and raised a number of new issues. This article will provide suggested changes in the following areas: C^2, funding, staffing, structure, and quality control.

Command and Control

such as good military order and discipline, weapons training, physical fitness, and individual Soldier skill proficiency are to survivability and mission success.

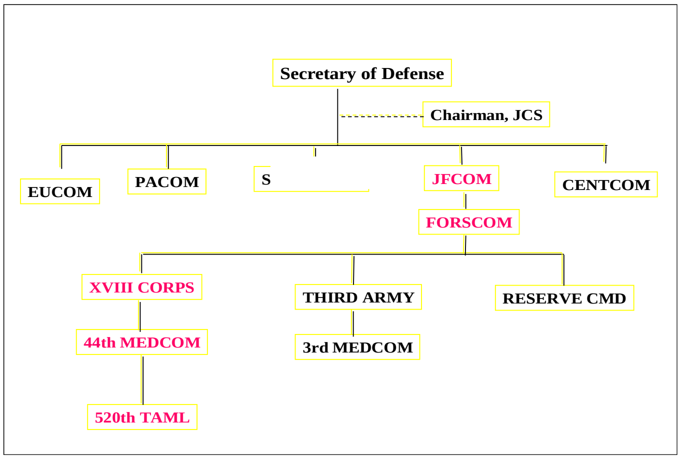

Fig 1.

There is a negative impact in terms of the depth and nature of this C^2 relationship. While the original intent was to make the TAML a theater asset, experience has shown that the organization is considered a FORSCOM resource that is tightly controlled with utilization as dictated by the 44th MEDCOM. This relationship has restricted important training opportunities for the TAML to interact with the other chemical and biological assessment assets that are part of the Chemical Corps. To realize the optimum benefit of the entire chemical and biological force protection system in the theater requires a close working relationship between the detection units (BIDS, FOX, and Portal Shield), Technical Escort, the TAML and the technical consultation provided by various supporting table of distribution and allowances (TDA) organizations (Figure 2). Lack of appreciation for these relationships within the depth of the TAML's chain of command coupled with the funding issues discussed below have significantly affected the training opportunities available for the entire chemical and biological assessment system to develop appropriate doctrine and operational relationships.

The Iraq deployment demonstrated the necessity for developing the appropriate C^2 relationships during training. The technical escort units were not deployed in a timely manner with the forward-deployment team of the TAML and the supporting chemical units. Adjustments to chain of custody and critical decontamination responsibilities of prospective hazardous specimens had to be adjusted. Analytical issues such as when to run negative controls and possible inhibition of the TAML's biological assays caused by the particular buffer systems used to collect BIDS specimens are just some of the technical issues that require common doctrine and standard operating procedures as well as mutual training events prior to actual combat deployment.

The AMLs would be more efficiently managed, trained, and utilized if they were moved under the C^2 of the Research Development and Engineering Command (RDECOM), Aberdeen Proving Ground, MD. This would place the AMLs in the same chain of command with the Technical Escort units and more directly linked with the Chemical Corps. This would also provide the necessary interaction between the AML subject matter experts and the research and development assets within RDECOM.

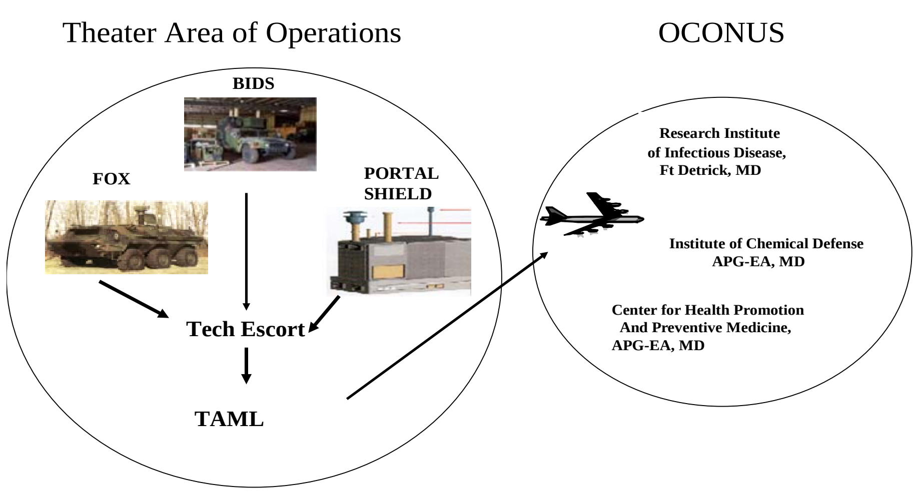

Fig 2.

Funding

The TAML was never provided with a training and resource model (TRM). Historical records show that despite numerous data calls provided by past TAML command staffs, FORSCOM has been unable to develop an appropriate funding model to support the technical resources needed by the organization. Prior to the terrorist attacks on 11 Sept 01, the TAML had a well-documented and valid $1.2M unfunded requirement for technical replacement, upgrade, and training. The funds provided shortly after 11 Sept 01 were critical to providing badly needed technical and training requirements for the TAML which were directly responsible for the success to mission fulfillment during the recent Iraq deployment.

Without an adequate TRM it is impossible for the command staff to budget and execute appropriate best business practices. The funding stream during the fiscal year is erratic and unpredictable. Maintaining modernization of the various aspects of the complex analytical capability and technical training requires a committed funding source and careful budget execution. Under the current financial support, the organization is left with a management system that is constantly making difficult spending decisions in an attempt to maintain an acceptable degree of technical relevancy.

Staffing

Because the unit is organized under a TOE structure, there are no positions available for hiring civilian technical expertise. The assumption of the original architects of the TAML may have assumed that the necessary consultation, training, and technical maintenance support would be available from experienced scientific civil service professionals from the various TDA organizations within the TAML's geographic area. Practical experience has shown that while this level of expertise is available, the organization would be better served by a small number of dedicated civilian technicians. A model for this support exists with the shared training support provided to the TAML's biological assessment section through a memorandum of agreement with the U.S. Army Research Institute of Infectious Disease. Under the terms of the agreement, the TAML supports half the salary for one civilian technical professional to provide the necessary training and certification needed to train the section's new 91Ks in the various aspects of proper sample preparations, analytical analysis and data interpretation of biological agents. These types of shared positions or full time civilian positions are needed to retain institutional memory, cut the cost of contract technical training, and possibly reduce the cost of maintenance contracts of certain types of analytical equipment.

Structure

All three services have developed theater level chemical and biological confirmation units. In comparison, the Army has developed the most robust and complete organization. The unit is equipped and staffed to support in-depth chemical, biological and preventive medicine missions with multiple analytical technologies available in each section. Additionally the organization is equipped with an assortment of military tents, expandable ISO-Shelters, MILVANs, generators, environmental control units and shipping pallets along with the required prime movers.

This robust capability is also a liability in terms of mobility and deployment. Under the current concept of a "28 man team" the deployment equipment list (DEL), with all the necessary prime movers is approximately 94 short tons. The Iraq deployment showed that there just is not enough aircraft load space-available to compete with the other theater assets to place the team in the theater in a timely manner. Critical decisions were made concerning the minimum equipment needed to meet the restricted frame space and still accomplish the mission. All vehicles were eliminated from the first team deployed, which caused significant delays in moving the unit's equipment off the Airport Debarkation (APOD) point. This situation also leaves the unit at the mercy of ground handling individuals that may not be familiar with the equipment specific to medical units. This was painfully demonstrated by a broken pintle ring caused by attempting to back a dolly set up at the APOD without trained individuals monitoring the movement.

To maintain relevance to the reality of rapid deployment requirements and restricted transport capabilities the AML must develop a laboratory platform that is lighter, mobile and agile while maintaining the same level of sophistication in its analytical capabilities.

In an attempt to solve this problem, the TAML staff entered a collaborative project with RDECOM in Aug 02. Working closely with the civilian contractors that develop and fabricate the BIDS units, a discarded BIDS container was stripped of all hardware and mounting brackets. Over the next 4 months, a select group of Soldiers from the TAML, guided by the consulting services of the RDECOM contractors, designed and fabricated a mobile analytical laboratory (Figure 3). The final product contains all the chemical and biological warfare agent assessment analytical capability found in the traditional "28 man team" yet has a DEL under 10 short tons. This concept lacks the throughput capability of the full laboratory but provides a rapidly deployable confirmation support platform that is easily sustainable in austere environments. The mobile laboratory was deployed to Kuwait with the second 28-man team in support of Iraqi Freedom and proved to be reliable and robust.

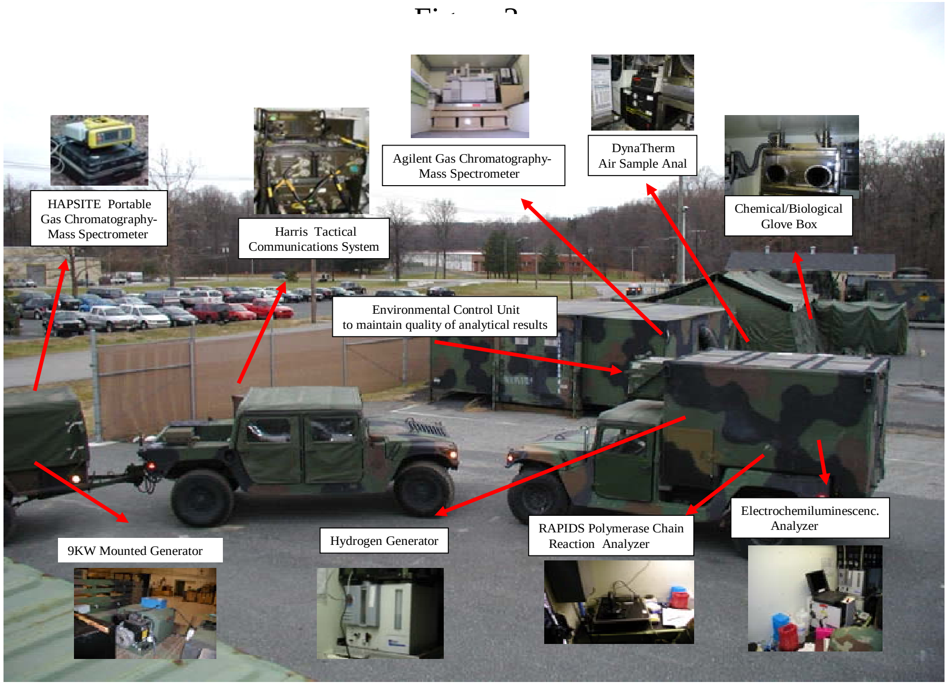

Fig 3.

Quality Control

Because the TAML mission does not involve patient care, little attention has been paid to a formal quality control program. While the organization has developed internal quality control measures, there is a need for an independent external quality control program. Such a program is needed to standardize and monitor all the force protection chemical and biological laboratory assets across all three services. Such a program should be managed from the Joint Forces Command level and be driven from a single Department of Defense directive. Standards should be set for methodologies and performance criteria and supported by periodic proficiency testing. Such a program would assist the Combat Commander's staff in comparing laboratory assets available in support of theater operations and planning.

Conclusion

The recent Iraq deployment of the TAML has been an important validation that confirmation level analytical capabilities can be transported over rough main supply routes and operated in austere conditions. The initial deployment team crossed the Iraq/Kuwait demilitarized zone on G+1 as part of the 86th Combat Support Hospital Medical Team. After traveling 4 days over 150 miles of unimproved roads and desert sand, the team set up operations at Tallil Air Base, 10 miles south of An Nasiriyah, Iraq. While setting up the laboratory, the team had to weather a severe sand storm with blowing dust and sand that reached gusts of 65 miles/hour. Despite this demanding terrain and austere environment, the team was operational within 48 hours and provided theater laboratory services during the Iraqi Freedom campaign.

As U.S. military forces continue to face the prospect of fighting adversaries with chemical and biological capabilities, it will be critical to provide a comprehensive and responsive detection and confirmation system on the battlefield. Until science and technology progress to the point where both sensitivity and specificity can be fielded at the point of detection level, the theater commander will continue to need laboratory assets that provide confirmation capability. For the AMLs to remain relevant and robust, the changes suggested above will be required. The organization must be a hybrid combination of both TOE and TDA with a command and control support that provides seamless interaction with all elements of the chemical and biological detection and assessment system. The AML subject matter experts must be provided the opportunity for a close working relationship between both the civilian and military research and development community. Additionally, there must be a mechanism for periodic review of prospective replacement or enhancement technology and a funding line to support required modernization.

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WRITING AND SUBMITTING ARTICLES FOR THE AMEDD JOURNAL

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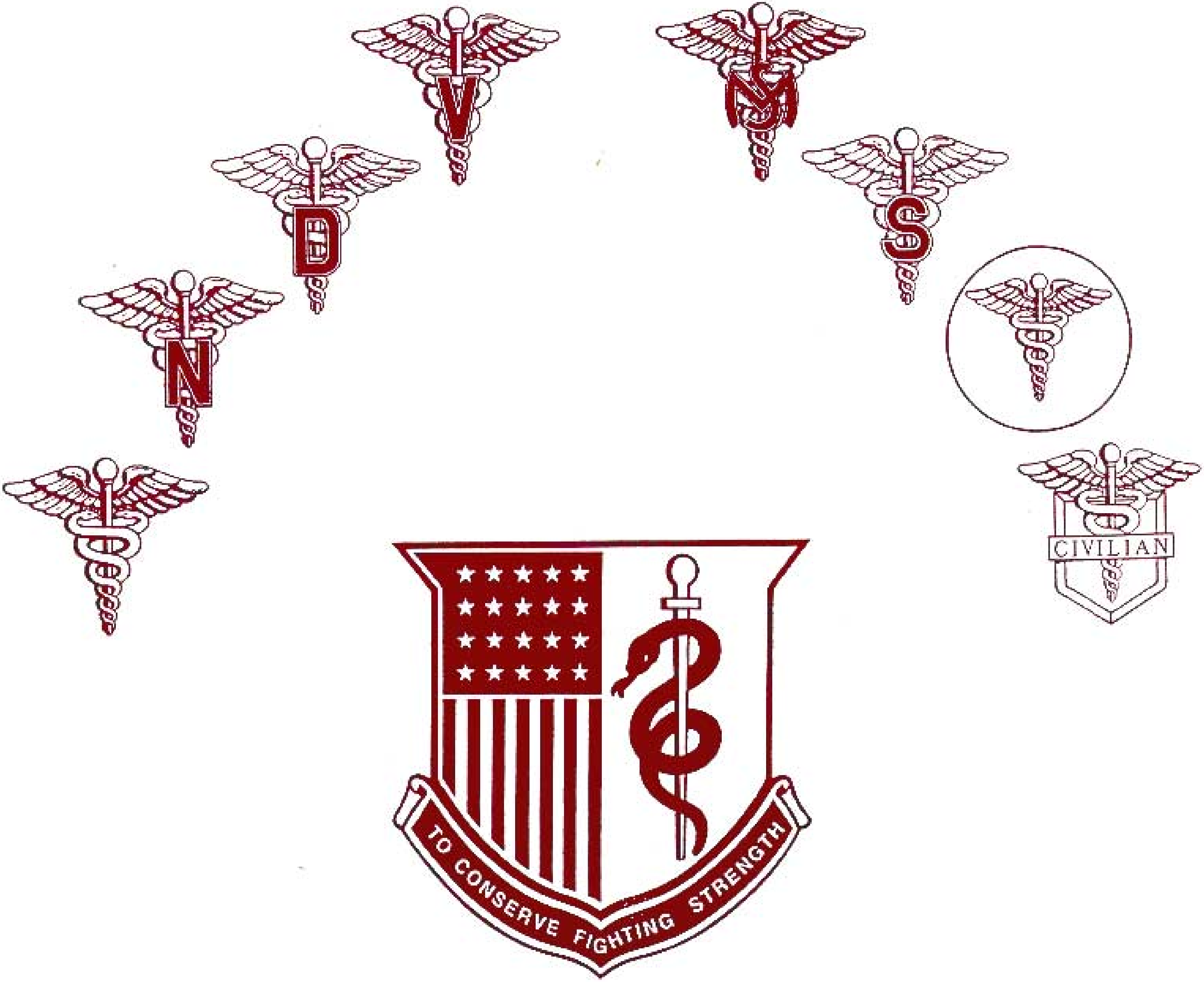
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