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The December 2017 MSMR opens with an article on the association between injuries from motor vehicle accidents and insomnia. Next is a report on the association between diagnoses of seizures and prior traumatic brain injury and post-traumatic stress disorder. The third article reports on the prevalence of hepatitis B and hepatitis C infections among Air Force basic trainees who donated blood for transfusion purposes. Lastly, there is an article about the association between diagnoses of fatigue and various other comorbidities.

CONTENTS AND SELECTED SUMMARIES


Elizabeth A. Erickson, MD (Lt Col, USAF); Shatana Stahelman, PhD, MPH; Mark G. McNellis, PhD

Insomnia is the most common sleep disorder in adults. A potential consequence of insomnia is increased risk of motor vehicle accidents (MVAs). To examine the relationship between insomnia and MVA-related injuries in the U.S. Armed Forces, this retrospective cohort study compared incidence rates of MVA-related injuries from 2007 through 2016 between service members with diagnosed insomnia and an unexposed cohort. After adjustment for multiple covariates, service members with insomnia had more than double the rate of MVA-related injuries compared to service members without insomnia (adjusted incidence rate ratio 2.08). A subanalysis of service members with insomnia during 2014–2016 found no difference in risk of MVA-related injury based on days’ supply of sleep aid medications prescribed in 365 days following insomnia diagnosis.


Julie A. Bytnar, MPH (SGT, USA); Shatana Stahelman, PhD, MPH; Saixia Ying, PhD

Traumatic brain injury (TBI) is a known risk factor for seizures. Evidence also shows that post-traumatic stress disorder (PTSD) is associated with seizures, but the relationship in the absence of TBI remains unclear. This retrospective study spanning 2007–2016 separately quantifies the rates of seizures diagnosed among deployed and non-deployed active component military service members to understand the factors associated with seizures and whether they differ in deployed settings. Higher rates of seizures were associated with service members who were in the Army or Marine Corps; female; black; younger; lower enlisted; in a combat-specific, armor/motor transport, or healthcare occupation; and who had no more than one previous deployment. These associations were similar among both deployed and non-deployed service members. Either a TBI or recent PTSD diagnosis was associated with a 3- to 4-fold increased seizure rate. For service members who had received both diagnoses, seizure rates among the deployed and the non-deployed were two and three times the rates among those with only one of those diagnoses, respectively. If the current results are supported by future investigations, there may be implications for both clinical care and military policy.

Douglas F. Taylor, DO (Capt, USAF); Ryan S. Cho, MD (Maj, USAF); Jason F. Okulicz, MD (Lt Col, USAF); Bryant J. Webber, MD, MPH (Maj, USAF); John G. Gancayco, MD (Lt Col, USAF)

Hepatitis B virus (HBV) and hepatitis C virus (HCV) can cause significant morbidity in military service members. Prevalences of HBV and HCV infections among military recruits accessioning into the U.S. Air Force have not previously been described. The Joint Base San Antonio-Lackland Blood Donor Center was queried for the results of HBV and HCV screening tests among all basic military trainees who donated blood between 25 November 2013 and 16 April 2016. The estimated prevalences of HBV and HCV infections among recruit blood donors were 0.0098% and 0.007%, respectively. This study suggests that the overall estimated prevalence of HBV and HCV infection is much lower among U.S. Air Force basic trainees than among other active and reserve component members and U.S. civilian populations. Discussion covered the uncertainty about whether or not trainee blood donors are representative of all trainees with respect to the prevalences of HBV and HCV infections. Additional studies are needed to determine cost effectiveness of screening for viral hepatitis among military populations.


Robert M. Guido, MD, MPH (CPT, USA); Shauna Stahman, PhD, MPH; Saixia Ying, PhD

Fatigue is a common complaint in the civilian population and may be a presenting symptom of more serious physical and mental disorders. Data from the Defense Medical Surveillance System (DMSS) were utilized to characterize the incidence and burden of fatigue in active component military members from 1 January 2007 through 31 December 2016. A subanalysis of 3 years within this surveillance period (2012–2014) was also conducted to assess the burden of comorbidities related to incident fatigue and the strength of the association between fatigue and selected comorbidities. The study identified 211,213 incident cases of fatigue with an overall incidence rate of 18.1 per 1,000 person-years between 2007 and 2016. Mental disorders and musculoskeletal disease accounted for about 35% of all medical encounters and about 40% of all hospital days within a year of those diagnosed with fatigue in 2013. The adjusted odds ratio for fatigue was highest in those with male hypogonadism, thyroid disorder, and sleep problems. These results show that fatigue is a common diagnosis with high incidence and burden among active component U.S. military. By focusing on the conditions that frequently occur and are highly associated with fatigue, more rapid diagnosis and treatment of the underlying cause of service member fatigue is possible.

Full articles can be viewed at: www.health.mil/MSMR

A publication of the Armed Forces Health Surveillance Branch, Silver Spring, MD
The January 2018 MSMR features three articles related to influenza. The first describes an outbreak of influenza and rhinovirus illness among Coast Guard trainees in Cape May, NJ. The second article documents the patterns of influenza incidence in DoD beneficiaries during the 2016–2017 influenza season and the levels of vaccine effectiveness associated with that year’s vaccine. The last article examines the performance of combinations of clinical observations as case definitions for influenza-like illness for use in influenza surveillance.

CONTENTS AND SELECTED SUMMARIES

PAGE 2 Outbreak of Influenza and Rhinovirus Co-circulation Among Unvaccinated Recruits, U.S. Coast Guard Training Center Cape May, NJ, 24 July–21 August 2016

Krista C. Swanson, MPH; Nellie Darling, MS; Perry Kremer, PA-C, MPAS (CDR, USCG); Matthew Doepking, PA-C, MPAS (LT, USCG); Shane C. Stelnor, MD, MPH (CDR, USPHS/USCG); Christopher A. Myers, PhD; Anthony W. Hawksworth; Jose L. Sanchez, MD, MPH (COL, USA, Ret.); Stic Harris, DVM, MPH; Michael J. Cooper, PhD (CAPT, USPHS)

Although seasonal influenza vaccinations are mandatory for military and Coast Guard recruits, the vaccine expires annually in June. On 29 July 2016, the U.S. Coast Guard Training Center Cape May, NJ, identified an increase in febrile respiratory illness (FRI) among recruits. During 24 July–21 August, a total of 74 recruits tested positive for respiratory infections: influenza A (H3) (n=34), rhinovirus (n=28), influenza/rhinovirus co-infection (n=11), and adenovirus/rhinovirus co-infection (n=1), while 41 recruits were considered suspected cases. Influenza predominated during 24 July–6 August, whereas rhinovirus predominated during 7 August–20 August. Incidence rates were highest among recruits in weeks 2–4 of an 8-week training cycle. Key factors for outbreak control included rapid detection through routine FRI surveillance, quick decision-making and streamlined response by using a single chain of command, and employing both nonpharmaceutical and pharmaceutical interventions.

PAGE 8 Brief Report: Department of Defense Global, Laboratory-based Influenza Surveillance Program’s Influenza Vaccine Effectiveness Estimates and Surveillance Trends for 2016–2017 Influenza Season

Lisa A. Shoubaki, MPH

Each year, the Department of Defense (DoD) Global, Laboratory-based Influenza Surveillance Program performs surveillance for influenza among service members of the DoD and their dependent family members. In addition, vaccine effectiveness (VE) studies are performed and the results are shared with the Food and Drug Administration, Centers for Disease Control and Prevention, and the World Health Organization for vaccine evaluation. During the 2016–2017 influenza season, a total of 5,555 specimens were tested from 84 locations.

(see next page)
The predominant influenza strain was A(H3N2), representing 73.8% of all circulating influenza. Sequence analysis of circulating influenza A(H3N2) showed that genetic clade 3C.2a was most predominant and shared a protein homology of 96.9%–99.3% when compared to the 2016–2017 vaccine component. Of influenza B strains detected, 60% were B/Yamagata and 40% were B/Victoria. Few respiratory specimens tested positive for influenza A(H1N1)pdm09 (n=29). Among non-influenza respiratory pathogens detected, rhinovirus/enterovirus was the most common (33.8%). The adjusted VE for all dependents against all influenza types was 48% (95% CI: 37%–56%). The adjusted VE against influenza A(H3N2) was 45% (95% CI: 33%–54%) overall. For influenza B, the adjusted VE was 55% (95% CI: 39%–66%) overall.

PAGE 10  
Assessment of 12 Influenza-like Illness Case Definitions Using Department of Defense Global, Laboratory-based Influenza Surveillance Program Data, 2011–2014

Laurie S. DeMarcus, MPH; Laurel V. Soderlund, MPH; Jameson D. Voss, MD, MPH (Maj, USAF)

Despite the growth in influenza surveillance programs, standardization of a globally accepted influenza-like illness (ILI) case definition remains difficult. With 2011–2014 Department of Defense Global, Laboratory-based Influenza Surveillance Program (DISP) data, 12 case definitions were evaluated using a combination of ILI case definitions from the Centers for Disease Control and Prevention, World Health Organization, and the DISP. The sensitivity, specificity, positive and negative predictive values, and odds ratios for each case definition were calculated. Additionally, area under the curve was calculated for a receiver operating characteristic curve to compare the case definitions. Between 2 October 2011 and 27 September 2014, 52.3% (5,575 of 10,662) of respiratory specimens submitted met the inclusion criteria. The case definition for the DISP had a sensitivity of 54.6% and specificity of 63.7%. Case definitions should be selected according to the objectives of the surveillance system and resources available. Sensitive case definitions capture a larger proportion of cases but at the cost of testing more specimens. Definitions with higher specificity result in fewer false positives but may miss more cases.

Full articles can be viewed at: www.health.mil/MSMR

A publication of the Armed Forces Health Surveillance Branch, Silver Spring, MD
Rationale for Utilization of Obesity Pharmacotherapy in the Active Duty Population

LCDR Karl Z. Nadolsky, DO

INTRODUCTION

Obesity is a chronic relapsing progressive disease defined by abnormal or excessive adiposity that may impair health and is staged based on the severity of the complications due to that adiposity.\textsuperscript{1-3} The obesity epidemic adversely affects the active duty military population with a prevalence of 13–18\% (based on body mass index [BMI] $\geq 30$ kg/m$^2$ underestimating cardiometabolic consequence of abdominal obesity and not accounting for ethnic differences).\textsuperscript{4-6} Retirees’ and dependents’ 30\% prevalence\textsuperscript{7} approaches the general community in the US\textsuperscript{8-9} and similarly around the world (including “overweight” classified as BMI $\geq 25$ kg/m$^2$).\textsuperscript{10} Obesity prevalence in the military veteran population has also risen coinciding with the general population including significant disparities.\textsuperscript{11-12} The prevalence is unfortunately similar in military recruits.\textsuperscript{13} These trends pose serious health risks to the active duty and veteran population with very high morbidity and mortality associated with it.\textsuperscript{14-17} Data from three cycles of the Millennium Cohort Study documented doubling of obesity rates per BMI in active duty members (10–20\%) and veterans (14–32\%) correlated with statistically significant higher rates of complications including hypertension, type 2 diabetes (T2DM), obstructive sleep apnea, depression, and post-traumatic stress disorder.\textsuperscript{18} This unfavorably impacts readiness and comprises the whole military family leading to yearnings to develop multidisciplinary strategies to combat the problem.\textsuperscript{19-20} There is also understandable substantial financial strain put upon the Department of Defense (DoD) health care system.\textsuperscript{21}

COMPLEXITY OF OBESITY AND APPROPRIATE MEDICAL TREATMENT

Obesity is a complex disease with an intricate and diverse spectrum of etiologies. This complexity involves multifarious pathophysiology integrating several systems regulating appetite, metabolism, and complications. This requires a comprehensive treatment approach to optimize behavioral therapy and often necessitates more intensive therapy including pharmacotherapy and/or surgery. The understanding of neuroendocrine control of body weight and adiposity homeostasis has led to the approval of several medications indicated as chronic adjunctive treatment of obesity. Intensity of treatment, to include pharmacotherapy and surgery, should be guided by the clinical severity of the disease of obesity.\textsuperscript{22} The active duty population also draws consideration for a sense of urgency because their careers are dependent on military readiness.

OBESITY AND READINESS

Obesity at all stages of severity adversely effects readiness. Administratively, all branches of the armed forces have body composition standards that, while imperfectly utilizing anthropometric measurements, serve as a barrier for recruitment and entrance along with risk of failing those standards and separation from the military. This creates potential for losing otherwise highly qualified personnel along with the time and effort put forth to educate and train those individuals not to mention the financial detriment. Although some of these members are very physically fit (which is good for combat readiness and long-term mortality),\textsuperscript{23} obesity generally hinders physical capabilities possibly making physical demands of combat increasingly difficult.\textsuperscript{24-26} Military service success also encompasses other aspects adversely affected by obesity including appearance, risk of injury, ability to deploy, and the health and well-being as noted previously.

OBESITY IS COSTLY

The financial cost of obesity and its complications continue to rise around the world along with the prevalence.\textsuperscript{27-28} A retrospective evaluation of TRICARE beneficiaries under the
PHARMACOTHERAPY

Despite the increased morbidity and mortality of obesity, there have been very few effective pharmaceutical options available for obesity treatment until 2012, targeting some of those complicated neuroendocrine pathways. Unfortunately, there are administrative and coverage barriers for prescribing these medications, especially for active duty, according to standard of care in military treatment facilities (Fig. 1). A brief overview of the newer medications’ benefits will be offered here.

Phentermine is primarily a sympathomimetic amine acting as a norepinephrine and possibly dopaminergic-releasing agent centrally in the arcuate nucleus to suppress appetite. Topiramat is a carbonic anhydrase inhibitor with gamma-aminobutyric acid modulation approved for treating migraines and epilepsy but has also been studied for obesity and T2DM. Topiramat combined with phentermine in extended release formulation (phen/top ER) is approved for chronic treatment of obesity and has been shown to be superior for mean weight loss when compared with the individual components. \(^3\) The placebo-subtracted average weight loss in phase 3 clinical trials for phentermine/topiramat (phen/top) ER ranged about 7–9% and the results were maintained for the completers who extended to 2 yr. \(^4\) The combination has been shown to delay the progression to T2DM in those at high risk (metabolic syndrome or pre-diabetes) \(^5\) and in a pooled analysis of Phase III Clinical Trials Assessing Phen/Top ER, higher Cardiometabolic Disease Staging score predicted effectiveness of weight Loss therapy to prevent T2DM. \(^6\) A phase 2 trial of high-dose phen/top ER in subjects with T2DM and baseline Hemoglobin A1c (HbA1c) of 8.7% resulted in an average of 7% more weight loss than placebo with corresponding improvement of HbA1c of 1.6% compared with 1.2%. \(^7\) This improvement was associated with better blood pressure and lipids along with fewer glycemic medication requirements. A sub-analysis of subjects with T2DM in the phase 3 trial, CONQUER, showed a significantly higher proportion of those taking phen/top ER achieving HbA1c goals. \(^8\)

Liraglutide is a GLP-1 receptor agonist that has been approved for the treatment of T2DM at a dose of 1.8 mg daily and recently approved for chronic obesity treatment at 3 mg daily. Liraglutide slows gastric emptying and, in addition to incretin effects, acts centrally in the pro-opiomelanocortin neurons of the arcuate nucleus to improve satiation, reduce appetite, and lower energy intake. Liraglutide at 3 mg daily was shown to be superior for weight reduction compared with other doses and to orlistat in an early trial. \(^9\) The large phase 3 trial SCALE Obesity and Pre-diabetes showed nearly 6% placebo-subtracted weight loss on average including nearly 11% mean weight loss for those who “responded” early with 4% weight loss at 16 wk. \(^10\) Additionally, liraglutide dramatically decreased progression to diabetes in those with pre-diabetes by approximately 80% over 3 yr. \(^11\) In the SCALE diabetes trial, \(^12\) there was an average of about 4% placebo-subtracted weight loss and HbA1c reduction of 1% more than placebo and also statistically better in both regards than the 1.8 mg dosing.

Naltrexone is a µ-opioid receptor antagonist historically used for opioid and/or alcohol addiction and bupropion is a dopamine and norepinephrine reuptake inhibitor approved for depression and smoking cessation. The combination of naltrexone/bupropion in ER formulation is approved by Food and Drug Administration (FDA) for the chronic treatment of obesity. The combination works synergistically to act on the POMC neurons while mitigating negative feedback from resulting endorphins to reduce appetite in addition to modulating the mesolimbic reward pathway and eating behavior. \(^13\) In the phase 3 clinical trials of naltrexone/bupropion ER, the mean placebo-subtracted weight loss was about 5–6%, whereas those achieving the 5% goal for early response at 16 wk averaged nearly 12% weight loss accompanied by improvements of several cardiometabolic parameters. \(^14\) In patients with T2DM, there was an average of about 4% more weight loss than placebo accompanied by 0.5% better HbA1c reduction. \(^15\)

Lorcaserin is a 5-hydroxytryptamine-2c (5-HT\(_{2c}\)) receptor agonist that also works centrally on POMC neurons to reduce appetite and energy intake. Phase 3 trials showed a placebo-subtracted weight loss of about 3–4%, which was fairly stable extended to 2 yr. \(^16\) Early response to therapy, indicated by achieving 5% weight loss in 12 wk, predicted success and a mean weight loss of nearly 11%. \(^17\) For patients with T2DM, HbA1c decreased by 0.6% more than placebo and interestingly was not significantly altered by weight loss response to therapy. \(^18,19\) Cardiovascular risk factors also improved consistently with lorcaserin use.

Adverse effects and concerns of risks outweighing the benefits have been a significant barrier to the appropriate adoption and utilization of obesity pharmacology. In the phase 3 trials of the currently available medications for the chronic treatment of obesity, they were generally well tolerated. They all technically belong to different classes of medications with different adverse effect profiles and different contraindications. The American Association of Clinical Endocrinologists developed a comprehensive clinical practice guideline and handy algorithm for the medical care of patients with obesity and included an exhaustive review of data to assist clinicians in personalizing treatment with these new medications utilizing the patients’ medical histories and medication contraindications, cautions, and side effects, which should be referred to for a resource in this manner. \(^20\)

Cardiovascular concerns have been at the forefront in obesity medication development secondary to previously
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<td>Orlistat</td>
<td>Lipase inhibitor</td>
<td>Pregnancy, Chronic Malabsorption, Cholestasis, Nephrolithiasis, Known hypersensitivity</td>
<td>Steatorrhea, Fecal urgency &amp; flatulence, Malabsorption fat-soluble vitamins</td>
</tr>
<tr>
<td>Lorcaserin</td>
<td>SHT2-c receptor agonist</td>
<td>Pregnancy, Known hypersensitivity</td>
<td>Headache, Dizziness, Fatigue, Nausea, Dry mouth, Constipation</td>
</tr>
<tr>
<td>Phentermine / Topiramate CR</td>
<td>Norepinephrine-releasing agent</td>
<td>Pregnancy, Glaucoma, Hyperthyroidism, Current or recent MAOI treatment, Known hypersensitivity</td>
<td>Paresthesia, Dizziness, Dysgeusia, Insomnia, Constipation, Dry mouth</td>
</tr>
<tr>
<td>Naltrexone / bupropion CR</td>
<td>Opioid antagonist</td>
<td>Pregnancy, Uncontrolled HTN, Seizure disorder, Anorexia or Bulimia nervosa, Severe depression, Drug or alcohol withdrawal, Chronic opioid use, Use of other bupropion product, Current or recent MAOI treatment, Known hypersensitivity</td>
<td>Headache, Nausea/vomiting, Constipation, Dizziness, Insomnia, Dry mouth, Diarrhea</td>
</tr>
<tr>
<td>Liraglutide 3mg</td>
<td>GLP-1 agonist</td>
<td>Pregnancy, Personal or family history of medullary thyroid carcinoma or MEN2, Known hypersensitivity</td>
<td>Nausea/vomiting, Diarrhea, Constipation, Dyspepsia, Abdominal pain GERD</td>
</tr>
</tbody>
</table>

available medications coming off the market due to adverse events.

Despite concerns of adverse serotonin effects on cardiac valves, no concerning valvulopathy was found in trials of lorcaserin including those with pre-existing valvulopathy. A cardiovascular outcome trial involving naltrexone/bupropion ER was conducted with early reassuring statistics but was terminated early due to leaked study information compromising the outcomes and the resulting data remain unclear. Liraglutide was shown to have cardiovascular outcome benefits at the diabetes treatment dose of 1.8 mg daily compared with placebo or usual targeted care in those with T2DM and established atherosclerotic cardiovascular disease.

Although generally well tolerated, considerations for the burdens of active duty personnel must be paid special attention. For example, the potential steatorrhea and fecal urgency associated with orlistat could pose a substantial barrier to combat, watch, or other time-involved duties. Both liraglutide and naltrexone/bupropion ER are associated with more nausea and vomiting than placebo, which improves with continued use but also may be a barrier to adherence in the active duty population and must be counseled appropriately. Overall, if prescribed thoughtfully and monitored as indicated, adverse effects of all the pharmacologic agents can be meaningfully minimized.

One concern raised regarding coverage for obesity pharmacology focuses on the sheer numbers of patients for whom the medications would be technically indicated. The United States FDA approved the medications with indications being BMI ≥ 30 kg/m² or BMI ≥ 27 kg/m² plus complications. With prevalence noted above, that would include an enormous number of patients. Investigating and applying methods of suitable prescribing practices must be emphasized to mitigate the potential for overprescribing and optimizing benefit.

Initially, clinical judgment on when to initiate a trial of obesity pharmacology is critical. The American Association of Clinical Endocrinologist guidelines emphasize this point with consideration of those patients who have not responded to intensive lifestyle therapy, experienced weight regain after responding to lifestyle therapy, and those with more severe complications of obesity up front. Specifically regarding active duty, restrictions may need to be considered initially for those in positions most critical in avoiding adverse effects just like any medication. This could include pilots, nuclear security, weapons handlers, or others that would require good communication between the obesity treatment team and the primary medical officer. Due to the special circumstance of active duty responsibilities and deployability, initially restricting prescribing capabilities should be strongly considered. This author suggests that major medical treatment facilities’ comprehensive multidisciplinary programs put into place have access to obesity pharmacotherapy. Endocrinologists and/or obesity specialists who are diplomates of the American Board of Obesity Medicine could be granted capability to prescribe and continue as indicated.

The next consideration is deciding who should remain on these medications chronically or indefinitely. The Endocrine Society Clinical Practice Guidelines for obesity pharmacology recommend stopping medications after 3 mo if 5% weight loss has not been achieved. This is similar to the FDA-prescribing recommendations with some slight differences among the medications. For phentermine/topiramate ER, it is advised to use 3% weight loss at 12 wk on the recommended dose to evaluate response and continuation with an option for titration to the higher dose then with a 5% goal after another 12 wk. Liraglutide 3 mg prescribing information instructs a 4% goal at 16 wk to continue medication. As previously mentioned, the FDA-indicated early response goal of 4% was shown to be the appropriate target for termination or continuation criteria of liraglutide as those who achieved that mark at 16 wk faired very well with an average of about 11% weight loss compared with 3% for non-responders at 1 yr. Similar findings corresponding to FDA stoppage criteria for naltrexone/bupropion ER and lorcaserin were also confirmed as noted above. Perhaps another obvious indication for holding a medication would be intolerable side effects either subjectively or objectively.

CONCLUSION
Pharmatherapy, as indicated, should be incorporated into the thorough treatment of our active duty population at need as recommended in the DoD/VA guidelines. Appropriate clinical utilization of these medications, just as with any drug for the treatment of chronic disease, must be practiced with a goal of benefits outweighing the risks. If prescribed, monitored, and stopped according to the evidence-based guidelines cited, the progress in adhering to that goal will be attained. Currently, several discordant military policies confuse properly treating our active duty members leading to frustration and disappointment. Coverage remains a significant barrier as TRICARE currently excludes these important tools. Further evaluation and research is necessary to make broader recommendations to those who are not geographically near a large military medical treatment facility where multidisciplinary treatment programs can provide comprehensive care. Leaders both in the military and our political system should support the progress toward optimally treating obesity up to the standard of care.

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COMMENTARY

MILITARY MEDICINE, 183, 3/4:51, 2018

USU's Pediatric Interest Group: Preparing the Next Generation of Military Pediatricians

ENS Michael Harding, USPHS*; ENS Jessica Wilder, USN*; LT Meaghan Sledge Wido, USN†; Lt Col Courtney Judd, USAF‡

Bearing the epithet “America’s Medical School,” the F. Edward Hébert School of Medicine at the Uniformed Services University of the Health Sciences (USU) prepares future providers for the unique circumstances surrounding the care of service members and their families. A student-run Pediatric Interest Group helps to facilitate exposure to the unique field of military pediatrics. Military pediatricians care for an incredibly varied patient population that includes military dependents, foreign recipients of humanitarian aid, and soldiers, airmen, sailors, and marines, both inside and “outside the wire.”1 In addition to providing top-notch medical care for dependents, pediatricians in the Military Health System (MHS) must attend to stresses associated with frequent relocations to new communities and schools, the challenges of residing in foreign countries, and geographic separations and deployments.2 USU’s Pediatric Interest Group helps prospective pediatricians hone their medical skills and prepare to build resilience in the patients and families for whom they provide care.

The 2016–2017 leadership of the USU Pediatric Interest Group emphasizes the collaborative, multi-service nature of today’s military health system, boasting representatives from the Army, Navy, Air Force, and U.S. Public Health Service. A brief description of the group’s mission and activities is published yearly in the Student Handbook. Each month, the group’s four leaders host guest speakers that highlight the depth and breadth of potential careers in pediatrics. These topics – selected by group leaders and arranged by faculty sponsors – have included tactical combat casualty care, pediatric cardiology, CBRN (chemical, biological, radiological, nuclear) training, and humanitarian plastic surgery in the Dominican Republic. Attendance at these meetings regularly exceeds 50 students, and catering is made possible by grants from the Uniformed Services Chapters of the American Academy of Pediatrics, the American Academy of Pediatrics Section on Uniformed Services, and from private charitable donations. Accordingly, the Pediatric Interest Group is one of the few groups on campus that does not require members to pay dues. Group leaders also arrange shadowing opportunities in the Walter Reed National Military Medical Center’s inpatient pediatric ward, newborn nursery, neonatal intensive care unit, and specialty clinics. During these shadowing experiences, students observe military medical teamwork in action and have the opportunity to connect what they have been learning in class to real-life patient care.

Another important function of the Pediatric Interest Group is coordinating community service projects. On Martin Luther King, Jr. Day, USU medical students joined forces with the residents of the National Capital Consortium Pediatric Residency Program to help beautify D.C. elementary schools in lower income neighborhoods during a “National Day of Service.” Members have also served various populations directly through work as community health educators on topics ranging from doctor visits to nutrition, and as food servers who provided a home-cooked meal to families of hospitalized patients at the local Fisher House. Coordination of volunteer activities with other interest groups mirrors medicine’s real-world, interdisciplinary approach.

The Pediatric Interest Group helps connect students with mentorship and research opportunities. In fact, one past group member’s senior capstone project was the application of the Student Teaching AIDS to Students (STATS) program to the local community. The program promotes HIV awareness in high schools by providing practical, scientifically based information and resources to teenagers. Medical student volunteers partner with other health providers to visit local high school
health classes and teach about HIV prevention and control. Given that Washington, D.C. and Maryland rank first and third in the nation, respectively, for rates of adults and adolescents living with diagnosed HIV infection,\textsuperscript{3} volunteers hope to educate and empower high school students to take ownership of their health at this critical period in their lives. Volunteers also gain an invaluable opportunity to improve their communication skills with adolescent patients. Thus far, the outpouring of support from USU students has been inspiring, as has been the enthusiasm of our community partners.

Our efforts to increase interest in pediatrics have produced tangible results. An increasing number of students is being exposed to pediatrics within the military, and many students are applying to and matching into pediatric residencies. For the last 15 yr, we have consistently seen between 8% and 12% of each USU graduating class pursue a career in pediatrics.

Through interactive group meetings, mentorship opportunities, service projects, and early clinical exposure, the USU Pediatric Interest Group plays a vital role in preparing the next generation of military physicians to care for our service members and their families.

REFERENCES
Dietary Supplements: Regulatory Challenges and Issues in the Department of Defense

Patricia A. Deuster; Andrea T. Lindsey; Jonathan M. Scott

It is widely recognized that military populations regularly use a wide variety of dietary supplements (DS) ranging from those marketed for better health and joint health to weight-loss and performance-enhancing supplements. Based on the 2015 Department of Defense (DoD) Survey of Health-Related Behaviors, 32.0% of service members report using at least one DS daily, and 13.0% of males report using body-building supplements each day. Women use body-building supplements less frequently (5.4% daily) but are more likely to use weight-loss supplements daily (8.6%) than men (6.3%). Military personnel typically take more DS than other populations and gravitate toward products marketed to enhance physical performance, to include stimulants, protein and amino acid supplements, and combination products. If all DS were safe, this topic would not be an issue, but not all are. DoD now relies on Operation Supplement Safety (available at OPSS.org) as the “go-to” resource for DS education and related content.

The Dietary Supplement Health and Education Act of 1994 (DSHEA) amended the Federal Food, Drug, and Cosmetic Act to define DS as products intended to supplement the diet, including vitamins, minerals, herbs and botanicals, amino acids, and substances such as enzymes, organ tissues, glandulars, and metabolites. As the law implies, almost any dietary ingredient that occurs “naturally” can technically be sold as a DS in the United States. The law states that supplement ingredients in the food supply or sold in the United States before October 15, 1994, are presumed to be safe and not subject to review by the Food and Drug Administration (FDA) for safety before being marketed. Any dietary ingredient marketed in the United States after October 15, 1994, is considered a “new dietary ingredient”, and although it must undergo a review by FDA, no authoritative list of dietary ingredients marketed in DS before October 15, 1994, exists. Therefore, manufacturers and distributors are responsible for determining if an ingredient is a new dietary ingredient. The likelihood that some multi-ingredient DS being promoted to service members are adulterated or contaminated is high.

Because of FDA regulations, an almost never-ending assortment of ingredients—from mysterious botanicals to unapproved pharmaceuticals—appear in DS. Currently, because DS can be marketed in the United States without the manufacturer ever providing any evidence of safety or efficacy, thousands of products (that have never been adequately tested) are readily available to American consumers. The FDA does all it can within the scope of the law, but unfortunately, the military is a prime target for the dark parts of DS subculture. Importantly, service members are prime targets for DS companies because they believe—based on marketing and peer interactions—such products will increase muscle strength, enhance performance, and provide an edge. Interestingly, many websites directly make outrageous claims and market to military members. Statements such as “military grade,” “supplements designed for soldiers,” “You must be Active Duty, Retired, Reserve, or National Guard to purchase from this website,” and “inspired by the real heroes, made for everyone” are common. Moreover, manufacturers will typically send the DS purchased by Warfighters to any location in the world free of charge. Thus, the military has become truly a field laboratory of what could be considered the dark side of DS. Some of the pressing issues within the DoD relate to the following:

- Adulteration of products
- Power of the industry
- Adverse event (AE)-reporting processes
- Access to DS on bases

Examples and explanations for each of the issues are provided.

ADULTERATION OF PRODUCTS

The Consortium for Health and Military Performance at the Uniformed Services University has a formal agreement with...
the U.S. Anti-Doping Agency to test various products that have been associated with AEs or are being used by service members and appear to be of concern. Over the past 5 yr, many DS have tested positive for steroids, stimulants, and selective androgenic receptor modulator substances. Overall, many performance-enhancing and body-building DS are adulterated or contain problematic combinations of ingredients. As such, they pose various risks, to include compromising readiness, and potentially being released from the military.5

POWER OF THE INDUSTRY
The DS industry and trade associations are extremely powerful, and as such many “likely” illegal/unsafe dietary ingredients are available for sale in the United States. Their power also makes it difficult for DoD and other federal agencies to move various efforts forward. Two examples are provided. The first relates to three amendments (S.A. 1560, 1561, and 1562) filed to the 2016 DoD spending bill by Senators Dick Durbin (D-IL) and Richard Blumenthal (D-CT). The amendments were as follows:

• SA 1560 calls for the military health system to record DS AEs, to generate standard reports on AE data that can be aggregated for analysis, and to issue automated alerts to signal a significant change in AE reporting or to signal a risk of interaction with a medication or other treatment.
• SA 1561 would modify the electronic health record system of the military health system to include data on DS use by members of the Armed Forces.
• SA 1562 would require DS sold by a retail establishment operating on a military installation to (1) be verified by an independent third party for recognized public standards of identity, purity, strength, and composition and adherence to related process standards; or (2) comply with Defense Commissary Agency policy on inventory carried by commissaries.

In response to the proposed amendments, the Natural Products Association (NPA) launched a “Save Our Supplements” webpage to engender opposition. Interestingly, the amendments would have imposed actions on the military system that DoD had been considering, one as a direct attempt to improve the quality of the supplements being sold on bases. DoD received pushback from the industry and Dr. Dan Fabricant, CEO of the NPA, stated “People may think that this doesn’t apply to them, just the military but we’ve seen this exact same play many times before, I will bet anyone dollars to donuts that a broader challenge is coming next and coming soon. We need folks to send in emails, it’s that simple.”

The second example shows how, despite having significant scientific evidence, the FDA is always up against industry. The ingredient – vinpocetine – is a synthetic compound reportedly derived from periwinkle or vinca minor. It has been sold as a DS since the 1990s and marketed for improving brain function, visual acuity, memory, and focus, as well as rapid weight loss and/or fat loss and increases in energy, as well as a number of clinical conditions.5 Whether vinpocetine is effective for any of these uses is unclear, but its legality has been challenged.9 On October 5, 2015, Senator Claire McCaskill asked the FDA to take action to cease the sale of all DS containing vinpocetine and in less than a year – on September 6, 2016 – the FDA concluded that vinpocetine (1) is not a constituent of periwinkle or vinca minor, or any other plants; (2) does not meet the definition of a dietary ingredient; and (3) is excluded from the definition of a DS in the Federal Food, Drug, and Cosmetic Act (DSHEA/FD&C Act). Despite FDA’s decision, they agreed to accept public comments on this tentative conclusion until November 7, 2016.5 By the close of the comment period, over 835 comments had been submitted challenging the FDA’s stance. Comments came from several industry trade associations, including the NPA (Washington, DC) and the Council for Responsible Nutrition (Washington, DC), and they continue to argue vinpocetine should absolutely remain a dietary ingredient. Again, NPA’s CEO Daniel Fabricant, Ph.D., responded by saying “It would appear that removal of this ingredient would bear little incremental public health effect (per the notice) but a significant incremental cost associated with the change in regulatory status.”10 The NPA also submitted a formal letter requesting an extension of the comment period by 10 mo or until September 6, 2017. Thus, the question remains open in March 2017, but this example shows the absolute power of the DS industry and trade associations, as well as Congress, where Sen. Orrin Hatch urged FDA to withdraw the notice in the Federal Register regarding vinpocetine. Overall, when the FDA tries to follow regulations and protect the public, forces stronger than them take over.

AE DOCUMENTATION AND REPORTING
One of the only mechanisms the FDA has to remove problematic/dangerous ingredients/supplements is to accumulate a significant number of AEs showing harm, and AE associated with DS are of concern. A serious AE can take a warfighter out of action for days to months. Service members using multiple DS and/or DS that contains multiple dietary ingredients are likely to report AE such as palpitations, tingling, and numbness.11–14 Based on current data, the proportion reported to the FDA is unclear, but remains very low.13,14 Since the beginning of 2017, we know of at least two serious hepatic injuries and two cardiac arrests – luckily they are still alive, but the medical care required for these warfighters and the disruption of their lives are significant. What happens when there is an AE? Unfortunately, less than 1% of military providers report AE to the FDA, despite the finding that over 60% of physicians have seen AEs.13,15 The DoD has been trying to develop an easy “workflow” approach that requires limited time for providers to report AEs and therefore capture signals. However, coordinating with electronic health records, pull downs with all supplements listed for easy entry, and a central repository for collecting and analyzing AEs have
been difficult with so many other higher priorities. Importantly, the DoD could become a model for the civilian sector if they develop a process that reduces workload and ensures submission to the FDA, as any serious AE is a threat to readiness and operational performance.

ACCESS TO DS ON BASES
Currently, DS are sold in a variety of venues on bases: exchanges, commissaries, and other commercial locations, to include General Nutrition Centers Holdings Inc. (GNC) stores. These commercial settings want to sell products to make money and please customers. As such, they are not always informed about the latest ingredients and potential for complications from combinations of multiple substances. Perhaps one of the most notable events is the multiple important enforcement actions imposed on GNC by the Department of Justice to address concerns with the safety, purity, and potency of DS. These actions primarily included payment of money and regulatory/administrative actions. The primary actions included having GNC (1) commit to and adhere to voluntary compliance measures; (2) voluntarily undertake organizational changes with respect to its sale of DS; (3) commit to fulfill all terms of the Department of Justice agreement. It is not the intent of this editorial to describe all aspects of the agreement, but this action may reduce the number of problematic supplements available in GNCs on bases. We hope the other commercial entities on bases will follow the actions imposed on GNC, as the general consensus among service members is that “if it is sold on base, it must be safe,” and we know this is not always the case.

Of additional concern is the knowledge that service members’ have a limited understanding with regard to how the FDA regulates DS safety and efficacy. Over 73% of service members surveyed believe that all DS sold are safe for consumption because of U.S. requirements. Moreover, more than half of service members (53.6%) believe that the U.S. Government requires all DS sold on base (and elsewhere) to work as promised. This gap in knowledge regarding DS further reinforces the need for a strong commitment from retailers on military bases (and elsewhere) to sell safe products and new partnerships are being formed to ensure this happens.

In summary, we have provided an overview of key issues related to DS within the civilian and military communities. Many DS pose a public health threat, but the current regulatory framework requires an overhaul if we want to ensure the safety and readiness of our military personnel. Operation Supplement Safety is the DoD educational resource devoted to DS and the military. Please visit OPSS.org for information on supplements.

CONFLICT OF INTEREST
The authors have no financial relationships or conflicts to disclose.

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Military Health System Transformation Implications on Health Information Technology Modernization

Saad Khan, DrPH, MBBS, MSHA, MPH

ABSTRACT With the recent passage of the National Defense Authorization Act for Fiscal Year 2017, Congress has triggered groundbreaking Military Health System organizational restructuring with the Defense Health Agency assuming responsibility for managing all hospitals and clinics owned by the Army, Navy, and Air Force. This is a major shift toward a modern value-based managed care system, which will require much greater military–civilian health care delivery integration to be in place by October 2018. Just before the National Defense Authorization Act for Fiscal Year 2017 passage, the Department of Defense had already begun a seismic shift and awarded a contract for the new Military Health System-wide electronic health record system. In this perspective, we discuss the implications of the intersection of two large-scope and large-scale initiatives, health system transformation, and information technology modernization, being rolled out in the largest and most complex federal agency and potential risk mitigating steps. The Military Health System will require an expanded unified clinical leadership to spearhead short-term transformation; furthermore, developing, organizing, and growing a cadre of informatics expertise to expand the use and diffusion of novel solutions such as health information exchanges, data analytics, and others to transcend organizational barriers are still needed to achieve the long-term aim of health system reform as envisioned by the National Defense Authorization Act for Fiscal Year 2017.

With the recent passage of the National Defense Authorization Act for Fiscal Year 2017 (NDAA), Congress has triggered groundbreaking Military Health System (MHS) organizational restructuring with the Defense Health Agency (DHA) assuming responsibility for managing all hospitals and clinics owned by the Army, Navy, and Air Force. This is a substantial shift toward a modern, value-based, managed care system requiring improved military–civilian health care delivery integration that must be in place by October 2018. Even before passage of the NDAA, the Department of Defense (DOD) had already begun a seismic shift and awarded a $4.3 billion contract for the new MHS-wide electronic health record (EHR) system, called MHS GENESIS, to a consortium of Leidos, Cerner, Accenture, and others in July of 2015, to replace its aging legacy EHR. Although planning and organizational activities have been underway for well over a year, the first and second site deployments have more recently occurred in February and July 2017 with two more sites slated to launch in the fall of 2017, with full MHS deployment expected to be completed in 2022. Against the backdrop of this sweeping organization-altering legislative mandate coupled with a health system-wide information technology deployment, the MHS finds itself charting a course where flux is the only certainty. Previous reviews of military health and related health information technology (HIT) efforts have provided broad recommendations for change. We focus here on the organizational implications of MHS GENESIS deployment with a full replacement of a legacy EHR and the NDAA’s simultaneous requirement to institute far-reaching organizational management and administrative restructuring. We highlight opportunities and current challenges, suggesting strategies for navigating major simultaneous technology and organizational transformations.

NATIONAL DEFENSE AUTHORIZATION ACT FOR FISCAL YEAR 2017

As is common with the annual Congressional Authorization for the DOD, it is expansive and reflects the broad nature of activities of the Department from procuring fighter aircraft to military pension benefits. Title VII of the law, which covers health care provisions, is a key component we briefly review here, contains over 50 sections. Although many of the sections in Title VII have potential implications for health IT modernization, there are several that stand out.

Section 702 is the most far-reaching and noteworthy component, with the Director of the DHA being given full...
administrative authority over all medical treatment facilities (MTFs) as of October 2018. This includes not only budgetary control but also information technology oversight, health care administration and management, along with general administration. Key to DHA control over MTF information technology, there will be a designated Deputy Assistant Director for Information Operations along with three other Deputy Assistant Directors for Finance, Health Care Operations, and Medical Affairs, all reporting to DHA Assistant Director, who reports to DHA Director. Essentially, there will no longer be three different silos of HIT operations between the Army, Navy, and Air Force and all HIT procurement, ownership, and operation will be managed centrally through a single organization.

Section 706 directs the Secretary of Defense to establish high-performance, military–civilian, integrated health delivery systems by partnering with health maintenance organizations, integrated health systems, accountable care organizations, and other systems. Each of these partnerships is expected to deliver benefits that include improved access for beneficiaries, enhanced readiness of MTF providers, and sharing of staff, equipment, and training resources. Furthermore, key outcomes from this effort include measurable health quality improvement based on national standards, greater efficiency with reduced care variation and medical error prevention, improved population health outcomes and early disease detection, and prevention and treatment activities among others.

Sections 709 and 718 call for the improvement of patient access to health care services. The law directs the Secretary of Defense to implement a singular standardized medial appointment system for MTFs with no variation from site to site, set productivity standards for all providers with optimal appointment levels, and improve utilization of telehealth across the health service continuum. Finally, Section 741 directs the DOD to provide a report on plans for implementing all information technology capabilities for interoperability with the Department of Veterans Affairs (VA), which is yet to be completed.

MHS GENESIS AND TRANSFORMATION

Transitioning and modernizing the over two decades old legacy, EHR will not serve as a panacea for transforming the MHS into a modern health care system, but the initiative has triggered a detailed health system review unlike before. The NDAA is unparalleled in its mandate to transform the MHS, and although HIT such as MHS GENESIS is a cornerstone for the information infrastructure requisite to achieve the NDAA innovations, much more is required. In an analysis of HIT and health care transformation funded by U.S. Department of Health and Human Services Office of the National Coordinator, Gold notes, “such functionalities require much more than the presence of EHR; the data must also be liquid, integrated into the work flow, and used for analysis. Even in advanced systems, it takes years to create HIT infrastructure. Building this infrastructure and transforming delivery simultaneously are difficult, although probably unavoidable, for most providers. Progress will likely be slow…” Deploying GENESIS coupled with the NDAA reorganization provides an unprecedented opportunity for MHS introspection while developing and diversifying an aging infrastructure requisite for a modern integrated health care delivery system. Here, we summarize the organizational implications of the convergence of transitioning to MHS GENESIS under the NDAA.

Various studies have highlighted committed leadership, clear organizational lines of authority, and shared vision and ownership as key ingredients for successful HIT implementations, including EHRs. As such, the major provision of the NDAA to transition and centralize all MTF administration and operations under the DHA, including information technology, is timely and reinforces the necessary unified leadership and command structure as the agency moves to a singular enterprise-wide EHR across Army, Navy, and Air Force. To lead this unified effort, the DHA will need a central cross-cutting authority that seamlessly integrates all components of people, process, and technology.

Although a final structure and strategy are still evolving, DHA has taken steps to put organizational supporting components in place. As several studies have noted, the need for engagement of a respected clinician to build end user buy-in and support and links to executive management have been essential strategies for EHR deployments. Key to this is the Office of the Functional Champion, led by a physician who reports directly to the Director of DHA. The office serves as the key influencer, motivator, and lead for realizing, promoting, and diffusing the benefits and value of the new EHR. If DHA is to fulfill the role of administrator for all MTFs in the face of a profound and complex enterprise-wide mission HIT transition, then expanding, consolidating, and empowering the role of the Office of the Functional Champion to lead the transition must be a priority. Indeed, Adler goes as far to say, “Identify an EMR champion – or don’t implement.”

Over 60% of the health care services provided by the MHS are through purchased care outside of MTFs. For fiscal year 2017, of the almost $25 billion that DHA requested to support patient care, only $9.2 billion supports direct care at MTFs, whereas nearly $16 billion is spent on purchased care. Not surprisingly, the NDAA directs the DOD to establish a tightly linked integrated network with the private sector that provides expanded access outside of MTFs to beneficiaries while requiring comparable health quality and population health metrics tracking. However, as recently reported in a MHS review, there is no alignment between direct care and purchased care, especially around quality metrics. The report further identified a significant gap in the ability of the MHS to aggregate and analyze system-wide health care information and noted, “Although the MHS has a wealth of data, the ability to analyze those data and use the results to guide decision making in quality and patient safety is nascent.” Although the current MHS legacy EHR has been able to support care coordination
and MHS GENESIS will further strengthen this coordination, it is limited to the MHS direct care network. The expanded access to beneficiaries, coupled with the requirement for comparable, transparent, and visible health care quality and service metrics across MTFs and purchased care through civilian providers, further increases the cross-user population. As such, more robust data are needed to link, aggregate, and analyze beneficiary health care services across military and civilian providers.

A first step in being able to link across both federal and civilian providers was launched in June 2016 with the Virtual Lifetime Electronic Record Health Information Exchange (VLER HIE) Initiative. Although it currently only links a small set of civilian providers to the DOD and VA, it provides important information such as prescriptions, allergies, illnesses, lab and radiology results, immunizations, and past medical procedures. However, the necessary quality and population health monitoring and management metrics are still lacking along with other health service details. Therefore, given the demand for better provider coordination and richer standardized data and metrics, approaches for augmenting the current HIE will need to be explored as MHS GENESIS continues to be rolled out.

Implementing a unified scheduling system, improving clinician productivity and expanded telemedicine capability called for in the NDAA are all opportunities ripe for health informatics engagement. Although deployment of MHS GENESIS presents a platform for better patient engagement and improving access, it may potentially further stress MHS providers. A recent American Medical Association-funded study further concluded that physicians spend almost 50% of the day on EHR and desk work and less than one-third on direct clinical face time with patients along with another 1–2 h of personal time at home each night to “keep up.” In addition, even with a long history and advances in MHS telehealth systems, they are not integrated with legacy EHR systems. The limitations are in part due to a lack of standard policy for documentation, charges, and workload along with a lack of appropriate EHR data fields for relevant information that must be captured in telehealth encounters. As such, deployment of MHS GENESIS and other HIT initiatives while necessary, to serve to catalyze transformation; they will have to be tempered by necessary people and process limitations that have not evolved at the same pace as the technology. Broad-based organized change management activities and formalization of a health informatics organization and training of requisite informaticists are needed to prepare not only the user base but develop and grow a cadre of clinician informatics specialists. Critically, these informaticists can support the rapid MHS health information reforms and transformation that are planned over the next several years.

Although DOD along with the VA has been on the forefront of EHR deployment and usage, the patchwork of legacy systems including the largest (Composite Health Care System, Armed Forces Health Longitudinal Technology Application, and Essentris and VA’s Veterans Information Systems and Technology Architecture) have become increasingly costly, complex, and disparate to operate and maintain. Furthermore, a number of reviews have repeatedly criticized both Departments’ inability to more readily interoperate with the their existing EHRs and the lack of appropriate management controls, in nearly two decades of attempting to increase interoperability between their respective EHRs. DOD’s transition to MHS GENESIS and the VA’s recent announcement on the selection of the same Cerner EHR provides a renewed opportunity to identify and chart a joint path built on modern technologies with interoperability built in from inception. Importantly, given the major HIT roll out at DOD and the just initiated effort at the VA, it is an opportune time to develop a joint innovation strategy and develop once novel approaches. Digital health platforms, cloud-based health, big data analytics, and others that may not only make health data sharing seamless between agencies but provide new levels of analytic and visualization on longitudinal population health information that transcends both agencies and shows a complete picture of beneficiary health and services across the care continuum.

CONCLUSIONS
Replacing and modernizing core operating clinical and administrative information systems including an EHR serving over 9.5 million beneficiaries can be daunting and fraught with risks for any organization. Compounding the modernization effort with a simultaneous organizational transformation and consolidation of three military branches’ health care operations into one as mandated by the NDAA serves to further exacerbate risks of project failure. Nonetheless, careful planning and strategy organized around a singular unified leadership structure could serve as the bedrock to stabilize and focus direction and outcomes of information systems modernization while leveraging organizational restructuring as a tool to better harness new information and data streams. Finally, developing people, harnessing new informatics resources, and exploring novel technologies will be essential but must be evaluated and tempered by impacts on health outcome, quality, and costs.

ACKNOWLEDGMENT
The author thanks Charlie Rupprecht and Patrick Grady for their critical review, edits, and engaging debate about the future of the MHS throughout the drafting work. I have obtained written permission from all persons named in the Acknowledgment.

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Imaging of Combat-Related Thoracic Trauma – Review of Penetrating Trauma

Lt Col John P. Lichtenberger, III, USAF, MD*; Capt Andrew M. Kim, USAF, MD*; Capt Dane Fisher, USAF, MD*; 2d Lt Peter S. Tatum, USAF, OMS-IV†; Maj Brian Neubauer, USAF, MD‡; MAJ (P) P. Gabriel Peterson, USA, MD§; Brett W. Carter, MD║

ABSTRACT

Introduction
Combat-related thoracic trauma is a significant contributor to morbidity and mortality of the casualties from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Penetrating, blunt, and blast injuries were the most common mechanisms of trauma. Imaging plays a key role in the management of combat-related thoracic trauma casualties. This review discusses the imaging manifestations of thoracic injuries from penetrating trauma, emphasizing epidemiology and diagnostic clues seen during OEF and OIF.

Materials and Methods
The assessment of radiologic findings in patients who suffer from combat-related thoracic trauma is the basis of this review article. The imaging modalities for this study include multi-detector computed tomography and chest radiography.

Results
High-velocity penetrating projectile injuries appear as hemorrhage and re-expansion pulmonary edema from the temporary cavity and a linear, blood-filled track from the permanent cavity. In cases where the projectile passes totally through the body, entrance wounds at the skin surface and tracks through the subcutaneous tissues may be the only indications of penetrating trauma. When assessing vascular injury, special attention should be paid to the right hilum in contrast-enhanced multi-detector computed tomography, as contrast is concentrated in the superior vena cava and superior cavoatrial junction may obscure small fragments. Additionally, CT angiography may show vessel disruption or extravasation of contrast distal to normal vessel location in addition to intraluminal filling defects and pseudo-aneurysms. Tension pneumopericardium may rarely complicate penetrating or blunt chest trauma. On imaging, distension of the pericardial sack by pneumopericardium and compression of the heart support the diagnosis of tension. On multi-detector computed tomography in the acute trauma setting, fluid in the pleural space should be considered hemothorax, particularly when Hounsfield units are above 35. Acutely, extravasated blood will have similar attenuation to the thoracic vasculature, whereas clotted blood will have higher values of 50–90 Hounsfield units.

Conclusion
Combat-related thoracic trauma continues to be a significant contributor to the morbidity and mortality of those injured during OEF and OIF. This review of the imaging manifestations of penetrating thoracic injury during OEF and OIF focuses on key diagnostic findings for clinicians caring for combat casualties. The distinct injury pattern and atypical imaging manifestations of penetrating trauma are important to recognize early due to the acuity of this patient population and the influence of accurate diagnosis on clinical management.

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*Department of Radiology and Radiological Sciences, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814.
†Rowan School of Osteopathic Medicine, 42 East Laurel Road, Stratford, NJ 08084.
‡Department of Medicine, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814.
§Department of Radiology, Walter Reed National Military Medical Center, 8901 Wisconsin Avenue, Bethesda, MD 20889.
║Department of Diagnostic Radiology, The University of Texas MD Anderson Cancer Center, 1515 Holcombe Blvd, Houston, TX 77030.
doi: 10.1093/milmed/usx034
Published by Oxford University Press on behalf of Association of Military Surgeons of the United States 2017. This work is written by (a) US Government employee(s) and is in the public domain in the US.
Imaging of Combat-Related Thoracic Trauma – Blunt Trauma and Blast Lung Injury

Lt Col John P. Lichtenberger, III, USAF, MD*; Capt Andrew M. Kim, USAF, MD*; Capt Dane Fisher, USAF, MD*; Lt Peter S. Tatum, 2d, USAF, OMS-IV†; Maj Brian Neubauer, USAF, MD‡; MAJ (P) P. Gabriel Peterson, USA, MD§; Brett W. Carter, MD¶

ABSTRACT

Introduction
Combat-related thoracic trauma (CRTT) is a significant contributor to morbidity and mortality of the casualties from Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Penetrating, blunt, and blast injuries are the most common mechanisms of trauma to the chest. Imaging plays a key role in the battlefield management of CRTT casualties. This work discusses the imaging manifestations of thoracic injuries from blunt trauma and blast injury, emphasizing epidemiology and diagnostic clues seen during OEF and OIF.

Materials and Methods
The assessment of radiologic findings in patients who suffer from combat-related blunt thoracic trauma and blast injury is the basis of this work. The imaging modalities for this work include multi-detector computed tomography (MDCT) and chest radiography.

Results
Multiple imaging modalities are available to imagers on or near the battlefront, including radiography, fluoroscopy, and MDCT. MDCT with multi-planar reconstructions is the most sensitive imaging modality available in combat hospitals for the evaluation of CRTT. In modern combat, blunt and blast injuries account for a significant portion of CRTT. Individual body armor converts penetrating trauma to blunt trauma, leading to pulmonary contusion that accounted for 50.2% of thoracic injuries during OIF and OEF. Flail chest, a subset of blunt chest injury, is caused by significant blunt force to the chest and occurs four times as frequently in combat casualties when compared with the civilian population. Imaging features of CRTT have significant diagnostic and prognostic value. Pulmonary contusions on chest radiography appear as patchy consolidations in the acute setting with ill-defined and non-segmental borders. MDCT of the chest is a superior imaging modality in diagnosing and evaluating pulmonary contusion. Contusions on MDCT appear as crescentic ground-glass opacities (opacities through which lung interstitium and vasculature are still visible) and areas of consolidation that often do not respect the anatomic boundaries of the affected lobes. Additionally, small pulmonary contusions may exhibit sub-pleural sparing and may distinguish contusion from pneumonia or other lung pathology. Although pulmonary laceration is typically the result of penetrating trauma, laceration may also be caused by displaced rib fractures or significant shearing forces on the lung without penetrating injury. Because of elastic recoil of the normal pulmonary parenchyma surrounding the injury, pulmonary lacerations may present as late as 48–72 h after injury. Pulmonary lacerations may appear similar to pulmonary contusions on chest radiography initially and will require MDCT for definitive diagnosis. Blast injury is a defining injury of modern combat. Blast lung injury is initially diagnosed with chest radiography, where the pattern of lung opacities has previously been described by clinicians as “batwing” or “butterfly” because of its central appearance in the lung. “Peribronchovascular” may be a more accurate description of primary blast lung based on its appearance on MDCT. This pattern may differentiate primary blast lung injury from other causes of thoracic trauma.

Conclusion
CRTT continues to be a significant contributor to the morbidity and mortality of those injured during OEF and OIF. The distinct injury patterns and atypical imaging manifestations of blunt trauma and blast lung injury are important to recognize early because of the acuity of this patient population and the influence of accurate diagnosis on clinical management.

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Military Trauma and Surgical Procedures in Conflict Area: A Review for the Utilization of Forward Surgical Team

CDR Yi-Ling Cai, MC, PhD*; CAPT Jin-Tao Ju, MC, PhD*; CDR Wen-Bao Liu, MC, PhD*; CDR Jian Zhang, MC, MD†

ABSTRACT

Introduction
Forward surgical teams (FSTs) have been used as highly mobile surgical facilities that provide “damage control” medical support in modern wars. FST regiments differ greatly in different armed services and nations. We systemically reviewed the utilization of FSTs around the world with an emphasis on the medical conditions and workloads encountered by FSTs in modern wars.

Materials and Methods
We searched for terms related to FSTs, such as “Forward Surgical Team” and “Field Surgical Team,” in the PubMed, EMBASE, Web of Science, and MEDLINE databases and collected any articles that provided numerical data on the organization of medical personnel combat casualty characteristics, including the casualty composition, injury types and locations, and mechanisms of injury, and surgical procedures performed. Technical articles, case reports of specific types of injury or disease, and literature reviews of previous experiences and logistical theories were discarded.

Results
We identified 24 articles involving 29 FSTs that were included in the analysis. The FSTs were typically composed of 8–20 medical personnel and had limited medical capacity. Battle-related injuries constituted approximately two-thirds of all injury types treated by the FSTs. The extremities, torso, and head and neck were the three most frequently injured sites and accounted for approximately 51.1%, 16.6%, and 13.2% of all wounds, respectively. The three most frequent injury mechanisms were fragments or explosive injuries (44.8%), gunshot wounds (28.1%), and motor vehicle accidents/road traffic accidents (9.1%). Soft tissue surgeries (41.0%) and orthopedic operations (31.6%) were the two procedures that were most frequently performed by the FSTs. The average numbers of surgical procedures performed by small FSTs (1.27/unit-day) and full FSTs (1.28/unit-day) seemed to be comparable.

Conclusion
Modern conflict may require more flexible small FSTs, especially during the initial phases of war. More orthopedic surgeons should be included in FSTs, and orthopedic skill training should be intensified before deployment. The utilization of FSTs and level III facilities must be evaluated within the context of the battlefield conditions, medical care requirements, and evacuation efficiency.

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*Faculty of Navy Medicine, Second Military Medical University, 800 Xiang Yin Road, Shanghai 200433, China.
†Department of General Surgery, Chang Zheng Hospital, Second Military Medical University, 415 Feng Yang Road, Shanghai 200003, China.
doi: 10.1093/milmed/usx048
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Extra-Articular Retained Missiles; Is Surveillance of Lead Levels Needed?

CPT Walter N. Nickel, DO*; LCDR Theodore J. Steelman, MD*; ENS Zena R. Sabath, BA†; LTC Benjamin K. Potter, MD, FACS

ABSTRACT

Background
Although gunshot wounds are relatively common, lead toxicity associated with extra-articular retained missiles (EARMs) is an uncommon, yet potentially devastating, complication. Although the risk of lead toxicity with intra-articular retained missiles is well known, EARMs are routinely left in situ or only removed in selected circumstances secondary to the relatively rare occurrence of complications.

Methods
We first describe a patient with systemic lead poisoning associated with retained lead fragments after a gunshot-induced left femoral shaft fracture. We then performed a systematic review of the literature to answer the following questions: (1) In the setting of retained extra-articular bullets and/or bullet fragments, is regular monitoring and/or surveillance of lead levels in the blood routinely indicated? and, if so, (2) what are the selected factors that portend an increased risk for elevations in blood lead levels in the setting of retained extra-articular bullets and/or bullet fragments? The systematic review was conducted according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) reporting guidelines, of the English language literature utilizing Medline (PubMed), EMBASE, Cochrane, and CINAHL on the topic of lead poisoning, retained bullet, and gunshot wound, and then searched for additional references by manually searching of bibliographies of the included references. Studies were included if they provided clinical data on one or both of our study questions; included studies were evaluated using the accepted levels of evidence.

Findings
Routine monitoring or surveillance of lead levels in blood is recommended in all cases of EARM at the time of hospital admission and again at discharge, followed by monthly intervals until 3 mo post-injury and then again at 1 yr post-injury. The studies identified demonstrated significant risk factors for elevated blood lead levels in the setting of EARM, which included the number of retained missiles and concomitant fracture.

Discussion
Recommendations for routine monitoring and surveillance of blood lead levels in all cases of EARM are conflicting, but such monitoring appears to be warranted given that the potential risks and morbidity associated with systemic lead poisoning are outweighed by any potential harm of short-term, blood lead level monitoring. Outside of concomitant fracture, the evidence for making further clinical recommendations regarding selected risk factors that portend an increased risk for elevated blood lead levels after gunshot injury is weak. Larger level II and III studies are needed to determine the indications for and frequency of lead toxicity screening after retained EARM.

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*Uniformed Services University-Walter Reed Department of Surgery, Walter Reed National Military Medical Center, 8901 Wisconsin Avenue, Bethesda, MD 20889.
†Uniformed Services University-Walter Reed Department of Surgery, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20814.
doi: 10.1093/milmed/usx076
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A Comparison of Veterans with Post-traumatic Stress Disorder, with Mild Traumatic Brain Injury and with Both Disorders: Understanding Multimorbidity

Joseph F. Kulas, Ph.D., ABPP*†; Robert A. Rosenheck, M.D.*†

ABSTRACT

Introduction
Mild traumatic brain injury (mTBI) and post-traumatic stress disorder (PTSD) are common military service-related conditions diagnosed both singly and together in veterans returning from recent military conflicts overseas. The impact of these disorders in real-world Veterans Health Administration practice has not been studied extensively, and few studies have examined the association of these disorders both by themselves and together with sociodemographic characteristics, psychiatric and medical comorbidities, health service utilization, and psychotropic medication fills. This study aims to add to the broader study of multimorbidity and the impact it has on patient care.

Materials and Methods
This study used a national Veterans Health Administration sample (N = 164,884) to compare characteristics of veterans diagnosed with mTBI, PTSD, and with both disorders. Relative rates of diagnosis with psychiatric and medical disorders, utilization of medical and psychiatric services, and prescription rates of psychotropic medication fills were examined to determine the impact that the disorders had on these rates, both in isolation and together.

Results
With few exceptions, diagnosis with PTSD, both alone and in the presence of mTBI, was associated with greater risk of comorbid psychiatric diagnosis, higher service utilization, and greater psychotropic medication fills. Notable correlates specific to mTBI included headache, seizure disorder, paraplegia, and cerebrovascular accident.

Conclusion
PTSD thus plays the dominant role in the development of psychiatric difficulties and service use independently of mTBI. The recognition of the central importance of psychiatric difficulties in the functional outcomes of individuals who have experienced an mTBI suggests a need to assure access of veterans to psychiatric treatment services.

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Assessment of Deployment-Related Exposures on Risk of Incident Mental Health Diagnoses Among Air Force Medical Service Personnel: Nested Case–Control Study

Genny M. Maupin*; Col Anthony P. Tvaryanas†; Edward D. White‡; Heather J. Mahaney*

ABSTRACT

Background
Recent military conflicts in Iraq (Operation Iraqi Freedom), Afghanistan (Operation Enduring Freedom), and elsewhere have been associated with psychological impacts among military personnel. However, relatively little is known about the relationship between those conflicts and psychological health of military health care professionals. Previous work has shown certain demographic factors associated with diagnosed mental health conditions after deployment. However, unique exposures in the deployed environment may be present that are also associated. Understanding the relationship between the demographic factors, exposures, and post-deployment mental health (PDMH) conditions has not been investigated. The purpose of this study was to determine the association between occupational and/or environmental exposures and incident PDMH conditions in a defined population of United States Air Force health care personnel returning from the deployed environment (i.e., deployment-related exposures).

Methods
A nested case–control study compared cohort members with \(N = 4,114\) and without \(N = 14,073\) a PDMH condition in terms of deployment-related occupational and/or environmental exposures. PDMH conditions were identified using the electronic health record and exposures were determined using post-deployment health assessments. Demographic-adjusted multivariable logistic regression models were used to compute odds ratios (ORs).

Results
The final regression model comprised five exposure and 12 demographic variables. Reported exposures were not strongly associated with incident PDMH conditions (OR ranged from 1.22 to 1.38) and were lower than some demographic factors. Demographic characteristics with relatively large effect sizes (ORs less than 0.5 or greater than 1.5) included the protective factors of Air Force Guardsman (OR: 0.45), reservists (OR: 0.34), and surgeons (OR: 0.32), as well as the risk factor of nurses (OR: 1.51). All model parameters had a \(p\)-value less than 0.0001 and the area under the receiver operating characteristic curve was 0.668.

Conclusions
Given the low area under the receiver operating characteristic, the final statistical model had only marginal performance in its ability to correctly identify cases. Thus, other factors should be studied to identify additional predictors for PDMH conditions.

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*711th Human Performance Wing, U.S. Air Force School of Aerospace Medicine, Aeromedical Research Department, 2510 5th Street, Building 840, Wright-Patterson AFB, OH 45433-7913.
†711th Human Performance Wing, Human Systems Integration Directorate, 2698 G Street, Building 190, Wright-Patterson AFB, OH 45433.
‡Air Force Institute of Technology, Department of Mathematics and Statistics, 2950 Hobson Way, Wright-Patterson AFB, OH 45433. doi: 10.1093/milmed/usx056 Published by Oxford University Press on behalf of the Association of Military Surgeons of the United States 2017. This work is written by (a) US Government employee(s) and is in the public domain in the US.
Depression in Female Veterans Returning from Deployment: The Role of Social Factors

Holly Sairsingh, DSW, LCSW*; Phyllis Solomon, PhD†; Amy Helstrom, PhD*; Dan Treglia, PhD, MPP‡

ABSTRACT

Objective
Women are serving in the armed forces and deployed to areas of conflict in increasing numbers. Problems such as depressive symptoms and risks related to combat exposure can have negative effects on adjustment following service; understanding the relationship between these problems may contribute to strategies providers can use to facilitate healthy adjustment after deployment. The purpose of this study is to examine social factors as they relate to mental health adjustment, namely depressive symptoms among female veterans who served in Iraq and Afghanistan as part of Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OND). We hypothesized that combat exposure would predict higher levels of depressive symptoms and that social support would moderate the relationship between combat exposure and depression.

Methods
In a cross-sectional design, 128 female Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn veterans completed an online survey about combat experience, social support, depression, demographic characteristics, and behavioral health symptom history. We conducted multiple regression analyses to examine linear and moderating relationships.

Results
There was no significant relationship between combat exposure and depression; social support did not significantly moderate the relationship between combat exposure and depression. However, higher levels of social support and financial comfort were significantly related to lower levels of depression.

Conclusion
This study highlights the role of social factors, specifically social support and perceived financial status, as potential barriers to healthy emotional readjustment following deployment. These findings suggest that it may be beneficial for mental health providers to screen female veterans and refer them to appropriate services to reduce financial stressors and strengthen their use of social support. More research should continue to examine more fully the impact of combat exposure on female service members’ mental health and work to isolate the factors most strongly related to depression.

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*Corporal Michael J. Crescenz VA Medical Center, MIRECC (116), 3900 Woodland Ave., Philadelphia, PA 19104.
†School of Social Policy and Practice, University of Pennsylvania, 3701 Locust Walk, Philadelphia, PA 19104.
‡School of Social Policy and Practice, University of Pennsylvania, 3815 Walnut Street, Philadelphia, PA 19104.

doi: 10.1093/milmed/usx065
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Recovery from Mild Traumatic Brain Injury Following Uncomplicated Mounted and Dismounted Blast: A Natural History Approach

Anna E. Tschiffely, PhD; LTJG Ashraful Haque, MD, MPH; LCDR Francis J. Haran, PhD, USN; CAPT Craig A. Cunningham, PhD, USN; LT Melissa L. Mehalick, PhD; Todd May, DO, USN; Keith Stuessi, MD; LCDR Peter B. Walker, PhD, USN; LCDR Jacob N. Norris, PhD, USN

ABSTRACT

Objective
The purpose of this study is to utilize a natural history approach to describe and understand symptom recovery in personnel diagnosed with a blast-related mild traumatic brain injury (mTBI) resulting from an improvised explosive device blast.

Participants and Design
The population included military personnel who experienced a blast mTBI while mounted (vehicle; \( n = 176 \)) or dismounted (on foot; \( n = 37 \)) (\( N = 213 \)). Patients had no co-morbid psychiatric or muscle–skeletal issues and were treated within 72 h of injury. Prevalence and duration of self-reported symptoms were separately analyzed by injury context (mounted vs dismounted).

Results
Headache was prominently reported in both mounted (85%) and dismounted (75%) populations. The mean time from injury to return to full duty was between 7.8 d (mounted) and 8.5 d (dismounted). The dismounted population reported visual changes that lasted 0.74 d longer.

Conclusion
Our analysis implicates that headache is a common and acutely persistent symptom in mTBI regardless of injury context. Additionally, patients in mounted vs dismounted injury did not report significant differences in symptom prevalence. Although knowing the injury context (i.e., dismounted vs mounted) may be beneficial for providers to understand symptom presentations and deliver accurate anticipatory guidance for patients with blast-related mTBI, no significant differences were observed in this population. This may be due to the population characteristic as the trajectory of recovery may vary for patients who were not able to return to full duty within 30 d or required higher levels of care.

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*Operational and Undersea Medicine Directorate, Department of Neurotrauma, Naval Medical Research Center, Silver Spring MD. ‡Henry M. Jackson Foundation, Bethesda, MD 20817. §Naval Submarine Medical Research Laboratory, Naval Submarine Base New London, Groton CT 06349. ¶Nursing Research & Consultation Services Naval Medical Center Portsmouth, Portsmouth, VA 23708.

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Does Mobile Care (‘mCare’) Improve Quality of Life and Treatment Satisfaction Among Service Members Rehabilitating in the Community? Results from a 36-Wk, Randomized Controlled Trial

Jeanette R. Little, BS, MS; Holly H. Pavliscsak, BS, MHSA; Mabel R. Cooper, RN, BSN, CCRC; Lois A. Goldstein, RN, BSN; Stephanie J. Fonda, PhD

ABSTRACT

Introduction
Research has shown that mobile phones can help with management of numerous health problems. As an adjunct to care management provided to injured service members rehabilitating in their communities, particularly those with mild traumatic brain injury (mTBI), post-traumatic stress (PTS), and/or behavioral health problems, the Army developed a mobile phone application called “mCare.” This study examined whether service members who received mCare had higher well-being, were more satisfied with their care, and viewed mCare as a valuable part of their care management as compared with their counterparts who received standard care management alone, and whether those with mTBI, PTS, and/or behavioral health problems benefited differently from mCare.

Materials and Methods
In-processing service members at four community-based warrior transition units were recruited for participation in a 36-wk, randomized, controlled trial and allocated to receive standard care management plus mCare (n = 95) or standard care management alone (n = 87). Participants in the mCare group received daily questionnaires, tips, and appointment reminders. All participants were asked to complete the General Well-being Schedule (GWS) at baseline, 12, 24, and 36 wk, and the Case Management Quality Questionnaire (CMQQ) at 12, 24, and 36 wk. All participants and care managers were approached to complete interviews about the usability/likeability of mCare or standard care management. The analyses tested for group differences in completion of the intervention, graphed means for the GWS and CMQQ by group/subgroup, and statistically compared the longitudinal trends in these outcomes using mixed models in which group, time, and group*time were included as regression variables. The analyses also tallied interview responses and identified thematic quotes. The study protocol was reviewed and approved by the Walter Reed National Military Medical Center’s Institutional Review Board.

Results
Estimated rate of change in GWS scores was −2.2 (standard error = 1.0; t = −2.1; p = 0.0382). Estimated rate of change in CMQQ scores was −0.8 (standard error = 0.5; t = −1.52; p = 0.1299). Neither change was meaningful. Rates of change in the GWS and CMQQ scores did not differ by group or by behavioral health, mTBI, and PTS subgroups within the groups. The interviews found that 83% of mCare participants liked the communication with their care managers versus 73% of standard care management participants. Participants in both the mCare group and the care managers said that they liked the application’s appointment tracking and reminders. Care managers thought mCare was particularly useful for people with mTBI, PTS, and cognitive problems.

Conclusion
mCare did not result in differences in general well-being and satisfaction with care management among service members rehabilitating in their communities, some with mTBI, PTS, and/or behavioral health problems. But participants and care managers who used mCare said that they found it useful. Study limitations included the diversity of clinical issues of the participants, greater missing data among mCare participants, and the high baseline quality of care management in the settings observed. The fact that patients and care managers liked mCare, apart from no changes in outcomes, is important because health care is increasingly adopting mobile solutions.

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Telemedicine and Advanced Technology Research Center, Mobile Health Innovation Center, Building 38711, Fort Gordon GA 30905-5650. doi: 10.1093/milmed/usx035

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Opioid Use Patterns Among Active Duty Service Members and Civilians: 2006–2014


ABSTRACT

Introduction
Between 2001 and 2009, opioid analgesic prescriptions in the Military Health System quadrupled to 3.8 million. The sheer quantity of opioid analgesics available sets the stage for issues related to misuse, abuse, and diversion. To address this issue, the Department of Defense implemented several directives and clinical guidelines to improve access to appropriate pain care and safe opioid prescribing. Unfortunately, little has been done to characterize changing patterns of opioid use in active duty service members (ADSM), so little is known about how combat operations and military health care policy may have influenced this significant problem. We examined changes in opioid use for ADSM between 2006 and 2014, compared trends with the civilian population, and explored the potential role of military-specific factors in changes in opioid use in the Military Health System.

Materials and Methods
After obtaining Institutional Review Board approval, administrative prescription records (Pharmacy Data Transaction Records) for non-deployed ADSM were used to determine the number of opioid prescriptions dispensed each year and the proportion of ADSM who received at least one prescription per month between 2006 and 2014. Based on the observation and the literature, we identified December 2011 as the demarcation point (the optimal point to identify the downturn in opioid use) and used it to compare opioid use trends before and after. We used an autoregressive forecast model to verify changes in opioid use patterns before and after 2011. Several interrupted time series models examined whether military system-level factors were associated with changes in opioid use.

Results
Between 2006 and 2014, 1,516,979 ADSM filled 7,119,945 opioid prescriptions, either in military treatment facilities or purchased through TRICARE. Both active duty and civilian populations showed signs of decreasing use after 2011, but this change was much more pronounced among ADSM. The forecast model showed a significant difference after 2011 between the projected and actual proportion of ADSM filling an opioid prescription, confirming 2011 as a point of divergence in opioid use. Interrupted time series models showed that the deflection point was associated with significant decreases. A significant increase of 0.261% in opioid prescriptions was seen for every 1,000 wounded in action service members in a given month. Troops returning from Operation Enduring Freedom, Operation Iraqi Freedom, or Operation New Dawn did not appear to influence the rates of use. Even after accounting for returning troops from Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn and wounded in action counts, the deflection point was associated with a lower proportion of ADSM who filled an opioid prescription, leading to a decrease of 1.61% by the end of the observation period (December 2014).

Conclusion
After December 2011, opioid use patterns significantly decreased in both civilian and ADSM populations, but more so in the military population. Many factors, such as numbers of those wounded in action and the structural organization of the Military Health System, may have caused the decline, although more than likely the decrease was influenced by many factors inside and outside of the military, including policy directives and cultural changes.
Vape and Aviate: Electronic-Cigarette Use and Misuse in Naval Aviation

LT Matthew T. Hall, MC, USN*; LT Ryan P. Austin, MC, USN*; CDR Tai A. Do, MC, USN†; Andrea McGlynn, MS‡

ABSTRACT

Introduction
Electronic cigarettes (EC) are an emerging form of nicotine replacement that has had a discernible increase in prevalence in the general population. Little is known regarding EC use among different military demographic groups or the extent of influence that social determinants of health may have on the behavior. The purpose of this study was to assess the prevalence and correlates of EC use in a select population of active duty U.S. Naval personnel. This study is unique in that it allows for EC behavior comparison between a traditionally healthy demographic (aviators, a subset of aircrew) and a representative general military population sample.

Materials and methods
Cross-sectional survey data were collected anonymously and analyzed in 2015–2016. Active duty Naval personnel (n = 977) were asked about ever trying ECs, frequency of use, and when was the last time an EC was used. Participants were assessed similarly regarding cigarette use. Descriptive and inferential statistics as well as multinomial logistic regression analyses were conducted using categorical and ordinal variables assigned to usage and demographic factors. This protocol was approved by the Institutional Review Board at Naval Hospital Portsmouth located in Portsmouth, Virginia.

Results
Within the study population, 31.4% have tried ECs, 9.3% were current users, and only 3.8% were dual (EC and cigarettes) users. EC use was significantly associated with paygrade (enlisted), primary job duty (non-aircrew), and education (less than a bachelor degree, p < 0.001, p < 0.01, and p < 0.001, respectively). ECs were used at some point as a smoking cessation tool for 43.6% of current EC users (p < 0.001), 21.6% of current smokers, and only 5.6% of former smokers. Continued EC use after ever trying ECs (30.0%) was only slightly more prevalent as continued cigarette use after ever trying cigarettes (27.3%). Smokers were nearly five times more likely to currently use ECs compared with non-smokers. Trying cigarettes was associated with nearly 12 times the risk for trying ECs compared with those who never tried cigarettes. No significant misuse of ECs was noted; however, several cases of drinking, tasting, and touching EC fluid were reported.

Conclusion
This study is unique in that it examines the use of electronic cigarettes among selected healthy and baseline groups within the active duty U.S. Navy population. The current prevalence of EC use among active duty personnel is much higher than previously thought. Continued use of ECs after ever trying them appears to exceed that of cigarettes even among healthy populations such as aircrew. The findings of increased risk of EC use among those with lower income and less than a bachelor’s degree suggest social determinants of health implications. This study sheds new light on EC use, characteristics of use, addiction implications, and highlights concerns for a growing health risk behavior.
U.S. Service Member Deployment in Response to the Ebola Crisis: The Psychological Perspective

COL Maurice L. Sipos, MS USA*; Paul Y. Kim, MA†; COL Stephen J. Thomas, MC USA (Ret.)‡; Amy B. Adler, PhD†

ABSTRACT

Introduction
In the fall of 2014, the United States and other nations responded to the worst outbreak of the Ebola virus disease in history. As part of this effort, U.S. service members deployed to West Africa to support a spectrum of activities that did not involve direct patient care. Although previous studies identified the psychological impact of responding to an outbreak, these studies were limited to retrospective data, small sample sizes, and medical personnel. The goals of the present study were to (a) document the mental health and well-being of troops deploying in response to an infectious disease outbreak; (b) identify their stressors, attitudes toward deployment, and health risk concerns; and (c) understand the role of combat experience in adjusting to these types of missions.

Materials and Methods
Study participants at both pre- and during deployment were active duty U.S. soldiers in a combat aviation battalion from a large U.S. military installation. U.S. soldiers were surveyed (n = 251) 3 wk before deploying to Liberia (October 2014) and surveyed again during their deployment (February 2015; n = 173). Participants were primarily male (86.1%), junior ranking (56.0%), and just over half had previous combat deployment experience (51.2%). Surveys were anonymous and not linked to one another over time.

Results
Overall rates of mental health problems were low (2.4% at pre-deployment and 5.8% during deployment), whereas sleep problems were reported by 4.9% at pre-deployment and 12% during deployment. At pre-deployment, top stressors focused on health threats; fewer stressors were reported during deployment. Soldiers were relatively less concerned about contracting Ebola than other more prevalent diseases. Soldiers with combat experience reported more somatic and sleep problems at pre-deployment than those without previous combat experience. There were no significant differences during deployment between those with and without previous combat experience.

Conclusion
Overall, a small proportion of respondents reported significant rates of mental health problems. In contrast, sleep problems were reported by 12% during deployment. In terms of attitudes toward the mission, the vast majority reported that they knew what to do to protect themselves from disease and that they understood the potential risk involved. The study also confirmed previous findings that soldiers with previous combat experience had more somatic symptoms at pre-deployment than those without, although this distinction appeared limited to the pre-deployment phase. Results can be used to address anxiety by personnel during pre-deployment and to inform leadership preparing personnel to deploy in response to future infectious disease outbreaks.

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ABSTRACT

Introduction
Previous studies suggest that autonomic dysfunction may be an underlying factor in Gulf War Illness. This study examined self-reported symptoms of autonomic dysfunction and their relationship with physical functioning among veterans with Gulf War Illness.

Materials and Methods
We abstracted medical records of Gulf War Veterans clinically evaluated at the New Jersey War Related Illness and Injury Study Center between 2010 and 2016. The outcome measure was the Veteran version of the Short Form Health Survey (VR-36) physical functioning scale. Autonomic function was assessed using a composite variable constructed from the chart abstraction to mimic the Composite Autonomic Symptom Scale (COMPASS-31).

Results
Seventy-six veterans were included in the final analysis. The autonomic symptom burden score was 45 (±14). Increased autonomic symptom burden, greater mental health burden (PTSD/depression), and greater body mass index were individually associated with poorer physical functioning. A general linear regression containing these variables revealed that patients with both PTSD and depression ($b = -15.2$, $p = 0.03$) or either PTSD or depression ($b = -22.7$, $p < 0.01$) had lower physical functioning than those without; the other variables became not significant (body mass index: $p = 0.07$; autonomic function: $p = 0.89$).

Conclusion
The average autonomic function score indicated significant burden in Gulf War Veterans, consistent with published research. We did not detect an independent association between autonomic symptom burden and physical functioning, likely due to the non-specific nature of the measure used to capture autonomic symptoms or the stronger association between mental health conditions and physical functioning. Future work utilizing valid and standardized instruments to clinically evaluate autonomic function is warranted.
Breast Cancer Treatment and Survival Among Department of Defense Beneficiaries: An Analysis by Benefit Type and Care Source

Janna Manjeliev skaia, PhD, MPH*; Derek Brown, MS, PhD(c)*; Stephanie Shao, MPH†; Keith Hofmann, BS‡; COL Craig D. Shriver, MC USA*†; Kangmin Zhu, MD, PhD*†

ABSTRACT

Background
Use of treatment for breast cancer is dependent on the patient’s cancer characteristics and willingness to undergo treatment and provider treatment recommendations. Receipt of breast cancer treatment varies by insurance status and type. It is not clear whether different benefit types and care sources differ in breast cancer treatment and outcomes among Department of Defense beneficiaries.

Methods
The objectives of this study are to assess whether receipt of breast cancer treatment varied by benefit type (TRICARE Prime vs non-Prime) or care source (direct care, purchased care, and both) and to examine whether survival and recurrence differed by benefit type and/or care source among female Department of Defense beneficiaries with the disease. Study subjects were women aged 40–64 yr, diagnosed with malignant breast cancer between 2003 and 2007. Multivariable logistic regression analyses were conducted to assess the likelihood of receiving treatment by benefit type or care source. Multivariable Cox proportional hazard models were used to investigate differences in survival and recurrence by benefit type or care source.

Findings
A total of 2,668 women were included in this study. Those with Prime were more likely to have chemotherapy, radiation, hormone therapy, breast-conserving surgery, surveillance mammography, and recurrence than women with non-Prime. Survival was high, with 94.86% of those with Prime and 92.58% with non-Prime alive at the end of the study period. Women aged 50–59 yr with non-Prime benefit type had better survival than women with Prime of the same age. No survival differences were seen by care source. In regard to recurrence, women aged 60–64 yr with TRICARE Prime were more likely to have recurrent breast cancer than women with non-Prime. Additionally, women aged 50–59 yr who used purchased care were less likely to have a recurrence than women who used direct care only.

Discussion/Impact/Recommendations
To our knowledge, this is the first study to examine breast cancer treatment and survival by care source and benefit type in the Military Health System. In this equal access health care system, no differences in treatment, except mastectomy, by benefit type, were observed. There were no overall differences in survival, although patients with non-Prime tended to have better survival in the age group of 50–59 yr. In regard to care source, women who utilized mostly purchased care or utilized both direct and purchased care were more likely to receive certain types of treatment, such as chemotherapy and radiation, as compared with women who used direct care only. However, survival did not differ between different care sources. Future research is warranted to further investigate variations in breast cancer treatment and its survival gains by benefit type and care source among Department of Defense beneficiaries.

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*John P. Murtha Cancer Center, Walter Reed National Military Medical Center, 11300 Rockville Pike, Suite 1120, Rockville, MD 20852.
†Uniformed Services University, 4301 Jones Bridge Road, Bethesda, MD 20814.
‡Kennell and Associates, Inc., 3130 Fairview Park Drive, Suite 450, Falls Church, VA 22042.
do: 10.1093/milmed/usx031
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Overuse Injuries in the IDF’s Combat Training Units: Rates, Types, and Mechanisms of Injury

MAJ Oren Schwartz, MD IDF Medical Forces†; LTC Itzik Malka, MD IDF Medical Forces‡; Cara H. Olsen, Prof§; Israel Dudkiewicz, Prof║; Brigadier General Tarif Bader, MD IDF Medical Forces*¶

ABSTRACT

Introduction
Overuse injuries are responsible for most lost training days and attrition from combat training in the Israeli Defense Forces (IDF) as in armies around the world. The purpose of this study is to understand the rates, types, and mechanism of occurrence of overuse injuries in the IDF in order to provide the IDF’s commanders a detailed updated situation report in order to enable commanders decision-making, prevention policy, and further research of this highly significant military public health issue.

Methods
A cross-sectional study including 20,000 soldiers recruited to combat units during the year of 2013 was performed. Most of the data were collected from the IDF’s computerized medical consultation records package. Descriptive statistics (percent, mean, standard deviation, and median) were used in order to express results. The study was approved by the IDF’s institutional review board.

Results
The overall injury rate was 24.5%. The total number of injuries was 6,393 with an average of 1.32 ± 0.22 injuries per injured soldier. The injury rate was 18.4% in the infantry units and 36.1% in non-infantry units. Of all injuries, 87% occurred in the lower back and lower limb regions. The most frequent injury sites were the calf and ankle (34%), the knee region (22%), and the lower back (19%). Of all injuries, 74% occurred during running (45%) or long-distance walking (29%). The average lost training days due to injuries was 9 d per soldier and 6.5 d per injury. The total number of stress fractures was 494 – 2.5% of all soldiers (four fractures per 100 person years). The calf and ankle region was the most frequent site of stress fractures and accounted for 84% of all stress fractures, the vast majority of them (95%) were fractures of the distal tibia. The average number of lost training days due to stress fractures was 16 ± 6.1 per fracture.

Conclusions
As in other armies around the world, overuse injuries in the IDF are a major public health problem and poses a significant challenge to the IDF’s commanders and the medical corps policy leaders. Further studies should be performed in order to identify the risk factors for these injuries especially in the lower back and the lower limb regions as part of the effort to try and reduce the rates of these injuries as much as possible. This study emphasizes the need for a continuous surveillance and monitoring system for overuse injuries as a significant and integral component of any intervention plan in the domain of overuse injuries.

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†Injury Prevention and Rehabilitation Center, IDF Medical Forces Headquarters, Aharon Kazir st., Ramat-Gan 5262000, Israel.
‡Physicians Hospital Unit, IDF Medical Forces Headquarters, 1 Aharon Kazir st., Ramat-Gan 5262000, Israel.
§Department of Preventive Medicine and Biostatistics, Uniformed Services University of the Health Sciences, 4301 Jones Bridge Road, Bethesda, MD 20895.
║Department of Rehabilitation, Sourasky Medical Center, Weiseman 6 st.,Tel-Aviv 642390, Israel.
¶General Surgeon Headquarters, IDF Medical Forces Headquarters, 1 Aharon Kazir st., Ramat-Gan 5262000, Israel.

Military / Government work disclaimer: The authors declare that all facts and opinions mentioned in this study do not reflect or portray the opinions of the IDF commanders or the Israeli government.

* Prof. Dudkiewicz and Tarif Bader equally served as the principal investigators of this study and equally contributed to the design, data analysis, writing, drafting the work, and revising.

doi: 10.1093/milmed/uxz055

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Comparison of Body Composition Metrics for United States Air Force Airmen

1st Lt J. R. Griffith, USAF*; Edward D. White, III, PhD*; Lt Col R. David Fass, PhD†; Lt Col Brandon M. Lucas, PhD†

ABSTRACT

Background
The United States Air Force currently uses AFI 36–2905 for cardiovascular fitness standards and evaluation. Regarding its fitness test, the Air Force considers waist circumference (WC) twice as important as push-ups or sit-ups. Because of this weighting, one assumes that the Air Force considers WC relatively correlated with overall fitness or at least cardiovascular fitness. To our knowledge, the Air Force has not considered on a large scale how body mass index (BMI), height-to-weight ratio (H-W), or waist-to-height ratio (WHtR) compares with WC with respect to its fitness test.

Methods
Using a 5.38 million record database from the Air Force Fitness Management System, we evaluated how WC, BMI, WHtR, and H-W correlate with fitness as assessed by the 1.5-mile run in addition to total fitness, which incorporates the 1.5-mile run time, number of push-ups and sit-ups. As this previously collected data were anonymous to us, this study fell under the definition of exempt status and approved by the institutional review board overseeing Joint Base San Antonio. For each waist metric, we performed a simple ordinary least squares regression to ascertain the correlation between that particular metric and either run time or total fitness; when incorporating more than one explanatory variable or covariate (to control for age and/or sex), we performed multiple ordinary least squares regressions. Due to the large database size and to mitigate against a type I error, we used an alpha of 0.001 for all statistical hypothesis tests.

Findings
Approximately 18% of the 5.38 million records belonged to women. With respect to sex differences, males appeared noticeably faster and performed more push-ups on average than females. The number of sit-ups completed was more comparable, with males having a slight advantage. Males also appeared to have larger WC, BMI, H-W, and WHtR measurements. We compared the ordinary least squares results between WC, H-W, WHtR, and BMI and ranked them by R². Models varied in R² from 1% to 46% depending on the covariates in the model, with sex having a greater effect than age. Whether individually or adjusting for age and sex, WHtR performed better than the other body composition variables with an average rank score of 1.1 and a median improvement of approximately 4% to the current Air Force metric of WC.

Discussion
From our findings, we present a 20-point WHtR scoring system for the Air Force to use in lieu of its traditional usage of WC. We used this assessment chart to score all Airmen in our database and compared the results to their current scores on the abdominal circumference portion of the test with respect to predicting run time, after accounting for sex, age, and number of push-ups and sit-ups. The R² value improved from 40.3 to 43.6, a relative improvement of approximately 8%, a fairly significant effect given the database consisted of over 5 million records. Future studies should investigate the longitudinal effect of varying waist metrics over time on run time or total fitness performance.
A Study on the Leptospirosis Outbreak Among US Marine Trainees in Okinawa, Japan☆

CDR Joy Dierks, MC USN*; CDR Tammy Servies, MC USN†; CDR Tai Do, MC USN‡

ABSTRACT

Introduction
The US Marines operate the Jungle Warfare Training Center (JWTC) in Northern Okinawa, where leptospirosis is endemic. The JWTC endurance course involves prolonged fresh and stagnant water exposures in a simulated jungle warfare environment. Since a leptospirosis outbreak in 1987, JWTC has required prophylactic use of doxycycline at 200 mg weekly during exposure to the endurance course. This policy is based on a 1982 study in a similar environment in Panama. In August and September of 2014, an outbreak of leptospirosis occurred among 81 Marines training at JWTC. We analyzed data from the largest reported outbreak of leptospirosis among US military members.

Materials and Methods
Two hundred and thirty nine US Marines who completed the endurance course were interviewed by trained personnel regarding their exposures and use of prophylactic medication utilizing a standardized questionnaire. All available personnel who went through the course during the outbreak period were interviewed regardless of whether or not they became ill. The Armed Forces Health Surveillance Branch’s case definition was used to identify cases.

Results
Eighty-one cases in 239 personnel were identified (attack rate = 33.9%). Exposures linked to being a case were swallowing water in the stagnant pond (attack rate ratio [ARR] = 2.3, 95% confidence interval [CI] = 1.4–3.7), cuts on the body (ARR = 1.5, 95% CI = 1.01–2.11), and insect bites (ARR = 2.0, 95% CI = 1.2–3.4). Exposures not linked to being a case were taking doxycycline before the exposure (ARR = 3.2, 95% CI = 0.5–22.2), taking doxycycline after the exposure (ARR = 0.9, 95% CI = 0.6–1.3), and swallowing water in the natural stream (ARR = 1.3, 95% CI = 0.9–1.9).

Conclusions
Attack rate data indicate that whether or not personnel took pre- or post-exposure doxycycline made no difference statistically. Increased internal exposure (via swallowing water or through broken skin) increased risk of symptomatic disease. This new study combined with a growing body of literature should prompt researchers to re-examine recommendations for those with significant water exposure in areas with high leptospirosis levels.

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† Department of Preventive Medicine and Biostatistics, Uniformed Services University, 4301 Jones Bridge Road, Bethesda, MD 20814.
‡ Naval Hospital Okinawa, PSC 482 Box 1600 FPO AP, Okinawa 96562-1600, Japan.
☆ Previous Presentation: Poster at Preventive Medicine 2016, American College of Preventive Medicine, February 24–27, Washington, DC.

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doi: 10.1093/milmed/usx013

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CAPT Darrell E. Singer, MC, USPHS*; Ligong Chen, MD*; Stephanie Shao, MPH†; Jonathan Goldsmith, MD‡; Celia Byrne, PhD*; COL David W. Niebuhr, MC, USA (Ret.)*

ABSTRACT

Introduction
Sickle cell trait (SCT) affects an estimated 5.02% of non-Hispanic blacks, 1.08% of Hispanics, and 0.1% of Whites in the U.S. military. Policies for SCT screening and occupational restrictions vary by service. Population-based studies of SCT with quantification of military-relevant outcomes are lacking.

Methods
The study design was a retrospective cohort of 15,081 SCT-positive versus 60,320 SCT-negative U.S. active duty personnel enlisted from 1992 to 2012 and followed through 2013. Military-relevant outcome included number and days of deployment, length of service, and cause of death.

Results
SCT-positive versus SCT-negative service members experienced more deployments ($p < 0.01$) and longer number of days deployed for all services, especially the Army ($p < 0.001$). The median length of service was longer for SCT-positive service members stratified by service and by gender ($p < 0.05$). The adjusted risk of length of service greater than 5 yr by SCT status was 1.37 (95% confidence interval 1.31–1.43) with greater than a three-fold higher risk in the Navy and Air Force compared with the Army. Crude mortality rate was not significantly different by SCT status, although deaths due to suicide, self-directed violence, and other non-specific causes were more common in SCT-positive service members.

Conclusion
We found that SCT-positive service members deployed more frequently, for greater lengths of time, and remained in service longer. No significant difference in crude mortality ratio was discovered. Additional research on military-relevant outcomes and a cost-effectiveness analysis of SCT screening practices are needed to inform evidence-based SCT enlistment policies.

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COL Timothy A. Mitchener, DC USA*; LT Noel E. Dickens, DC USN†; John W. Simecek, DDS, MPH‡

ABSTRACT

Background
Few studies have examined the causes or mechanisms of oral–maxillofacial (OMF) injury among deployed military populations. This study reports causes of OMF injuries to U.S. Department of Defense personnel deployed to Afghanistan in Operation Enduring Freedom (OEF) or to Iraq in Operation Iraqi Freedom (OIF) and Operation New Dawn (OND). This study provides follow-on analysis of a previous report of OMF injury rates among U.S. military personnel in Iraq and Afghanistan from 2001 to 2014.

Methods
The populations studied were military personnel deployed to Afghanistan in OEF or Iraq in OIF and OND, who sought care at a level III military treatment facility for one or more OMF injuries. Injuries were identified in the Department of Defense Trauma Registry using diagnosis codes associated with OMF battle and non-battle injuries. Causes associated with these injuries were identified by evaluation of the data field “dominant injury mechanism.” All OMF injuries incurred from October 19, 2001, to June 30, 2014, were included.

Findings/Results
Approximately 89% of all OMF battle injuries in both OIF/OND and OEF were due to explosives or explosive devices. The three leading causes of OMF non-battle injuries for both OIF/OND and OEF were motor vehicle crashes/accidents (MVCs), falls, and “other blunt” trauma. MVCs as well as other blunt trauma accounted for a greater percentage of OMF non-battle injuries in OIF/OND than in OEF (p < 0.01). OMF non-battle injuries due to falls were more likely to occur in OEF (p = 0.05). Helicopter/plane crashes were responsible for a significantly higher percentage of OMF non-battle injuries in OEF compared with OIF/OND (p < 0.01).

Discussion/Impact/Recommendations
Across both theaters of war, Iraq and Afghanistan, the main causes of OMF battle and non-battle injuries were consistent. Battle injuries were primarily due to explosives or explosive devices and the three main causes of non-battle injuries were MVCs, falls, and other blunt trauma. However, the distribution of causes differed by war theater. Future studies should focus on potential reasons for cause distribution disparities in MVCs and helicopter/plane crashes as they can only be partially explained by topography and infrastructure differences between Iraq and Afghanistan. Further surveillance is needed to understand the scope of OMF injuries in military-armed conflicts and operations.
Collapse in the Heat – From Overhydration to the Emergency Room – Three Cases of Exercise-Associated Hyponatremia Associated with Exertional Heat Illness

COL Robert C. Oh, MC, USA, CPT Bryan Malave, MC, USA, CPT Justin D. Chaltry, MC, USA

ABSTRACT Exertional heat illness and exercise-associated hyponatremia continue to be a problem in military and recreational events. Symptoms of hyponatremia can be mistaken for heat exhaustion or heat stroke. We describe three cases of symptomatic hyponatremia initially contributed to heat illnesses. The first soldier was a 31-yr-old female who “took a knee” at mile 6 of a 12-mile foot march. She had a core temperature of 100.9°F, a serum sodium level of 129 mmol/L, and drank approximately 4.5 quarts of water in 2 h. The second case was a 27-yr-old female soldier who collapsed at mile 11 of a 12-mile march. Her core temperature was 102.9°F and sodium level was 131 mmol/L. She drank 5 quarts in 2.5 h. The third soldier was a 27-yr-old male who developed nausea and vomiting while conducting an outdoor training event. His core temperature was 98.7°F, a serum sodium level of 129 mmol/L, and drank approximately 4.5 quarts of water in 2 h. 

Three Cases of Exercise-Associated Hyponatremia

Three Cases of Exercise-Associated Hyponatremia

A Case of Non-simultaneous Bilateral Partial Triceps Tendon Repair

LT Eric Goodrich, DO, MC (FS) USN, LCDR Richard P. Goodrich, DO, (SMO/UMO/DMO) MC USN, MBA, MS

ABSTRACT A partial triceps tendon tear is an uncommon injury. Even rarer is a bilateral partial triceps tendon tear in which there has been one documented case. This case report illustrates a 37-yr-old African-American male who sustained non-simultaneous bilateral partial triceps tendon avulsions. He sustained a traumatic right partial triceps tendon avulsion after a fall onto an outstretched right arm that required operative repair after failure of conservative treatment. Five months later, he sustained a similar injury after falling on an outstretched left arm that was repaired 9 d later. His post-operative courses were uncomplicated. He returned to full duty at his 6 mo and remained symptom free at 12 mo. The case demonstrates that operative treatment of partial triceps tendon avulsions using bone tunnels yields good outcomes in high-demand patients who have failed conservative treatment and who have had an operative repair of the contralateral extremity.

doi: 10.1093/milmed/usx105

Spontaneous Lung Herniation Through the Chest Wall

LT Michele Cox, MC USN, LCDR Darshan Thota, MC USN, LCDR Ruth Trevino, MC USN

ABSTRACT A 71-yr-old male with a medical history significant for chronic obstructive pulmonary disease presented to emergency department for worsening cough, right-sided pleuritic chest pain, and dyspnea. This was the patient’s third visit to the emergency department in 4 d. The patient was initially treated for chronic obstructive pulmonary disease exacerbation and subsequently evaluated for congestive heart failure. He was ultimately diagnosed with a spontaneous herniation of the lung parenchyma through the chest wall. The patient was transferred to an outside host nation facility for definitive treatment and repair of the chest wall defect. Refractory cough and dyspnea failing to respond to typical treatments should warrant an expanded differential to include the rare etiology of atraumatic spontaneous lung herniation.

doi: 10.1093/milmed/usx063

False-Positive Monospot in a Returning Traveler with Dengue Fever

LT Kimberly Boyd, MC, USN, CDR Joshua M. Harrison, MC, USN, CDR Michael J. Kavanaugh, MC, USN

ABSTRACT The heterophile antibody (Monospot), initial test of choice for Epstein–Barr virus (EBV)-associated infectious mononucleosis, is both sensitive (70–92%) and specific (96–100%). False positives have been demonstrated in cases of viral hepatitis, human immunodeficiency virus, leukaemia, lymphoma, pancreatic cancer, systemic lupus erythematosus, and rubella. We present a case of a 46-yr-old male who developed fever, chills, headaches, myalgia, fatigue, and photophobia 1 d after returning from the Philippines. He demonstrated a mild transaminitis and significant thrombocytopenia (12,000 cells/μL). His initial evaluation revealed a positive heterophile antibody test. Without a classic EBV presentation, a fever in returning traveler evaluation was instituted resulting in a positive dengue test by direct fluorescence IgM (8.82 IU) and IgG (7.13 IU), respectively. Both his EBV DNA polymerase chain reaction and IgM by viral capsid antigen were negative. Dengue, an RNA flavivirus, and the dengue antibody have demonstrated cross-reactivity with other flaviviruses including Japanese encephalitis virus, yellow fever virus, West Nile virus, and St. Louis encephalitis. However, EBV is a double-helix DNA herpesvirus and structurally very different. To our knowledge, this is the first reported case of cross-reactivity between dengue and EBV that describes a potential false positive for the heterophile antibody test.

doi: 10.1093/milmed/usx046

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