THE UNITED STATES ARMY MEDICAL DEPARTMENT

# JOURNAL

ARMY MEDICINE:
MAINTAINING, RESTORING, AND IMPROVING HEALTH

*October – December 2012*

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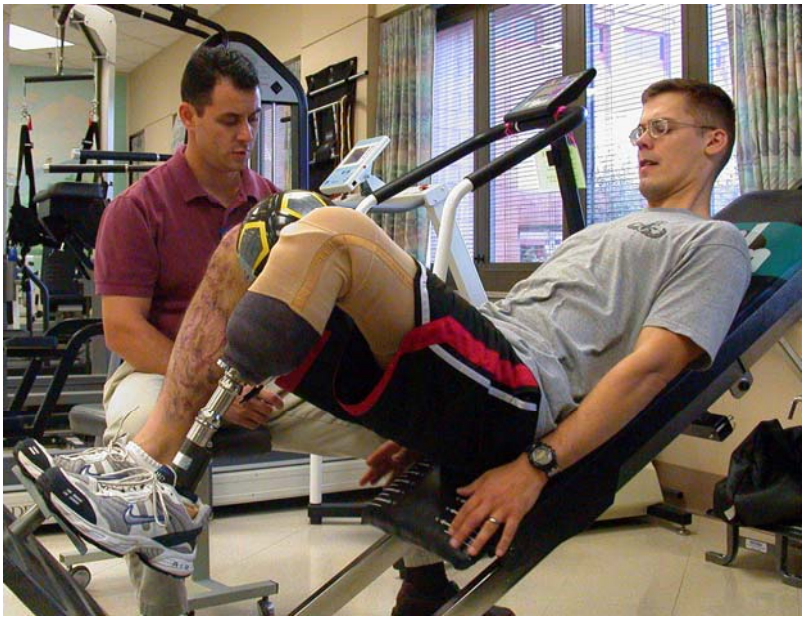

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# Perspectives

## Commander's Introduction

MG Philip Volpe

> *Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.*

That statement is the first of the basic principles enumerated in the preamble to the Constitution of the World Health Organization, adopted on July 22, 1946.* The simplicity and clarity of those 21 words are as true today as 66 years ago, without a single amendment or elaboration. It is as applicable to an organization, a society, or a nation as it is to an individual. The interrelationship of those levels of health is clearly captured in the stated vision of Army Medicine:

> Strengthening the health of our Nation by improving the health of our Army.

In the recently issued Army Medicine Strategy (August 10, 2012), The Surgeon General lays out a shift in perspective for our profession, "from a healthcare system to a system for health." The history of Army Medicine is rich in groundbreaking success in research and proactive efforts in preventive medicine, public health, and health promotion for our forces. Routinely, these achievements are extended beyond the military and greatly benefit the healthof people around the world. The transformation of our healthcare system will build on those achievements and expand the perspective to more directly address the health of the individual, indeed, the very lifestyle factors that affect personal health, and, by extension, the health of our Army and our nation.

Since its inception in 1994 by then Army Surgeon General LTG Alcide LaNoue, the *AMEDD Journal* has been on the forefront, providing information supporting the three basic strategies for of health promotion: advocacy, enabling, and mediation as presented in the WHO Charter for Health Promotion. The *Journal* presents articles that cover the entire range of health and healthcare. Over the last 7 years, the *AMEDD Journal* has regularly featured articles dedicated to force health protection and public health, reflecting the diverse skills and expertise of Army medical professionals.

This issue of the *AMEDD Journal* maintains the standard, incorporating articles on nutrition, personal health responsibility, physical fitness, and drug abuse. It also contains articles on trauma care, operational planning, Army nursing, dentistry, and lessons learned from the combat theaters. Throughout theses pages, the *Journal* continues to showcase the diversity, sophistication, and talent of medical professionals who accept the responsibility for the health of our military personnel and their families, both today and tomorrow.

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### EDITOR'S PERSPECTIVE

The Warrior Transition Unit (WTU) program has been very successful in its primary mission, providing extended treatment and/or rehabilitation services to Wounded Warriors to return them to active duty or prepare them for the transition to civilian life. Their wounds are healed, they adapt to losses of limbs and other disabilities, and their psychological and behavioral health issues are addressed and treated. However, even as their bodies are being restored from combat injuries, their lifestyle choices may become detrimental to their overall health, both immediate, complicating the rehabilitation and treatment efforts, and over the long term, with weight-related chronic conditions such as diabetes. In the opening article in this issue, CPT Adam Kieffer and MAJ Renee Cole report on their study of nutrition choices and weight gain among Wounded Warriors assigned to WTUs at four Army medical centers. Their examination revealed that the Warrior recovery process presents a dichotomy in weight management: during healing the major concern is prevention of weight loss; following release to the WTU for outpatient treatment and rehabilitation, weight gain becomes problematic. The article presents detailed data gathered from Warfighters as to their body mass index, the nature of their injuries, and their self-assessments of their lifestyle choices related to nutrition and weight management. Further, the study subjects were asked their opinions of their own weight and physical

*http://www.who.int/governance/eb/who_constitution_en.pdf

condition. This article should be of great interest to those charged with assisting Wounded Warfighters through their recovery, rehabilitation, and transition periods, presenting another, more subtle aspect of restoring the health of those who have sacrificed so much.

MAJ Derek Licina opens his article with the following:

> According to the World Health Organization, chronic diseases with preventable risk factors have surpassed infectious diseases as the major cause of morbidity and mortality worldwide.

That simple statement frames the ironic reality facing humankind: as successful as medical science has been in discovering and countering diseases, our personal lifestyle choices are becoming increasingly detrimental to our overall health and wellness. MAJ Licina's article explores the quandary facing society, are individuals personally responsible for their negative lifestyle choices? On the surface, a simple question. But as explored in this excellent article, the answers are not so simple. MAJ Licina presents and develops several different, and often conflicting, philosophies of human responsibility. Today, those philosophies are clearly reflected in political perspectives and positions, thus driving the debate as to how healthcare resources (which are undeniably finite at some point) should be financed and allocated across the population as a whole. Who is ultimately at fault: the individual, the society, the environment, a combination? Further, important questions always arise when the discussion turns to public policy to address negative behaviors. Can a free society continue to exist if personal behavior becomes regulated and controlled? Should all potentially harmful nutritional and drug substances be banned, as well as activities which may result in chronic illness or injuries requiring long-term commitment of resources to treat? MAJ Licina's article is a well-developed, thought-provoking examination of questions that are very relevant to the current national debate regarding healthcare and use of medical resources.

It is not easy to become a member of the US military. The physical, intellectual, and ethical standards are high, and strictly applied. Only a small percentage of the age-qualified population can initially meet those standards, and even then, a number of them do not complete training and are eventually separated. The standards and screening process produce a Warrior force comprised of select individuals of the highest character, motivation, and ability, especially in comparison to the population as a whole. However, military people are still products of society, and it is inevitable that a certain percentage bring society's ills into the service with them. Drug abuse is one of the more pernicious of those societal problems that the military must address on a continuing basis. Dr Cristobal Berry-Caban and his coauthors have contributed a sobering article describing one of the latest dangerous drug abuse practices to find its way into the military. New types of synthetic hallucinogenic drugs, popularly known as "spice" and "bath salts," have emerged over the last 8 years. Initially available for purchase in the open market because they purportedly were a mixture of legal herbs, they actually contain added synthetic drugs, a class of sophisticated designer drugs which produce euphoric highs, but also significant adverse effects as well. In their article, Dr Berry-Caban et al detail the composition and effects of these compounds, as well as the efforts of the military to deal with their abuse by service members which has been identified in recent years. This is an important article which should be must reading for leaders and supervisors at all levels.

Presenting the other (positive) end of the behavioral spectrum, the article by LTC Donald Goss and Dr Michael Gross discusses recent trends in running footware (including none), detailing the relationship of various footstrike patterns and injury incidence to footware preferences. Since military personnel must maintain a high level of physical fitness throughout their careers, it is important that those responsible for requiring and supporting their exercise efforts remain current on both the benefits and risks associated with exercise techniques and equipment, especially any potential for debilitating injury. LTC Goss and Dr Gross conducted a detailed study of a cross-section of regular runners to explore the mechanics of various running techniques associated with footware, to determine if there were any injury trends, positive or negative, associated with either the style of running, the footware, runner experience, or a combination of factors. Their article presents the analysis of the extensive data collected during the study, and compares the various injury profiles related to styles and footware. This information contributes to the range of knowledge to support Army medicine's move of emphasis to the achievement and preservation of health for all Warfighters.

Although a hemostatic agent may be effective in hemostasis and hemorrhage control, extensive loss of blood may dictate administration of intravenous fluid in resuscitation efforts, whether at point-of-injury

or during evacuation. Unfortunately, introduction of such fluid may dislodge newly developed clots with resulting renewed hemorrhage. Dr Don Johnson and his team examined the effectiveness of QuikClot Combat Gauze in maintaining control of serious bleeding in the presence of hemodilution from intravenous fluids. As in the BleedArrest evaluation discussed above, they used the porcine model in a carefully planned laboratory setting to replicate hemodilution conditions, with meticulous data management throughout their procedures. Their article is a clear presentation of the planning, the process, the analysis, and the data-supported conclusions. These 2 articles are more excellent examples of the professionalism that is found throughout the Army Medical Department, from the battlefield to the laboratory.

COL Collins Lyons and his coauthors have contributed another excellent article from Army dentistry to join those that have been published in the *AMEDD Journal* throughout its history. They present a case in which they encountered, diagnosed, and removed a rare, fortunately benign, tumor from a patient's mandible. The article meticulously describes the process from first examination through tumor diagnosis and removal, and clearly articulates the variables and possible alternative diagnoses that should be considered when encountering similar symptom and condition presentations. This is a textbook example of dental professionalism at its best, another indication of the high level of skill, talent, and knowledge that is the standard of the Army Dental Corps.

On July 27, 2011, a 102 year chapter in the history of Army Medicine came to a close. The Walter Reed General Hospital opened in 1909 on the site that developed into one of the most respected medical complexes in the world. The campus of the Walter Reed Army Medical Center provided medical and dental care to many generations of military personnel and their families, including treatment and rehabilitation services for Wounded Warriors from every armed conflict during those 10 decades. It also hosted world renowned research institutes, as well as education and training for medical and dental personnel of the US Army. COL Samuel Passo and Nolan Watson have written a very interesting and informative article chronicling specifically the history of dentistry, including patient care, dental research, and education and training at the Walter Reed campus. The evolution of the dental sciences at Walter Reed closely parallels that of the medical sciences, and the reader will recognize the value of the symbiotic relationships enabled by the collocation of top level resources of the two disciplines. This article captures an important component of the Army Dental Corps' 101 year history, and presents it in a well-written and organized form. It is a good read.

Under the best of circumstances, planning for medical support of combat operations is a difficult and imprecise proposition, based on estimates, assumptions, intelligence reports, and historical data. The level of difficulty is elevated when the planning involves a multinational force, due to the increased complexity of coordination, communication, command relationships, and variations in capabilities and resources. Existing doctrinal approaches and planning models are difficult to apply in such situations, since they often do not address the variables and peculiarities of the force structures. Even more problematic is the fact that most planning tools are classified and/or only accessible by specific personnel. In their article, LTC Soo Lee Davis and Col Martin Bricknell describe the approach they used to develop an operational casualty estimate for a major multinational offensive operation in the area around Kandahar City in 2010. The article is a virtual tutorial on the medical planning process in a deployed combat environment, clearly articulating the necessary attention to detail across a broad scope of research, coordination, resource identification, communication, and timing. It should be of great interest to all operational planners who are anticipating deployment as part of a multinational force, especially when their command will be responsible for the bulk of the deployed area medical resources.

As the deployments into and out of the combat theaters of Iraq and Afghanistan cycled in the years after January 2003, the Army Nurse Corps began to see an alarming trend among the returning Army nurses. More and more of the returning nurses began to express a desire to leave the Army Nurse Corps, the Army, and sometimes the nursing profession altogether. Based on extended periods of combat in our history, the nature of current combat operations is somewhat unusual in that military medical personnel at nondeploying commands, medical centers or facilities can be individually assigned to deploying units (perhaps several times), returning from each deployment to the facility or location from which they departed, and experiencing a "culture shock" at the different environment. COL Denise Hopkins-Chadwick describes a study chartered by the Army Nurse Corps to determine the deployment-related factors that prompt the negative attitudes toward continuing as a military nurse, or even a nurse at all. In her article, COL Hopkins-Chadwick focuses on one part of the study, that

of the nurses' experiences upon returning home. From that information, she derives evidence-based support strategies for both the returning nurses and those with whom they work upon return to smooth and ease the transition from the deployed environment back to "normal." This and other results of the study have been integrated into orientation classes and content of the Army Nursing Leader Academy to ensure that current and future leaders, supervisors, and coworkers understand the complexities and stresses inherent in transitioning across such completely different working and living environments.

There is a history of advancements in medical science produced during wars and military conflicts. Unfortunately, as a rule, such progress was usually not realized for medicine in general until cessation of hostilities, as individual medical professionals came back to evaluate and develop the discoveries and techniques that were applied during the conflicts. Usually no formal research or distribution of information was applied in the combat environment, just innovation and trial-and-error to improve the situation of the moment. LTC Laura Feider and her coauthors have contributed an article describing how military medicine has instituted in-theater research teams to provide a formal structure for conducting "there and now" combat relevant medical research to benefit both the theater operating forces in real time, and military medicine over the long term. Their article discusses in detail the role of military nurses in the Joint Combat Casualty Research Team, and presents the variety of nursing research protocols that have been evaluated, as well as those proposed for future investigation. This is an interesting and informative article that reflects both the proactive attitude that frames modern military medicine in deployed combat environments, and the broad scope and very high level of capabilities, skills, experience, and motivation that is the standard of today's Army Nurse Corps.

Articles in previous editions of the *AMEDD Journal* have discussed at length the evolving capabilities and sophistication of military helicopter medical evacuation (MEDEVAC), and how it can and should be improved. The most recent combat operations have fostered positive changes in where and how stabilization and resuscitation of trauma patients is performed, which has also changed the character of many of the requirements for en route MEDEVAC care of those patients. Those requirements are being addressed in some ways, but MAJ Michael Wisseman and MAJ Christopher VanFossen do not think that those measures are sufficient to provide the ever-increasing level of critical care expertise demanded during transportation of critically injured trauma patients. In their article, they describe the background of the current situation, and provide statistics illustrating the increase in the number of MEDEVAC missions during which critical care interventions were required. They then examine the changes in MEDEVAC medical crewmember training that have been instituted and explain the difficulties inherent in such an approach, especially over the long term outside of combat operations. They develop an approach based on several years of in-theater MEDEVAC operations during which nurses, and sometimes physicians, were required to provide the en route critical care necessary to keep the patient stable and/or perform resuscitation. Their proposal is the assignment of Army critical care or trauma nurses as permanent members of Army medical evacuation crews. They lay out the advantages, not only directly to the patients, but also to the professional capabilities of the evacuation unit as a whole. MAJs Wisseman and VanFossen develop their proposal carefully and logically, citing statistics and other documentation in support of their position. This article should be closely read by those charged with developing the doctrine and planning guidance that will create the MEDEVAC structure of the future. This capability has become an absolutely indispensable fixture on the modern battlefield, and it should provide the best capabilities possible to maximize the potential for survival of our Warfighters who must go into harm's way.

MAJ Scott Phillips and his coauthors have contributed an informative article presenting a relatively recent innovation in professional nursing roles which provides advanced generalist clinical skills for a defined group of patients at the unit of care level. The role, the Clinical Nurse Leader (CNL) was conceived and developed by the American Association of the Colleges of Nursing in conjunction with leaders in nursing education and other experts. The CNL is neither administrative nor management, but is intended to be an advanced generalist clinician, the "go to" person at the bedside when knowledge assistance and experienced guidance is required. MAJ Phillips et al build their case for adopting CNLs within AMEDD at the 5 major Army medical centers (at a minimum), not only for the obvious benefits to direct patient care, but also as a key component in meeting the organizational and strategic objectives of both AMEDD and MEDCOM, in particular those articulated in the MEDCOM balanced scorecard approach to organization and function. The article discusses a pilot test of the CNL role within one unit at William Beaumont Army Medical Center to evaluate the various workplace dynamics

and parameters that will be involved in any institutional incorporation within AMEDD. The pros and cons of implementing this additional role into the existing manpower and organizational systems are examined and analyzed. This is a thought-provoking look at adopting a beneficial innovation from the civilian sector into the military medical structure. It deserves careful consideration by those defining and shaping military medicine for the future.

It is a familiar occurrence for planning, instructions, guidelines, and important decisions involved in large-scale evolutions of big organizations to be made from the macro perspective—necessarily so, to a point. Therefore, it is no surprise that those involved in executing that evolution at the other end of the spectrum, the smallest units and their individuals, often are mystified at the direction they receive, some of which seems to have no correlation to the reality with which they must contend. This is, of course, the time-honored conundrum of the military member, especially when deploying into a fluid, dynamic combat environment. However, during an extended period of deployment cycles such as those defining the US involvement in Iraq and Afghanistan over the last decade, the big-picture aspects of operations should be institutionalized enough to allow inquiry into the "details" to see if attention is warranted, can improvements be made, and if there are any ideas or concerns among those individuals involved which should be addressed. MAJ (Ret) Dave Cannon of the AMEDD Lessons Learned Division describes an effort by Lessons Learned to do just that: upon their return, ask those deployers at the lowest common denominator, the small unit, for their individual feedback regarding their predeployment and operational experiences in theater. The responses were statistically correlated to spot trends, relationships, and outliers within the data to provide perspective and foundation for determining required actions. The article describes the implications of the responses, some corrective actions already completed or in process, as well as several changes to organizational structure to improve flexibility and capability in the combat environment. Of interest are the correlation of some variables such as deployment location and time spent deployed to the resulting responses. Such information, ideas, and insight would likely not become visible at higher levels of the command structure, as the enormous workload of simply getting in and out of theater tends to overwhelm those who are making it happen. Further, when units return and are faced with adjusting to the new garrison environment, and personnel are often dispersed over time, it quickly becomes too late to obtain reliable information. This article is an interesting and insightful snapshot of a large, important effort to see the operational deployment from the perspective of those who make it happen.

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# Weight Change, Lifestyle, and Dietary Behavior in the US Military's Warrior in Transition Units

CPT Adam J. Kieffer, SP, USA
MAJ Renee E. Cole, SP, USA

ABSTRACT

Objective: To identify lifestyle factors that may contribute to weight changes experienced by Warfighters assigned to Warrior in Transition Units (WTU).

Design: Multicenter, cross-sectional, descriptive study at 4 military installations (Fort Hood, TX; Fort Bliss, TX; Fort Sam Houston, TX; and Fort Gordon, GA). Participants completed a self-reported questionnaire regarding environmental, social, and dietary lifestyle behaviors. Study participants were recruited and data collected from February through July 2009.

Results: Four hundred twelve wounded Warfighters (97.6% Soldiers) participated; 51% indicated they were overweight and 61% desired weight loss. About 51% exceeded a normal body mass index (18.5 to 27.4 kg/m$^2$) according to Army height and weight standards. Roughly 85% of all participants experienced weight change following their injury. Limited activity was self-reported as the main reason for weight gain (66.2%), and deployment as the main reason for weight loss (21.7%). Lifestyle factors that changed included skipping meals, eating snacks, eating at sit-down restaurants, performing aerobic and anaerobic physical activity. The majority of participants (more than 70%) consume 3 standard meals per day, with 25% reporting that the meal typically skipped was breakfast.

Conclusion: The WTU Soldiers saw themselves as overweight, desired to lose weight, and reported several changes in lifestyle factors upon entry into the WTU. There is a need for more focused nutrition-related and physical fitness-oriented interventions to aid Warrior recovery, promote rehabilitation, and decrease length of time in the WTU.

*A Warrior in Transition is a Soldier who is assigned/attached in a Warrior Transition Unit and whose primary mission is to heal.*[1]

The Warrior in Transition Unit (WTU) program is a comprehensive continuum of care for service members and their families, with WTU units located at US military installations throughout the world. A Warfighter who requires significant medical treatment or rehabilitation anticipated lasting 6 months or more in order to return to duty or successfully transition to veteran status is assigned to a WTU.[2] The WTU achieves individualized care by assigning a "triad" to each service member: the primary care manager, nurse case manager, and squad leader or platoon sergeant.[3] This collaboration of both military and civilian leadership ensures a centralized support network for the Warfighters and their families, streamlined appointments and treatments, and efficient documentation.[4] The length of stay in the WTU is dependent on the severity of illness or injury and the extent of treatment required.[3] As of April 2010, there were 9,200 Soldiers in the 32 WTUs throughout the United States.[5]

Body weight is a polarized issue in any hospital setting, depending on the stage of healing. Preventing weight loss is a concern for patients and Warfighters who have experienced severe trauma, burns, and/or amputation. They are encouraged to consume adequate calories to meet their increased resting metabolic demands.[6,7] Once released from the inpatient setting and enrolled in the WTU, the concern becomes preventing unwanted weight gain as metabolic needs return to normal after healing. In the outpatient setting, excess body weight is detrimental, increasing the Warfighter's risk for delayed wound healing, hyperlipidemia, type 2 diabetes, and cardiovascular disease.[8,9]

*Department of Defense* (DoD) *Directive 1308.3*[10] provides guidelines on body weight standards for the military services. The directive states that service members must maintain a combat-ready body weight and body fat. Assessment of this standard includes body fat testing, from which WTU participants are exempt while healing. Specifically for the Army, the Army Weight Control Program requires Soldiers to maintain a healthy weight-

for-height and body fat percentage based on age and gender.[11] A healthy weight-for-height is assessed with the use of body mass index (BMI; kg/m²).[12] The Army allows for a higher BMI (up to 27.5 kg/m²) in Soldiers compared to nationally accepted civilian classification for normal BMI (up to 25 kg/m²) due to an expected higher lean body mass.[11] Soldiers can face disciplinary action, including discharge, if they do not meet these standards. For example, in 2010 the Army released approximately 1,200 initial enlistees within the first year of service for not meeting weight for height standards.[14] Gaining weight while in the WTU may have a negative effect on a Warrior's transition back to duty. On the other hand, many WTU Warfighters are released from active duty and enter the national pool of veterans. Research assessing veteran weight status, including veterans from the Gulf, Iraq, and Afghanistan wars, indicates that veterans have a higher prevalence of overweight rates than the national norm with 73% of male and 54% of female veterans being overweight. Further, in those studies, veterans tended to gain 2.2 kg/year more than those still on active duty over a 6-year period of assessment.[15-18]

Although observations suggest that Warfighters gain weight while in the WTU, no published information currently exists regarding their dietary habits, lifestyle factors, and weight trends. It can be reasonably assumed that significant changes in the Warfighter's life (such as new residence, injuries, limited access to food preparation, inactivity) could dramatically affect lifestyle and eating behaviors. Weight gain can be detrimental to recovery and may contribute to health-related comorbidities, prolonging the Warfighter's recovery.[2] By assessing the WTU weight change, lifestyle behaviors, attitudes, and access to healthy food and preparation equipment, a nutrition intervention can be tailored to the WTU to increase the speed of recovery. A tailored intervention could provide them with sufficient tools to increase their quality of life while assigned to the WTU and assist in their transition back to duty or return to civilian life. The objective of this study was to determine what lifestyle factor changes, following injury and enrollment in the WTU, may affect their weight status.

## SUBJECTS

Four hundred twelve Warfighters assigned to WTUs were recruited across 4 locations: San Antonio Military Medical Center (SAMMC), Fort Sam Houston, Texas; William Beaumont Army Medical Center (WBAMC), Fort Bliss, Texas; Carl Darnell Army Medical Center (CDAMC), Fort Hood, Texas; and Dwight D. Eisenhower Army Medical Center (EAMC), Fort Gordon, Georgia. These WTU locations were chosen to reduce geographical bias and increase diversity in the sample population. The only inclusion criterion for this study was age of 18 years or older. There was no exclusion criterion.

Study participants were recruited and data collected from February through July 2009.

## METHODS

The study was a multicenter, cross-sectional, descriptive design. To assess weight change and lifestyle factors, a self-reported questionnaire was created. The survey consisted of 5 sections totaling 24 questions with 142 possible variables: demographic (gender, height, weight, length of time in WTU, etc); living arrangements and transportation (such as access to transportation, type of lodging); tobacco habits; weight and lifestyle behaviors (for example, perceived weight, perceived weight gain or loss post injury, changes in lifestyle factors post injury, physical activity); and food and nutrition (number of meals consumed per day, location of consumption, changes to dietary habits post injury, etc). The WTU Warfighters were classified above and below a BMI of 27.5 kg/m$^2$ as well as by the National Heart, Lung, and Blood Institute's (NHLBI) BMI classifications[14]: underweight (BMI <18.5 kg/m$^2$); normal weight (BMI 18.5 to 24.9 kg/m$^2$); overweight (BMI 25.0 to 29.9 kg/m$^2$); and obese (BMI ≥30.0 kg/m$^2$). Access to basic food preparation equipment was assessed through a 12-variable question to identify what aspects of food preparation were within the WTU Warfighter's control, and ranged from no access beyond a dining facility to items such as refrigerator, microwave, cookware, silverware, and food storage area. The survey was pilot tested by subjects representative of the population and SAMMC health professionals to assess content validity prior to distribution. Recruitment occurred at primary care appointments and WTU information sessions. The study followed a protocol approved by the Institutional Review Boards at SAMMC (also covering CDAMC), WBAMC, and EAMC, and was classified as an exempt protocol. Warfighters who volunteered to complete the survey received a free water bottle as an incentive, funded by the SAMMC Department of Clinical Investigation.

## STATISTICAL ANALYSIS

The sample size was determined by a margin of error at the 95% confidence interval for a probability estimate of 50%. The 95% confidence interval (CI) for a binomial probability was calculated from the Wald equation yielding the need for 384 subjects to estimate a probability of 0.50 with a 95% CI of 0.50±0.05 (5% error). To allow for a 5% margin of error, a target sample size of 400 completed surveys was chosen.

Data were analyzed using SPSS version 16.0 (SPSS Inc, Chicago, Illinois). Descriptive statistics and frequencies were utilized for nominal data. Chi-square analysis was conducted comparing BMI ≥27.5 kg/m$^2$ (overweight), BMI <27.5 kg/m$^2$ (normal weight), and NHLBI BMI >25 kg/m$^2$, with current accommodations, injury, changes in lifestyle habits, amount of activity, food prep/cooking access, and Soldier demographics of those who gained weight compared to those who lost weight following injury. Spearman's rho correlation analysis was completed on the continuous BMI scale data and various categorical data.

## RESULTS

### Demographics

The demographic descriptive results (Table 1) show that wounded Warfighters within the 4 locations were predominately US Army Soldiers (97.6%), most likely white males aged 23 to 43 years in the ranks of specialist (E-4) to staff sergeant (E-6). A variety of injuries were listed, with 24% requiring assistance for ambulation, 30% with a traumatic brain injury, and 7% resulting in extremity amputation. The majority of participants (66.4%) reported having basic access to food preparation equipment such as a refrigerator, microwave, and cooking supplies, and that participants living in the barracks/billets were more likely to report insufficient access compared to Soldiers living off-post ($P$<.05). Location of residence differed greatly among installations, but overall, 50% were assigned to individual on-post housing (barracks/billets) and 50% to family housing.

### Weight Change

Two hundred two participants (51.1%) had BMI values ≥27.5 kg/m$^2$ and did not meet height and weight standards specified by *Army Regulation 600-9*.[11] The BMI distribution across the WTU military installations is presented in the Figure. Using NHLBI criteria for categorizing BMI, 4% of participants were underweight, 23.1% were normal weight, 42.6% were overweight, and 33.2% were obese. The majority of participants (51.1%) self-reported themselves as overweight. The BMI was positively correlated with WTU length-of-stay ($P$=.017; $r$=0.121) and age ($P$=.002; $r$=0.157). Men were more likely to gain weight than women while in the WTU ($P$<.05).

No significant trend was found to support that weight was only gained during deployment and following injury. Some participants reported weight gain while others reported weight loss before and after their injury/illness. Prior to entering the WTU, 37.5% of participants experienced weight change. Deployment, stress, desire to lose weight, and illness were the main reasons for weight loss; while stress, illness, medications, and limited activity were cited for causes of weight gain. The majority (85%) of participants experienced a weight change following their injury (n=342); 63.3% gained weight while 21.9% lost weight. Limited activity and medication use were listed as the main reasons for weight gain (66% and 46% respectively). Deployment was listed as the main reason for weight loss prior to injury (21.7%).

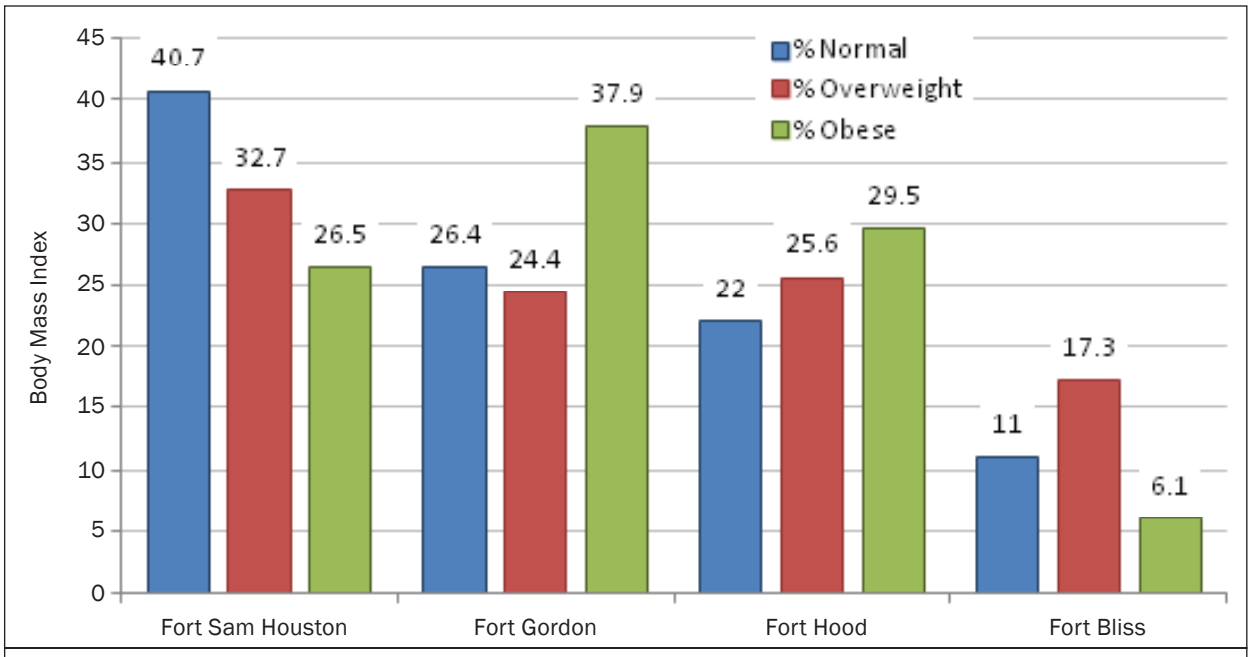
### Lifestyle Factors that May Contribute to Weight Change

Warfighters with a BMI ≥27.5 kg/m$^2$ were more likely to make lifestyle changes following injury ($P$=.000; $r$=-0.206). More than 50% of participants changed at least one of the following lifestyle factors (Table 2):

Table 1. Demographics of WTU Warriors (N=412*)

| | n (%) |
|---|---|
| Location | |
| Fort Sam Houston, TX | 134 (32.6) |
| Fort Gordon, GA | 117 (28.5) |
| Fort Hood, TX | 111 (27.0) |
| Fort Bliss, TX | 49 (11.9) |
| Gender | |
| Male | 363 (89.0) |
| Female | 45 (11.0) |
| Military Service | |
| Army | 402 (97.6) |
| Marine Corps | 4 (1) |
| Air Force | 1 (0.2) |
| Navy | 1 (0.2) |
| Not indicated on survey | 4 (1) |
| BMI (mean =28.3 kg/m$^2$, SD ±5) | |
| BMI < 27.5 kg/m$^2$ (%)† | 193 (48.9) |
| BMI ≥ 27.5 kg/m$^2$ (%)‡ | 202 (51.1) |
| Mean Age 33 years, SD±10) | |
| Race/Ethnicity | |
| Black | 75 (18.4) |
| White | 229 (56.3) |
| Hispanic | 66 (16.2) |
| Asian | 4 (1.0) |
| Other | 33 (8.1) |
| Length of stay in WTU | |
| 0–6 months | 177 (44.3) |
| 6 months–1 year | 109 (27.3) |
| 1 year–2 years | 90 (22.5) |
| >2 years | 24 (6.0) |
| Military Rank | |
| E1–E3 | 32 (8.0) |
| E4–E6 | 298 (74.1) |
| E7–E9 | 50 (12.4) |
| O1–O3 | 13 (3.2) |
| O4–O6 | 7 (1.7) |
| WO1–WO5 | 2 (0.5) |
| Highest education attained | |
| High school | 125 (30.9) |
| Some college | 183 (45.2) |
| Associates degree | 42 (10.4) |
| Bachelors degree | 45 (11.1) |
| Graduate degree | 10 (2.5) |
| Residence | |
| Barracks/Billets | 195 (46.6) |
| On-post family housing | 32 (7.8) |
| Fisher House | 6 (1.5) |
| Guest house | 25 (6.1) |
| Off-post family housing | 151 (36.8) |
| Injury/Illness | |
| Traumatic brain injury (TBI) | 29.5% |
| Burn | 5.3% |
| Amputation | 7.3% |
| No amputation | 33.2% |
| Other | 56.2% |
| Require assistance for moving | 24.0% |

*Not all questions in each category were completed by all participants. Percentages are calculated for total responses in the category.
†Allowable BMI per *Army Regulation 600.9*
‡Overweight BMI per *Army Regulation 600.9*




Body mass index distribution of WTU study subjects by military installation.

skipping meals, eating snacks, eating at sit-down restaurants, performing aerobic and anaerobic physical activity. Warfighters usually consumed 3 standard meals at their assigned housing (38% to 56%) or the dining facility (25% to 34%). They reported that the meal typically skipped was breakfast and about 50% consumed snacks throughout the day. Approximately 57% of participants reported ambulating daily, whereas only 20% of participants reported performing physical activity 4 to 5 times weekly. No statistical differences existed between lifestyle factors (dietary or physical activity) and residence, meal frequency, BMI, or other demographic variables.

Table 2. Percentage of subjects who indicated changes (or none) in lifestyle factors following injury.

| | More | Less | No Change |
|---|---|---|---|
| Attend a weight loss program | 5.5 | 7.3 | 86.7 |
| Used diet/low calorie food | 22.5 | 9.3 | 68.2 |
| Ate smaller portions | 37.0 | 11.6 | 51.4 |
| Skipped meals* | 38.1 | 13.6 | 48.3 |
| Ate snacks* | 23.6 | 26.4 | 50.0 |
| Drank alcohol | 8.3 | 24.5 | 67.2 |
| Ate carbohydrates | 20.0 | 20.8 | 59.2 |
| Ate sweets | 16.2 | 27.9 | 55.9 |
| Drank sugary beverages | 17.8 | 28.2 | 54.0 |
| Ate high fat foods | 17.2 | 25.9 | 56.9 |
| Ate fruits | 33.5 | 14.7 | 51.8 |
| Ate vegetables | 34.7 | 12.3 | 53.0 |
| Ate at fast food restaurants | 18.3 | 30.0 | 51.4 |
| Used sugar-free sweeteners | 15.5 | 10.9 | 73.6 |
| Ate at buffets | 8.4 | 30.9 | 60.7 |
| Ate at sit-down restaurants* | 22.6 | 28.7 | 48.7 |
| Drank crystal light or sugar-free beverages | 13.5 | 17.9 | 68.3 |
| Took dietary supplements | 7.3 | 11.4 | 81.3 |
| Drank sports beverages | 25.6 | 18.2 | 56.2 |
| Performed aerobic activity* | 26.3 | 35.5 | 38.2 |
| Performed anaerobic/strength activity* | 21.7 | 39.5 | 38.8 |

*50% or more of the subjects changed this lifestyle factor.

### Interest in Specific Health Topics

Sixty-one percent of participants reported wanting to lose weight. Participants were asked to rate their level of interest (none, somewhat, very) in the following topics: healthy foods, healthy shopping, cooking, meal planning, weight management, sports nutrition, healthy snacks, and supplements. All topics received interest (>50%), however, learning about healthy foods and snacks created the strongest interest.

## COMMENT

The results from this study support the hypothesis that Warfighters experience weight change following injury; 63% of Soldiers gained weight postinjury, and 61% were trying to lose weight. To date, this is the first study published evaluating lifestyle factors contributing to weight change in the WTU following their injury.

At the time of the study, *DoD Directive 1308.3*[10] did not address weight standard adjustments for excess weight gain during the rehabilitative process. It is unknown how an elevated BMI would affect a WTU Warfighter's reintegration process especially when faced with the burden of negative administrative consequences of failing to meet current weight-for-height standards. This study found that nearly 51% of WTU Warfighters did

not meet Army standards for BMI and over 60% did not meet NHLBI criteria for normal weight BMI. It has been established that unintentional weight gain can affect the recovery of patients receiving treatments.[8,9] Being overweight or obese (BMI $\geq$25 kg/m$^2$) can increase the risk for impaired glucose tolerance, hyperlipidemia, and cardiovascular disease and is associated with increased mortality and delayed wound healing.[8,9,19-22] Nearly half of the WTU Warfighters believed that medications contributed to their weight change. Although some behavior health medications are shown to cause weight gain, obesity may be burdensome and require patients to take additional medications to combat side effects of that obesity.[23-25] Recent research suggests that emotions, environmental triggers, stress, medication use, and sleep deprivations contribute to the weight management challenges by interrupting the homeostatic and hedonic system balance of food intake.[19-20,26-35,50] It is plausible that all of these unconventional factors can effect WTU Warfighters in their recovery efforts and thus warrant further investigation.

Results showed that more than 50% of WTU Warfighters changed their meal patterns, timing, and frequency including skipping meals, eating snacks, and eating at sit-down restaurants. Skipping meals, especially breakfast, has been shown to hinder weight control.[36-38] Additionally, regular frequency of meals and structured meal patterns have been associated with decreased appetite, increased nutrient utilization, and increased weight control compared to irregular eating patterns.[39-49] Promotion of these behaviors may assist with weight control in the WTU.

Beneficial changes are continually improving the WTU accommodations, but this study found that WTU Warfighters living in the barracks were less likely to have sufficient access to food preparation equipment compared to WTU Soldiers living off-post or in family housing. Even though some WTU facilities have access to a central kitchen with adequate food preparation and cooking supplies, Warfighters may not have the cooking skills or adequate nutrition knowledge to develop healthy meal options. Although participants' nutrition knowledge was not assessed, heavy marketing and access to quick, high calorie food outlets, such as fast food restaurants, have a direct effect on weight control balance.[50] Future research could focus on how to encourage awareness of and use of food preparation in the barracks and assess effect on weight change following injury. Nutritional programs aimed at smaller meal consumption, inclusion of breakfast, making healthier food choices, and cooking with limited access to kitchen utilities could improve Warfighters' rehabilitation while in the WTU. Dining facilities were reported as the second most common site for meal consumption, thus targeting the dining facility with programs such as the "Go for Green" nutrition performance program.[51] The dining facility can indeed be a beneficial resource for the WTU Warfighter in promoting healthier meal choices.

Physical activity plays a key role in weight management,[52-54] and our study determined that less than 30% of Soldiers in the WTU met the minimum recommendation for physical activity (30 minutes of moderate-intensity exercise most days of the week) established by the American College of Sports Medicine.[55] More than 50% of Soldiers indicated decreased physical activity as the main reason for their weight change. Physical activity should be promoted and tailored based upon factors such as injury and medical procedures. It is possible that a Soldier may have to learn to use unfamiliar exercise method and equipment to accommodate a specific injury. As wounded Warfighters transition to the WTU, physical activity alterations as part of their rehabilitation may assist their weight management efforts as well as promote healing.

Limitations of this study include: biases associated with self-reported BMI, inability to adjust BMI for percent body weight amputations (7% of total injuries reported), differences in WTU accommodations among installations, and questionnaire-design inability to verify the motivation for lifestyle change. On the other hand, a major strength was multicenter WTU sampling.

Overall, this study found that lifestyle factors (dietary and physical activity) changed following injury regardless of reported weight gain or loss. Warfighters with a BMI $\geq$25 kg/m$^2$ made more lifestyle changes than Warfighters with a BMI $<$25 kg/m$^2$, possibly because overweight Warfighters were more likely to try different methods to lose weight. Understanding their motivation for lifestyle change would help tailor an intervention specific to their needs. The majority of Soldiers indicated the desire for classes or additional training/information regarding weight management, healthy activities, and lifestyle changes. With the prevalence of weight change in the WTU and with weight gain being a health concern, optimal treatment should include weight management and physical activity strategies; providing individualized nutrition and physical education may promote a healthy lifestyle.

## CONCLUSION

This study determined that Soldiers have significant weight changes while in the WTU. A majority of Soldiers consider themselves overweight and want to lose weight. Lifestyle factors change upon entry into the

WTU and specific reasons behind these changes should be further studied. Physical activity is significantly reduced following injury and may contribute to weight gain. There is a need for more focused nutrition-related and physical fitness-oriented interventions and program for Warriors to aid recovery, promote rehabilitation, and decrease length of time in the WTU. Although current healthcare practices for WTU Warfighters is praiseworthy, it is important to address the Warfighter's weight gain and possible effects it may have on their return to duty. Dietitians reinforce nutritional supplements and adequate energy needs while inpatient to promote healing, but Warfighters are not necessarily educated on how to make adjustments in caloric intake as healing and energy needs subside, nor habits to support long-term proper weight management. Establishing a nutrition education intervention as the Warfighter transitions from inpatient to the WTU outpatient setting for rehabilitation may promote effective weight management and prevent interruptions to the reintegration process.

## REFERENCES


1. *Department of the Army Warrior Transition Unit Consolidated Guidance (Administrative).* Washington, DC: Headquarters, US Dept of the Army (G-1); March 20, 2009:21.
2. *Army Regulation 40-400: Patient Administration*. Washington, DC: US Dept of the Army; January 2010 [revised September 2011].
3. Casey G, Geren P. A Statement on the Posture of the United States Army 2008. Washington, DC: Office of the Secretary of the Army; February 26, 2008. Available at: http://www.army.mil/aps/08/APS2008.pdf. Accessed August 2012.
4. MEDCOM Implementation of the Army Medical Action Plan. *MEDCOM Now*. May 14, 2007. Available at: http://www.army.mil/docs/MEDCOM_Now/MEDCOM_Now_Vol1-Issue1.pdf. Accessed August 2012.
5. Becker B. Army officers defend units from critics. *New York Times*. April 26, 2010;A14. Available at: http://www.nytimes.com/2010/04/27/us/27warrior.html. Accessed August 2012.
6. Long C, Schaffel N, Geiger J, Schiller W, Blakemore W. Metabolic response to injury and illness: estimation of energy and protein needs from indirect calorimetry and nitrogen balance. *JPEN*. 1979;3(6):452-456.
7. Uehara M, Plank H, Hill G. Components of energy expenditure in patients with severe sepsis and major trauma: a basis for clinical care. *Crit Care Med*. 1999;27(7):1295-1302.
8. Chafer M, Ferraro K. Long-term obesity and avoidable hospitalization among younger, middle-aged, and older adults. *Arch Intern Med*. 2007;167(20):2220-2225.
9. Haricharan R, Dooley A, Weinberg J, McGwin J, MacLennan P, Griffin R, Loring W, Reiff D. Body mass index affects time to definitive closure after damage control surgery. *J Trauma*. 2009;66(6):1683-1687.
10. *Department of Defense Directive 1308.1: DoD Physical Fitness and Body Fat Program*. Washington, DC: US Dept of Defense; June 2004.
11. *Army Regulation 600-9: the Army Weight Control Program*. Washington, DC: US Dept of the Army; 2006.
12. Report of a WHO Expert Committee, Physical Status: The Use and Interpretation of Anthropometry. World Health Organization. Geneva, Switzerland: 1995.WHO Technical Report Series 854.
13. Institute of Medicine. *Weight Management: State of the Science and Opportunities for Military Programs*. Washington, DC: The National Academies Press; 2004. Available at: http://www.nap.edu/catalog.php?record_id=10783. Accessed August 2012.
14. Mission: Readiness. *Too Fat to Fight: Retired Military Leaders Want Junk Food Out of America's Schools*. Washington, DC: Mission: Readiness; 2010. Available at: http://www.missionreadiness.org/2010/too-fat-to-fight/. Accessed November 15, 2011.
15. Almond N, Kahwati L, Kinsinger L, Porterfield D. Prevalence of overweight and obesity among U.S. military veterans. *Mil Med*. 2008 Jun;173(6):544-549.
16. Coughlin SS, Kang HK, Mahan CM. Selected health conditions among overweight, obese, and non-obese veterans of the 1991 Gulf War: Results from a survey conducted in 2003-2005. *Open Epidemiol J*. 2011;4:140-146.
17. Rosenberger PH, Ning Y, Brandt C, Allore H, Haskell S. BMI trajectory groups in veterans of the Iraq and Afghanistan wars. *Prev Med*. 2011 Sep;53(3):149-154.
18. Littman AJ. Jacobson IG, Boyko EJ, Powell TM, Smith TC. Weight change following US military service. *Int J Obes (Lond)*. April 10, 2012. doi: 10.1038/ijo.2012.46. Available at: http://www.nature.com/ijo/journal/vaop/ncurrent/full/ijo201246a.html. Accessed August 2012.
19. National Heart, Lung and Blood Institute. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*. Rockville, MD: National Institutes of Health; 1998. Available at: http://www.ncbi.nlm.nih.gov/books/NBK2003/. Accessed August 2012.

20. Stevens J, Cai J, Pamuk ER, Williamson DF, Thun MJ, Wood JL. The effect of age on the association between body-mass index and mortality. *N Engl J Med*. 1998;338(1):1-7.

21. Flegal K, Graubard B, Williamson D, Gail M. Excess deaths associated with underweight, overweight, and obesity. *JAMA*. 2005;293(15):1861-1867.

22. Bowman T, Kurth T, Sesso H, Manson J, Gaziano J. Eight-year change in body mass index and subsequent risk of cardiovascular disease among healthy non-smoking men. *Prev Med*. 2007;45(6):436-441.

23. Vieweg W, Julius D, Fernandez A, Tassone D, Narla S, Pandurangi K. Posttraumatic stress disorder in male military veterans with comorbid overweight and obesity: psychotropic, antihypertensive, and metabolic medications. *J Clin Psychiatry*. 2006;8(1):25-31.

24. Sharma AM, Padwal R. Obesity is a sign – overeating is a symptom: an aetiological framework for the assessment and management of obesity. *Obes Rev*. 2010;11(5):362-370.

25. Zinn AR. Unconventional wisdom about the obesity epidemic. *Am J Med Sci*. 2010;340(6):481-449.

26. Dalen J, Smith BW, Shelley BM, et al. Weight, eating behavior, and psychological outcomes associated with a mindfulness-based intervention for people with obesity. *Complement Ther Med*. 2010;18:260-264.

27. Bass J, Takahashi JS. Circadian integration of metabolism and energetics. *Science*. 2010;330:1349-1354.

28. Knutson KL. Sleep duration and cardiometabolic risk: a review of the epidemiologic evidence. *Best Pract Res Clin Endocrinol Metab*. 2010;4:731-743.

29. Born JM, Lemmens SFT, Martens MJI, et al. Differences between linking and wanting signals in the human brain and relations with cognitive dietary restraint and body mass index. *Am J Clin Nutr*. 2011;94:392-403.

30. Havermans RC, Giesen JC, Houben K, Jansen A. Weight, gender, and snack appeal. *Eat Behav*. 2011;12:126-130.

31. Loxton NJ, Dawe S, Cahill A. Does negative mood drive the urge to eat? the contribution of negative mood, exposure to food cues and eating style. *Appetite*. 2011;56:368-374.

32. Odgen J, Stavrinaki M, Stubbs J. Understanding the role of life events in weight loss and weight gain. *Psychol Health Med*. 2009;14(2):239-249.

33. Pandit R, de Wong JW, Vandershuren LJ, Adan RA. Neurobiology of overeating and obesity: the role of melancortins and beyond. *Eur J Pharma*. 2011;660:28-42.

34. Ziauddeen H, Subramaniam N, Gaillard R, Burke LK, Farooqi IS, Fletcher PC. Food images engage subliminal motivation to seek food. *Intl J Obes*. Dec 28 2011; doil:10.1038/ijo.2011.239 [Epub ahead of print].

35. Lemmens SG, Rutters F, Born JM, Westerterp-Plantenga MS. Stress augments food 'wanting' and energy intake in visceral overweight subjects in absence of hunger. *Physiol Behav*. 2011;103:157-163.

36. Fricker J, Giroux S, Fumeron F, Apfelbaum M. Circadian rhythm of energy intake and corpulence status in adults. *Int J Obes*. 1990;14:387–393.

37. Cho S, Dietrich M, Brown C, Clark C, Block G. The effect of breakfast type on total daily energy intake and body mass index: results from the third national health and nutrition examination survey (NHANES III). *J Am Coll Nutr*. 2003;22:296–302.

38. Howarth N, Huang T, Roberts S, Lin B, McCrory M. Eating patterns and dietary composition in relation to BMI in younger and older adults. *Int J Obes*. 2007;31(4):675-684.

39. Speechly DP, Rogers GG, Buffenstein R. Acute appetite reduction associated with an increased frequency of eating in obese males. *Int J Obes Relat Metab Disord*. 1999;23(11):1151-1159.

40. Smeets AJ, Westerterp-Plantenga MS. Acute effects on metabolism and appetite profile of one meal difference in the lower range of meal frequency. *Br J Nutr*. 2008;99(6):1316-1321.

41. Yannakoulia M, Melistas L, Solomou E, Yiannakouris N. Association of eating frequency with body fatness in pre- and postmenopausal women. *Obesity (Silver Spring)*. 2007;15(1):100-106.

42. Farshchi HR, Taylor MA, Macdonald IA. Beneficial metabolic effects of regular meal frequency on dietary thermogenesis, insulin sensitivity, and fasting lipid profiles in healthy obese women. *Am J Clin Nutr*. 2005;81(1):16-24.

43. Taylor MA, Garrow JS. Compared with nibbling, neither gorging nor a morning fast affect short-term energy balance in obese patients in a chamber calorimeter. *Int J Obes Relat Metab Disord*. 2001;25(4):519-528.

44. Farshchi HR, Taylor MA, Macdonald IA. Decreased thermic effect of food after an irregular compared with a regular meal pattern in healthy lean women. *Int J Obes Relat Metab Disord*. 2004;28(5):653-660.

45. Drummond SE, Crombie NE, Cursiter MC, Kirk TR. Evidence that eating frequency is inversely related to body weight status in male, but not female, non-obese adults reporting valid dietary intakes. *Int J Obes Relat Metab Disord*. 1998;22(2):105-112.

46. Louis-Sylvestre J, Lluch A, Neant F, Blundell JE. Highlighting the positive impact of increasing feeding frequency on metabolism and weight management. *Forum Nutr*. 2003;56:126-128.

47. Verboeket-van de Venne WP, Westerterp KR. Influence of the feeding frequency on nutrient utilization in man: consequences for energy metabolism. *Eur J Clin Nutr*. 1991;45(3):161-169.

48. Bellisle F, McDevitt R, Prentice AM. Meal frequency and energy balance. *Br J Nutr*. 1997;77(suppl 1):S57-S70.

49. Farshchi HR, Taylor MA, Macdonald IA. Regular meal frequency creates more appropriate insulin sensitivity and lipid profiles compared with irregular meal frequency in healthy lean women. *Eur J Clin Nutr*. 2004;58(7):1071-1077.

50. Swinburn BA, Caterson I, Seidell JC, James WP. Diet, nutrition and the prevention of excess weight gain and obesity. *Public Health Nutr*. 2004;7(1A):123-146.

51. Joint Culinary Center of Excellence. Go For Green Nutrition Education Program. Available at: http://www.quartermaster.army.mil/jccoe/Operations_Directorate/QUAD/nutrition/nutrition_main.html. Accessed August 2012.

52. Pacy PJ, Webster J, Garrow JS. Exercise and obesity. *Sports Med*. 1986;3(2):89-113.

53. Blundell JE, King NA. Effects of exercise on appetite control: loose coupling between energy expenditure and energy intake. *Int J Obes Relat Metab Disord*. 1998;22(suppl 2):S22-S29.

54. Hopkins M, Jeukendrup A, King NA, Blundell JE. The relationship between substrate metabolism, exercise, and appetite control: does gylcogen availability influence the motivation to eat, energy intake or food choice?. *Sports Med*. 2011;41(6):507-521.

55. American College of Sports Medicine. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc*. 2007;39(8):1423-1434.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| Vegetables | Fruits | Grains | Dairy | Protein Foods |
|---|---|---|---|---|
| Eat more red, orange, and dark-green veggies like tomatoes, sweet potatoes, and broccoli in main dishes.<br><br>Add beans or peas to salads (kidney or chickpeas), soups (split peas or lentils), and side dishes (pinto or baked beans), or serve as a main dish.<br><br>Fresh, frozen, and canned vegetables all count. Choose "reduced sodium" or "no-salt-added" canned veggies. | Use fruits as snacks, salads, and desserts. At breakfast, top your cereal with bananas or strawberries; add blueberries to pancakes.<br><br>Buy fruits that are dried, frozen, and canned (in water or 100% juice), as well as fresh fruits.<br><br>Select 100% fruit juice when choosing juices. | Substitute whole-grain choices for refined-grain breads, bagels, rolls, breakfast cereals, crackers, rice, and pasta.<br><br>Check the ingredients list on product labels for the words "whole" or "whole grain" before the grain ingredient name.<br><br>Choose products that name a whole grain first on the ingredients list. | Choose skim (fat-free) or 1% (low-fat) milk. They have the same amount of calcium and other essential nutrients as whole milk, but less fat and calories.<br><br>Top fruit salads and baked potatoes with low-fat yogurt.<br><br>If you are lactose intolerant, try lactose-free milk or fortified soymilk (soy beverage). | Eat a variety of foods from the protein food group each week, such as seafood, beans and peas, and nuts as well as lean meats, poultry, and eggs.<br><br>Twice a week, make seafood the protein on your plate.<br><br>Choose lean meats and ground beef that are at least 90% lean.<br><br>Trim or drain fat from meat and remove skin from poultry to cut fat and calories. |
| **For a 2,000-calorie daily food plan, you need the amounts below from each food group.**<br>To find amounts personalized for you, go to Choose**MyPlate**.gov. | | | | |
| **Eat 2½ cups every day**<br><br>**What counts as a cup?**<br>1 cup of raw or cooked vegetables or vegetable juice; 2 cups of leafy salad greens | **Eat 2 cups every day**<br><br>**What counts as a cup?**<br>1 cup of raw or cooked fruit or 100% fruit juice; ½ cup dried fruit | **Eat 6 ounces every day**<br><br>**What counts as an ounce?**<br>1 slice of bread; ½ cup of cooked rice, cereal, or pasta; 1 ounce of ready-to-eat cereal | **Get 3 cups every day**<br><br>**What counts as a cup?**<br>1 cup of milk, yogurt, or fortified soymilk; 1½ ounces natural or 2 ounces processed cheese | **Eat 5½ ounces every day**<br><br>**What counts as an ounce?**<br>1 ounce of lean meat, poultry, or fish; 1 egg; 1 Tbsp peanut butter; ½ ounce nuts or seeds; ¼ cup beans or peas |

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**Cut back on sodium and empty calories from solid fats and added sugars**

Look out for salt (sodium) in foods you buy. Compare sodium in foods and choose those with a lower number.

Drink water instead of sugary drinks. Eat sugary desserts less often.

Make foods that are high in solid fats—such as cakes, cookies, ice cream, pizza, cheese, sausages, and hot dogs—occasional choices, not every day foods.

Limit empty calories to less than 260 per day, based on a 2,000 calorie diet.

**Be physically active your way**

Pick activities you like and do each for at least 10 minutes at a time. Every bit adds up, and health benefits increase as you spend more time being active.

**Children and adolescents:** get 60 minutes or more a day.

**Adults:** get 2 hours and 30 minutes or more a week of activity that requires moderate effort, such as brisk walking.

# Negative Health Behavior: A Personal Responsibility or Not?

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According to the World Health Organization, chronic diseases with preventable risk factors have surpassed infectious diseases as the major cause of morbidity and mortality worldwide.[1] Five of these diseases—cardiovascular diseases, diabetes, obesity, cancer, and respiratory diseases—kill more than 33 million people a year and account for over 46% of the global burden of disease. Out of this 33 million, 12 million people die as a result of heart attack and/or stroke each year. Furthermore, over one billion adults in both developing and developed countries worldwide are overweight, with 300 million clinically obese.[1] The deaths of an additional 5.4 million people annually are attributable to tobacco-related illnesses.[2]

Within the United States, 7 of 10 Americans die each year as a result of chronic diseases.[3] Commensurate with international statistics of both developed and developing countries, heart disease, cancer, and stroke make up more than 50% of all deaths annually.[4] These 3 diseases in conjunction with diabetes and arthritis are the most prevalent, costly, and preventable in the United States. Further exacerbating the current rate of US mortality is a growing obese population where one in every 3 adults living here is clinically obese.[5] Additionally, the most recent empirical study by the Centers for Disease Control and Prevention using 2000-2004 US data estimated 443,000 individuals die each year,[6] including 3,000 adult nonsmoker deaths as a result of exposure to secondhand smoke.[7] Beyond the human toll, the report found the economic impact of smoking-attributable health care costs to be approximately $96 billion, which did not include the estimated productivity losses of $97 billion—collectively $193 billion annually.[6]

There are multiple factors leading to this increase in chronic diseases. One of the primary causes is the epidemiologic transition of developing countries driven by 3 major determinants: ecobiologic; socioeconomic, political, and cultural; and medical and public health interventions.[8] One example of these components is the migration of rural agrarian populations to more urban-based communities as a result of industrialization and economic development. This dramatic increase in chronic diseases is creating a double burden of disease as these countries and individuals continue to struggle with the impact of infectious diseases.[9] As individuals move between these environments, behaviors are modified which could have a deleterious effect on those unaccustomed or without social and community networks to address new risk factors. Negative changes in dietary habits, reduced physical activity, and an increase in tobacco product use and alcohol consumption are the primary driving factors of this rapid increase of chronic diseases worldwide, including the United States.

In an effort to mitigate the rapid growth of these diseases and their associated costs, nations are looking at ways to address the root causes of these risk factors and associated behaviors. Simultaneously, they are determining how existing health care systems could be modified to meet the growing demand due to these chronic diseases. As a result, the debate surrounding personal and social responsibility in relation to health behavior and negative outcomes has intensified. Different philosophies have emerged, as well as methods to establish a role for responsibility in healthcare and develop appropriate intervention strategies to minimize unhealthy behaviors. Both are discussed as they identify the roles that individuals and societies play in addressing this growing health burden of global proportions.

## PHILOSOPHY OF INDIVIDUAL RESPONSIBILITY

A US survey conducted in July 2006 found that 53% of Americans thought it would be fair to ask people with unhealthy lifestyles to pay higher insurance premiums than those with healthy lifestyles.[10] In the United Kingdom, a June 2010 poll found 35% of the population surveyed believed higher taxes on alcohol, cigarettes, and unhealthy food would be the best way to reduce their National Health Service spending.[11] Both of these national surveys indicate that their respective populations see a role for individual responsibility in negative health behavior as it relates to health insurance. However, much controversy revolves around individual rights to make independent choices and whether states or healthcare systems have the right to intervene by demanding personal responsibility for health.[12]

Some Americans use car insurance as a proxy when discussing health insurance and the role of individual responsibility. For example, individuals must pass a driver's license test to gain the right to drive, which requires some type of minimum insurance coverage. If over time individual failures such as speeding tickets or traffic accidents accumulate, penalties in the form of higher deductibles or the potential of being dropped by an insurance company occur. Similarly, the idea that individuals must show a minimum level of preventive services conducted before using a warranty for larger vehicle repairs could be applied to health insurance.[13] Most notably, Dr C. Everett Koop, a former US Surgeon General, stated "the plain fact is that we Americans do a better job of preventive maintenance on our cars than on ourselves" while noting car insurance does not cover preventive maintenance for vehicles.[14] Both of these examples highlight the perceived need for individuals to be accountable in reducing and eliminating their negative health risks while investing in preventive services such as health promotion activities and vaccination programs. Others argue against the auto insurance comparison, stating that individuals can simply avoid speeding by deciding to do so which does not adversely impact their individual costs.[15] Simply deciding to lose weight, stop smoking, or reduce cholesterol is not enough, as there are numerous individual and societal barriers. Those include a lack of fitness center availability, poor smoking cessation program access, and a paucity of healthy food options coupled with unfortunate human genetics.[15]

As health reform is implemented in the United States, some maintain that since it is for the population, they must "become full participants and assume much greater responsibility for their actions if health benefits are to be maintained at an affordable cost."[13] Directly associated with cost is the issue of poor compliance by the individual patient which is commonly cited by physicians as an impediment to positive health outcomes.[13] Encouraging individuals to assume responsibility for completing preventive screening tests, obtaining proper vaccinations, and taking prescribed medications by either incurring penalties or obtaining a cost savings are options available. It is perceived that responsible patients and communities support physicians by acting responsibly, which could have a direct impact on overall cost-effectiveness of the health care system.[13]

However, others acknowledge reasons may exist outside of individual control which directly and indirectly impact patient compliance with medical recommendations and their ability to keep individual appointments. Some of these factors include poor physician-patient communication, adverse side effects of medication, limited access to modes of transportation and child care, rigid work schedules, language barriers, and other cultural barriers.[16-18] Additionally, it is argued that in order to encourage personal responsibility, more fundamental social and structural issues must be addressed.[19]

## PHILOSOPHY OF SOCIETAL RESPONSIBILITY

The terms "lifestyle" and "health behavior" automatically imply individual culpability rather than considering the role social and physical environments may have in reinforcing individual negative behavior.[20] Dr Koop acknowledged that American health problems are due more to society, "especially the shameful prevalence of poverty in this rich country," than from problems with the healthcare system.[14] Some posit that poverty is the single biggest factor underlying adverse health outcomes which worsen when poverty intensifies.[21] Within the United States, Medicaid is the program which supports the medical needs of the impoverished and has been the recent target of state efforts to address individual responsibility by imposing paternalistic health requirements, such as those in West Virginia. Enforcing individual responsibility will not necessarily improve the impoverished individual's health coverage, access, or independence,[19] but will more likely further exacerbate unhealthy behaviors and an already poor health status. This is highlighted today by the situation in which individuals living in poverty experience a higher rate of HIV/AIDS and are the least likely to have access to both the healthcare and treatment so desperately needed, even 25 years after the disease was first recognized.[22]

To address this issue from a social inequalities perspective, studies indicate a higher prevalence of unhealthy behaviors among lower socioeconomic status individuals, which correlates directly to an overall worse health status among this group.[23-25] Stringhini et al[26] examined the British Whitehall II cohort established in 1985 which included 10,308 civil servants stratified by socioeconomic status, and assessed 4 risk factors (smoking, alcohol consumption, diet, and physical activity) over 4 periods of time from 1985 to 2004 and found those within the lowest socioeconomic status had a 1.6 times higher risk of death due to preventable diseases than those in the highest socioeconomic status.[26] However, do these individual decisions to participate in unhealthy behaviors alone result in the negative health outcomes in a form of causal responsibility?

Buyx argues that there are problems with the theory of causal responsibility.[12] In order to hold an individual accountable for their behaviors, a direct link must be

identified and other external factors completely eliminated. She states the reality of most conditions which are cited as preventable (eg, diabetes, high blood pressure, some cancers) are multifactoral and influenced by individual behavior and environmental, societal, and even genetic components. Therefore, holding individuals responsible for a condition without one single causal factor is a "great challenge."[12] Her thoughts are similar to those of Daniels who rejects the concept of enforcing individual accountability through costs associated with risky lifestyle choices.[27] Daniels claims measuring causal contribution is practically unfeasible.

Further confounding the issue is the theory of freedom of health behavior. In order to show direct attribution for accountability purposes, individuals would have to exhibit complete control over the negative behavior and choose it freely. Buyx highlights the problem with the theory by stating many unhealthy behaviors are actually socially accepted norms.[12] In Stinghini's study of the British Whitehall II cohort, her group found a higher prevalence rate of smoking, unhealthy diet, and low levels of physical activity among participants in the lower socioeconomic status which directly correlated to higher rates of mortality.[26] This would imply social acceptance of the unhealthy behaviors among the lower SES, thereby removing complete freedom of individual control. As a result, one would have to eliminate these externalities to define what level of responsibility the individual should bear. Buyx does not use this argument to remove personal responsibility from the debate, rather to inform the substance of the deliberation. She acknowledges the need to appropriately manage scarce health resources and the role that personal responsibility has in leading to better health.[12]

## PHILOSOPHY OF CORESPONSIBILITY

Anyone participating in the debate over individual versus societal responsibility for unhealthy behaviors can see merit to both arguments. Harlad Schmidt brings these 2 perspectives together in his concept of health responsibility as coresponsibility.[28] First mentioned in Article 1 from Book V of the German Social Security Code, "coresponsibility" was bestowed upon citizens to lead healthy lifestyles and take an active role in prevention, treatment, and rehabilitation to avoid sickness and disability.[29] Schmidt's concept acknowledges health is affected by both individual behavior and factors beyond their immediate control, therefore, it is neither exclusively an individual nor social responsibility. He cites this as necessary to assess the causal factors, both prospective and retrospective, that result in the particular health state as well as determining attribution of praise or blame with associated positive or negative outcomes.[28] The concept of health responsibility as coresponsibility is found in the ecological model of social behavior which targets health behaviors through multifaceted approaches in order to generate positive health outcomes. Although explicitly defined by Schmidt after the ecological model was developed, coresponsibility is evident in the construct.

## ECOLOGICAL MODEL

An early framework which incorporated individual and environmental determinants in assessing behavior was proposed by Brofenbrenner.[30] The significance of this framework and other ecological models is their premise that individual behavior is affected by the social environment, and, in a symbiotic relationship, the individual can in turn affect the social environment. Leveraging the original work done by Brofenbrenner and other ecological model pioneers, McLeroy et al[20] developed an ecological model for health promotion with patterned behavior as the outcome of concern as determined by the following 5 factors[20]:

1. Intrapersonal factors
2. Interpersonal process and primary groups
3. Institution factors
4. Community factors
5. Public policy

The unhealthy behavior of smoking which results in a significant number of chronic diseases and high rate of mortality mentioned earlier in this article will be used to illuminate each of these factors and set precedence in determining where intervention could occur and where responsibility should reside.

Intrapersonal factors are the characteristics of the individual which are the target of intervention. It is assumed that the individual has control over his or her behavior and therefore should have both the responsibility and ability to make the necessary behavioral change. Smoking interventions such as educational programs through peer counseling or media campaigns can assist individuals in changing their knowledge, attitudes, and beliefs to bring about a positive health behavior change.

The second factor of interpersonal process and primary groups focuses around external influences of health related behaviors. Both positive and negative social norms are exuded by human networks which impact individuals within and outside of the groups.[20] These networks also provide resources such as information and emotional support which could be leveraged to assist in modifying unhealthy individual behavior.[31] Therefore,

interventions focused on these factors seek to modify group influences which could encourage and facilitate positive health behaviors of individuals. One example would be changing the acceptable norm of smoking within a network based on consistent messaging and modeling by the group against the toxic habit.

Third, institution factors, also referred to as organizational factors, are another level of environmental determinants that impact individual health behavior. Since individuals spend one-third to one-half of their lives in organizational settings ranging from school to the workplace, the role organizations can and do play in health related behaviors cannot be underestimated.[20] In an effort to assuage the adverse impact smoking has on productivity and increased costs associated with medical support, organizations began to modify their cultural norms to discourage tobacco use. Examples include the enforcement of smoking bans and/or restrictions at the worksite and encouraging (with encentives) employee enrollment in smoking cessation programs. Although the impact of eliminating individual unhealthy behavior through these interventions is an outcome of this effort, a change in organizational culture which institutionalizes positive health behaviors is the objective.

According to McLeroy et al, the fourth factor of community has 3 meanings[20]:

1. Community refers to mediating structures such as families, friendship networks, and neighborhoods.
2. Community includes relationships among organizations in a defined area.
3. Community is defined in geographical and political terms

Each of these definitions defines communities as relationships and the role they perform in supporting individuals. In the case of smoking cessation programs, a disadvantaged community may not have the resources necessary to effectively implement the required intervention program. Therefore, strategies within this factor will focus on linking communities without resources to other community agencies such as regional health departments to close the requirement gap.

The final factor in this ecological model for health promotion is public policy. Through the use of public policy interventions, national laws mandating the protection of society are enforced and other strategies to address health risks associated with diseases are developed. Laws derived as a result of public policy banning smoking in public facilities and increasing taxes on tobacco products highlight the role individual responsibility has in protecting the welfare of society. As a result, this ecological model reinforces the concept of coresponsibility in health by focusing interventions on 5 separate and overlapping factors from the individual to society and external environment.

This discussion concludes with the situation in the United States, where 443,000 individuals die each year as a result of smoking and $193 billion is spent for smoking-related healthcare costs.[6] What percentage of this economic burden should individuals carry as a result of unhealthy behavioral choices? As much of this disease burden is carried by the disenfranchised, what can they actually afford? Since individuals and their environments influence and impact health behavior, governments should develop intervention solutions impacting both. The ecological model for health promotion, in concert with the theory of coresponsibility, provides an actionable framework to address unhealthy risk behaviors in a multifaceted approach. The United States and its citizens cannot afford anything less.

## REFERENCES


1. Ten facts about chronic diseases page. World Health Organization Web site. Available at: http://www.who.int/dietphysicalactivity/publications/facts/chronic/en/. Accessed August 7, 2012.
2. Global tobacco control. Smoking and tobacco use page, Centers for Disease Control and Prevention Web site. 2012. Available at: http://www.cdc.gov/tobacco/global/index.htm. Accessed August 7, 2012.
3. Chronic diseases and health promotion. Chronic disease prevention and health promotion page, Centers for Disease Control and Prevention Web site. Available at: http://www.cdc.gov/chronicdisease/overview/index.htm. Accessed August 7, 2012.
4. Kung HC, Hoyert DL, Xu J, Murphy SL. Deaths: final data for 2005. *Natl Vital Stat Rep*. 2008;56(10):1-120.
5. Ogden CL, Carroll MD, McDowell MA, Flegal KM. Obesity among adults in the United States–no statistically significant change since 2003-2004. *NCHS Data Brief*. 2007;Nov(1):1-8.
6. Smoking-attributable mortality, years of potential life lost, and productivity losses–United States, 2000-2004. *MMWR Morb Mortal Wkly Rep*. 2008;57(45):1226-1228.
7. 2006 Surgeon General's report–the health consequences of involuntary exposure to tobacco smoke. Smoking and tobacco use page, Centers for Disease Control and Prevention Web site. 2006. Available at: http://www.cdc.gov/tobacco/data_statistics/sgr/2006/index.htm. Accessed August 7, 2012.

8. Omran AR. The epidemiologic transition. a theory of the epidemiology of population change. *Milbank Mem Fund Q*. 1971;49(4):509-538.

9. Merson MH, Black RE, Mills A. *International Public Health: Diseases, Programs, Systems, and Policies*. 2nd ed. Sudbury, MA: Jones and Bartlett; 2006.

10. Bright B. Many Americans back higher costs for people with unhealthy lifestyles. *Wall Street Journal* [serial online]. July 19, 2006. Available at: http://online.wsj.com/article/SB115324313567509976.html. Accessed August 7, 2012.

11. Kirby J. 35% back higher taxes on unhealthy lifestyles. *The Independent* [serial online]. June 13, 2010. Available at: http://www.independent.co.uk/life-style/health-and-families/health-news/35-back-higher-taxes-on-unhealthy-lifestyles-1999357.html. Accessed August 7, 2012.

12. Buyx AM. Personal responsibility for health as a rationing criterion: why we don't like it and why maybe we should. *J Med Ethics*. 2008;34(12):871-874.

13. Brook RH. Rights and responsibilities in health care: striking a balance. *JAMA*. 2010;303(22):2289-2290.

14. Koop CE. A personal role in health care reform. *Am J Public Health*. 199;85(6):759-760.

15. Schmidt H, Voigt K, Wikler D. Carrots, sticks, and health care reform–problems with wellness incentives. *N Engl J Med*. 2010;362(2):e3.

16. Steinbrook R. Imposing personal responsibility for health. *N Engl J Med*. 2006;355(8):753-756.

17. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005;353(5):487-497.

18. Johnson MO. Meeting health care needs of a vulnerable population: perceived barriers. *J Community Health Nurs*. 2001;18(1):35-52.

19. Hermer LD. Personal responsibility: a plausible social goal, but not for MEDICAID reform. *Hastings Cent Rep*. 2008;38(3):16-19.

20. McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q*. 1988;15(4):351-377.

21. Foege WH. Social determinants of health and healthcare solutions. *Public Health Rep*. 2010;125(suppl 4):8-10.

22. Fee E, Parry M. Jonathan Mann, HIV/AIDS, and human rights. *J Public Health Policy*. 2008;29(1):54-71.

23. Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? variation in adult health behaviors and psychosocial characteristics by stages of the socioeconomic lifecourse. *Soc Sci Med*. 1997;44(6):809-819.

24. Martikainen P, Brunner E, Marmot M. Socioeconomic differences in dietary patterns among middle-aged men and women. *Soc Sci Med*. 2003;56(7):1397-1410.

25. Black D, Davidson N, Townsend P. *Inequalities in Health: The Black Report*. Harmondsworth, Middlesex, England: Penguin Books; 1982.

26. Stringhini S, Sabia S, Shipley M, et al. Association of socioeconomic position with health behaviors and mortality. *JAMA*. 2010;303(12):1159-1166.

27. Daniels N. *Just Health: Meeting Health Needs Fairly*. Cambridge, United Kingdom: Cambridge University Press: 2008.

28. Schmidt H. Just health responsibility. *J Med Ethics*. 2009;35(1):21-26.

29. Schmidt H. Personal responsibility for health–developments under the German healthcare reform 2007. *Eur J Health Law*. 2007;14(3):241-250.

30. Bronfenbrenner U. The ecology of human development: experiments by nature and design. Cambridge, MA: Harvard University Press; 1979.

31. Cohen S, Syme SL. *Social Support and Health*. Orlando, FL: Academic Press; 1985.

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# Synthetic Cannabinoid and Cathinone Use Among US Soldiers

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ABSTRACT

New hallucinogenic drugs of abuse, known generically as "spice" and "bath salts," have become readily available in the United States. Spice is one of many names that refers to a variety of synthetic cannabinoids that act on the body in a way similar to delta-9-tetrahydrocannabinol (THC). A large and complex variety of synthetic cannabinoids, most often cannabicyclohexanol, JWH-018, JWH-073, or HU-210, are used in an attempt to avoid the laws that make cannabis illegal, making synthetic cannabis a designer drug. Bath salts, on the other hand, is one of many names for a group of cathinone-containing hallucinogens that produces sympathomimetic effects in its users. Both have become popular among those seeking chemical euphorias with decreased chance of detection. Consequently, both have become a problem for maintaining mentally fit Soldiers, unit readiness, and morale in the US armed forces.

New hallucinogenic drugs of abuse, known generically as "spice" and "bath salts," have become readily available in the United States. Spice refers to a variety of synthetic cannabinoids that act on the body in a way similar to delta-9-tetrahydrocannabinol (THC). Bath salts refer to a group of hallucinogens that contains various cathinone-like chemicals.

Synthetic cannabinoids have been an area of research since the 1960s for both academia and industry.[1] This is understandable because compounds that mimic the anti-inflammatory and analgesic properties of THC without the psychotropic effects could have significant academic and industrial application.[2] Not surprisingly, these synthetic cannabinoids found their way into the world of recreational drug use. Synthetic cannabinoids were initially available in Europe in 2004 under the brand name Spice.[3] Since then, the substance has continued to increase in popularity. Over time, "spice" came to refer generically to all herbal mixtures with synthetic cannabinoids. There are a number of products marketed with different brand names that are still referred to as spice products.

When spice blends first went on sale in the early 2000s, it was thought that they achieved an effect through a mixture of legal herbs. Subsequent laboratory analysis from Germany and Austria in 2008 showed this was not the case; in fact they contained added synthetic cannabinoids that act on the body in a way similar to cannabinoids found naturally in cannabis, such as THC. A large and complex variety of synthetic cannabinoids, most often cannabicyclohexanol, JWH-018, JWH-073, or HU-210, are used in an attempt to avoid the laws that make cannabis illegal, making synthetic cannabinoids designer drugs.[4]

Spice is used as an alternative to marijuana because of the similarity of their "high" effects. Depending on the synthetic compound in specific commercial brands, spice can be anywhere from 4 times to over 100 times more potent than THC. Furthermore, since their introduction, they have been undetectable by routine urine drug screens. This is a significant draw for abusers. Only recently have specific tests for these drugs become available. Significant adverse effects of spice have been documented, including seizure activity, agitation, hallucinations, myocarditis, and chest pain, as well as compulsive dosing to sustain effect. Redosing is common for both spice and bath salts.

Bath salts are distinguished by their packaging and locations for retail sale from the preparations that are traditionally used as bath or soaking preparations. The most common substances identified in these products are 3,4-methylenedioxypyrovalerone (MDPV), mephedrone, and derivatives of cathinone, all of which produce sympathomimetic effects. Bath salts pose significant health risks and can cause severe symptoms, including death. Since the main ingredients can be compounds similar to 3,4-methylenedioxy-N-methylamphetamine ("ecstasy"), other methamphetamines, Khat, or cocaine, there can be a wide variety of symptoms based on which compound predominates. These symptoms include severe paranoia,

violent behavior, hallucinations, decreased need for sleep, lack of appetite, chest pain, and self-mutilation.

Both spice and bath salts are sold over the internet and in various retail locations under multiple brand names. Labels on packets of bath salts and spice state "not for human consumption" and inform consumers that the powder should not be smoked or used as snuff. Nonetheless, the drugs can be inhaled, ingested, smoked, or (in the case of bath salts) injected. Users may develop cardiac and circulatory disturbances, agitation, delirium, paranoia, and psychosis. There have been several cases in which users have attempted to inflict injury on themselves or others. The agitation and delirium may persist for days to weeks.

Similar to spice products, bath salts are sold online and in drug paraphernalia stores under a variety of names. Because these products are relatively new to the drug abuse scene, knowledge about their precise chemical composition and short-term and long-term effects is limited. In addition, because the main ingredients can mimic several different known hallucinogens and stimulants, it is difficult to predict the effect on the user from "brand to brand" or even from packet to packet.

Reports from users indicate the euphoric high of bath salts and spice typically lasts 2 to 4 hours with the letdown effects lasting several hours thereafter. Reported doses for bath salts range from 5 mg to 10 mg for the more lipophilic MDPV, and 100 mg to 250 mg for mephedrone.[5]

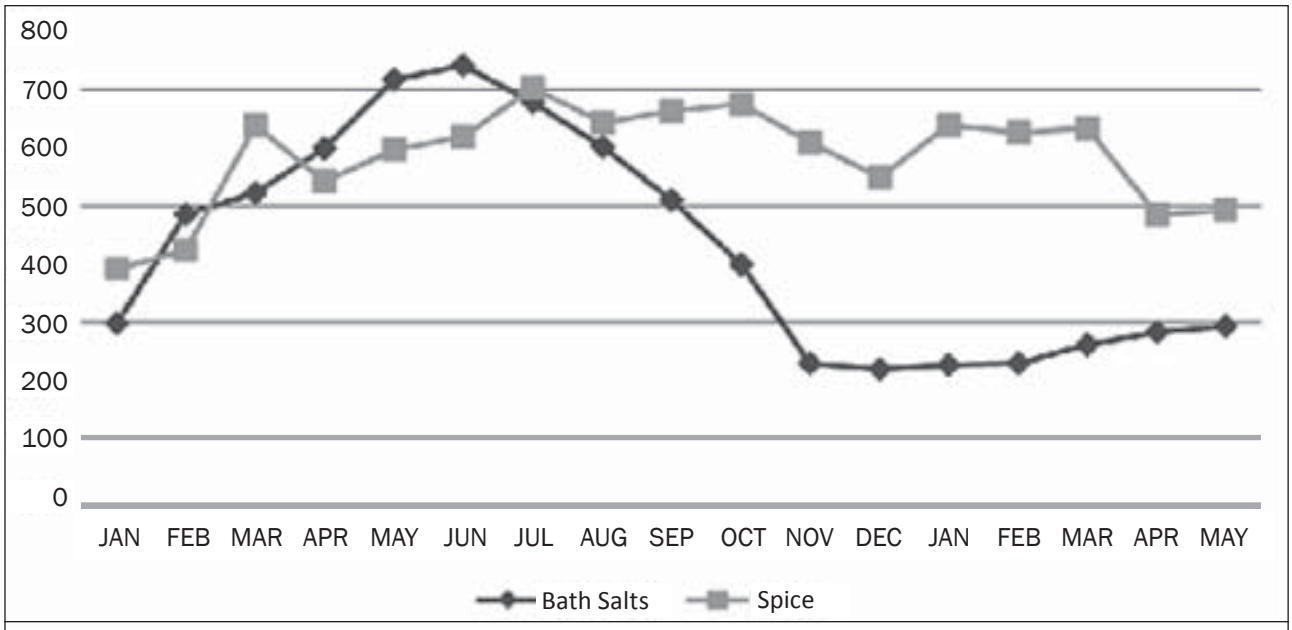
Since research on spice and bath salts is still developing, there are few published studies on how these synthetic drugs affect the user. However, case studies have been published that show the harmful side-effects of using spice and bath salts. These demonstrate that spice and bath salts differ in their clinical presentations. In these case studies the majority of the patients are young (18 to 25 years of age), healthy males. Analyzing case studies is the only current way to differentiate the clinical presentations of these designer drugs. For example, in 4 spice case reports, all patients were male, aged 19 to 25 years.[6,7] They all presented to the Emergency Department (ED) with symptoms of either unresponsiveness, paranoia, or seizure activity. All laboratory tests and drug screens proved unremarkable for the 4 patients, however 1 patient was tachycardic (122 bpm) and 3 patients were hypertensive. Also, one patient was combative and had to be restrained. Only upon interviewing the patients were the providers able to determine that the use of spice was the cause for the patients presenting symptoms.[7,8] In an examination of 2 bath salt cases, both patients were female, aged 22 and 27 years respectively. One presented to the ED with symptoms of hallucinations/delusions, while the other presented with suicidal ideation. Upon examination, both were observed as being anxious and frightened, but apart from that all other vital signs, laboratory tests, and drug screens were unremarkable. The hallucinations/delusions experienced by one patient were so severe that she called the police and told them that someone was trying to break into her home. When the police arrived, the patient had barricaded herself in her bedroom because she thought she was about to be killed. She also told police that there was a dead body in her hallway, which was also part of her hallucination.[8] Of these 6 cases examined, 2 were Soldiers stationed at Fort Bragg, North Carolina.[7]

Spice and bath salts use among active duty military is mostly anecdotal. However, there have been several high profile media reports. At the Naval Air Station, Pensacola, Florida, 28 Sailors were involved in incidents with spice over a 2-year period.[9] At Hill Air Force Base near Salt Lake City, Utah, the US Air Force discharged 7 Airmen in early 2010 for spice use, and another 11 Airmen were pending disciplinary action.[10] In October 2011, it was reported that 64 Sailors were found to have either been using or distributing spice, and they were being processed for separation from the military.[11]

Poison control centers in the United States fielded 304 calls for bath salt exposures and 2,906 calls for spice exposures in 2010.[12] In 2011, these increased to 6,138 closed human exposure calls for bath salts and 6,959 exposure calls for spice. While bath salt calls to poison control centers appear to be declining, the number of spice related calls continues to increase.[12] The distribution of these calls from January 2011 through May 2012 is presented in the Figure.

Although synthetic cannabinoids do not produce positive results in routine urine drug tests for cannabis, it is possible to detect the metabolites in human urine. The Department of Defense Forensic Toxicology Drug Testing Laboratories (FTDTL) currently tests urine samples for spice and bath salts upon request. A downside to FTDTL testing is the approximately 3 weeks required to receive results, and the tests are only for known synthetic stimulant metabolites. The FTDTL does not currently test for spice and bath salt substances in routine urine drug screening due to technological and resource constraints.

The synthetic cannabinoids contained in the various spice products have been made illegal in many European countries.[13] Responding to similar potential health concerns, on March 1, 2011, the US Drug Enforcement




Calls to poison control centers in the United States for exposure to bath salts or spice, January 2011 through May 2012. Source: American Association of Poison Control Centers (bath salts data, synthetic marijuana data); http://www.aapcc.org/dnn/NewsandEvents/NewsMediaResources.aspx, accessed June 11, 2012.

Agency published a final order placing 5 synthetic cannabinoids into Schedule I of the Controlled Substances Act (CSA) (21 USC §801). This action was based on a finding by the Administrator that the placement of these synthetic cannabinoids into Schedule I of the CSA was necessary to avoid an imminent hazard to the public safety. As a result of this order, the full effect of the CSA and its implementing regulations including criminal, civil, and administrative penalties, sanctions, and regulatory controls of Schedule I substances were imposed on the manufacture, distribution, possession, importation, and exportation of these synthetic cannabinoids. Prior to this announcement, several US states had already made them illegal under state law.[9]

The Food and Drug Administration Safety and Innovation Act (S.3187, Title XI, Sec. 1152), enacted on July 9, 2012, permanently bans the chemical compounds marketed and sold as bath salts in the United States.

The branches of the US Armed Forces set their own laws against these substances. Per *Army Regulation 600-85*,[14] both spice and bath salts fall in the category of substances that could cause impairment or intoxication, and the regulation states that Army personnel are not to use such substances. Soldiers may face disciplinary action under the Uniform Code of Military Justice (UCMJ)* and/or administrative action for using these illicit substances. *Army Regulation 600-85* prohibits Soldiers from using substances:

> for the purpose of inducing excitement, intoxication, or stupefaction of the central nervous system.[14(p24)]

These regulations are in place to protect Soldiers and to discourage them from jeopardizing their fitness and mental readiness. In addition to spice and bath salts, the following substances are also specifically prohibited by the UCMJ: hemp or products containing hemp oil; controlled substance analogues (designer drugs); chemical propellants or inhalants (huffing); dietary supplements that are banned by the US Food and Drug Administration; prescription or over-the-counter drugs and medications (if illicit or excessive use beyond what is normal, sufficient, or prescribed); and naturally occurring substances (to include but not limited to Salvia divinorium and jimson weed).[14(pp24-25)]

Outside of the use prohibition in *Army Regulation 600-85*, the Army implements and enforces bans against the possession, distribution, and introduction of these products on an installation-by-installation basis. Until spice and bath salts were banned,[15,16] the promulgation of an installation General Order banning the possession, use, sale, distribution, or introduction of these products was the most common solution to the spice dilemma. Fort Bragg, North Carolina, has adopted this policy

*The Uniform Code of Military Justice (UCMJ), a federal law (64 Stat 109, 10 USC, chap 47) is the judicial code which pertains to members of the United States military. Under the UCMJ, military personnel can be charged, tried, and convicted of a range of crimes, including both common-law crimes (eg, arson) and military-specific crimes (eg, desertion)

concerning Soldiers using spice and bath salts. Under the Fort Bragg policy, Soldiers can be punished for possession or transfer of the drugs; they do not have to be using the drug to face regulatory action. Violators of the policy face punishment under the UCMJ.

Table 1. Patient demographics.

| Gender | No. (N=155) | Percentage |
|---|---|---|
| Male | 144 | 92.3 |
| Female | 12 | 7.7 |
| **Age** | | |
| 19-24 | 84 | 54.2 |
| 25-29 | 54 | 34.8 |
| 30-39 | 12 | 7.7 |
| >40 | 5 | 3.2 |
| Mean Age=25.59 | | |

## METHODS

The target population included all active duty Soldiers presenting to the emergency department at Womack Army Medical Center, Fort Bragg, North Carolina, that reported that they had taken spice, bath salts, or were suspected of having ingested these drugs between October 2010 and September 2011. Statistical analyses were conducted using IBM SPSS Statistics version 18 (IBM Corporation, Armonk, NY). All values were statistically analyzed using frequency distributions with calculations of means and standard deviations. Continuous variables were assessed for normality of distribution and compared using 2-tailed *t* tests. Categorical variables were compared using the $\chi^2$ test. Statistical significance was established at a *P* value less than or equal to 0.05. This project was reviewed by the Womack Army Medical Center Institutional Review Board.

## RESULTS

At the time of admission, 155 patients stated that they were using an illegal substance or were suspected by a provider of using an illegal substance including spice or bath salts (Table 1). The majority of patients were male (144, 92.3%) and under 30 years of age (mean age=25.6; range=20-52). Of the patients that were suspected of using spice or bath salts, 12 (7.7%) tested positive for spice and 13 (8.3%) tested positive for bath salts (Table 2).

Rates of spice use were greatest among individuals aged 19 to 24 (75.0%). Comparatively, rates for bath salts use were also greatest among individuals aged 19 to 24 (69.2%). All patients that tested positive for bath salts or spice were male.

Of the 26 admitted patients, 19.2% had used bath salts and 11.5% had used spice. The majority of bath salt (46.2%) and spice patients (58.3%) were sent home and one bath salt patient was transferred to a different hospital.

## COMMENT

Use of synthetic cannabinoids and synthetic stimulants/hallucinogens within the Army is a problem that not only affects the individual Soldier, but also the Soldier's unit and the Army as a whole. While seeking help for substance abuse may have been taboo among military personnel in the past, great strides have been made to create a better atmosphere for seeking assistance.[17]

Soldiers who use spice and bath salts will sometimes present to the ED due to the dangerous side effects of these substances. There are many medical challenges that should be addressed concerning these patients. Users tend to be panicked, diaphoretic, tachycardic, and/or hyperthermic. The substances may also trigger depression, restlessness, suicidal ideation or action, paranoia, or hallucinations. In severe cases, security personnel may be required to control the patient prior to sedation. It is important to also note that these patients may require high doses of sedatives to achieve control. Healthcare professionals with a long history in medicine and prehospital care may see these users as the modern day equivalent of the LSD abusers during the 1960s.

Military installations face many challenges when treating patients who have used spice and bath salts. First, only 5 military hospitals have inpatient drug rehabilitation facilities:

- Walter Reed National Military Medical Center, Bethesda, Maryland
- Eisenhower Army Medical Center, Fort Gordon, Georgia
- Fort Belvoir Community Hospital, Virginia
- Naval Medical Center, San Diego, California
- Malcolm Grow Medical Center, Joint Base Andrews Naval Air Facility, Maryland

Furthermore, military treatment facilities do not routinely perform illegal drug testing unless requested by the Soldier's chain of command. In our study, patients in the Emergency Department who are suspected of synthetic drug use are tracked by the Womack Army Medical Center Department of Social Work and referred to the Department of Behavioral Health.

Unfortunately, there are no published guidelines for admission versus discharge. The provider should look for and consider potential complications from the sympathomimetic effects such as heat stroke, arrhythmias, and seizures. Also, providers should keep in mind that even patients without any critical physiologic abnormality can still be combative and agitated with active hallucinations, and may require sedation and observation. Physicians should also be aware of chronic issues like

insomnia, short-term memory loss, and persistent cognitive changes that can affect these patients.

Upon discharge, patients are instructed to return to the ED if symptoms return or worsen. Also, patients are referred to the Army's Alcohol and Substance Abuse Program (ASAP), and are not allowed to drive, handle weapons, or perform tasks that require critical thinking until they are cleared on a follow-up visit.

It is obvious that opportunities to obtain these drugs of abuse are widespread, and unfortunately many Soldiers are apparently availing themselves of these opportunities. From past experiences with other substance abuse, it is likely that the number of Soldiers presenting to the emergency department represents a minority of the Soldiers using these substances. With the apparent increasing opportunity for use and the rising number of cases, the military must be proactive in curbing this trend to maintain combat readiness.

Training, pamphlets, guidebooks, and posters are offered through the ASAP to assist commanders, Families, and Soldiers in identifying substance abuse problems and risk factors within themselves and others. Classes that address stress factors common to Soldiers are provided throughout normal duty, as well as during and immediately after deployments.

Resources are abundant and can be found online, through family readiness groups, and within the chain of command. Military OneSource (http://www.militaryonesource.mil) and ASAP are starting points for confidential information and help. Military OneSource offers 12 free counseling sessions per person, per issue. These are confidential and not reported to the Soldier's chain of command unless he or she presents a danger to himself/herself, or others.

Table 2. Distribution of patient test results.

| Detected Drug | No. (N=155) | Percentage |
|---|---|---|
| Alcohol | 16 | 10.3 |
| Bath Salts | 13 | 8.3 |
| Benzodiazepines | 33 | 21.2 |
| Cocaine | 20 | 12.8 |
| Spice | 12 | 7.7 |
| THC | 26 | 16.7 |
| Negative | 36 | 23.0 |

Little is known about the metabolism and toxicology of synthetic cannabinoid compounds. Furthermore, it cannot be assumed that the risks associated with the use of synthetic cannabinoids are comparable to those seen with THC. There is reason for concern that these drugs may have a greater potential to cause harm. Moreover, because of the lack of information on the synthetic cannabinoid and synthetic cathinone experience, dose intake, the interaction between other drug consumption, and prior psychiatric comorbidity, further studies to reliably assess these risks are warranted.

## REFERENCES


1. Rosenbaum CD, Carreiro SP, Babu KM. Here today, gone tomorrow…and back again? A review of herbal marijuana alternatives (K2, spice), synthetic cathinones (bath salts), kratom, Salvia divinorum, methoxetamine, and piperazines. *J Med Toxicol*. 2012;8(1):15-32.
2. Huffman JW. CB2 receptor ligands. *Mini Rev Med Chem*. 2005;5(7):641-649.
3. Dresen S, Ferreirós N, Pütz M, Westphal F, Zimmermann R, Auwärter V. Monitoring of herbal mixtures potentially containing synthetic cannabinoids as psychoactive compounds. *J Mass Spectrom*. 2010;45(10):1186-1194.
4. The European Monitoring Centre for Drugs and Drug Addiction. *Understanding the 'Spice' phenomenon*. 2009. Available at: http://www.emcdda.europa.eu/publications/thematic-papers/spice. Accessed April 5, 2012.
5. Zimmermann US, Winkelmann PR, Pilhatsch M, Nees JA, Spanagel R, Schulz K. Withdrawal phenomena and dependence syndrome after the consumption of spice gold. *Dtsch Arztebl Int*. 2009;106(27):464.
6. Simmons J, Cookman L, Kang C, Skinner C. Three cases of "spice" exposure. *Clin Toxicol (Phila)*. 2011;49(5):431-433.
7. Berry-Cabán CS, Berry CE, Ee J, Ingram V, Kim E. Synthetic cannabinoid overdose in a 20-year-old male US soldier. *Subst Abus*. 2012. In press.
8. Antonowicz JL, Metzger AK, Ramanujam SL. Paranoid psychosis induced by consumption of methylenedioxypyrovalerone: two cases. *Gen Hosp Psychiatry*. 2011;33(6):640.e5-640.e6.
9. Flor A. Spice-I want a new drug. *The Army Lawyer*. July 2010:23-25. Available at: http://www.loc.gov/rr/frd/Military_Law/pdf/07-2010.pdf. Accessed April 5, 2012.
10. Dougherty JM. 7 Hill airmen discharged for spice use. *Deseret News*. March 27, 2010. Available at: http://www.deseretnews.com/article/700020576/7-Hill-airmen-discharged-for-spice-use.html. Accessed April 5, 2012.

11. Basu S. Air Force gets new instruments to test for synthetic marijuana. *US Med*. 2012;48(5):1,6
12. American Association of Poison Control Centers. Bath salts data & synthetic marijuana data information pages [updated June 8, 2012]. Available at: http://www.aapcc.org/dnn/NewsandEvents/NewsMediaResources.aspx. Accessed June 11, 2012.
13. Möller I, Wintermeyer A, Bender K, et al. Screening for the synthetic cannabinoid JWH-018 and its major metabolites in human doping controls. *Drug Test Anal*. 2011;3(9):609-620.
14. *Army Regulation 600-85: The Army Substance Abuse Program*. Washington, DC: US Dept of the Army; February 2, 2009 [December 2, 2009].
15. Chemicals used in "bath salts" now under federal control and regulation; DEA will study whether to permanently control three substances [press release]. Washington, DC: US Drug Enforcement Administration; October 21, 2011. Available at: http://www.justice.gov/dea/pubs/pressrel/pr102111.html. Accessed April 5, 2012.
16. Chemicals used in "spice" and "K2" type products under federal control and regulation for additional 6 months; DEA continues studies to determine whether to permanently control five substances [press release]. Washington, DC: US Drug Enforcement Administration; February 29, 2012. Available at: http://www.justice.gov/dea/pubs/pressrel/pr022912.html. Accessed April 5, 2012.
17. McFarling L, D'Angelo M, Drain M, Gibbs DA, Olmsted KLR. Stigma as a barrier to substance abuse and mental health treatment. *Mil Psychol*. 2011;23(1):1-5.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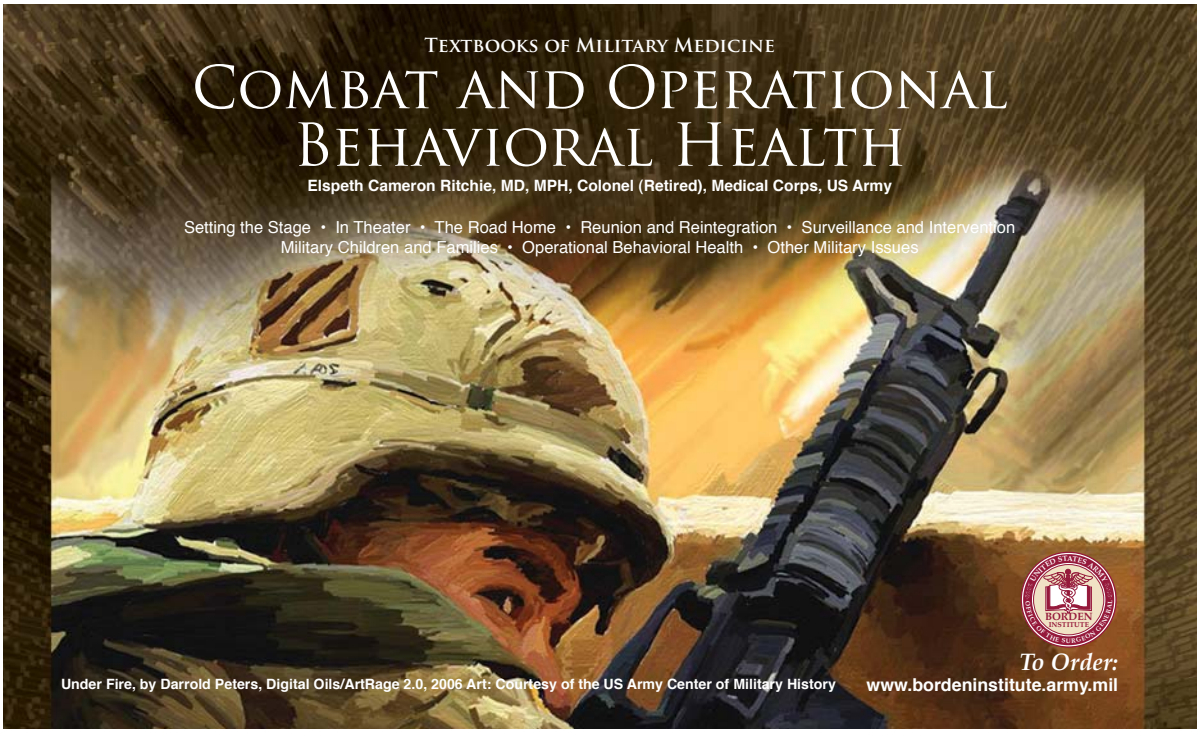

# Relationships Among Self-reported Shoe Type, Footstrike Pattern, and Injury Incidence

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ABSTRACT

Context: Some runners are experimenting with barefoot or minimalist shoe running to reduce lower extremity overuse injuries. However, there has been little research to examine injury trends associated with barefoot or minimalist shoe running.

Objective: To assess the association of self-reported shoe selection with reported foot strike patterns, compare overall injury incidence associated with different shoe conditions, and identify differences in injury location between different shoe conditions.

Design: Retrospective descriptive epidemiology survey.

Methods: We recruited 2,509 runners (1,254 male, 1,255 female) aged 18 to 50 to complete an anonymous online survey. The survey assessed running tendencies, footstrike patterns, shoe preferences, and injury history. Reported footstrike patterns were compared among 3 shoe groups: traditionally shod, minimalist shoes, and barefoot runners. Overall and specific anatomical injury incidence was compared between traditionally shod and minimalist shoe-wearing runners. We did not include 1,605 runners in the analyses due to incomplete data or recent changes in footstrike patterns and/or shoe selection.

Results: Shoe selection was significantly associated with reported footstrike ($\chi^2_4$=143.4, $P$<.001). Barefoot and minimalist runners reported a more anterior footstrike than traditionally shod runners. Traditionally shod runners were 3.41 times more likely to report injuries than experienced minimalist shoe wearers (46.7% shod vs 13.7% minimalist, $\chi^2_1$=77.4, $P$<.001, n=888). Minimalist shoe wearers also reported fewer injuries at the hip, knee, lower leg, ankle, and foot than traditionally shod runners.

Conclusion: Barefoot and minimalist shoe wearers reported a more anterior footstrike than traditionally shod runners. Traditionally shod runners were more likely to report injuries of the lower extremities than runners who wear minimalist shoes. Additional longitudinal prospective research is required to examine injury incidence among various footstrike patterns and shoe preferences.

Many healthcare providers have received questions regarding barefoot or minimalist shoe running from clients with or without a history of previous injury. In our recent review of literature,[1] we noted that little to no injury comparisons exist between runners wearing traditional running shoes and those running in minimalist footwear.

With annual injury incidence averaging 50% and the majority of injuries occurring at the knee,[2] several authors have suggested barefoot or minimalist shoe running as a possible method to reduce injury rates among runners.[3-6] Rearfoot striking runners in traditional shoes contact the ground with a relatively dorsiflexed ankle and extended knee. This initial posture causes rearfoot strikers to rely heavily on the knee extensors to attenuate vertical ground reaction forces using eccentric muscle activation.[7] Increased activation of the knee extensors may increase patellofemoral compression and tibio-femoral joint loading. Barefoot runners have demonstrated a more anterior foot strike with slight plantar flexion and increased knee flexion,[3,8,9] reduced initial vertical ground reaction forces,[10] reduced stride length,[9,11] and increased stride frequency[9,11] compared with rearfoot strikers in traditional shoes. Runners who wear minimalist footwear may demonstrate running mechanics similar to those involved in barefoot running,[9] or some runners wearing minimalist shoes may still use a rearfoot strike pattern.[12,13]

In an effort to assess injury incidence among foot strike patterns and shoe conditions, we developed and implemented an online survey instrument. The purposes of this survey were to assess the association of different shoe selection with reported foot strike patterns, to compare overall injury incidence associated with different shoe conditions and strike patterns, and to identify potential anatomic location differences in injury

proportions between different shoe conditions. We hypothesized that barefoot and minimalist shoe runners would describe a more anterior foot strike pattern than traditionally shod runners. We also expected that experienced minimalist shoe runners would report fewer knee injuries and more foot and ankle injuries.

## METHODS

### Subjects

After receiving local approval from the institutional review board at our university and a local military facility, we recruited 2509 runners (1254 male and 1255 female) aged 18 to 50 who reported running at least 6 miles per week. The recruiting was accomplished by posting messages on university, military, and local running club listservs; posting flyers in local fitness centers; and by posting a link to the survey on several websites frequently viewed by runners. We made an intentional effort to recruit additional barefoot and minimalist shoe wearing runners to draw conclusions based on these groups.

Figure 1. Derivation of analysis sample size (N=904).

### Data Collection

The survey consisted of a maximum of 41 questions that participants completed based on responses to previous questions. We conducted pilot testing of the survey instrument with 10 physical therapy students and 10 military personnel. The mean survey completion time was 7 minutes. No questions were deemed ambiguous or offensive during pilot testing, so the composition of survey questions remained intact. We collected the survey data using an anonymous online survey posted on www.surveymonkey.com during a 16 month period from September 2010 through December 2011. Only "experienced" runners who reported using the same footstrike pattern and shoe condition for a minimum of one year were included in the injury comparisons.

### Data Analysis

We used chi-squared analysis to compare reported footstrike proportions among runners wearing traditional shoes, barefoot runners, and runners who reported wearing minimalist shoes. We used chi-squared analyses to compare retrospective lower extremity injury incidence rates overall and at each anatomic region between runners in traditional and minimalist shoes. We also used chi-squared analysis to compare lower extremity injury incidence rates among reported footstrike groups regardless of shoe selection. We calculated relative risk ratios for incidences of lower extremity injuries when chi-squared analyses were significant at the alpha=0.05 level. We also used chi-squared analysis to compare lower extremity injury incidence rates among 3 groups of runners with various levels of running experience. Finally, we described the proportion of runners who reported changing their footstrike pattern or shoe preferences over the preceding year. Even though these runners were not used in the injury analyses, we reported the reasons runners gave for making changes in their footstrike pattern or shoe preferences.

## RESULTS

Of the 2509 individuals who initiated the survey, 2157 (86%) completed the survey. Not all participants answered every question. Some questions were skipped based on previous responses and some were skipped due to participant choice. Runners who reported changing their footstrike pattern or running shoe preference in the previous 12 months (n=1363) were excluded from further analyses. Since a large proportion of our sample reported changing their footstrike pattern or shoe preference or both, this reduced the size of our sample to 1146 for data analysis. From these runners, 904 completed all of the questions related to injury incidence and reported wearing traditional shoes or minimalist shoes, or running barefoot (Figure 1).

Seventy-three percent (662/904) of the participants in our survey reported using traditional shoes and not changing their footstrike pattern in the previous year, 25% (226/904) reported wearing minimalist shoes and not changing their footstrike pattern in the previous year, and only 2% (16/904) reported running barefoot greater than 50% of the time and not changing their footstrike pattern for over a year. These 904 runners were used for comparisons of self-reported footstrike associations among shoe conditions. With only 16 primarily barefoot runners, we lacked sufficient statistical power to draw injury associations from this group. We examined injury associations between the remaining 888 runners wearing traditional and minimalist shoes. We report

sample sizes for each question because sample size varied from question to question based on subject qualification and participation.

Runners in traditional shoes, minimalist shoes, and barefoot runners were similar in age, height, and mass. Most barefoot runner and runners who wore minimalist shoes were men. More minimalist shoe runners reported running faster and farther than those in other groups. Barefoot runners reported a greater number of total years running. Barefoot and minimalist shoe runners reported a shorter period of time in their current shoe condition (Table 1).

Table 1. Demographics of questionnaire respondents.

| Shoe Preference | Traditional Shoes | Minimalist Shoes | Barefoot |
|---|---|---|---|
| Number | 662 | 226 | 16 |
| Gender | Male: 282, 42.6%<br>Female: 380, 57.4% | Male: 156, 69%<br>Female: 70, 31% | Male: 12, 75%<br>Female: 4, 25% |
| Age | 37.2±8.5 years | 39.0±8.4 years | 37.3±9.0 years |
| Height | 1.74±0.11 m | 1.74±0.09 m | 1.80±0.08 m |
| Mass | 72.3±13.6 kg | 76.5±10.2 kg | 76.7±10.1 kg |
| Years Running | 6.4±5.7 years | 9.2±8.3 years | 12.2±10.5 years |
| Years in Current Shoe Type | 4.5±3.7 years | 2.1±1.4 years | 2.1±1.4 years |
| Years Using Current Footstrike | 4.2±3.8 years | 3.4±3.4 years | 2.7±2.4 years |
| Weekly Mileage | 20.3% 6-10 mpw<br>34.2% 11-20 mpw<br>25.4% 21-30 mpw<br>12.5% 31-40 mpw<br>7.6% >40 mpw | 20.8% 6-10 mpw<br>31.7% 11-20 mpw<br>24.6% 21-30 mpw<br>9.5% 31-40 mpw<br>13.4% >40 mpw | 12.5% 6-10 mpw<br>33.3% 11-20 mpw<br>29.2% 21-30 mpw<br>20.8% 31-40 mpw<br>4.2% >40 mpw |
| Training Pace | 20.7% <6 mph<br>35.4% 6.1-7 mph<br>28.2% 7.1-8 mph<br>11.2% 8.1-9 mph<br>4.5% >9 mph | 12.7% <6 mph<br>26.5% 6.1-7 mph<br>33.9% 7.1-8 mph<br>17.7% 8.1-9 mph<br>9.2% >9 mph | 12.5% <6 mph<br>45.8% 6.1-7 mph<br>33.3% 7.1-8 mph<br>8.3% 8.1-9 mph<br>0% >9 mph |

Descriptive statistics reported as mean±SD.
"mpw" indicates miles per week.
"mph" indicates miles per hour.

## Footstrike

Irrespective of shoe type, 31% (280/904) of runners in our sample reported using a rearfoot strike, 43% (389/904) a midfoot strike, 20% (181/904) a forefoot strike, and 6% (54/904) reported being unsure of their footstrike tendencies. Fifty-eight percent (524/904) of runners surveyed reported using their preferred strike pattern exclusively. Twenty-three percent (208/904) of respondents stated that they varied their strike pattern and 19% (172/904) were unsure of the variability of their strike pattern.

Table 2: Associations of shoe type and self-reported footstrike.

| Shoe Type | Reported Footstrike | | |
|---|---|---|---|
| | Rearfoot | Midfoot | Forefoot |
| Traditional | 240 (41.4%) | 266 (45.9%) | 74 (12.7%) |
| Minimalist | 12 (5.9%) | 99 (48.5%) | 93 (45.6%) |
| Barefoot | 0 (0.0%) | 9 (60.0%) | 6 (40.0%) |

## Shoe Selection

Approximately 73% (662/904) of the runners in this sample reported wearing traditional running shoes (35.8% stability, 22.2% cushioned, and 15.1% motion control). Twenty-five percent (226/904) reported using minimalist footwear, and 1.8% (16/904) reported running barefoot greater than 50% of the time. Shoe selection was significantly associated with reported footstrike ($\chi^2_4$=143.4, $P$<.001). Barefoot and minimalist runners reported a more anterior footstrike than traditionally shod runners (Table 2, n=799).

## Injuries

We asked runners:

> If an injury is defined as something that caused you to modify your training schedule for at least 1 week due to pain or discomfort (with or without formal medical care), have you experienced any lower extremity injuries in the past 12 months that you believe were caused by running?

Runners who reported running greater than 50% of their mileage in bare feet represented a small portion of our sample (n=16). One third (5/16) of these runners reported wearing shoes for some portion of their weekly mileage. The mean length of time these runners reported running primarily barefoot in this group was 25 months ±17 months. Due to the small sample size of barefoot runners, we were unable to make any injury associations from this group.

Runners wearing traditional shoes were 3.41 times more likely to report injuries than experienced minimalist shoe wearers (46.7% traditional vs 13.7% minimalist, $\chi^2_1$=77.4, $P$<.001, n=888). Traditional shoe wearers were 2.64 times more likely to report foot injuries ($\chi^2_1$=10.11, $P$=.001), 2.84 times more likely to report ankle injuries ($\chi^2_1$=7.24, $P$=.007), 3.2 times more likely to report lower leg injuries ($\chi^2_1$=13.62, $P$<.001), 3.2 times more likely to report knee injuries ($\chi^2_1$=19.3, $P$<.001), and 9.8 times more likely to report hip injuries ($\chi^2_1$=15.36, $P$<.001) than experienced minimalist shoe runners (Figure 2). The mean length of time the experienced minimalist

shoe wearers reported wearing these shoes was 26 months ±16 months. Injury incidence associations at the thigh and low back demonstrate a similar trend as with other anatomical regions, but chi-shared analyses were not statistically significant between groups, likely due to a small number of reported thigh [4] and low back [1] injuries among minimalist shoe runners.

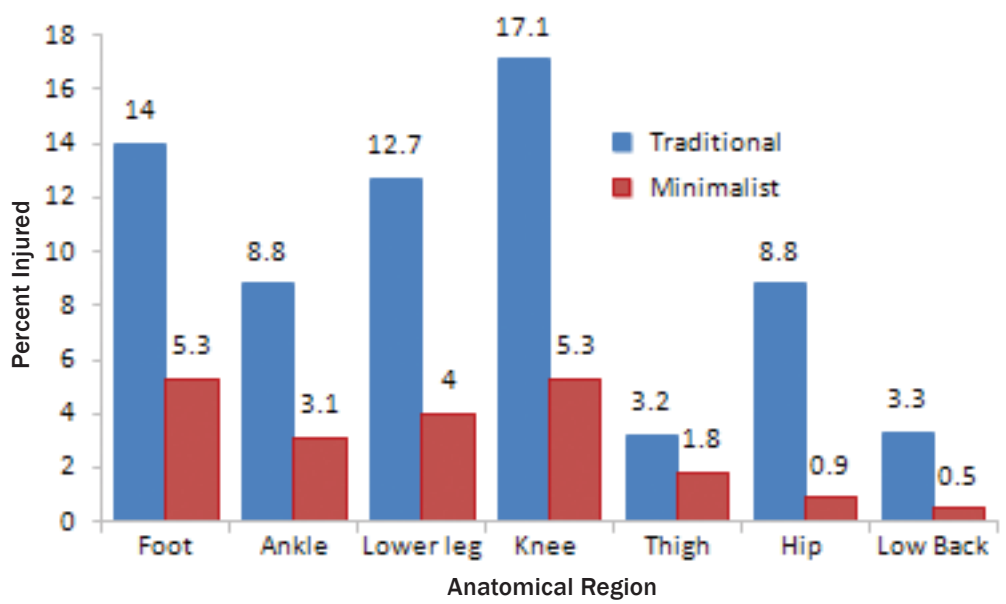


Figure 2. Self-reported injury rates by shoe type.

We combined shoe preference groups to examine injury incidence rates among footstrike groups. Runners reporting greater than one year of using a rearfoot strike pattern reported a one year injury incidence of 52.4%, while experienced midfoot strikers 34.7%, and experienced forefoot strikers reported an injury incidence of 22.8% ($\chi^2_2$=46.07, $P$<.001, n=881).

Injury incidence rates did not differ between high and low mileage groups. Respondents who ran more than 30 miles per week reported overall injury incidence rates of 41.4%. Those who reported running fewer than 20 miles per week reported injury incidence of 35.9% ($\chi^2_1$=2.02, $P$=.16, n=765, power=0.79 for small effect size, 0.1). Injury rates were also similar among reported training pace groups.

Since minimalist shoe wearers and barefoot runners reported more overall years running, we conducted a secondary analysis to examine associations between running experience and injury incidence. Running experience was significantly associated with injury incidence ($\chi^2_2$=6.17, $P$=.046, n=721). Runners who reported more years experience running reported fewer injuries. Injury incidence in runners who reported 1 to 5 years experience with running was 55% (219/398); runners with 6 to 10 years running experience reported injury incidence of 48.7% (92/189); 43.3% (58/134) of runners with greater than 10 years experience running and reported injuries (Table 3).

Table 3. Associations of running experience and injury incidence.

| Years Running | Injury | No Injury |
|---|---|---|
| 1 to 5 years | 219 (55.0%) | 179 (45.0%) |
| 6 to 10 years | 92 (48.7%) | 97 (51.3%) |
| >10 years | 58 (43.3%) | 76 (56.7%) |

### Reasons for Change of Shoe or Footstrike Preferences

The runners described in this section were not used in any of the previous analyses, but we believe it is noteworthy to describe the reasons given for runners' decisions to change shoe preference or footstrike pattern. Approximately 35% (866/2509) of the overall survey respondents reported changing their strike pattern in the previous 2 years. Eighty-two percent (707/866) of those who changed their footstrike reported formerly being a rearfoot striker. Of those who changed their strike pattern, 46% (397/866) did so because of injury. The 397 runners who changed their footstrike pattern due to injury reported a total of 500 injuries. Fifty-three percent of those injuries occurred at the knee among 66% of the runners who reported knee injuries (264/397).

Approximately 34% (848/2509) of runners in the overall survey reported changing their primary shoe type in the last 2 years. Eighty-three percent (702/848) of those who changed their primary shoe type had worn traditional running shoes previously. Forty-four percent (372/848) of runners who changed shoes reported that they did so because of injuries. The 372 runners who changed their footstrike pattern due to injury reported a total of 411 injuries. Forty-nine percent of these injuries occurred at the knee with 58% of these runners reporting a knee injury (214/372).

## COMMENT

Little research has been conducted concerning injury trends that are associated with barefoot/minimalist shoe running or other alternative running styles. We hypothesized:

1. Barefoot and minimalist shoe runners would describe a more anterior foot strike pattern than traditionally shod runners.
2. Experienced minimalist shoe runners would report fewer knee injuries and a greater incidence of foot and ankle injuries.

Our data support our first hypothesis. Reported footstrike pattern was associated with shoe selection. Barefoot and minimalist shoe wearers reported using a more anterior footstrike pattern. The second hypothesis was partially supported. Experienced minimalist shoe runners reported fewer knee injuries without an increase in reported foot and ankle injuries. While we did not form a hypothesis concerning overall injury incidence between shoe groups, minimalist shoe runners reported fewer injuries. Our results indicate that experienced minimalist shoe wearers who have been wearing minimalist shoes for more than one year reported fewer injuries at the hip, knee, lower leg, ankle, and foot.

While significant associations were observed among reported footstrikes and injury incidence, the accuracy of self-reported footstrike has not been documented in the literature. Previous authors have reported a predominant prevalence of rearfoot strikers among traditionally shod runners.[3,14,15] With the recent attention to a more anterior footstrike and minimalist shoe selection in the popular media after the publication of "Born to Run" by Christopher McDougall,[5] many runners have attempted to alter their footstrike tendencies or shoe preferences, or both. This point is evidenced by the many individuals who reported a change in their footstrike pattern or shoe preference in an attempt to reduce injuries, particularly knee injuries. Individual runners may or may not be able to report their own foot strike pattern accurately. We recently tested 87 runners using an instrumented treadmill and observed a self-reported accuracy of 69% for runners' ability to discern between a rearfoot and a more anterior footstrike pattern.[13] We readily admit that this is not excellent reliability, but hopefully it gives the reader a sense of context when interpreting our survey data.

Another limitation of this survey study is the reliability of self-reported shoe type worn by each respondent. In an effort to improve this reliability, we did not assess injury differences among motion control, stability, or cushioned shoe categories. Instead, we have combined these 3 groups into a "traditional shoe" category for comparisons to runners who wore minimalist shoes and to barefoot runners. We believe it is reasonable to assume that these runners knew if they were choosing to run barefoot, in a minimalist shoe, or in a traditional shoe since the average runner in this sample had been running for approximately 8 years. In our own recent laboratory sample of 87 runners, we have observed a self-reported accuracy of 98% for runners who reported wearing either traditional shoes or minimalist shoes.[13] The proportions of minimalist runners and anterior foot strikers in this study should not be taken as representative of the US population as a whole since running clubs consisting of primarily barefoot and minimalist shoe runners were specifically recruited for participation.

We chose to use self-reported injury data instead of medical diagnostic information for its ease of collection and because we believe that many runners will simply alter their training schedule rather than seek medical attention for minor "overuse" injuries. Runners may report these injuries in a survey, but the injuries may not appear in a medical record. While injury surveys are commonly published in the literature,[16-19] self-reported injury data may have limitations relative to the accuracy of the data. We chose to ask about injuries by body region and not trust reliability of self-report diagnoses (eg, "foot" injury vs plantar fasciitis or metatarsalgia; and "knee" injury vs patellofemoral pain syndrome or patellar tendonopathy). While this strategy limited the amount of information gathered, we believe keeping the choice regional and not diagnosis specific likely maintained some of the reliability of the self-reported data.

While age did not differ between our groups of traditional shoe and minimalist shoe runners in our sample, runners who wore minimalist shoes reported more years of running experience. This fact may be a potential confounder and may contribute to the lower injury incidence seen in minimalist shoe runners. Runners with more experience may have learned how to avoid injuries better than less experienced runners, and/or runners who are repeatedly injured over the first several years of running may choose to quit running and pursue an alternative form of exercise.

In our survey study, shoe selection and reported footstrike pattern were both significantly associated with reported injury incidence. We believe reported shoe selection is likely more reliable than reported footstrike pattern. These associations are preliminary in nature and do not imply cause and effect relationships. It is possible that this convenience sample of minimalist

shoe wearing participants is biased and enthusiastic to share their experiences. Further research with prospective longitudinal samples is needed to investigate the injury prevention capabilities of alternative running styles with validated footstrike patterns compared to traditionally shod rearfoot striking running. For further description of the running mechanics of runners using different running styles, we refer the reader to our previously published review article.[1]

## CONCLUSION

Self-reported footstrike pattern was associated with shoe selection. Barefoot runners and minimalist shoe wearers reported a more anterior footstrike than did traditionally shod runners. Experienced minimalist shoe runners reported fewer overall injuries and fewer injuries, specifically at the hip, knee, lower leg, ankle, and foot than did traditional shoe wearing runners. Runners who reported using a more anterior footstrike pattern reported fewer injuries than rearfoot striking runners. Additional prospective longitudinal research is needed to study injury incidence among runners using different footstrike patterns and shoe preferences.

## ACKNOWLEDGEMENTS

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## REFERENCES

1. Goss DL, Gross MT. A review of the mechanics and injury trends among various running styles. *US Army Med Dept J.* 2012;2012(July-Sep.):62-71.
2. van Gent RN, Siem D, van Middelkoop M, van Os AG, Bierma-Zeinstra SM, Koes BW. Incidence and determinants of lower extremity running injuries in long distance runners: a systematic review. *Br J Sports Med.* 2007;41(8):469-480.
3. Lieberman DE, Venkadesan M, Werbel WA, et al. Foot strike patterns and collision forces in habitually barefoot versus shod runners. *Nature.* 2010;463(7280):531-535.
4. Dreyer D. *Chi Running.* Vol 2. New York, NY: Fireside; 2009.
5. McDougall C. *Born to Run*. New York: Alfred A. Knopf; 2009.
6. Robbins S, Gouw GJ, McClaran J, Waked E. Protective sensation of the plantar aspect of the foot. *Foot Ankle*. 1993;14(6):347-352.
7. Arendse RE, Noakes TD, Azevedo LB, Romanov N, Schwellnus MP, Fletcher G. Reduced eccentric loading of the knee with the pose running method. *Med Sci Sports Exerc.* 2004;36(2):272-277.
8. De Wit B, De Clercq D, Aerts P. Biomechanical analysis of the stance phase during barefoot and shod running. *J Biomech.* 2000;33(3):269-278.
9. Squadrone R, Gallozzi C. Biomechanical and physiological comparison of barefoot and two shod conditions in experienced barefoot runners. *J Sports Med Phys Fitness.* 2009;49(1):6-13.
10. Divert C, Mornieux G, Baur H, Mayer F, Belli A. Mechanical comparison of barefoot and shod running. *Int J Sports Med.* 2005;26(7):593-598.
11. Divert C, Mornieux G, Freychat P, Baly L, Mayer F, Belli A. Barefoot-shod running differences: shoe or mass effect?. *Int J Sports Med.* 2008;29(6):512-518.
12. McCarthy C, Porcari JP, Kernozek T, Willson J, Foster C. Like barefoot, only better?. *ACE Certified News.* 2011;September 2011:8-12.
13. Goss DL. *A Comparison of Lower Extremity Joint Work and Initial Loading Rates among Four Different Running Styles* [dissertation]. Chapel Hill, North Carolina: Dept of Allied Health, University of North Carolina; 2012.
14. Hasegawa H, Yamauchi T, Kraemer WJ. Foot strike patterns of runners at the 15-km point during an elite-level half marathon. *J Strength Cond Res.* 2007;21(3):888-893.
15. Larson P, Higgins E, Kaminski J, et al. Foot strike patterns of recreational and sub-elite runners in a long-distance road race. *J Sports Sci.* 2011;29(15):1665-1673.
16. Marti B, Vader JP, Minder CE, Abelin T. On the epidemiology of running injuries. The 1984 Bern Grand-Prix study. *Am J Sports Med*. 1988;16(3):285-294.
17. McKean KA, Manson NA, Stanish WD. Musculoskeletal injury in the masters runners. *Clin J Sport Med*. 2006;16(2):149-154.
18. RunningUSA Inc. Road Running Information Center Annual Marathon Report [2009]. RunningUSA.org Web site. Available at: http://www.runningusa.org/node/16414. Accessed February 16, 2012.
19. Taunton JE, Ryan MB, Clement DB, McKenzie DC, Lloyd-Smith DR, Zumbo BD. A prospective study of running injuries: the Vancouver sun run "in training" clinics. *Br J Sports Med.* 2003;37(3):239-244.

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# The Effects of BleedArrest on Hemorrhage Control in a Porcine Model

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## ABSTRACT

The purpose of this study was to examine the effectiveness of the hemostatic agent BleedArrest compared to control. This was a prospective, experimental design employing an established porcine model of uncontrolled hemorrhage. The minimum number of animals (n=10 per group) was used to obtain a statistically valid result. There were no statistically significant differences between the groups ($P>.05$) indicating that the groups were equivalent on the following parameters: activating clotting time, the subject weights, core body temperatures, amount of one minute hemorrhage, arterial blood pressures, and the amount and percentage of total blood volume. There were significant differences in the amount of hemorrhage ($P=.033$) between the BleedArrest (mean=72, SD±72 mL) and control (mean=317.30, SD±112.02 mL). BleedArrest is statistically and clinically superior at controlling hemorrhage compared to the standard pressure dressing control group. In conclusion, BleedArrest is an effective hemostatic agent for use in civilian and military trauma management.

Trauma represents the leading cause of morbidity and mortality in all populations with uncontrolled hemorrhage as the major cause of complications and death.[1-6] Historically, 20% of combat casualties were killed in action. Ninety percent of those casualties never reached a field hospital with hemorrhage as the major cause of death.[5] In Vietnam, almost 40% of Soldiers who died of exsanguination had a source of bleeding that could possibly have been controlled by a hemostatic agent.[6] Uncontrolled hemorrhage accounts for almost 50% of the battlefield deaths prior to evacuation in the more recent conflicts of Iraq and Afghanistan.[3]

If trauma victims survive the initial blood loss and injury, they are prone to hypothermia, coagulopathy, acidosis, infection, and multiple organ failure. These complications result in an increase in morbidity and mortality even after successful resuscitation.[1,2,7-9] Therefore, rapid hemostasis and control of bleeding is not only essential for initial survival, but also for optimal recovery.

Several hemostatic agents have been investigated in multiple animal models over the past decade with mixed and inconclusive results.[7,10-26] The purpose of this study was to examine the effectiveness of the hemostatic agent BleedArrest (Hemostasis LLC, Saint Paul, MN). The mechanism of action of BleedArrest is based on the absorbance of plasma by amylopectin, a plant-based starch. The result is the concentration of platelets and coagulation factors at the site of injury supporting the formation of a robust clot. The research question guiding this study was: Is there a statistically significant difference in the amount of bleeding between BleedArrest and the control group?

## MATERIALS AND METHODS

This study was a within and between subjects experimental design employing an established porcine model of uncontrolled hemorrhage. The research protocol was approved by the Institutional Animal Care and Use Committee. The animals received care in accordance with the Animal Welfare Act and The Guide for the Care and Use of Laboratory Animals. Twenty male Yorkshire swine weighing between 70 kg and 89 kg were randomly assigned (n=10 per group) to one of 2 groups, BleedArrest or the control group. The rationale for using swine of this size was that they represent the average weight of the US Army Soldier.[27] The swine were observed for 3 days to ensure a good state of health, fed a standard diet, and were NPO [no food or water] after midnight the day of the experiment. This study was conducted in 4 phases: induction/stabilization, hemorrhage, hemostasis, and blood loss.

## INDUCTION/STABILIZATION PHASE

The induction phase started with an intramuscular injection of ketamine (20 mg/kg) and atropine (0.04 mg/kg). Subjects were placed supine on a litter and transported to an operating room followed by inhaled isoflurane (4% to 5%). After placement of an endotracheal tube, a peripheral IV catheter was inserted and the isoflurane concentration was reduced to 1% to 2% for the remainder

of the experiment. The swine were ventilated with a standard Narkomed anesthesia machine (Dräger, Telford, PA). Heart rate, electrocardiography, blood pressure, oxygen saturation, end-tidal carbon dioxide, and rectal temperatures were continuously monitored for the remainder of the experiment. A Thermal Industries of Florida (TIF) scale, Model 9010A, (SPX Service Solutions, Owatonna, MN) was placed between the litter and operating room table. The TIF scale is an electronic scale that measures pressure applied in pounds per square inch and is precise within 0.5 oz and accurate within 0.5%. The scale was zeroed per manufacturer's instructions. While manual pressure was applied to the wound during the experiment, the scale was observed to ensure pressure was maintained at 25 psi within ±0.5 oz to ensure continuity from subject to subject.

The left carotid artery was cannulated with a 20 guage (Ga) angio-catheter using a cut down technique. A central venous catheter was inserted using a modified Seldinger technique for fluid volume management and blood sampling. The catheters were attached to a hemodynamic monitoring system (Hewlett Packard, Palo Alto, CA) for continuous monitoring of the arterial blood pressures. All catheters were continuously flushed with 0.9% saline solution (5 mL per hour) to maintain patency. Following line placement, the NPO fluid deficit was corrected with 0.9% normal saline, per the Holliday-Segar formula. The investigators used an activated clotting time (ACT) test to screen all subjects for coagulopathy prior to procedures. The upper limit in this study for all subjects was an ACT less than 150 seconds. Subjects were further monitored for 30 minutes to ensure hemodynamic stability prior to intervention. Body temperature was monitored via a rectal probe and maintained at greater than 36.0°C using a forced-air warming blanket. A complex groin injury as described by Alam and colleagues was generated to simulate a penetrating injury.[12,13] The injury included dissection of the proximal thigh soft tissues including the skin, quadriceps, and adductor muscles to expose the femoral artery and vein just below the inguinal ligament. All subjects were hemodynamically stable prior to intervention.

## HEMORRHAGE PHASE

Following the 30-minute stabilization period, the exposed femoral artery and vein were transected with a scalpel blade. The swine were allowed to hemorrhage for one minute simulating the response time of a battlefield health care provider. Blood was collected by gauze, absorbent pads underneath the animals, and in a suction canister by use of a suction tip catheter placed in the distal portion of the wound.

## HEMOSTASIS PHASE

After one minute of hemorrhage, proximal pressure was applied to the transected femoral vessels, and 4 in by 4 in gauze was used to blot the blood from the wound per the hemostatic agent manufacturer's guidelines. At this time, the hemostatic agent was poured into the wound followed by standard wound packing including a layer of petroleum gauze and roller gauze (Kerlix, Covidien, Mansfield, MA). The control group received proximal pressure and standard wound packing. Firm manual pressure of 25 psi was applied for 5 minutes to the injury site as measured by the TIF scale.[28] After 5 minutes, all groups received a pressure dressing of rolled gauze and a 10-pound sandbag. This dressing was left in place for 30 minutes. 500 mL of 6% Hextend in lactated ringer's solution (Hospira, Inc., Lake Forest, IL) IV was administered to all subjects in accordance with current battlefield resuscitation protocol recommended by the Committee on Tactical Combat Casualty Care.[29]

## BLOOD LOSS PHASE

After 35 minutes of pressure on the wound (5 minutes manual pressure plus 30 minutes with the pressure dressing), the standard pressure dressing was removed being careful to keep the clot intact. The rationale for using the petroleum gauze was that it allowed removal of the pressure dressing with minimal clot disruption. For the purposes of this study, hemostasis was defined as a clot formation with oozing of no more than 2% of the swine's total blood volume over a 5-minute period (approximately 100 mL in a 70 kg pig). Blood loss was measured over 2 time periods: the initial injury to intervention and postintervention to the completion of the study. Blood loss was calculated by weighing the dressings, the absorbent pads underneath the animals, and blood suctioned from the distal portion of the wound before and after transection of the femoral vessels.

## RESULTS AND COMMENT

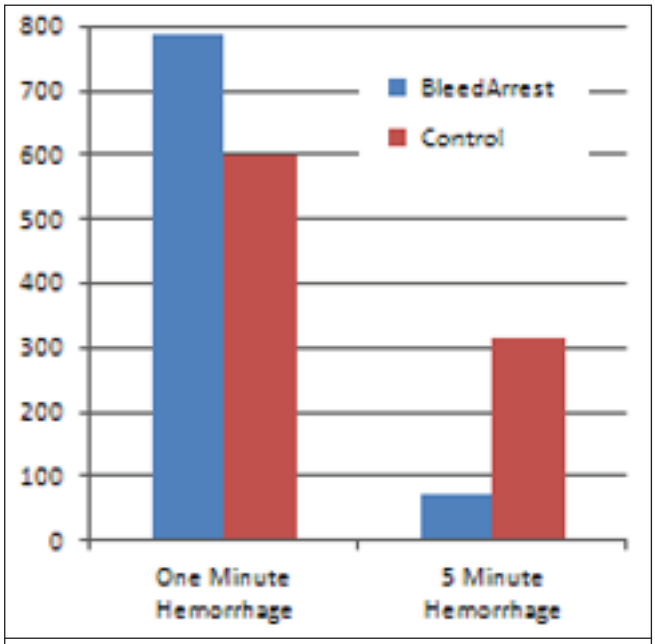
The minimum number of animals was used to obtain a statistically valid result. A large effect size was determined for this experiment based upon previous work by Alam and Pusateri.[7,13,19,30] Using G-Power 3.00 for Windows (Institut Für Experimentelle Psychologie, Dusseldorf, FRG), an effect size of 0.6, a power of 0.80, and an alpha of 0.05, it was determined that a sample size of 10 swine per group was needed for this study. Investigators evaluated coagulation studies with all subjects. There were no statistically significant differences between the groups in reference to the amount of initial bleeding after one minute ($P$=.533): BleedArrest group ranged from 492 to 1569 mL (mean=789.22, SD±121.60

mL) and control group ranged from 100 to 992 mL (mean=601.50, SD±84.03 mL). The body weights, core body temperatures, amount of blood volume, and the amount of the initial one minute hemorrhage were analyzed using a multivariate analysis of variance. There were no statistically significant differences between the groups ($P$>.05) indicating that the groups were equivalent on these parameters. Blood loss after 35 minutes of pressure on the wound (manual pressure and pressure dressing) was calculated for each group over a five minute observation period following removal of dressings and exposure of the formed clot. The amount of bleeding BleedArrest group ranged from 0 to 648 mL (mean=72, SD±72 mL) and control group ranged from 0 to 1002 mL (mean=317.30, SD±112.02 mL). A repeated analysis of variance test was used to analyze the data, the one minute and 5 minute hemorrhage postintervention, and indicated a significant difference between the BleedArrest and control groups ($P$=.033). The results are summarized in the Figure.

The US Army's goal is for each Soldier to carry a hemostatic agent, but research should be conducted to determine the most efficacious and cost effective agent. In addition, many civilian disaster teams and first responders are exploring the potential for hemostatic agent use in the prehospital setting. Pusateri outlined the ideal qualities of hemostatic agents for civilian and military use. These include (1) the ability to rapidly stop large vessel arterial and venous bleeding within 2 minutes of application when applied to an actively bleeding wound through a pool of blood; (2) no requirement for mixing or preapplication preparation; (3) simplicity of application by wounded victim, buddy, or medic; (4) lightweight and durable; (5) long shelf life in extreme environments; (6) safe to use with no risk of injury to tissues or transmission of infection; and (7) inexpensive.[31] This study compared BleedArrest against a standard pressure dressing control in a porcine model of uncontrolled hemorrhage. A complex groin injury was generated simulating penetrating trauma in an anatomical area not protected by conventional body armor or amenable to use of a tourniquet. The hemostatic agent BleedArrest rapidly controlled arterial and venous bleeding. It was statistically and clinically superior at controlling hemorrhage compared to the standard pressure dressing control group. BleedArrest is packaged in a 250 g easy-to-open envelope. The investigators used enough of the hemostatic agent, mean weight of 24.3 g, to completely fill the groin injury cavity. Standard packaging of the agent in small waterproof packets would allow it to be easily carried by Soldiers, medics, and other healthcare providers in pockets, backpacks, or medic bags. BleedArrest has a shelf life of 3 years and is approved by the Federal Drug Administration (FDA). Investigators noted that the agent did not produce any exothermic reaction when applied to the wound, there were no obvious signs of tissue damage, and does not carry a risk of infection. This hemostatic agent is relatively inexpensive, costing less than $30.00 for a single application.[32]

## CONCLUSION

BleedArrest was statistically and clinically superior at controlling hemorrhage compared to the standard pressure dressing control group. This hemostatic agent is simple to use, lightweight, demonstrates no known risk of tissue injury, has a long shelf life with FDA approval, and isrelatively inexpensive. Based on this study and the requirements outlined by Pusateri, BleedArrest is an effective hemostatic agent for use in the management of hemorrhage and trauma.




Amount of bleeding (in mL) by group and time.

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## REFERENCES

1. Sauaia A, Moore FA, Moore EE, et al. Epidemiology of trauma deaths: a reassessment. *J Trauma*. 1995;38(2):185-193.
2. Sauaia A, Moore FA, Moore EE, Haenel JB, Read RA, Lezotte DC. Early predictors of postinjury multiple organ failure. *Arch Surg.* 1994;129(1):39-45.
3. Champion HR, Bellamy RF, Roberts CP, Leppaniemi A. A profile of combat injury. *J Trauma*. 2003;54(suppl 5):S13-S19.
4. Asensio JA, Petrone P, O'Shanahan G, Kuncir EJ. Managing exsanguination: what we know about damage control/bailout is not enough. *Proc (Bayl Univ Med Cent)*. 2003;16(3):294-296.
5. Bellamy RF. The causes of death in conventional land warfare: implications for combat casualty care research. *Mil Med*. 1984;149(2):55-62.
6. Mabry RL, Holcomb JB, Baker AM, et al. United States Army rangers in Somalia: an analysis of combat casualties on an urban battlefield. *J Trauma*. 2000;49(3):515-529.
7. Alam HB, Burris D, DaCorta JA, Rhee P. Hemorrhage control in the battlefield: Role of new hemostatic agents. *Mil Med*. 2005;170(1):63-69.
8. Cosgriff N, Moore EE, Sauaia A, Kenny-Moynihan M, Burch JM, Galloway B. Predicting life-threatening coagulopathy in the massively transfused trauma patient: hypothermia and acidoses revisited. *J Trauma*. 1997;42(5):857-862.
9. Heckbert SR, Vedder NB, Hoffman W, et al. Outcome after hemorrhagic shock in trauma patients. *J Trauma*. 1998;45(3):545-549.
10. Pusateri AE, Holcomb JB, Kheirabadi BS, Alam HB, Wade CE, Ryan KL. Making sense of the preclinical literature on advanced hemostatic products. *J Trauma*. 2006;60(3):674-682.
11. Sondeen JL, Coppes VG, Holcomb JB. Blood pressure at which rebleeding occurs after resuscitation in swine with aortic injury. *J Trauma*. 2003;54(Suppl 5):S110-S117.
12. Alam HB, Chen Z, Jaskille A, et al. Application of a zeolite hemostatic agent achieves 100% survival in a lethal model of complex groin injury in swine. *J Trauma*. 2004;56(5):974-983.
13. Alam HB, Uy GB, Miller D, et al. Comparative analysis of hemostatic agents in a swine model of lethal groin injury. *J Trauma*. 2003;54(6):1077-1082.
14. Acheson EM, Kheirabadi BS, Deguzman R, Dick EJ,Jr, Holcomb JB. Comparison of hemorrhage control agents applied to lethal extremity arterial hemorrhages in swine. *J Trauma*. 2005;59(4):865-875.
15. Kozen BG, Kircher SJ, Henao J, Godinez FS, Johnson AS. An alternative hemostatic dressing: Comparison of CELOX, HemCon, and QuikClot. *Acad Emerg Med*. 2008;15(1):74-81.
16. Gegel B, Burgert J, Cooley B, et al. The effects of BleedArrest, celox, and TraumaDex on hemorrhage control in a porcine model. *J Surg Res*. 2010;164(1):e125-e129.
17. Gegel BT, Burgert JM, Lockhart C, et al. Effects of celox and TraumaDEX on hemorrhage control in a porcine model. *AANA J.* 2010;78(2):115-120.
18. Jewelewicz DD, Cohn SM, Crookes BA, Proctor KG. Modified rapid deployment hemostat bandage reduces blood loss and mortality in coagulopathic pigs with severe liver injury. *J Trauma*. 2003;55(2):275-281.
19. Pusateri AE, Modrow HE, Harris RA, et al. Advanced hemostatic dressing development program: animal model selection criteria and results of a study of nine hemostatic dressings in a model of severe large venous hemorrhage and hepatic injury in swine. *J Trauma*. 2003;55(3):518-526.
20. Littlejohn LF, Devlin JJ, Kircher SS, Lueken R, Melia MR, Johnson AS. Comparison of celox-A, ChitoFlex, WoundStat, and combat gauze hemostatic agents versus standard gauze dressing in control of hemorrhage in a swine model of penetrating trauma. *Acad Emerg Med*. 2011;18(4):340-350.
21. Kheirabadi BS. Evaluation of topical hemostatic agents for combat wound treatment. *US Army Med Dep J.* April-June 2011:25-37.
22. Kheirabadi BS, Acheson EM, Deguzman R, et al. Hemostatic efficacy of two advanced dressings in an aortic hemorrhage model in swine. *J Trauma*. 2005;59(1):25-34; discussion 34-35.
23. Kheirabadi BS, Arnaud F, McCarron R, et al. Development of a standard swine hemorrhage model for efficacy assessment of topical hemostatic agents. *J Trauma*. 2011;71(suppl):S139-S146.

24. Kheirabadi BS, Edens JW, Terrazas IB, et al. Comparison of new hemostatic granules/powders with currently deployed hemostatic products in a lethal model of extremity arterial hemorrhage in swine. *J Trauma*. 2009;66(2):316-328.

25. Kheirabadi BS, Scherer MR, Estep JS, Dubick MA, Holcomb JB. Determination of efficacy of new hemostatic dressings in a model of extremity arterial hemorrhage in swine. *J Trauma*. 2009;67(3):450-460.

26. Samudrala S. Topical hemostatic agents in surgery: A surgeon's perspective. *AORN J*. 2008;88(3):S2-S11.

27. The 1988 US Army Anthropometry Survey [database online]. http://ioe.engin.umich.edu/ioe491/AthroData.html. Accessed 01/2012.

28. Operating Instructions, TIF9010 Certified Weight Scale. Miami, FL: TIF Instruments, Inc. Available at: www.tequipment.net/pdf/TIF/TIF9010C.pdf. Accessed January 2012.

29. Tactical combat casualty care page [updated 2010]. US Military Health System Website. Available at: http://www.health.mil/Education_And_Training/TCCC.aspx. Accessed January 2012.

30. Pusateri AE, Delgado AV, Dick EJ Jr, Martinez RS, Holcomb JB, Ryan KL. Application of a granular mineral-based hemostatic agent (QuikClot) to reduce blood loss after grade V liver injury in swine. *J Trauma*. 2004;57(3):555-562.

31. Pusateri AE, McCarthy SJ, Gregory KW, et al. Effect of a chitosan-based hemostatic dressing on blood loss and survival in a model of severe venous hemorrhage and hepatic injury in swine. *J Trauma*. 2003;54(1):177-182.

32. BleedArrest Website. St Paul, MN: Hemostasis LLC. Available at: http://www.bleedarrest.com/index.html. Accessed January 2012.


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# The Effects of QuikClot Combat Gauze on Hemorrhage Control in the Presence of Hemodilution

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ABSTRACT

Introduction: Although hemostatic agents may be effective at stopping hemorrhage, they may fail because of hemodilution from intravenous fluids. The purpose of this study was to investigate the effects of QuikClot Combat Gauze (QCG) on rebleeding in a class II hemorrhage in the presence of hemodilution in a lethal femoral injury.

Methods: This was a prospective experimental, between swine subjects design. Pigs were assigned to one of two groups: QCG (n=15) or control (n=15). Thirty percent of the pig's blood was exsanguinated and then a 3:1 ratio of ringers lactate was administered. A groin injury was created by transecting the femoral artery and vein to simulate a battlefield injury and allowed to bleed for one minute. After one minute of hemorrhage, proximal pressure was applied to the injury, and QCG was placed into the wound followed by standard wound packing. The control group underwent the same procedures with the exception of the hemostatic agent. For both groups, 5 minutes of direct pressure was applied to the wound followed by a standard pressure dressing. Dressings were removed after 30 minutes, and the amount of hemorrhage was calculated in milliliters for each group for a period of 5 minutes. An activated clotting time was used to exclude any pigs with coagulation pathology.

Results: A multivariate analysis of variance indicated that there were no significant differences in the groups relative to weight, amount of one minute hemorrhage, fluid deficit replacement, blood volume, and the activated clotting time ($P>.05$) indicating that the groups were equivalent on these parameters. A *t* test indicated that there was significantly less bleeding ($P=.002$) in the QCG group (36 mL±112 mL) compared to the control group (340 mL±297 ml).

Conclusion: QCG produces a robust clot that can more effectively tolerate hemodilution compared to a control group.

Historically, approximately 20% of combat causalties were killed in action with hemorrhage as the major cause of death.[1] Uncontrollable hemorrhage accounts for 50% of the battlefield deaths before evacuation in both Iraq and Afghanistan.[1-3] Hemorrhage control and resuscitation are the top priorities in trauma care.[4] Uncontrolled hemorrhage is the leading cause of preventable death, not only in military, but also civilian trauma.[4-7] Some clinicians recommend the administration of one to 2 liters of crystalloid fluid resuscitation for patients in hypovolemic shock. Fluid resuscitation has the metabolic benefit of replenishing the oxygen debt accumulated during hemorrhage.[8] However, resuscitation with intravenous fluid may result in dislodging newly developed clots and hemorrhage. As rebleeding is a real potential because of resuscitation, the Committee on Tactical Combat Casualty Care advocates permissive hypotension, specifically low volume resuscitation, to keep the casualty alive with a palpable pulse or consciousness. In addition, they recommend that if there is a palpable radial pulse, no resuscitation fluids should be administered until there is definitive hemorrhage control.[9] Hemostatic agents may be effective in stopping bleeding but fail during resuscitation.[5,9-13] It is theorized that the bleeding results from 2 reasons: hemodilution and an increased blood pressure which in turn dislodges a fragile clot.[5,9-13] This was the first study to investigate the effects of hemodilution on rebleeding when a hemostatic agent, QuikClot Combat Gauze (QCG), is used to control bleeding. The purpose of this study was to investigate the effects of QCG on rebleeding in a Class II hemorrhage in the presence of hemodilution in a lethal femoral injury. The research question that guided the study was: Is there a statistically significant difference between the QCG group and the control group in hemorrhage after hemodilution?

DISCLAIMER: This research was sponsored by the TriService Nursing Research Program, Uniformed Services University of the Health Sciences (USUHS). The information or content and conclusions do not necessarily represent the official position or policy of, nor should there be any inference of official endorsement by the TriService Nursing Research Program, USUHS, the Department of Defense, or the US Government.

## BACKGROUND

Hemostatic agents have been investigated in multiple animal studies, including liver and complex groin injuries. These studies have produced inconsistent and mixed results regarding the effectiveness of hemostatic agents in controlling hemorrhage, indicating the need for additional investigation.[11,14-21] Hemostatic agents may be effective at the time of use, however, rebleeding may occur with resuscitation. Several investigators have emphasized the metabolic benefits of fluid resuscitation, however, the benefits must be weighed against the deleterious effects of rebleeding leading to death.[7,13]

Two agents that were widely used by the military, QuikClot (Z-Medica, Wallingford, CT) and WoundStat (TraumaCure, Bethesda, MD), have been removed from the US military inventory because of potential complications, specifically thermal tissue injury to patient and provider and microemboli formation.[16,20] Hemostatic agents have evolved from first generation granular or fine powders to second generation wafers and sponges. The newest agents are gauze dressings impregnated with a hemostatic agent designed to simplify application and decrease complications.

QCG is a rayon/polyester gauze impregnated with kaolin, a white aluminosilicate inert mineral. Kaolin promotes clotting by activation of factor XII, which in turn initiates the intrinsic clotting pathway via the activation of factor XI that ends with the formation of a fibrin clot. In addition, Kaolin promotes the activation of platelet associated factor XI which initiates the intrinsic clotting pathway in normal and factor XII deficient patients. There are limited data demonstrating the effectiveness of the QCG and no studies evaluating the effectiveness of the agent in the presence of hemodilution.

## MATERIALS AND METHODS

This study was a prospective, between subjects, experimental design using a porcine model. The protocol was approved by the Institutional Animal Care and Use Committee at the University of Texas Health Science Center, San Antonio, TX. The animals received care in compliance with the Animal Welfare Act, the Guide for the Use of Laboratory Animals, and the protocols of the University of Texas Health Science Center. Thirty Yorkshire swine weighing between 70 kg and 89 kg were randomly assigned (n=15 per group) to one of 2 groups, the QCG group or the control group. Swine of this size were used to represent the average weight of the US Army Soldier.[19] The swine were observed for at least 3 days to ensure good state of health, fed a standard diet, and remained NPO [no fluid or food] after midnight the day of the experiment. Anesthesia was induced with an intramuscular injection of ketamine (20 mg/kg) and atropine (0.04 mg/kg), followed by inhaled isoflurane (4% to 5%). After placement of an endotracheal tube, the investigators inserted a peripheral intravenous catheter, and the isoflurane concentration was reduced to between 1% and 2% for the remainder of the experiment. The animals were ventilated (tidal volume 8-10 mL/kg) with a standard Narkomed anesthesia machine (Dräger, Telford, PA) and continuously monitored for the remainder of the experiment with the following standard monitors: heart rate, electrocardiography, blood pressure, oxygen saturation, end-tidal carbon dioxide, and rectal temperatures. Body temperature was maintained greater than 36.0°C. When necessary, the investigators used a forced-air warming blanket. A Thermal Industries of Florida (TIF) scale, Model 9010A, (SPX Service Solutions, Owatonna, MN) was placed between the litter and operating room table. The TIF scale is an electronic scale that measures pressure applied in pounds per square inch and is precise within 0.5 oz and accurate within 0.5%. The scale was zeroed per manufacturer's instructions. While manual pressure was applied to the wound during the experiment, the scale was observed to ensure pressure was maintained at 25 psi within ±0.5 oz to ensure continuity from subject to subject. The right carotid artery was cannulated with a 20 gauge angio-catheter using a cut down technique. A right triple-lumen central venous catheter was inserted using a modified Seldinger technique for central venous pressure monitoring, fluid volume management, and blood sampling. The catheters were attached to a hemodynamic monitoring system (Hewlett Packard, Paolo Alto, CA) for continuous monitoring of the arterial and central venous pressures. All of the catheters were continuously flushed with 0.9% saline solution (5 mL per hour) to maintain patency. Following line placement, the NPO fluid deficit replacement was initiated with Normal Saline per the 4-2-1 method (Segar Holliday formula). The investigators used an activated clotting time (ACT) test to screen all subjects for coagulopathy prior to procedures. The upper limit in this study for all subjects was an ACT less than 150 seconds. All subjects were within this parameter.

An injury was made in one groin. The injury included dissection of the proximal thigh soft tissues (skin, quadriceps, and adductor muscles) to the femoral artery and vein without transection just below the inguinal ligament within the femoral crease. Subjects were then monitored for 30 minutes to ensure hemodynamic stability during which time the replacement of NPO fluid deficits were conducted. After the NPO deficit was replaced, 30% of the animal's blood volume was removed from the central line. A 3:1 replacement of Lactated Ringer's was administered to replace the blood lost via the central line to

dilute the blood. For example, if a pig weighed 70 kg, the blood volume was 4,900 mL; 30% exsanguination was 1,470 mL; and the replacement was 4,410 mL. All subjects were stable prior to intervention. Following the stabilization period, a scalpel was used to simultaneously transect the femoral artery and vein. The animals were allowed to hemorrhage for one minute, simulating the response time of a combat life saver, medic, or health care provider. Blood was collected from the wound by use of a suction catheter placed distal to the transected vessels. After one minute of hemorrhage, the wound was packed with petroleum impregnated gauze and either standard gauze or QCG according to the group the animal was assigned. Pressure was applied to the injury and 4 in by 4 in gauze was used to blot the blood from the wound per hemostatic agent manufacturer's guidelines. Twenty-five psi of pressure was measured by the TIF scale for 5 minutes, and then a 10 lb weight was applied for 30 minutes. After 35 minutes of pressure on the wound (manual pressure and the pressure dressing), the standard pressure dressing was removed, being careful to leave the clot intact. The petroleum gauze was used to allow removal of the pressure dressing with minimal clot disruption. For the purposes of this study, hemostasis was defined as a clot formation with oozing of no more than 2% of the swine's total blood volume over a 5-minute period (approximately 100 mL in a 70 kg pig). Swine blood volume approximates that of the adult human at 70 mL per kg. Blood loss was measured over 2 time periods, the initial injury to intervention and the intervention to the completion of the study. Measurement was accomplished through gentle suctioning of the blood in the distal part of the wound and collection on absorbent pads underneath the animal. In addition, all the dressings and hemostatic agents were weighed before their application and again at the conclusion of the experiment to determine the amount of exsanguination. The blood loss from the initial injury was determined by the weight of dressings before and after the transection of the femoral vessels, as well as any blood collected through suctioning of the wound. To determine the effectiveness of the hemostatic agents, the investigators determined blood loss in the same manner after the intervention.

## RESULTS

The minimum number of animals was used to obtain a statistically valid result. A large effect size was determined for this experiment based upon a review from previous work by Burgert et al. Using G-Power 3.00 (Institut Fur Experimentelle Psychologie, Dusseldorf, FRG), an effect size of 0.60, a power of 0.80 and an alpha of 0.05, it was determined a sample size of 15 swine per group (30 total) was needed for this study.[14] All subject specimens were within normal limits. Swine of similar size and weight were used in both groups. The QuikClot Combat Gauze group ranged from 70 to 89 kg (mean=76.4, SD=±8.4 kg) and the control group ranged from 70 to 84 kg (mean=77.6, SD=±5.6 kg). There were no statistically significant differences between the groups in reference to the amount of initial one minute bleeding ($P$=.417). The QuikClot Combat Gauze group ranged from 300 to 900 mL (mean=541.6, SD±243 mL) and control group ranged from 205 to 862 mL (mean=554.2, SD±305 mL). The body weights, NPO fluid defect and replacement, core body temperatures, arterial blood pressures, amount of blood volume, and amount of the initial one minute hemorrhage after the injury were analyzed using a multivariate ANOVA. There were no significant differences between the groups ($P$>.05). Blood loss after 35 minutes of pressure on the wound (manual pressure and the pressure dressing) was calculated for each group over a 5-minute period. The amount of bleeding for the QCG group ranged from 0 to 93 mL (mean=36±112 mL); and the control group ranged from 0 to 421 mL (mean=340±297 mL). An independent $t$ test used to analyze the data indicated there was a significant difference between the groups ($P$=.002), the QCG was more effective than the control.

## COMMENT

Research indicates that hemostatic agents are effective but may fail in the presence of hemodilution. This study compared the effects of QCG to a standard pressure dressing, the control, in a porcine model in the presence of hemodilution. Thirty percent of the subject's blood volume was removed and replaced with a crystalloid fluid bolus using 3:1 ratio to obtain hemodilution. A complex groin injury was generated simulating a blast type injury which is common in combat, the anatomical areas are not protected by conventional body armor, and a tourniquet cannot be placed to control hemorrhage. Both interventions were able to rapidly stop large vessel arterial and venous bleeding when applied to an actively bleeding wound through a pool of blood. The QCG performed significantly better than standard pressure dressing control group indicating that the agent is effective in the presence of hemodilution. This is the first study to investigate the effectiveness of a hemostatic agent in the presence of hemodilution. The QCG was easy to open, simple to use to pack the wound, and did not require premixing. This agent could be easily used by physicians, nurses, and ordinary citizens in providing care to trauma victims in both the military and civilian sectors. In this study, investigators noted the agent did not produce heat with application, and there were no obvious signs of tissue damage. There is significant concern and reports of thermal injury to human tissue with other hemostatic agents.

## CONCLUSION

Based on this study, hemodilution does not alter the formation of a robust clot when QCG is used, thereby minimizing the risk of rebleeding in a class II hemorrhage. Further research should be conducted to determine the maximum effective limits of hemodilution and its effects in a class III hemorrhage with hemostatic agents. Other hemostatic agents should be investigated using the same model.

## REFERENCES


1. Bellamy RF. The causes of death in conventional land warfare: implications for combat casualty care research. *Mil Med*. 1984;149(2):55-62.
2. Champion HR, Bellamy RF, Roberts CP, Leppaniemi A. A profile of combat injury. *J Trauma*. 2003;54(suppl 5):S13-S19.
3. Champion HR. Combat fluid resuscitation: introduction and overview of conferences. *J Trauma*. 2003;54(suppl 5):S7-S12.
4. Mabry RL, Holcomb JB, Baker AM, et al. United States Army Rangers in Somalia: an analysis of combat casualties on an urban battlefield. *J Trauma*. 2000;49(3):515-529.
5. Alam HB, Burris D, DaCorta JA, Rhee P. Hemorrhage control in the battlefield: role of new hemostatic agents. *Mil Med*. 2005;170(1):63-69.
6. Alam HB, Koustova E, Rhee P. Combat casualty care research: from bench to the battlefield. *World J Surg*. 2005;29(suppl 1):S7-S11.
7. Alam HB, Uy GB, Miller D, et al. Comparative analysis of hemostatic agents in a swine model of lethal groin injury. *J Trauma*. 2003;54(6):1077-1082.
8. Santibanez-Gallerani AS, Barber AE, Williams SJ, Zhao BSY, Shires GT. Improved survival with early fluid resuscitation following hemorrhagic shock. *World J Surg*. 2001;25(5):592-597.
9. Tactical combat casualty care page [updated 2010]. US Military Health System Website. Available at: http://www.health.mil/Education_And_Training/TCCC.aspx. Accessed January 2012.
10. Alam HB, Chen Z, Jaskille A, et al. Application of a zeolite hemostatic agent achieves 100% survival in a lethal model of complex groin injury in swine. *J Trauma*. 2004;56(5):974-983.
11. Kheirabadi B. Evaluation of topical hemostatic agents for combat wound treatment. *US Army Med Dep J*. April-June 2011:25-37.
12. Pepe PE, Mosesso VN Jr, Falk JL. Prehospital fluid resuscitation of the patient with major trauma. *Prehosp Emerg Care*. 2002;6(1):81-91.
13. Sondeen JL, Coppes VG, Holcomb JB. Blood pressure at which rebleeding occurs after resuscitation in swine with aortic injury. *J Trauma*. 2003;54(suppl 5):S110-S117.
14. Gegel B, Burgert J, Cooley B, et al. The effects of BleedArrest, Celox, and TraumaDex on hemorrhage control in a porcine model. *J Surg Res*. 2010;164(1):e125-e129.
15. Karsli ED, Erdogan O, Esen E, Acarturk E. Comparison of the effects of warfarin and heparin on bleeding caused by dental extraction: a clinical study. *J Oral Maxillofac Surg*. 2011;69(10):2500-2507.
16. Kheirabadi BS, Arnaud F, McCarron R, et al. Development of a standard swine hemorrhage model for efficacy assessment of topical hemostatic agents. *J Trauma*. 2011;71(suppl 1):S139-S146.
17. Kheirabadi BS, Edens JW, Terrazas IB, et al. Comparison of new hemostatic granules/powders with currently deployed hemostatic products in a lethal model of extremity arterial hemorrhage in swine. *J Trauma*. 2009;66(2):316-328.
18. Kheirabadi BS, Scherer MR, Estep JS, Dubick MA, Holcomb JB. Determination of efficacy of new hemostatic dressings in a model of extremity arterial hemorrhage in swine. *J Trauma*. 2009;67(3):450-460.
19. Lipkin ME, Mancini JG, Simmons WN, et al. Pathologic evaluation of hemostatic agents in percutaneous nephrolithotomy tracts in a porcine model. J Endourol. 2011;25(8):1353-1357.
20. Ogle OE, Swantek J, Kamoh A. Hemostatic agents. *Dent Clin North Am*. 2011;55(3):433-439.
21. Rhee P, Brown C, Martin M, et al. QuikClot use in trauma for hemorrhage control: case series of 103 documented uses. *J Trauma*. 2008;64(4):1093-1099.
22. Burgert J, Gegel B, Neal AR, et al. The effects of arterial blood pressure on rebleeding when BleedArrest, Celox and TraumaDex are used in a porcine model of lethal femoral injury. *Mil Med*. 2012;177(3):340-344.


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# Myofibroma of the Mandible: A Case Report

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## ABSTRACT

This report describes the case of a male aged 28 years who presented with a chief complaint of discomfort and swelling in the mandibular right molar area. An incisional biopsy was performed with a preliminary differential diagnosis of periodontal abscess, fibrotic lesion, or odontogenic tumor. Subsequent excision of the lesion was performed and histologic analysis confirmed the diagnosis of myofibroma.

## CASE HISTORY

The patient was a white male aged 28 years whose medical history was noncontributory. He was afebrile with no lymphadenopathy or trismus. He presented to the dental clinic with a chief complaint of pain and swelling in the lower right jaw that was unresolved after scaling and root planing. The patient stated that the swelling started approximately 1 to 2 months prior to his reporting to the dental clinic. The oral examination revealed good oral hygiene, minimal gingival inflammation, and no carious lesions. Teeth No. 30 and 31 had been restored with gold onlays that were in good condition. Buccal swelling was evident in the 30-31 area that was firm, fibrotic, and painful to palpation (Figure 1). Teeth No. 30 and 31 responded within normal limits to vitality testing and were negative to percussion. A complete periodontal examination was performed and the patient was periodontally healthy. A radiographic examination revealed a unilocular radiolucency that extended from the furcation entrance close to the apices of the mesial and distal root of tooth No. 30. The radiolucency did not involve tooth No. 31, and the periodontal ligament was intact around both molars (Figure 2). The differential diagnosis included: periodontal abscess, fibrotic lesions, and odontogenic tumor.

## SURGICAL PROCEDURE

After administering an inferior alveolar nerve block in the right mandible, mucoperiosteal flaps were elevated from teeth No. 28-31. Upon flap reflection, extensive resorption of the buccal plate in tooth No. 30 area was revealed. An incisional biopsy was performed to diagnose the lesion and determine a course of treatment. The flaps were closed with 4-0 vicryl and the patient scheduled for suture removal and a review of the oral pathology report. A week later the microscopic examination of the specimen confirmed a diagnosis of myofibroma. The results were reviewed with the patient and subsequent removal of the lesion scheduled. Several weeks later the patient returned for removal of the myofibroma. An inferior alveolar nerve block was performed in the lower right mandible. Mucoperiosteal flaps were reflected exposing the fibrotic lesion and the severe erosion of the buccal plate (Figures 3 and 4). The interproximal bone levels were within normal limits and the buccal furcation was intact despite the missing buccal plate. The entity was surgically excised (excisional biopsy) and the specimen placed in 10% formalin. The area was thoroughly debrided and osteoplasty performed. The surgical site was closed with 4-0 vicryl and postoperative instructions reviewed. Acetaminophen with codeine and chlorhexidine mouth rinse was prescribed. An ice pack was given to the patient to minimize swelling. The patient returned one week later for suture removal.

Figure 1. Buccal swelling in the area of teeth No. 30 and 31.

## GROSS AND MICROSCOPIC FINDINGS

The specimen was received in a container of 10% formalin and consisted of multiple soft tissue masses measuring from 0.3 cm to 1.5 cm at its greatest dimension. The largest specimen was serially sectioned (Figure 5). Microscopically, the tumors are well-defined or infiltrative,[1] arranged in whorls or short interlacing fascicles of spindled shaped myofibroblastic cells (Figure 6).[2] These cells appear intermediate between smooth

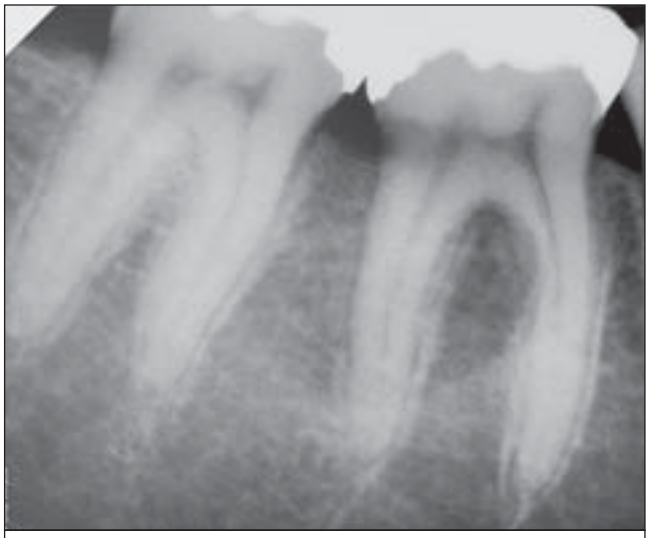

Figure 2. Periapical film of of teeth No. 30 and 31.

Figure 3. Myofibroma exposed.

muscle cells and fibroblasts[1] and have pale pink cytoplasm. The nuclei are elongated and blunt-ended with a vesicular chromatin pattern and one or 2 small basophilic nucleoli. Interspersed between the whorls of eosinophilic myoid cells are more cellular areas of primitive rounded, polygonal, or somewhat spindled shaped cells. These cells have limited cytoplasm and larger hyperchromatic nuclei.[2] These areas are highly vascular with branching hemangiopericytoma-like endothelial lined vascular channels and are usually concentrated in the center of the tumor.[3-6] At low power the pattern between the 2 cell types is described as having a biphasic or zoned appearance.[3,4,6,7] Pleomorphism or atypia are not expected features, however, focal calcification, stromal hyalinization, and necrosis are sometimes present. Mitotic activity is negligible.[1,3] Tumor cells are reactive to vimentin, smooth muscle actin, and muscle specific actin, and are nonreactive to desmin, S-100 protein, epithelial membrane antigen, and keratins.[3,4,8]

Figure 4. Eroded buccal plate, area of tooth No. 30.

## COMMENT

This case presents an excellent opportunity to develop a differential diagnosis for buccal swellings in the oral cavity. Epithelial and mesenchymal lesions can produce soft tissue masses. The swellings may be developmental, inflammatory, of neoplastic origin, or represent oral manifestations of a systemic disease. The radiolucent appearance of this lesion mitigates it being a calcifying odontogenic tumor. During the development of differential diagnoses, some factors to consider include location of the lesion, consistency, and the presence or absence of pain. An important component in diagnosis is to remember that the most commonly occurring lesions are most often what you encounter. The use of vitality testing and periodontal evaluations along with radiographic surveys can eliminate lesions of periapical or periodontal origin. The focus can now be shifted to the more common developmental odontogenic or neoplastic entities. In this case, firm fibrotic lesions to consider include myofibroma, irritation fibroma, neurofibroma, angiofibroma, myofibromatosis, and fibrotic pyogenic granuloma.

Myofibromatosis is an admixture of myofibroblasts and fibroblasts. Lesions fall into 2 categories: superficial myofibromatosis with nodules confined to the subcutaneous and submucosal stroma with occasional involvement of skeletal muscle or bone; and generalized myofibromatosis with visceral lesions.[9] Myofibromatosis presents in the paraoral area as single or multiple submucosal nodules, usually in neonates and infants.

Traumatic fibroma may arise in any location and represents fibrous hyperplasia due to trauma. Traumatic fibroma may be clinically indistinguishable from true neoplasms, benign salivary tumors, or cysts.[10]

Odontogenic fibroma is a benign neoplasm that presents as a painless expansion of the cortical plates.[11] This tumor occurs as frequently in the maxilla as it does in the mandible. Root resorption or divergence is common.

Neurofibroma arises from the sheath cells of nerves and the mandible is the most common site for central nerve sheath neoplasms.[12] Expansion of the buccal plate is common with no associated pain. Paresthesia may or may not be present.

The pyogenic granuloma is a benign mass of exuberant granulation tissue produced after injury (or local infection) resulting in excess vascular tissue.[10] The mass may become fibrous over time. The treatment is conservative surgical removal with a slight chance of recurrence.

Myofibroma is a rare benign soft tissue neoplasm of contractile myoid cells with predilection for the head and neck.[5,9,13,14] It occurs over a wide age range but is usually seen in young adults, mean age 27.[12] The most frequently affected areas are the cheeks, tongue, mandible, lips, palate, trunk, and extremities.[13] Myofibromatosis describes the multicentric and more aggressive form, usually seen in neonates and infants.[3] Solitary myofibromas are more common than the multicentric form[5] and typically present as a firm painless slow growing submucosal mass[7] which may exhibit rapid growth and can often spontaneously regress.[4,12,14] The radiographic appearance is nonspecific and may appear as a well-demarcated or ill-defined radiolucency, with or without calcifications.[15] Intraosseous tumors occur most commonly in the mandible.[2,14]

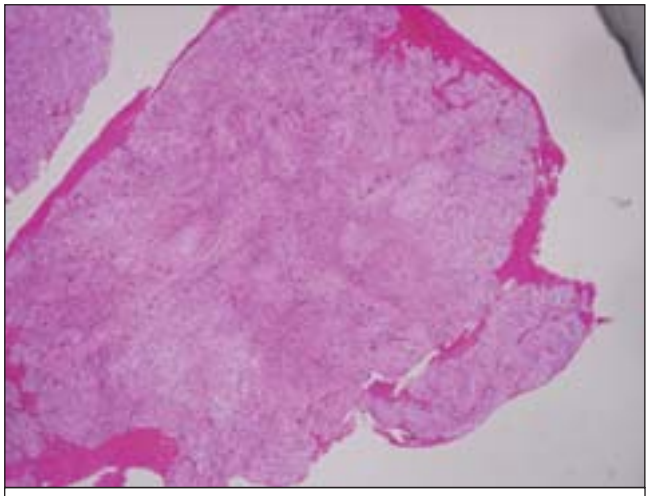

Figure 5. Serially sectioned tumor.

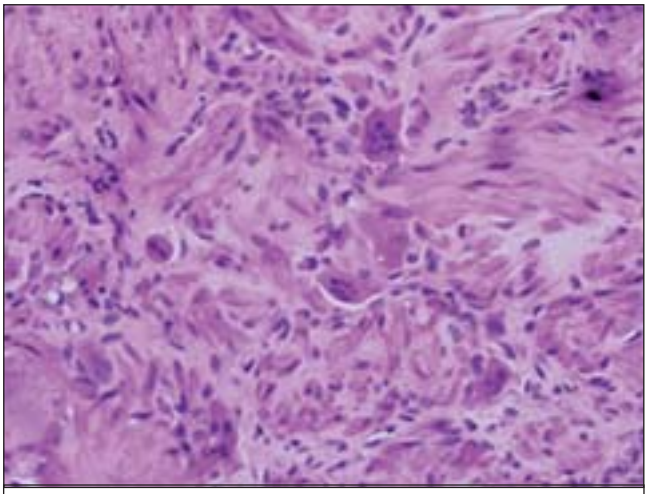

Figure 6. Myofibroblastic cells, magnification ×40.

## REFERENCES


1. Sedghizadeh PP, Allen CM, Kalmar JR, Miloro M, Suster S. Solitary central myofibroma presenting in the gnathic region. *Ann Diagn Pathol*. 2004;5:284-289
2. Allon I, Vered M, Buchner A, Dayan D. Central (intraosseos) myofibroma of the mandible: clinical, radiologic, and histopathologic features of a rare lesion. *Oral Surg Oral Med Oral Pathol AOral Readiol Endod*. 2007;103(4):e45-e53.
3. Jones AC, Freedman PD, Kerpel SM. Oral myofibromas: a report of 13 cases and review of the literature. *J Oral Maxillofac Surg*. 1994;52:870-875.
4. Scheper MA, Difabio VE, Sauk JJ, Nikitakis NG. Myofibromatosis: a case report with a unique clinical presentation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2005;99(3):325-330.
5. Vered M, Allon I, Buchner A, Dayan D. Clinicopathologic correlations of myofibroblastic tumors of the oral cavity. II. Myofibroma and myofibromatosis of the oral soft tissues. *J Oral Pathol Med*. 2007;36(5):304-314.
6. Oliver RJ, Coulthard P, Carre C, Sloan P. Solitary adult myofibroma of the mandible simulating an odontogenic cyst. *Oral Oncol*. 2003;39(6):626-629.
7. Lingen MW, Mostofi RS, Solt DB. Myofibromas of the oral cavity. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1995;80(3):297-302.
8. Montgomery E, Speight PM, Fisher C. Myofibromas presenting in the oral cavity: a series of 9 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2000;89(3): 343-348.

9. Foss RD, Ellis GL. Myofibromas and myofibromatosis of the oral region: A clinicopathologic analysis of 79 cases. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2000;89(1):57-65.
10. Eversole RL. *Clinical Outline of Oral Pathology*. Philadelphia: Lea and Febiger;1984:101.
11. Fowler CB. Benign and malignant neoplasms of the periodontium. *Periodontol 2000*. 1999;21:33-83.
12. Neville BW, Damm DD, Allen CM, Bouquot JU. Oral and Maxillofacial Pathology. Philadelphia: W.B. Saunders; 2002:457-461.
13. Fletcher CDM, Unni KK, Mertens F, eds. *World Health Organization Classification of Tumors. Pathology and Genetics of Tumours of Soft Tissue and Bone*. Lyon, France: IARC Press; 2002:59-61.
14. Sugatani T, Inui M, Tagawa T, Seki Y, Mori A, Yoneda J. Myofibroma of the mandible. Clinicopathologic study and review of the literature. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1995;80(3):303-309.
15. Kempson RL, Fletcher CDM, Evans HL, Hendrickson MR, Sibley RK. *Atlas of Tumor Pathology. Tumors of the Soft Tissues*. Washington, DC: American Registry of Pathology, Armed Forces Institute of Pathology; 1998;64-67.


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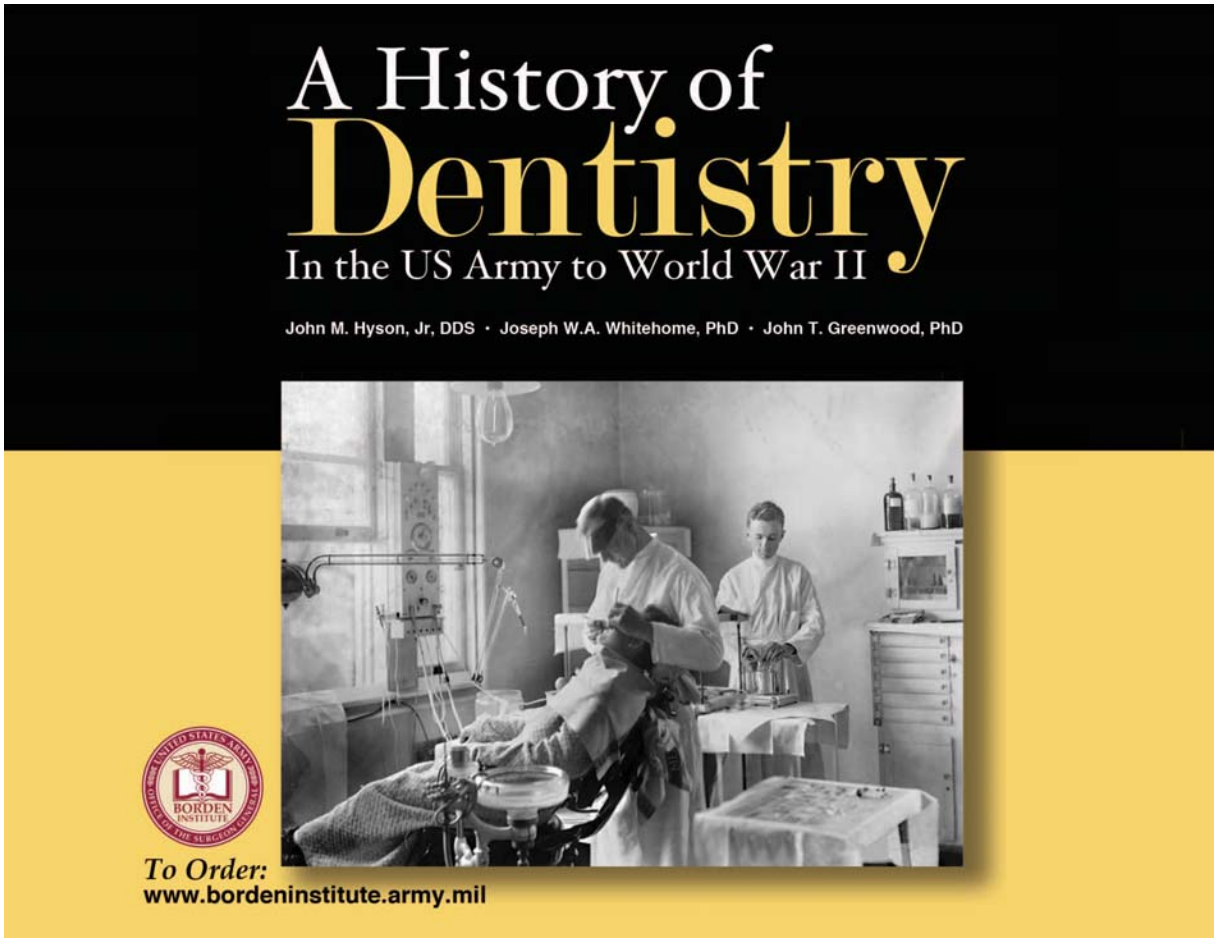

# Dentistry's Role in the History of the Walter Reed Army Medical Center

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The military tradition of "casing the colors" symbolizes the closing of a unit's operations. When the Walter Reed Army Medical Center (WRAMC) cased its colors on July 27, 2011, the impact was a cessation of operations of the many tenant units associated with the WRAMC. Two of those units were dental services delivery commands: the US Army Northern Region Dental Command and the Walter Reed Dental Activity. This history of Army dentistry at the WRAMC was prepared in recognition of the historical significance and legacy of its contribution to both the profession of dentistry and Army medicine as a whole.

In 1909, the first patients were admitted to a new Walter Reed General Hospital. These were the beginnings of what would quickly grow into a medical center founded on principles that would integrate patient care, teaching and research.[1] In 1909, the dentistry profession was represented in the Army only in the form of 30 contracted civilian dental surgeons[2(p203)] (as explained later, there were no commissioned dental officers until 1911). There is no indication that any of the 30 were assigned to Walter Reed General Hospital. However, dental organizations evolved, including dental and maxillofacial treatment in the hospital, and oral pathology services in the Armed Forces Institute of Pathology. The Army Medical Center was established at the hospital campus area in 1923, and in 1951 the entire complex was redesignated Walter Reed Army Medical Center.[1] Tenant units at the facility over the years included dental activities, a regional dental command, an area dental laboratory, the Army Dental School, and the US Army Institute of Dental Research. Education and training programs were imbedded in these dental organizations.

## FIRST CLINICAL DENTAL CARE

On March 3, 1911, Congress directed the Army to create a dental corps of commissioned dental officers. Hyson et al indicates that the first mention of dental officers at Walter Reed General Hospital was April 1917, "One dental officer was on duty and gave dental service to the entire command."[2(p279)] The declaration of war with Germany that same month changed this situation:

> From three dental surgeons in 1918, the personnel of the department increased to nine dental officers.… Five female technicians were on duty in the hygienic department of the clinic. This permitted the dental officers to spend their entire time operating.[2(p428)]

Weed[3] describes the organization of the Walter Reed General Hospital during World War I, including a dental department and a maxillofacial section in the Department of Professional Services. The following excerpts provide a good description of dental service at Walter Reed during the World War I era:

> The chief of the dental department was responsible for the dental service rendered at the hospital, for the supervision and instruction of all personnel assigned to his division, and for all the public property under his control. All military patients admitted to the hospital were examined by the dental survey officer, who furnished a report to the chief of his department. The chief of the dental department furnished imperative dental attention whenever indicated and elective dental attention as far as possible.
>
> Dental section. The dental service was divided into five subsections: Dental hygiene; X-ray; operative; prosthetic and oral surgery; and one dental officer for the survey of patients. The completion of the new dental building in August and its immediate occupancy facilitated the successful detachment of the dental department. The new building consisted of a large operating room, adequate for nine operators, an oral surgery department, including an operating room, and an extracting and record room, and quarters for the officer of the day and sergeant in charge, together with necessary storage space. A dental X-ray laboratory and developing room were provided and an officer was detailed to care for this work. From three dental surgeons in 1918, the personnel of the department increased to nine dental officers, one of whom was on duty to render emergency treatment at all hours of the day and night. In January, 1919, the prosthetic department was organized for the construction of splints for maxillofacial cases and prosthetic restoration of all kinds.…
>
> Maxillofacial section. The first maxillofacial patients arrived at the hospital on January 15, 1919, at which

time Walter Reed General Hospital was one of the three hospitals designated by The Surgeon General's Office to receive this class of patients. They were scattered throughout the surgical wards at first, until a chief of section was detailed to care for them, in February, when they were all assembled in three wards. Prior to March very little surgical operative work was done.… Coordination with the dental surgeon, necessary in the treatment of most of the cases, was early established.

At the end of the year 1918 the annual report for the hospital shows a capacity of 2,500 beds, and in the same report the record of the completion of temporary buildings, which includes the construction for the years 1917 and 1918, stands as follows:… Dental building: One-story tile construction, 24 by 350 feet, occupied by the dental, eye, ear, nose, and throat clinics.

## DENTAL COMMAND AND CONTROL ORGANIZATIONS

Initially and for many decades, clinical dental care was delivered at Walter Reed under the direct command of the hospital commander. In 1973, Health Services Command was established along with installation level reorganization such that dental services were provided by a hospital dental company, but it also was controlled by the Walter Reed Army Medical Activity and hospital commander. Studies of dental management by Dental Corps Chiefs MG Edwin Smith and MG Surindar N. Bhaskar resulted in public law, implemented October 20, 1978 that established the US Army Dental Activity (DENTAC) separate from the hospital and Medical Activity, and commanded by an Army Dental Corps officer[4] (J. E. King, oral communication, July 2011). Prior to the closing of WRAMC in 2011, the Walter Reed Dental Activity (WR DENTAC) operated 4 dental clinics supporting the National Capital Region: Walter Reed Hospital Clinic, Fort McNair, the Pentagon, and the Forest Glen-WRAMC Annex (T. R. Tempel Jr., written communication, July 2011).

As the Army Medical Department continued to adapt its command structure to the operational requirements of the Army, on 1 November 1993 it established the US Army Dental Command (DENCOM) with the WR DENTAC as one of 31 dental activities and 20 dental clinic commands. There were 8 dental service support areas (DSSAs) organized to reduce the span of control required of DENCOM. The Commander, WR DENTAC reported directly to the Commander, DENCOM, and had additional responsibilities as commander of the new administrative layer, the North Atlantic Dental Service Support Area, which evolved into the Northern Regional Dental Command (NRDC) in 1998.[4] The NRDC encompasses 7 dental activities and 3 dental clinic commands in 21 states and Washington, DC (T. R. Tempel, Jr., written communication, July 2011).

The Northern Regional Dental Command and Walter Reed Dental Activity focused on the dental health and readiness of Soldiers. The command also had the mission of operating 4 graduate education programs in dentistry. These training programs produced highly trained dental officers in the fields of oral and maxillofacial surgery, endodontics, and comprehensive dentistry. Additionally, the Soldiers of the Northern Regional Dental Command support 10 installations which deploy, mobilize, and demobilize Soldiers in support of Operation Enduring Freedom and previously Operation Iraqi Freedom. (T. R. Tempel, Jr., written communication, July 2011).

## GRADUATE DENTAL EDUCATION

By 1921, Walter Reed had been offering specialty residency programs in oral surgery, periodontics, endodontics, prosthodontics (fixed and removable), and pedodontics/orthodontics for several years. It also provided the dental internship, a precursor to the 2-year general dentistry residency (T. R. Tempel, Jr., oral communication, July 2011). However, recognizing the need for advanced training of Army dental officers in both clinical specialties and basic science, in September of 1921, three Dental Corps officers were sent to Dewey School of Orthodontic Training at New York University, and one officer to the Army Medical School for bacteriology training.

Commanders of the Walter Reed Dental Activity (DENTAC)

| | |
|---|---|
| 2010-2011 | COL Thomas R. Tempel, Jr. |
| 2008-2010 | COL Priscilla Hamilton |
| 2005-2008 | COL M. Ted Wong |
| 2002-2005 | COL Lawrence Cook |
| 1998-2002 | COL Thomas Striano |
| 1998 | COL Brent Koudelka |
| 1996-1998 | COL Gary Allen |
| 1993-1996 | COL William Priddy |
| 1990-1993 | COL Charles Bole II |
| 1989-1990 | COL Jack Vincent |
| 1988-1989 | COL Robert Brady |
| 1985-1988 | COL Robert Webster |
| 1984-1985 | COL Harley Ellinger |
| 1983-1984 | COL Peter Taylor |
| 1980-1983 | COL Emery Russell, Jr. |
| 1977-1980 | COL Ronald L. Vanswol* |
| 1976-1977 | COL William Radentz† |

*Became first commander of the new DENTAC October 20, 1978.
†COL Radentz directed dental activities during the MEDDAC dental management trials study.

## DENTAL INTERNSHIP PROGRAM

During Colonel Frank P. Stone's tenure as Dental Corps Chief, his office announced that effective July 1, 1939, the War Department and Surgeon General had authorized 8 dental internships at Army general hospitals. The goal was to improve on the skills of dental officer candidates and provide familiarity with the unique requirements of military dentistry.

Three interns were assigned to the Walter Reed General Hospital, and one each was assigned to the Letterman General Hospital

(San Francisco), Fitzsimons General Hospital (Denver), Army and Navy General Hospital (Hot Springs, Arkansas), William Beaumont General Hospital (El Paso), and the Station Hospital (Fort Sam Houston, Texas). The Army Dental School at the Walter Reed Army Medical Center developed a standardized training program for the internships emphasizing clinical dentistry and oral surgery.[2(pp814-815)]

## ARMY DENTAL SCHOOL

A new and critical link in the chain of professional development for dental officers was postgraduate level Army Dental School located on the grounds of Walter Reed General Hospital. Dental educators John Sayre Marshall and Robert Oliver conceived an Army dental school during meetings of the dental examining board in February 1901. As Oliver later related, "The primal reason actuating the original thought of these two dental educators was the manifest necessity of preparing and training young dental men, just entering the Corps, to meet the new conditions of life—physical, mental, and professional—in which they were suddenly thrust."[2(pp720-723)] COL William H. G. Logan, who became the first Chief of the US Army Dental Corps in 1917, strongly advocated such a school in February 1911.

However, it was not until January 6, 1922, that the Secretary of War authorized the new Army Dental School as a special service school of the War Department. The School's first commandant was COL Seibert D. Boak who had led the Dental Section of the Army Sanitary School at Langres, France during World War I. The Army Dental School's mission was to:

> teach newly appointed dental officers the practical application of approved methods of professional procedures in the military service, to furnish postgraduate courses in advanced military dental surgery to members of the Dental Corps, to provide an organization for the investigation, study and research of dental problems, a source of authoritative information on professional matters, and the training of enlisted personnel to meet the requirements of the dental service.[2(p721)]

MG Merritte W. Ireland, The Army Surgeon General, addressed the school's formal opening on 9 January 1922. Ireland's speech strongly endorsed not only the Army Dental School but also the role of the Dental Corps within the Army Medical Department. According to the *Annual Report of the Army Surgeon General, 1922*,[9] the opening of the Army Dental School corrected some of the most significant deficiencies in the development of the dental service and was one of the most important events in the history of the Dental Corps.[2(pp720-723)]

The Army Dental School was located in these temporary World War I buildings from 1922 to 1930 when the buildings were condemned and demolished. This photo was taken March 23, 1923. Source: Walter Reed Army Medical Center, Directorate of Public Works Archives.

Army Medical Schools Building 40 at the Army Medical Center in 1932. The Army Dental School and Walter Reed Central Dental Laboratory occupied parts of the first and second floors of the north wing of the building. In 1962, the US Army Institute of Dental Research occupied these spaces. Reproduced from: A History of the Army Dental School, March 14, 1938–Sept. 17, 1940. Source: Research Collections, Office of Medical History, US Army Medical Command, Fort Sam Houston, Texas.

The Army Dental School was located in temporary World War I buildings from 1922 to 1930, when those buildings were condemned. In October 1932, the Army Dental School and Walter Reed Central Dental Laboratory occupied parts of the first and second floors of the new north wing of the Army Medical School building 40. The new location contained the director's office, clerk's room, executive office, library, oral surgery amphitheater, bacteriology laboratory, preparation room, pathology laboratory, prosthetic laboratory (which housed the Walter Reed Central Dental Laboratory), chemical laboratory, mail room, X-ray dark room, photographic

room, and oral hygiene clinic (6 chairs equipped with Ritter Tri-Dental units). During a visit to the school's new facilities, Dr G. Walter Dittmar, then president of the American Dental Association, declared it to be one of the finest and most completely equipped that it had been his pleasure to inspect.

The Army Dental School was redesignated in 1948 as the Dental Division of the Army Medical Research and Graduate School, Army Medical Center, Washington, DC. Concurrently, the enlisted training school was moved to Fort Sam Houston. In 1955, the name was changed again to the Army Medical Service Graduate School. This redesignation resulted in the upgrading of the education programs to graduate and postgraduate levels.[10]

## US ARMY INSTITUTE OF DENTAL RESEARCH

Agencies change, seeking new ways to become more efficient and effective. Such is the case of the Army Dental School. In addition to the multiple personnel development missions with which the Army Dental School was founded on January 6, 1922, there were also the requirements:

> to provide an organization for the investigation, study, and research of dental problems, and serve as a source of authoritative information on professional matters.…[2(p721)]

As Chief of the Dental Corps, MG Joseph L. Bernier, realigned the focus to oral and dental research. On January 1, 1962, the dental division of the school was completely reorganized and renamed the US Army Institute of Dental Research (USAIDR). It was given separate institute status as an element of US Army Medical Research and Development Command.[10,11]

The USAIDR developed simplified techniques which allowed rapid and effective treatment of war-related maxillofacial injuries and dental diseases. It developed required military information on epidemiology, etiology, clinical treatment, the prevention and control of oral disease, and used the information as a basis for research. It conducted basic and clinical investigations on dental materials. It provided instruction as required for graduate education in the Advanced Theory and Science of Dental Practice Course and dental residency programs in clinical oral pathology, endodontics, and periodontics. USAIDR also conducted continuing education and training of dental personnel to maintain high professional treatment standards.[10]

Clinically relevant research designed to improve patient care was always the goal of USAIDR. Emphasis on clinical research began with the caries investigations of CPT Fernando Rodriguez in the 1920s, and was elaborated by those of MG Surindar N. Bhaskar and associates in the late 1960s and early 1970s.[10]

Between the time of CPT Rodriguez's work and World War II, much of the research emphasized methods of emergency treatment and the improvement of dental materials. Following World War II, attention focused on the importance of decalcification of teeth by bacteria. Investigations on Lactobacillus acidophilus and its decalcifying potential on sound enamel was a major project.[10] During the 1950s, the interest shifted to the nutritional aspects of dental disease. Research since the middle 1960s has emphasized problems and treatment of maxillofacial combat wounds.[10]

In October 1993, the USAIDR was reorganized as the US Army Dental Research Detachment (DRD), subordinate to the Walter Reed Army Institute of Research, located at the Walter Reed Army Medical Center. By 1997, the DRD had moved to the Great Lakes Naval Center near Chicago, ending the dental research and development presence at Walter Reed[4] (J. E. King, oral communication, July 2011).

At Great Lakes, the DRD collocated with the Navy's Institute of Dental and Biomedical Research and the Air Force's Detachment 1, Dental Evaluation and Consultation Service. Sometime between 1997 and 2010, the DRD was redesignated as the US Army Dental and Trauma Research Detachment (DTRD). On March 24, 2010, DTRD and the Navy and Air Force activities moved from the Great Lakes Naval Center to Fort Sam Houston, Texas. The 3 military dental research units are collocated in a new, 25,000 sq ft facility, the Battlefield Health and Trauma Research Institute[4,12] (J. E. King, oral communication, July 2011).

## DENTAL AND ORAL PATHOLOGY

In May 1862, Army Surgeon General William Hammond ordered establishment of the Army Medical Museum. Renamed the Armed Forces Institute of Pathology in 1949, it was relocated to the Walter Reed Army Medical Center in 1955. The Armed Forces Institute of Pathology (AFIP) has become a world leader in pathology consultation, education, and research, including an important dental and oral pathology component.[5(p3)]

The first Dental Corps officer was assigned to the Medical Museum/AFIP on July 1, 1926. In 1931, the American Dental Association designated the Dental Section of the Army Medical Museum as the official museum of the dental profession in the United States.[6(p18)] Later, the National Dental Museum, a Smithsonian Institute

facility, was established in Baltimore, Maryland.

The essential instrument that tied AFIP to the medical community it serves was the establishment of registries for various groupings of diseases. The Dental and Oral Pathology Register was added in 1933, which served to reactivate an 1895 arrangement with the American Dental Association (ADA) designating the Army Medical Museum as the national depository for the organization's dental specimens.[5(p69)]

The Dental and Oral Pathology Register became part of the American Register of Pathology, formed in cooperation with the National Research Council Division of Medical Sciences in 1930. Within 3 years, the Dental and Oral Pathology Register had 483 accessions. As time passed, accessions began to come from civilian dental professionals through the ADA as well as from Dental Corps officers. This collection provided significant research material and allowed the resident dental officer at the Army Medical Museum to provide consultation services and to conduct important pathological research. LTC James B. Mann was the assigned dental officer through much of the 1930s and made major strides on periodontoclasia and its surgical treatment. CPT Joseph L. Bernier, a trained oral pathologist and future chief of the Dental Corps (1960-1967), followed Mann as chief of oral pathology at the museum in 1938. By 1941, the registry had grown to 2,485 items.[2(pp789-800)] On May 26, 1955, AFIP Building #54 was dedicated at the Walter Reed Army Medical Center, with President Dwight D. Eisenhower speaking at the formal opening ceremony.

The Armed Forces Institute of Pathology continued to expand its advances in lifesaving diagnostic technologies by world-class pathologists and scientists. The many varied pathology branches conducted numerous research studies, education programs, and publications.[5(pix)] The Institute prepared personnel, including forensically trained dental officers, in forensic pathology skills through training and hands-on experience. Repeatedly, AFIP oral pathologists dramatically demonstrated their capabilities in dental identification while playing significant roles in numerous mass casualty situations, including the 1985 air crash that killed 248 Soldiers of the 101st Division near Gander Newfoundland, and, of course, the September 11, 2001 attacks on the Pentagon and World Trade Center.[4(pp18,22)]

The congressionally mandated military Base Closure and Realignment cycle of 2005 disestablished AFIP and relocated its militarily relevant functions to the National Naval Medical Center, Bethesda, Maryland; Dover AFB, Delaware; and Fort Sam Houston, Texas.[7] In addition, the Joint Pathology Center, the federal government's pathology resource center, was established in Silver Spring, Maryland.[8]

| Commanders and Directors, Dental School and Dental Research Activities at Walter Reed | |
|---|---|
| **Commandants, US Army Dental School** | |
| COL Seibert D. Boak, DC | 1922-1923 |
| COL Franklin P. Wing, DC | 1923-1925 |
| MAJ William S. Rice, DC | 1925-1929 |
| LTC Frank L. K. Laflamme, DC | 1929-1932 |
| **Directors, US Army Dental School** | |
| COL Robert H. Mills, DC | 1932-1936 |
| LTC John W. Scoval, DC | 1936-1938 |
| COL Terry P. Bull, DC | 1938-1940 |
| Dental school suspended with advent of World War II, used as field medicine training school | 1940-1948 |
| **Directors, Dental Division, US Army Medical Research and Graduate School** | |
| COL John S. Oratel, DC | 1948-1953 |
| COL George T. Perkins, DC | 1953-1954 |
| COL Thomas A. McFall, DC | 1954-1961 |
| **Directors, US Army Institute of Dental Research** | |
| COL George H. Timke, DC | 1961-1966 |
| COL George W. Burnett, DC | 1966-1968 |
| COL Peter M. Margetis, DC | 1968-1969 |
| COL Richard L. Howard, DC | 1969-1970 |
| BG Sirindar M. Bhaskar, DC | 1970-1973 |
| COL Simon Civjan, DC | 1973-1974 |
| COL Duane E. Cutright, DC | 1974 |
| **Commanders, US Army Institute of Dental Research** | |
| COL Duane Cutright | 1974-1980 |
| COL Thomas Sweeney | 1980-1985 |
| COL Harold Plank | 1987-1992 |
| COL William Posey | 1992-1996 |
| COL Michael Rethman | 1996-1999 |
| COL Leslie Raulin | 1999-2000 |

Source: Cutright and Daniels[10]
J. E. King, oral communications, July 2011

## CENTRAL DENTAL LABORATORY

Dental officers in the 1920s had to devote as much of their time as possible to their many patients, leaving them little time to work in their laboratories on prosthetic

The Armed Forces Institute of Pathology (AFIP) Building #54, completed in 1955. Source: National Museum of Health and Medicine, AFIP, WRAMC History Office, PAO Historical Collection.

appliances. It was not until fiscal year 1927 that the Army Dental School produced a sufficient number of well-trained enlisted dental mechanics who could make and also oversee the manufacture of prosthetics in a dental laboratory. This new resource relieved the dentists and their technicians of this time-consuming aspect of their work.

The Central Dental Laboratory moved from the Walter Reed Army Institute of Research into its own 9,500 sq ft building on February 23, 1954. Founded in 1927, the Laboratory's mission was to provide military patients with the best possible prosthodontic therapy. Source: WRAMC History Office, PAO Historical Collection.

In 1926-1927, the dental division opened 3 new corps area dental laboratories that provided the same service to Army dentists as commercial laboratories provided to their civilian colleagues. The first laboratory, Walter Reed Central Dental Laboratory, was opened at Walter Reed General Hospital and served all dental officers in the First through Seventh Corps areas. A similar laboratory at Letterman General Hospital supported the Ninth Corps Area, and another at the Station Hospital at Fort Sam Houston supported the Eight Corps Area.[2(p734)]

War Department Circular No. 42, dated August 3, 1938, redesignated the existing corps area dental laboratories as central dental laboratories and added new ones as follows: Army Medical Center, Washington, DC, serving the First, Second, and Third Corps areas; Fort McPherson, Georgia, serving the Fourth and Fifth Corps areas; Jefferson Barracks, Missouri, serving Fort Knox, Fort Benjamin Harrison, and Fort Hayes, and the Sixth and Seventh Corps areas; Fort Sam Houston, serving the Eighth Corps Area; and Presidio of San Francisco, serving the Ninth Corps Area.[2(pp800-803)]

The tenant central dental laboratories were exempt from the control of local post commanders, except for the purpose of "supply, inspection, and discipline." The Army Dental School trained:

> most of the enlisted supervisors and mechanics for the central dental laboratories.… No supplies and equipment for making dentures were to be given to other stations within the continental United States.[2(pp800-803)]

The trained enlisted personnel coming from the Army Dental School meant that the laboratories would "become a great asset to our expanding dental service.…" Brigadier General Leigh Fairbank said:

> The mechanical processes will now be delegated to properly trained enlisted men, under the supervision of a few dental officers. Now, the great majority of dental officers can devote their entire time to the dental health problems of a greater number of personnel.[2(pp800-803)]

The "central dental laboratory" designation was changed to "regional dental activity" in 1962, and to "area dental laboratory" in 1981. In 1991, the area dental laboratories at Alameda, California, and Walter Reed Army Medical Center were closed, leaving laboratories at Fort Gordon, Georgia, and Fort Sam Houston, Texas. On October 1, 1997, the laboratory at Fort Sam Houston was closed, leaving Fort Gordon's laboratory as the only remaining facility for dental support. On July 1, 1998, that laboratory was redesignated as the Army Dental Laboratory.[4(pp15,18,20,21)]

## CONCLUSION

The casing of the colors and closure of WRAMC on July 27, 2011, was an occasion of sadness, pride, and hope for the continued mission of excellence. A visitor to WRAMC is impressed with the relatively small size of the campus (easily walkable) and its enormous impact on development of patient care, teaching, and research in military (and civilian) medicine and dentistry. The caliber of clinicians, educators, researchers, and leaders that WRAMC produced is impressive. The innovations were numerous and spectacular, thinking "outside of the box." Perhaps the relatively small size and close proximity of leaders and educators in medicine and dentistry encouraged "cross-pollination" that would be hard to duplicate today.

We have many wide-spread centers of patient care, teaching, and research "connected" by our digital electronic technology. Even so, one wonders what may be missed by the loss of frequent personal interactions of these diverse leaders in the "close" campus of WRAMC during walks in the hallways, staff meetings, or in the

cafeteria. The interaction of two early pioneers of Army medicine, Surgeon General Merritte Ireland and Chief of Dentistry Robert Oliver, at the WRAMC campus is an excellent example of such benefits. As we look to the bright future of the next phase of WRAMC relocations in Bethesda, Maryland and Fort Belvoir, Virginia, we hope for the same energy, innovation, and determination as in our past.

Today, "center of gravity" of the US Army Dental Corps is primarily the DENCOM Headquarters at Fort Sam Houston. There is also very strong multiservice presence and interaction at Fort Sam Houston. Perhaps we can learn from the WRAMC history and create "pockets" of intimate personal and professional relationships for the sharing of ideas and missions in our future.

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## REFERENCES

1. Fleek SL, Sorge CF. *Walter Reed Army Medical Center. A Century of Service: 1909-2009*. Washington, DC: Walter Reed Army Medical Center; 2011.
2. Hyson JM Jr, Whitehorne J, Greenwood JT. *A History of Dentistry in the United States Army to World War II*. Washington, DC: Borden Institute, Office of The Surgeon General, US Dept of the Army; 2008.

COL Thomas R. Tempel Jr., Commander, US Army Northern Region Dental Command and the Walter Reed Dental Activity, 1SG Kimberley Dubard, Walter Reed DENTAC, and SFC Guillermo Lugo-Beltre, color bearer and NCOIC of WRAMC Dental Clinic, case the colors during the closing ceremonies of Walter Reed Army Medical Center on July 27, 2011. Photo courtesy of the Department of the Army.

3. Weed FW. *Military Hospitals in the United States*. Washington DC: US Army Medical Dept Office of Medical History; 1923:287-307. Lynch C, Weed FW, McAfee L, eds. *The Medical Department of the United States Army in the World War*. Vol 5.
4. Passo SA, King JE. Highlights in the history of US Army dentistry. *US Army Med Dept J*. January-March 2011:8-25. Available at: http://history.amedd.army.mil/corps/dental/DCHighlights2012.pdf. Accessed July 30, 2011.
5. Stone P. *Legacy of Excellence – The Armed Forces Institute of Pathology, 1862-2011*. Fort Detrick, MD: Borden Institute, Office of The Surgeon General, US Dept of the Army; 2011.
6. King JE, Hynson RG. *Highlights in the History of U.S. Army Dentistry*. Falls Church VA: Office of the Chief, US Army Dental Corps, Office of The Surgeon General, US Dept of the Army; 2007. Available at: http://history.amedd.army.mil/corps/dental/general/highlights/Highlights.pdf. Accessed September 2, 2011.
7. *Impact of Terminating, Relocating, or Outsourcing the Services of the Armed Forces Institute of Pathology*. Washington, DC: US Government Accountability Office; November 9, 2007. Report GAO-08-20 Military Base Realignments and Closures. Available at: http://www.gao.gov/products/GAO-08-20. Accessed September 3, 2011.
8. The Joint Pathology Center. Available at: http://www.jpc.capmed.mil/index.asp. Accessed September 5, 2011.
9. *Annual Report of the Army Surgeon General, 1922*. Washington, DC: US War Dept; 1922.
10. Cutright DE, Daniels JL. The US Army Institute of Dental Research: fifty-three years of dedicated research and education. *Mil Med*. 1977;142(1):45-48.
11. Bernier JL. Editorial views and news: military dental research and emergent science. *J Dent Res*. 1963;42(3):749-751.
12. Mellus DE, Amaya J. The US Army Dental and Trauma Research Detachment: Now Part of the Army Institute of Surgical Research. *US Army Med Dept J*. January–March 2011:68-69. Available at: http://www.cs.amedd.army.mil/amedd_journal.aspx. Accessed 4 September 2011.

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# Developing an Operational Casualty Estimate in a Multinational Headquarters to Inform and Drive Medical Resource Allocation

LTC Soo Lee Davis, MS, USA
Col Martin Bricknell, RMC, British Army

## ABSTRACT

This article presents a methodology to construct an operational casualty estimate for insurgent clearance operations conducted in 2 districts around Kandahar City appropriate for a multinational operational headquarters. It demonstrates how to identify relevant and recent historical data to establish a casualty rate, apply it against a tactical operational sequence and population at risk to get a daily casualty estimate, and compare that estimate to the capacity of the medical system. This allows medical planners from any contributing nation to express the medical risk and mitigation plan to operational leadership and the commander.

Medical planners serving on multinational operational staffs need an easy-to-use, accurate, nonproprietary casualty estimate model to properly plan for operations. The estimate tool cannot be software specific because it can be difficult and costly to acquire the software. The software may require special technical hardware and system provisions to operate on NATO equipment, and such permission may not be granted. The underlying data and statistical assumptions must be readily accessible to any contributing nation. Oftentimes, US military-developed casualty estimate models are classified or require US military accounts to access them. This article describes a methodology that the Regional Command South (RC(S)) developed to provide an operational casualty estimate for a critical operation in Kandahar Province. The guidance used to develop this model was NATO joint medical planning doctrine, an excerpt of which follows:

> A thorough threat assessment and a proper analysis of the environment together with a comparison with former campaigns provide the basis for the estimate of severity and patterns of casualties to be expected.… Medical planners will have to cooperate with J2 and J5 staff from the beginning in order to receive early ideas of the concept to be developed. The casualty rate estimation on the timeline produces a diagram showing the estimated casualty flow during the phases and subphases of the operation.… A tool suitable for NATO casualty rate estimation has to be developed based on recent valid data gathered from all types of operations. Hence, a prerequisite for a sufficient tool is a comprehensive database covering the whole spectrum of possible operations. A tool must be user-friendly, but take the complexity of the casualty rate estimation into account. In addition to this it has to be accessible for medical planners involved in NATO operations.[1]

## OPERATIONAL BACKGROUND

RC(S) is one of 6 Afghanistan International Security Assistance Force (ISAF) regional commands. Four Afghan provinces fall under the responsibility of RC(S): Kandahar, Zabul, Uruzgan, and Daykundi. Kandahar Province is the largest, most populated, and was the most critical to ISAF strategic objectives at the time. The medical support in RC(S) was designed around a "hub and spoke" model, with Kandahar as the hub. Kandahar Airfield contained a NATO Role-3 Hospital.[2(pp1-9–1-12)] Camp Hero, adjacent to Kandahar Airfield, included an Afghan National Army hospital, the Kandahar Regional Military Hospital (KRMH). Kandahar City was home to Mir Weis, an Afghan civilian hospital operated by the International Committee of the Red Cross. Zabul and Uruzgan Provinces served as two of the primary spokes from the hub of the healthcare system, both containing Role 2 healthcare facilities.

During the summer of 2010, Afghan National Security Forces (ANSF), supported by ISAF, embarked on security operations in and around Kandahar City. The operational objectives were to protect the civilian population from insurgent intimidation and violence and to promote stability and improved governance by the Government of the Islamic Republic of Afghanistan. The operation, designated Hamkari (meaning "cooperation" in Dari), consisted of 3 stages, the first of which was the

improvement of security and government presence in Kandahar City with the formation of a security ring protection force. This security ring consisted of a network of traffic checkpoints and police substations manned by partnered ANSF and ISAF personnel. This stage was nonkinetic, with the focus on increasing the number of police and security forces available in Kandahar City to directly support the civilian population. Concurrent to this effort, RC(S) began receiving US brigade combat teams to augment the one Canadian battle group whose operational area covered districts south and east of Kandahar City.

The second stage focused on clearing the Arghandab district northwest of Kandahar City. It commenced once 2nd Brigade, 101st Air Assault Division, Task Force Strike, was prepared to conduct deliberate operations in their area. Task Force Strike was successful in clearing key population areas and controlling major access routes into Kandahar City. This stage of the operation served as the anchor for the casualty estimate methodology outlined here.

Stage 3 required the clearance of 2 rural districts west and southwest of Kandahar City, Zhari and Panjwa'i. This stage was separated into phases 3A and 3B. Intelligence reports indicated the density of insurgent fighters was significantly greater in these areas than in Arghandab District. It also contained major insurgent logistical bases, which were heavily protected and fortified with defensive measures, such as improvised explosive device (IED) belts. The terrain, though rural, was much more difficult to operate in, and very conducive to concealing insurgent activities. One of the challenges of the terrain was the large number of grape fields, which consisted of undulating rows of dirt mounds, some as high as 6 feet. These grape fields were extremely difficult to maneuver through, and easily concealed tunnels, weapons caches, and antipersonnel mines, and channelized ISAF forces directly into IED belts emplaced by the insurgents.

The casualty rate in the Arghandab District operation was significant. The intelligence reports of an increased insurgent threat, and the advantage the terrain gave the enemy, suggested the third stage of Hamkari would be very challenging. We anticipated a potential for a higher casualty rate than in Arghandab. Therefore, it was imperative to conduct a thorough casualty estimate in order to assess whether or not RC(S) possessed sufficient medical capacity to support the potential casualty load. This analysis had to be completed early enough to give the healthcare system adequate time to shift assets if levels were determined to be insufficient. The analysis also had to be done quickly, because the operational plan unfolded rapidly and remained very dynamic. It required a casualty estimate methodology just as agile and efficient.

## METHODOLOGY

### Applying Operational Understanding to Develop the Casualty Numbers and Flow Estimate

Casualty estimates are heavily data-driven and best informed through information about the current campaign. Therefore, it is absolutely imperative that as much data as possible is captured in a mineable format. Historically, the RC(S) Combined Joint Medical office (CJMED) maintained a very comprehensive medical evacuation database for every patient handled by the ISAF system. This database has been in place since 2006 and has evolved as medical planners learned which fields were most relevant to inform future questions and analysis.

However, the casualty estimate cannot be generated using medical information alone, it must be coupled with operational information to provide the context for the casualty profile. Operational information is stored within a system termed Combined Information Data Network Exchange (CIDNE), which has been established across the entire theater of Afghanistan. The RC(S) possessed a robust and comprehensive history of key operational information. This, in addition to relevant summary information captured in slides and spreadsheets, provided a robust data set for basic analysis.

Deliberate planning for Phase 3A began in mid July 2010 with operations planned to commence in early September. CJMED planners actively participated in the military decision-making process and were aware of the potential for a much higher rate of casualties. We analyzed the medical capacity in RC(S) to determine its adequacy for increased casualties. To further compound the risk, Phase 3A was planned to commence prior to the Afghanistan elections. This had been a historically high-risk period, with increased insurgent activities intended to disrupt the democratic process through violence and intimidation.

CJMED established the relevant parameters to factor into the estimate. In order to account for the risk associated with the elections period, we analyzed recent RC(S) significant activity data from CIDNE, concentrating on those significant activities that were most likely to cause casualties.

We applied these statistics against the average number of significant activities RC(S) experienced per day in the last month. Applying the intelligence estimate (Joint Staff J2) against this baseline and assuming a gradual

increase in the weeks preceding election day, the peak on election day, followed by a gradual decrease in the weeks after election day, we produced a regional casualty estimate that was based on historical data. This accounted for the risk associated with baseline activities and the elections period.

The next step was to account for the risk associated with Phase 3A operations. We consulted with the Combined Joint Operations section (CJ35) and agreed that the Arghandab clear operation (Stage 2) would be most similar to Phase 3A operations. We determined which units comprised the task force assigned to the Arghandab clear operations, the size of each of those individual units, and the timeline for the operation. This gave us the total size of the force, or population at risk (PAR)—the denominator—as well as the duration of the operation. In order to determine the attrition rate for the Arghandab clear operations, we queried the casualty reporting databases to pull the actual numbers for all categories of casualties for the Arghandab clear operation—the numerator. This attrition rate was used as the "anchor" for determining the estimated casualty rate for Phase 3A operations.

CJ35 then provided a sequence matrix of all events associated with Phase 3A operations, which listed the size of the force (PAR), as well as the planned start and end dates. Since the intelligence estimates indicated Phase 3A operations would be much more intense, given the higher density of insurgent fighters and difficult terrain, CJ35 also added an increased intensity factor (IIF) to the Arghandab attrition rate (AAR). CJ35 applied the following IIF to each operational event: low, 10% more casualties (amber); medium, 20% more casualties (red); high, 30% more casualties (black).

The operational sequence was then placed into another matrix to determine the estimated number of casualties per day. The following formula was used for each event:

$$(AAR+(AAR\times IIF))\times PAR=\text{total number of casualties for the event}$$

We then made assumptions about the distribution of those casualties over the duration of the event. We categorized each event into short (1 to 3 days), medium (4 to 10 days), and long (11 to 21 days) durations. For short events, we expected only 10% of the total number of casualties would be suffered and all of the casualties would occur on the first day of the event. For medium events, we assumed an even distribution of the total expected casualties across a 9-day period. For long events, we presumed casualties would be higher in the early days, and diminish towards the end. To get the total number of casualties expected on any given day, we calculated the number of casualties expected as a result of baseline and elections activities. We mapped the Phase 3A expected number of casualties by event to the actual day the event was to start. We then added across all the simultaneous activities for each day.

### Matching The Casualty Numbers and Flow to the Capacity of the Medical System

The other component that must be understood is the capacity and efficiency of the Role 3 hospitals and the air evacuation assets in RC(S). The CJMED operations section recorded, tracked, and analyzed trends of the hospital capacity and air evacuation performance in RC(S). Because there was rarely an indication that there was insufficient capacity in the air evacuation systems,[3(p1-3)] we did not conduct in-depth analysis on these systems. However, we did know that hospital capacity could present an operational constraint and we sought to better understand the capacity and throughput of the hospital.

In April 2010, the RC(S) Medical Director requested the US Joint Combat Casualty Research Team to conduct a study to analyze the resource utilization in the Kandahar Air Field Role 3 hospital (KAFR3). They were asked to examine operating room utilization, and intensive care unit (ICU) and intermediate care ward (ICW) lengths of stay. Their findings provided a much better understanding of the flow of casualties through the hospital. Most significantly, we determined that casualty rates should be estimated per day, as opposed to per week or per month, because the lengths of stay of all categories of patients was almost always measured in days, and there was a wide variability in the number of casualties in any given day. There was no casualty estimate tool or model already developed that we could find which calculated number of casualties per day. This further necessitated the need for a locally developed methodology.

As expected, given the efficient strategic medical evacuation system and availability of higher levels of care outside of Afghanistan, ISAF casualties spent one day or less in the hospital. There was very little variability around this statistic. Afghan National Security Force casualties spent approximately 2 to 3 days in hospital before they were stable enough to be transferred to an Afghan facility for care. There was much more variability with this statistic. Afghan civilians and Afghan detainees spent the longest time in hospital, 3 to 6 days, and also had the most variability to their lengths of stay. This was primarily because it was not acceptable to transfer Afghan civilians away from their home province, and Afghan detainees that were still under the

custody of ISAF forces could not be transferred out of ISAF facilities for security reasons. Of all the hospital capabilities, ICU bed capacity had to be managed the most carefully because it is a more resource intensive capability, the scarcest capability, and served our most critically injured casualties.

The Table depicts how the ISAF system of care describes the amount of capacity remaining in the hospital. It expresses the amount of risk in exceeding hospital capacity via the traditional military "stoplight" model. This table does not account for the surge capacity that all hospitals possessed to get through a casualty crisis. While BLACK does indicate the highest risk, it does not indicate that the hospital would not be able to manage casualties during that time. It was meant to communicate that the system was under a tremendous amount of pressure and perhaps should be considered an operational constraint.

Hospital capacity expressed as risk.

| Status | ICU Fill | ICW Fill | Overall Fill | Risk |
|---|---|---|---|---|
| Green | ≤50% | ≤50% | Most Constrained of ICU vs ICW | Low |
| Amber | 51% to 75% | 51% to 75% | | Medium |
| Red | 76% to 99% | 76% to 99% | | High |
| Black | ≥100% | ≥100% | | Very High |

Understanding the dynamics of patient flow at KAFR3 helped us understand the casualty profile that the ISAF system of care could absorb in a day and the subsequent impact on available capacity the next day. We determined the range of casualty numbers for GREEN, AMBER, RED, and BLACK status (those numbers are intentionally not presented in this article). This calculation became very important in expressing the risk. Though it would have been ideal to understand the capacity and throughput of Kandahar Regional Military Hospital (KRMH), there was not the same capability to track and store data for later analysis. Given the ISAF system of care underwrites the risk in the Afghan system of care, we did not pursue a more deliberate analysis of KRMH.

## RESULTS

### Presenting the Analysis and Developing Mitigation Strategies

Graphing the total number of expected casualties per day, with the hospital capacity superimposed, gives a visual of where the high-risk periods are and the magnitude of the anticipated risk. The results of the analysis indicated that there was a significant potential for medical risk. This risk could potentially become an operational constraint. We also anticipated days in which there was very little spare capacity in the system to deal with a mass casualty event. We briefed our analysis and risks to the combined medical team whose key stakeholders consisted of the KAFR3 hospital, the casualty aeromedevac staging facility (the aviation task forces providing rotary-wing air evacuation), the 62nd Medical Brigade, the Afghan National Army (ANA) 205 Corps Surgeon, and the ANA KRMH Commander, to ensure they all had the same operational information. We then worked together to develop mitigating strategies.

We determined the most important method to mitigate risk was to affect the number of casualties the Role 3 hospitals could take in a day and still have capacity left to handle the next day's casualty profile. The combined team agreed this would be the most powerful strategy. We reallocated resources from across the theater to increase the KAFR3 capacity to handle surgical cases, as well as staff additional ICU and ICW beds. Figure 1 presents the casualty estimate per day, relative to hospital capacity, as well as the potential impact of hospital augmentation. While the ANA system of care attempted to do similar capacity increases, they were not able to obtain the resources to establish the extra capacity. They did have a contingency plan to set up a 40-bed minimal care ward in case of a large casualty surge.

The rotary-wing and fixed-wing aviation task forces also increased their capacity to conduct air evacuations by adding additional crews and aircraft to support the increased tempo of operations. The combined medical team agreed to adopt aggressive bed clearing practices to ensure the medical system was best prepared to handle the next day's events. Aggressive bed clearing was defined as maximum use of tactical evacuation to clear RC(S) of casualties by transferring them to other in-theater hospitals. It also included more frequent use of strategic evacuation assets for those casualties requiring evacuation out of theater. The casualty data pattern established 1 to 3 day peaks followed by 1 to 2 day troughs. Because there was no historical evidence of a sustained period of peak casualty rates, we decided the mitigation strategies described would be appropriate and sufficient.

### Informing the Operational Leadership and the Commander

It is important to keep the operational leadership and commander informed about the medical risk associated with operations. This is especially true if the risk cannot be sufficiently mitigated and remains an operational constraint. Current medical risk information allows commanders to decide if the operational plan should be adjusted to accommodate the constraint. Each headquarters will have a process for synchronizing the staff and gaining a forum with the commander to present

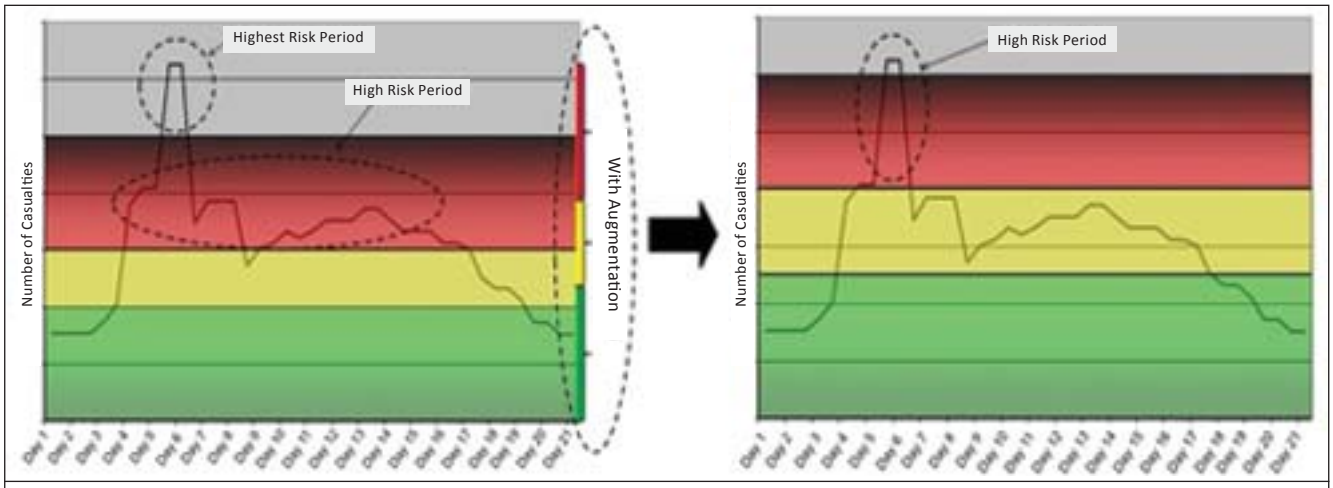


Figure 1. Phase 3A and election period casualty estimate per day relative to hospital capacity and associated medical risk, and potential impact of augmentation on hospital capacity and associated medical risk.

information, seek guidance, or get decisions. RC(S) CJMED planners continued to stay integrated with the operational staff throughout the analysis and operational planning. We periodically briefed the results of the casualty estimate to operational leaders, the chief of staff, and the commander. This ensured the wider staff was informed of the analysis and gave the commander confidence that the medical risk was properly evaluated and addressed.

## Refining the Model

As with any model, one must compare the assumptions and logic to determine its accuracy. When we plotted the estimate against the actual number of casualties that were handled by the augmented ISAF system of care, it was obvious that the assumptions built into the model overestimated the risk. We determined that because we used CIDNE data to drive the casualty estimate for baseline and the elections period, we built into the model the total number of casualties reported in the region, but not necessarily just those handled by the ISAF system. Kandahar City has 2 capable hospitals, one ANA and the other civilian. These hospitals handled a portion of the casualties that occurred in the region without ISAF involvement for evacuation or treatment. Figure 2 presents the actual data compared to the estimate.

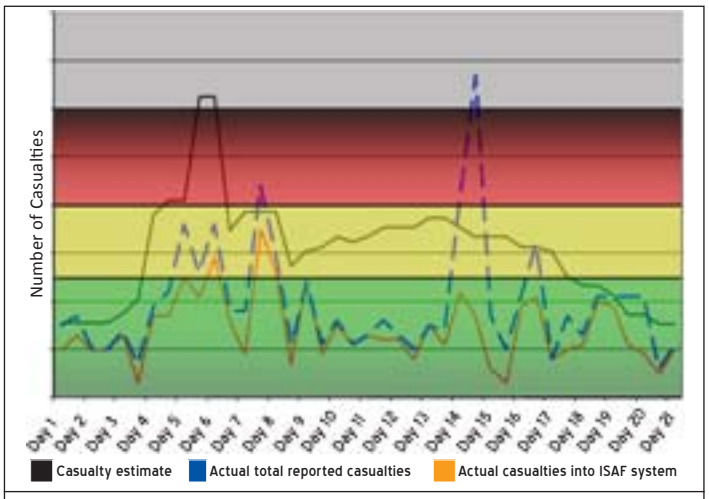


Figure 2. Comparison of Phase 3A and election period casualty estimate with actual casualties handled by the augmented ISAF system and actual total number of casualties reported in the region.

We backed out the elections assumptions to assess the accuracy of the methodology associated with the Phase 3A operations. This is demonstrated on the left portion of Figure 3. Based on this review, we concluded that while the model does not necessarily predict the exact number of casualties per day (exceedingly difficult to do), it did indeed predict the magnitude of the risk we expected. Ultimately, this is what drives resource decisions. Given we had good confidence in the assumptions, we used the same methodology and applied it against Phase 3B operations. The results indicated the amount of medical risk was manageable without external augmentation. Therefore, we released those assets back to their parent organizations and continued to monitor actual casualty rates. The right portion of Figure 3 displays these results.

We note that the model overestimated the medical risk for Phase 3B, despite the improved accuracy the model demonstrated for Phase 3A. After studying the operational information, we concluded that ISAF used different tactics, techniques, and procedures than were used in Phase 2 operations in the Arghandab District to counter the most dangerous threat of IEDs. The intelligence estimates were correct; the terrain was extremely difficult and there

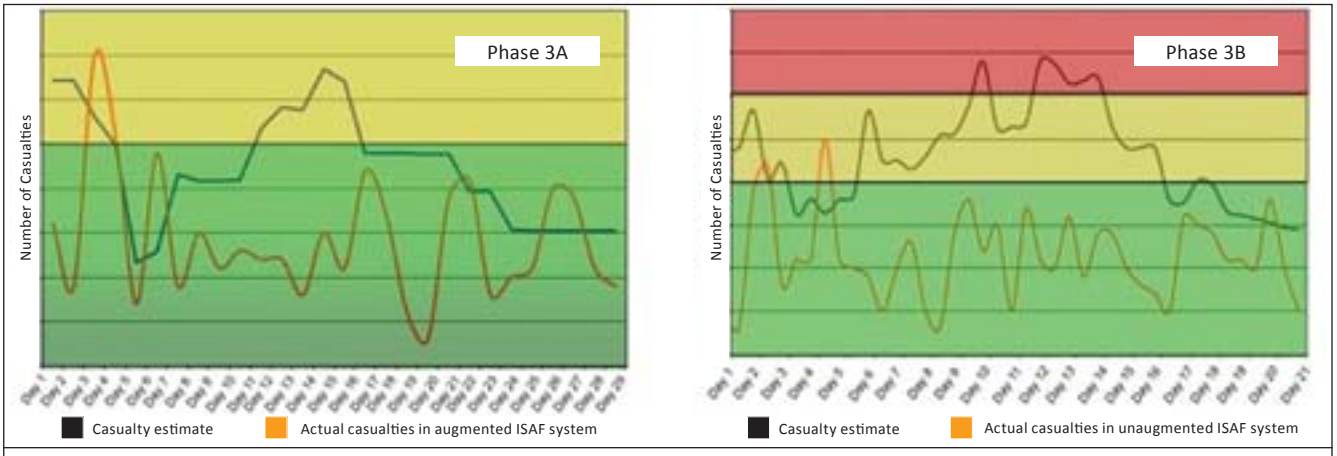


Figure 3. Phase 3A casualty estimate per day compared to actual casualties handled by the augmented ISAF system, and Phase 3B casualty estimate per day compared to actual casualties handled by the unaugmented ISAF system.

were many IED belts. However, ISAF used special mine clearing and antipersonnel obstacle removal systems to clear maneuver pathways. A single removal effort often caused multiple sympathetic detonations of IEDs. These clearing systems were not used as frequently in the Arghandab District because the population density was higher and the risk of collateral damage was too great. The areas cleared in Phase 3B were much more rural and sparsely populated, allowing ISAF to use more aggressive tactics.

## COMMENT

This methodology serves a very specific purpose not available in other casualty estimate models. It is an operational level casualty estimate that specifically addresses the daily medical capacity required within an area of responsibility. This is not the strategic process of assigning medical forces to the theater of operations to support the campaign. It is not the units' tactical decisions, such as moving medical capabilities around the battlefield to support daily operations. It is not intended to determine type and amount of logistical supplies to treat specific wounds. This model does not predict the level of granularity that some casualty estimate models attempt to do, such as evacuation category,[3(p1-10)] battle injury vs disease or nonbattle injury, or nationality of the casualty. We balanced the precision of the information and amount of complicated analysis necessary to factor in these elements against the simplicity and agility of the model. Making an assessment of the amount of casualties the Role 3 hospitals could absorb in a day, and expressing that as a degree of risk, accommodated for these detailed elements well enough. It enabled us to make an informed decision without investing in perfecting the information. The leadership of RC(S) changed from British-led to US-led division headquarters on November 2, 2010, and both authors of this article concluded our analysis of this subject.

## CONCLUSION

It is important for the medical planner to maintain excellent situational awareness of operational information and participate in the military decision-making process. This is achieved through membership in cross-functional planning teams and active listening at command-level summary briefs. Through this participation, a medical planner will develop an understanding of what operational information is relevant. This allows sufficient data to be captured with much less difficulty. Given the likelihood of future campaigns in a multinational environment, it is imperative to use simple and widely available software so that any contributing-nation medical planner can convert the discrete data into current medical planning information. The information can then be used to produce estimates and analysis to inform the medical risk and mitigation strategies. The steps outlined in this article are presented in Figure 4.

As stated in NATO medical support doctrine,

> Casualty estimates are one of the core tools of medical plans, they are major resource drivers and, although an inexact science, accuracy is important.[2(p1-32)]

A mass casualty plan is appropriate for handling single or multiple catastrophic events (aircraft accident, suicide bomber, etc) that must be managed over a day or two. It is nearly impossible to predict when these events will occur, and every medical system must be prepared to surge to get through such a casualty crisis of relatively short duration. In contrast, a mass casualty plan is insufficient to contend with a high, sustained rate of casualties, and its inadequacies will result in an enormous amount

of stress on the medical system and endanger probabilities of survival of casualties. Military medical planners can anticipate periods of sustained (measured in weeks) high levels of casualties with good casualty estimates. However, it is important to fully appreciate that augmentation of medical systems with personnel and/or equipment requires considerable time and coordination. This is especially true for projected personnel augmentation requirements. Healthcare is complex, and human–skill–set-centric, so personnel augmentations must be initiated as early as possible to allow the additional personnel time to travel and integrate into their new environments. It is, therefore, vital that projected casualty planning is accomplished with as much lead time as possible to allow the medical system adequate time to respond to identified augmentation requirements.

## REFERENCES


1. *STANAG 2542 MEDSTD (Edition 1)–Allied Joint Medical Planning Doctrine–AJMedP-1.* Brussels: North Atlantic Treaty Organization Standardization Agency; November 3,2009:3-15–3-16. Available at: http://nsa.nato.int/nsa/zpublic/stanags/current/2542eed01.pdf. Accessed July 18, 2012.
2. *AJP-4.10(A): Allied Joint Medical Support Doctrine*. Brussels: North Atlantic Treaty Organization Standardization Agency; March 2006. Available at: http://nsa.nato.int/nsa/zPublic/ap/AJP-4.10(A).pdf. Accessed July 18, 2012.
3. *STANAG 2546 MEDSTD (Edition 1–Allied Joint Doctrine for Medical Evacuation)–AJMedP-2.* Brussels: North Atlantic Treaty Organization Standardization Agency; November 24, 2008. Available at: http://nsa.nato.int/nsa/zpublic/stanags/current/2546eed01.pdf. Accessed July 18, 2012.


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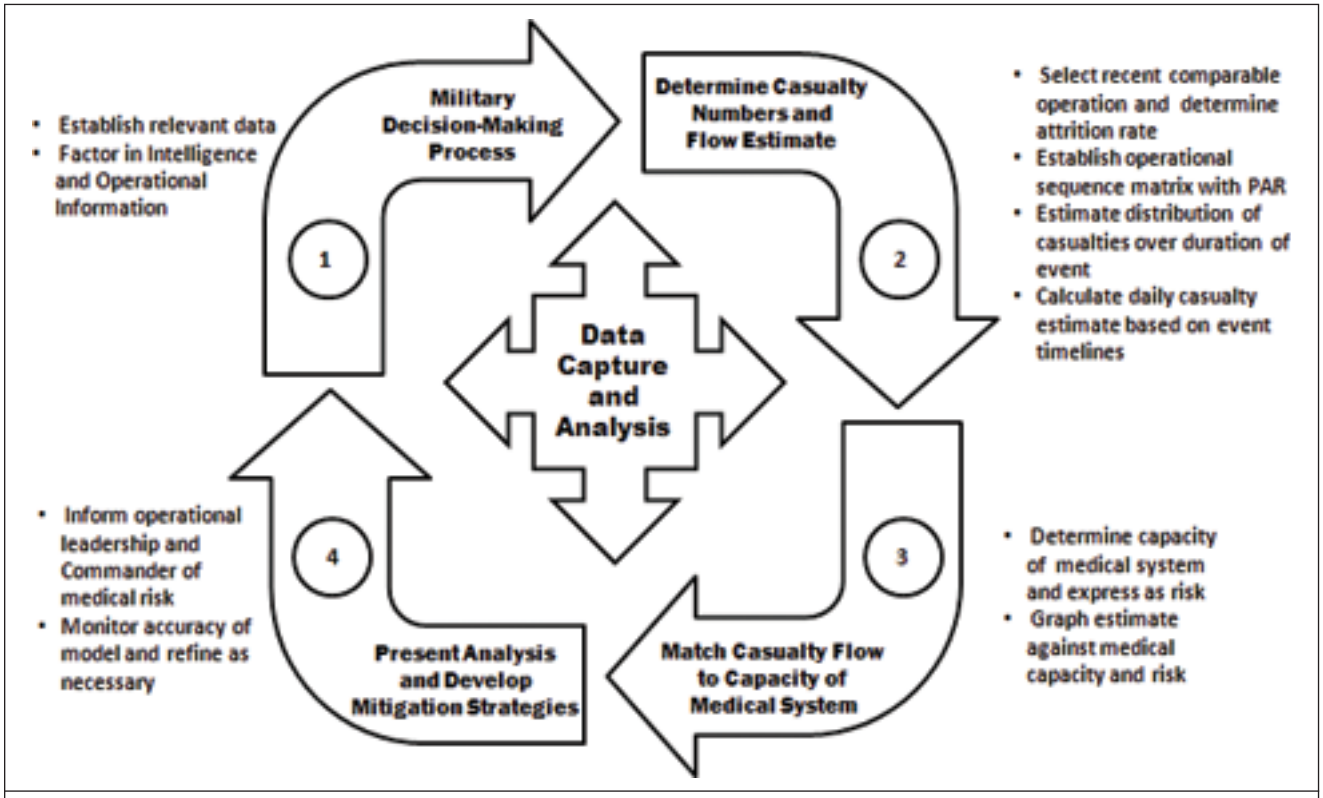


Figure 4. Diagrammatic presentation of the sequential steps involved in developing a casualty estimate, analyzing the medical risk, and developing mitigation strategies.

# Military Quantitative Physiology:

## Problems and Concepts in Military Operational Medicine

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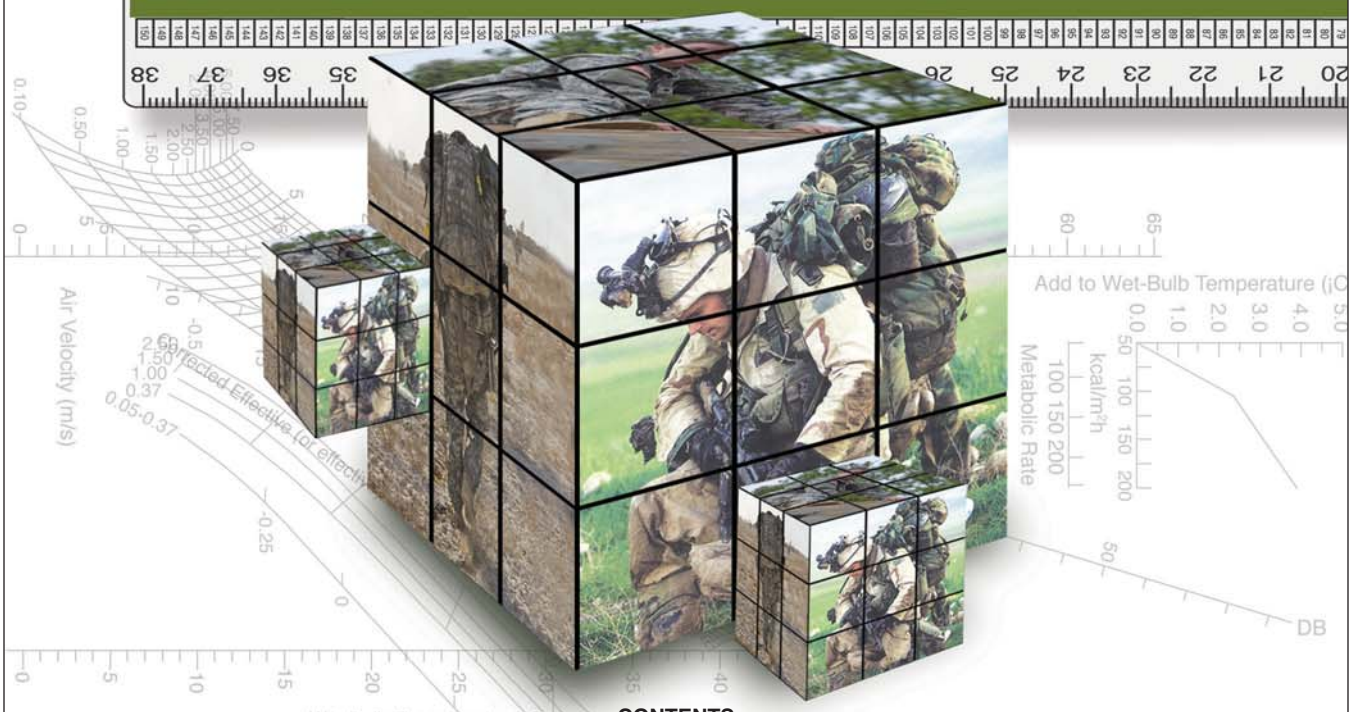

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# Strategies to Support Nurse Work Reintegration After Deployment Constructed From an Analysis of Army Nurses' Redeployment Experiences

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ABSTRACT

Many military nurses find a period of transition is necessary in order to fully return to work after deployment. Coworkers and supervisors can be a positive or negative force in that transition. Using data from a larger study, evidence-based strategies to support nurses who return to nursing work after deployment were developed. Having an understanding of what returning nurses say about their "coming home" phase can help coworkers and supervisors be a positive force in work transition. A table of tasks with explanations is provided to assist coworkers and supervisors in facilitating the transition back to noncombat nurse work.

Since January 2003, the United States and its allies have been engaged in extended military operations with most military nurses deploying into and out of combat environments. During these deployments, nurses have operated under extreme conditions exposing them to both primary and secondary trauma. As early as 2004, emerging evidence from these deployments supported the correlation between trauma exposure, increased behavioral health symptoms, and premature military attrition for the military population in general.[1,2] This evidence suggests that deployments have an impact on military personnel. Nurse work during deployment is different from nurse work after deployment, and most military personnel report an adjustment period after returning home from deployment.[3] With record numbers of military nurses returning from their first, second, and third deployments, the author used data collected during a Nurse Deployment and Retention Study to construct evidence-based strategies to support nurses returning from deployment to nondeployed nurse work. The goal is to facilitate the transition of nurses to nondeployed nurse work using the proposed supportive strategies.

## DEPLOYMENT NURSE WORK IS DIFFERENT

In a study of the most comparable deployed hospital, a full complement combat support hospital operating out of a fixed facility, Filliung et al[4] reported that nurses were taking care of a broader spectrum of injuries and illnesses as well as contending with greater complexity than when not deployed. The most common type of battle injuries were blast (79.3%) and gunshots (20.7%). The most common type of nonbattle injuries were crush (21.2%), with vehicle accidents at 13.6%. No nondeployed military treatment facility would have a patient profile that is comparable. If the patients are different, is the environment of providing care also different?

Mark et al[5] designed a study which closely examined the research question, "What is the nature of deployment experiences as perceived by Army Medical Department personnel?" Using a qualitative design, she and the other investigators conducted 12 focus groups and one individual interview. Twenty-four hours of transcription yielded 3,429 passages that were analyzed. Three areas of differences emerged: leadership, readiness, and safety. The authors noted that in their literature review of 9 other studies, the themes were consistent even when other studies included different services, branches, environments, and missions.

When it came to describing the actual environment, participants told investigators Scannell-Desch and Doherty[6] that living conditions were varied depending upon where the nurse was assigned, as well as how early or late in the military operations that they deployed. In the beginning, nurses would not shower for days, even weeks, living in dirty tents and containerized housing. However, nurses deploying later reported more mature housing and hygiene facilities. But most often, they report continuous nursing work with high levels of trauma and high levels of personal risk.[6] What are the effects of this different patient population and work environment on nurses once they return?

## EFFECTS OF DEPLOYMENTS ON NURSES

Unfortunately, most studies concerning the effects of deployment do not report findings by occupation. In fact, it has been noted that healthcare workers often do not

participate in the routine screenings for pre- and post-deployment health, especially when they are individual augmentees and do not return as part of a large group. A study by Akbayrak et al[7] provides insight with its examination of the effects that witnessing trauma and being exposed to personal threat had on Turkish military healthcare workers. Turkish military healthcare workers are often exposed to higher levels of trauma than their US counterparts due to natural disasters, terrorism, and the high rate of traffic accidents. Terrorism events have been common in parts of Turkey for the past 20 years. Military healthcare workers have witnessed the deaths of many people, including the loss of their loved ones, while under the threat of dying themselves. In the study, Turkish military healthcare workers were found to be at least as affected as their civilian counterparts by trauma exposure.

While studying military who had served in the Vietnam combat theatre of operations, Carson et al[8] reported that nurses were more vulnerable to the negative effects of trauma exposure, possibly due to the feelings of inadequacy that overwhelming mass casualty situations cause. Kolkow et al[9] found that in a population of healthcare workers responding to anonymous surveys after deployment, 9% met the criteria for posttraumatic stress disorder (PTSD) and 5% met the criteria for depression. They also found that threat of personal harm was the most predictive factor in PTSD. Scannell-Desch and Doherty[6] interviewed 37 Army, Navy, and Air Force nurses who had deployed to Iraq and/or Afghanistan on 4 to 16 month tours from 2003 to 2009. They concluded that nurse work during a war is unique for those doing it, regardless of education, preparation, or training. They postulated that there are many variables that impact the response that nurses have, and that the variables are both personal and professional. Specifically, the nurses they interviewed recalled images, sounds, and smells years after returning. These nurses would all describe at least one lasting memory of a patient, a memory that they said would stay with them for the rest of their lives. They shared their feelings toward the children caught in the combat and the outrage they had still today for the circumstances. Under the theme of "my wartime stress–I'm a different person now," they talked about how the war changed them. Some talked about having anxiety and panic attacks at work once back home, while also noting that their capacity for empathy and compassion had diminished. Short-fused anger, guilt, depression, sleep problems, and flashbacks were also reported. So, if nurse work deployed is different and deployment has lasting effects, what is the best way to support nurses as they transition from combat nurse work to the nurse work they will do once they return home?

## SUPPORT STRATEGIES

As each service and each branch within each service begins to examine the evidence and develop the best strategies to support reintegration after deployment, it is possible that some strategies will be the same for all and some may have service, branch, and gender specific implications. Doyle and Peterson[10] reviewed case studies that reported successful reentry and found that successful reintegration was related to inclusion of families and communities early in the process. Nonmedicalization of distress along with easy access to mental health professionals was also found to be key. In a study of military reservists done by Mcnulty,[11] organizational support was a good predictor of work adjustment. Specifically, organizational support in the form of job reassurance, differential pay, and reorientation training were meaningful.

## DEPLOYMENT-RELATED NURSE RETENTION STUDY

A few years after the current military conflicts started, senior Army Nurse Corps (ANC) leadership approached the nurse scientists at Madigan Army Medical Center (noted in the acknowledgements) expressing their concerns over the redeploying nurses who were telling them that they wanted to leave the Army Nurse Corps, and in some cases leave nursing altogether. The scientists designed a descriptive qualitative study using Hursselian Phenomenology studying the research question, "what is it about deployment that makes a nurse want to stay or leave the Army Nurse Corps upon return?"

Study participants talked about their experiences in 3 phases: preparing to deploy, being deployed, and coming home. The author uses the "coming home" data to construct evidence-based support strategies that redeployers and those who lead and work with them in medical treatment facilities can follow to facilitate the transition back to nondeployed nurse work.

## "COMING HOME" RESULTS

Three focus groups were conducted, each with 4 participants for a total of 12 participants. The response rate was 57%. Of the 43% who did not participate: 9% declined to participate and 88% were unavailable due to work schedule conflicts. Four specialties (medical/surgical, emergency department, intensive care unit, and operating room) and 6 combat support hospitals were represented. Most of the participants were 1st lieutenants (44%), followed by majors (33%), captains (15%), and 2nd lieutenants (8%). Focus group discussions were guided by the following questions:

- What is it about deployment that affects a nurse's decision to stay or leave the ANC?

- If you were the Chief of the ANC, what 2 or 3 things would you fix first in order to have a huge impact on ANC retention?

The following probes were used:

- What made these positive/negative experiences?
- How would you make it better?
- Is there anyone in the room who has different views?
- Pre, during, post?
- Being deployed with a unit with which you did not train or were not stationed?
- Deployment work issues?
- Comfort/environment issues?

Five themes emerged when study participants discussed the "coming home" phase of their deployment:

1. Recognize us and our families with a "welcome home."
2. Make an honest effort to give us assignments that move us forward in our career.
3. Treat us like we are staying in the military.
4. You make nursing work harder than it has to be at home.
5. Evaluate postdeployment health, suggest Army OneSource, collocate if possible.

Since 2005, these themes have been presented to countless nurses returning from deployment, and their input have resulted in only 2 modifications. The first theme "Recognize us and our families with a 'Welcome Home'" was changed to "Welcome Home for Everybody," and one of the recommendations in that theme (see below) was changed to read negotiable leave instead of 30 days leave. The following information is presented first with the theme followed by some representative quotes concluding with an explanation of the participants' discussions. Lastly, these themes, representative quotes, and explanations are reworked to create a list of evidence-based support strategies that can be used by leaders and peers who are welcoming deployed nurses back to the workplace.

### Recognize Us and Our Families With a "Welcome Home"

- When we came back, the leadership did nothing. It was just, "when do you want to come back to work?"
- It should be an immediate "welcome back," not followed with "by the way, do you want to kill yourself?"
- We were met by the commanding general. It was individualized. Recognition is important.
- Follow the recognition with 30 days of leave (individualized).

Nurses who had been individual augmentees or PROFIS* personnel expressed how awkward and lonely it was to walk off the plane for the first time back on American soil at a place where they did not live or were not assigned, because no one they knew was there to greet them. They were irritated by the "check the box" feeling they got from redeployment screeners. They appreciated any recognition, although they acknowledged that they were hesitant to notify their supervisors back home about when they were returning. They feared being put back to work too soon, or they did not feel a relationship with them anymore since they did not hear from them while they were deployed. They wanted some automatic leave to "decompress," but after that, they wanted to be able to negotiate their leave over the following year.

### Make an Honest Effort to Give Us Assignments that Move Us Forward in Our Career

- We were ready for new challenges. It was insulting to resume a preceptorship or return to a low-speed area.
- Even though I went back to the same floor, the paperwork had really changed.
- I was glad that I did not get a leadership position. I needed to decompress for a while.
- I wanted to go to the ICU but could not, at least let me freshen up my EKG skills or something.

Nurses expressed the frustration they felt when their coworkers and supervisors appeared to not understand the level of work they did while deployed. Some of them wanted to "decompress" and even take jobs outside of the emergency room or ICU for a while. Only on one occasion did a nurse indicate a desire to leave nursing altogether, but even then it was seen as a temporary emotion. Some of the nurses in these focus groups had deployed shortly after graduating from the Basic Officer Leader Course and were gone for a prolonged period of time. A few nurses discussed missing certain positions or opportunities while deployed that could have accelerated their career. Almost all of them expressed concern about their lack of connection and/or communication with their coworkers and supervisors back home. To them, they had been forgotten and even somewhat abandoned, which seemed to erect a wall with their leadership once they returned, making it all the more difficult to discuss

*PROFIS predesignates qualified Active Duty health professionals serving in other units to fill Active Duty and early deploying and forward deployed units of Forces Command, Western Command, and the medical commands outside of the continental United States upon mobilization or upon the execution of a contingency operation.

career advancement. They did not want to go back into an "orientation/preceptorship," but many administrative procedures had changed and they felt frustrated with the status as behind on training.

### Treat Us as if We Are Staying in the Military

- When I came back, the supervisors said I would be assigned to this floor until I left the Army. I don't know where they got the idea that I was getting out.
- Everyone kept saying "you are getting out of the Army aren't you?"
- I asked to be stationed near my family but was informed that since I had indicated that I was getting out, I could not move. I was still thinking about staying in, but when that happened, I was discouraged.

Often nurses have not firmly decided whether to stay or leave the military or nursing. The best course of action for coworkers and supervisors is to treat all returnees as though they are staying—continue to coach, teach, and mentor, no matter what the returning nurse may say.

- In the states, nursing work seems to be made more difficult than it has to be.
- It was almost a black hole for me. Reintegration was as though I was immersed in a fog.
- I took care of Soldiers with body parts blown off; here I took care of chronic alcoholics and smokers who did this to themselves. I became more callous.
- The staff make everything bigger than it really was. "You need to be quicker," and I would think that he's not really dying.
- Supervisors said I did not understand how things worked on the inpatient unit. I had some apathy.
- I got busted out for being laissez faire.
- I learned to separate from the job; here, nurses are overly involved in their work.
- This job seems less important; there you have a sense of doing the ultimate job. You're not worried about standard operating procedures. You're doing what is important.
- You can't ask the nurses here to be more sensitive to us, because they just don't get it. They won't understand.
- I don't worry about the paperwork and stuff. That stuff will take care of itself.

Perhaps the worst job for a returning nurse is to be in charge of a Joint Commission task force. Returning nurses need time to disengage from the pace of deployment. One example given was a nurse who returned to a recovery room position. His supervisor noted that he was not using oxygen on all of his recovering patients and assumed that he was not providing quality nursing care because he had lost his "edge" postdeployment. But when questioned, the nurse explained that he felt like some of the patients were doing so well that they did not need the oxygen, after all, he had seen patients in combat who really needed oxygen. A good leader would facilitate the transition of the returning nurse through patient, gentle coaching and nonjudgmental reinforcement to readopt the nondeployed standards.

### Evaluate postdeployment health, suggest Army Onesource, collocate if possible

- Immediately upon returning, we get tired of being asked if we are suicidal or homicidal.
- A few months after return, we need someone to check on us because that is when the issues surface.
- Recommend OneSource, let people know it is there at the 3 to 6 month mark.
- Chief Nurse interviews should be done 3 to 6 months after deployment, and Head Nurses should always be checking their people.
- I would really have liked a meeting to talk about how to make it better for the next group.
- We need our postdeployment health evaluated, ie, hearing, mental health, asthma.

Three things were heavily discussed under this theme. First: as medical personnel or individual augmentees, the returnees often were overlooked in postdeployment screening. Some of them even admitted to avoiding the postdeployment screening and using getting back to work as an excuse to not attend the usual "cattle calls." Second: they discussed the "honeymoon phase" of postdeployment, a time when they really had no negative reactions to deployment and were not really interested in thinking too deeply about the impact of deployment. But those feelings faded, most often in the 3 to 6 month postdeployment period. They did want to be "checked on," and rejected the suggestions of mandatory support groups, especially if they are led by people who do not have deployment experience. Third: they related best to those who had also deployed and often looked to see if people were wearing the right shoulder patch, indicating deployment veterans with whom they would have more in common.

## CONCLUSIONS

Taking the themes, representative quotes, and explanation given by one investigator, the author has constructed a list of tasks, presented in the Table, for coworkers and supervisors to use in supporting returning nurses. Since this study was completed, other nurse investigators have

How coworkers and supervisors can support and smooth the transition of redeploying nurses.

| | Task | Notes |
|---|---|---|
| 1. | Provide recognition and welcome back (for everyone). | Always say "welcome back." If you are meeting them in a common area, greet everyone, even if you do not personally know them. |
| 2. | Approve negotiated leave unless the nurse requests something different. | Better yet, contact them before they return and negotiate leave. |
| 3. | Evaluate postdeployment health (ongoing). | Remind them and give them time to do all of the reverse deployment screening. |
| 4. | Negotiate job assignment. If unable to provide first choice, create a plan to move toward first choice. | Best to begin conversation before they return. Be flexible, their aspirations will likely change. |
| 5. | Recognize that most people report the need for additional support at the 3 to 9 month postdeployment point, and that most people prefer an outside source or peers with the same experience. | After the "honeymoon phase," asking someone how reintegrated he or she is today on a scale of 1 to 100 (%) helps to identify if and when they need additional support. |
| 6. | Understand that most people report a period of apathy and callousness that may be perceived as loss of motivation and the intent to leave the ANC; this usually resolves over time. | The antidote for apathy and callousness at work is usually time, but if it is not gone at 9 months, support nurse in getting help and/or counseling. |
| 7. | Understand that personnel returning to the same work unit will find that things have changed while they were away. They may need a miniorientation. | Minimize labeling returning nurses as delinquent on training. Make reorientation fun and easy. |
| 8. | Provide time to re-inprocess, perhaps one or 2 days during the week. | Avoid immediate scheduling to rotating shifts. |

advanced postdeployment questions concerning returning nurses, classes have been added to hospital orientations, and content has been integrated into the Army Nursing Leader Academy which is made available to deploying and redeploying units and supplying units upon request.

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## REFERENCES

1. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems and barriers to care. *N Engl J Med*. 2004;351;13-22.
2. Hoge CW, Auchterlonie JL, Milliken CS. Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *JAMA*. 2006;296(5):1012-1032.
3. Blais A, Thompson MM, McCreary DR. The development and validation of the Army post-deployment reintegration scale. *Mil Psychol*. 2009;21(3):365-386.
4. Filling DR, Bower LM, Hopkins-Chadwick DL, Leggett MK, Basca C, Harris K, Steele N. Characteristics of medical-surgical patients at the 86th Combat Support Hospital during Operation Iraqi Freedom. *Mil Med*. 2010;175(12):971-977.
5. Mark DD, Connelly LM, Hardy MD, Robison J, Jones CC, Street TA. Exploring deployment experiences of Army Medical Department personnel. *Mil Med*. 2009;174(6):631-636.
6. Scannell-Desch E, Doherty ME. Experiences of US military nurses in the Iraq and Afghanistan wars, 2003-2009. *J Nurs Scholarsh*. 2010;42(1):3-12.
7. Akbayrak N, Oflaz F, Aslan O, Ozcan CT, Tastan S, Cicek HS. Post-traumatic stress disorder symptoms among military health professionals in Turkey. *Mil Med*. 2005;170(2):125-129.
8. Carson MA, Paulus LA, Lasko NB, et al. Psychophysiologic assessment of posttraumatic stress disorder in Vietnam nurse veterans who witnessed injury or death. *J Consult Clin Psychol*. 2000;68:890-897.
9. Doyle ME, Peterson KA. Re-entry and reintegration: returning home after combat. *Psychiatr Q*. 2005;76(4);361-370.
10. Kolkow TT, Spira JL, Morse JS, Grieger TA. Post-traumatic stress disorder and depression in healthcare providers returning from deployment to Iraq and Afghanistan. *Mil Med*. 2007;172(50):451-455.
11. McNulty PA. Reported stressors and healthcare needs of active duty Navy personnel during three phases of deployment in support of the war in Iraq. *Mil Med*. 2005;170:530-535.

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# Combat Casualty Care Nursing Research and the Joint Combat Casualty Research Team

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The Mayo brothers are quoted as saying, "the only winner in war is medicine."[1] Research within theaters of operations occurred in World War I, World War II, the Korean War, and the Vietnam War. There were no formal research teams during those wars, only healthcare providers seeking better ways to care for the wounded Soldiers. Many advances in medical care have been and are continuing to be made as a result of wars and conflicts—management of shock, psychology of combat stress, blood transfusions, resuscitation, behavioral health, and en route care just to name a few. However, there have been many shortcomings in evaluating and developing healthcare practices during these conflicts. Most advances were not based on formal research, they involved on-the-spot innovation and trial-and-error, and were based on personal experience and skills. New ideas were not easily or speedily shared, and often ideas were adopted after the conflict, not in real time.

Combat casualties from Iraq and Afghanistan are provided world-class healthcare through innovative research. Combat casualty care in Operations Iraqi Freedom, New Dawn, and Enduring Freedom is better than or comparable to trauma systems in the United States.[2] This article highlights the overall importance and effect on nursing of combat casualty care nursing research by the Joint Combat Casualty Research Team (JC2RT) since 2006.

The nurse members of the JC2RT directly support the mission of military nursing—the Nurse Corps of the US Army, Navy, and Air Force. All actions and tasks must lead and work toward promoting the wellness of Warriors and their Families, supporting the delivery of Warrior and Family healthcare to all those entrusted to our care, and ultimately positioning military nursing as a force multiplier for the future of military medicine. The JC2RT nursing team members consistently achieve performance excellence, foster innovation, build knowledge and capabilities, and ensure organizational credibility and sustainability.

## TEAM DEVELOPMENT

In October 2006, the first Deployed Combat Casualty Research Team (DC2RT) was deployed to Baghdad. The initial team consisted of one Army physician, one Army nurse (PhD), 3 Army nurses functioning as data collectors, and one noncommissioned officer-in-charge (lab technician) functioning in an administrative role. The team expanded to the Air Force Theater Hospital in Balad, Iraq, in 2008 when Air Force members joined the team. Figure 1 shows the locations of military hospitals in Iraq in 2006.

Six DC2RTs deployed to Iraq in support of Operation Iraqi Freedom from 2006 to 2009. One team deployed every 6 months to an Army theater combat support hospital, an Air Force theater hospital, or an Army forward operating base. In August 2009, the DC2RT formally transitioned to the Joint Combat Casualty Research Team with the headquarters moving from Baghdad, Iraq, to Bagram, Afghanistan, and satellite offices opened in Balad, Iraq, and Kandahar, Afghanistan. The JC2RT now includes 12 military professionals from the Army, Air Force, and Navy medical departments as delineated by the US Central Command (USCENTCOM) Assurance and Joint Manning Document.[3] The JC2RT 12 currently has 3 offices in Afghanistan: Bagram, Kandahar, and Camp Leatherneck (Figure 2).

The mission of the JC2RT is to "foster and facilitate combat relevant medical research within the USCENTCOM Joint Area of Operations." The JC2RT's guiding philosophy is "Joint Military Medical Research … Keeping the force ready and relevant."*

To fulfill this mission, healthcare providers and research scientists comprise the JC2RT. Typically, senior

*JC2RT STRATCOM, US Army Medical Command, February 2011. Internal military document not readily accessible by the general public.

Figure 1. Locations of US military hospitals in Iraq in 2006.

Figure 2. Currently JC2RT Team 12 has offices in Bagram, Kandahar, and Camp Leatherneck (Helmand Province, southwest of Kandahar).

healthcare providers such as physicians and PhD-level nurses are selected for the key positions of director and deputy director within the team. As the leader of the JC2RT, the director provides executive-level leadership to coordinate assigned JC2RT staff to develop, implement, manage, and regulate research activities within the theater of operations, as well as direct guidance and assistance to investigators initiating new research protocols to ensure the feasibility of in-theater research projects. In addition, the director is responsible for maintaining open lines of communication with USCENTCOM, their subordinate commanders, and the Institutional Review Board (IRB) of the US Army Medical Research and Materiel Command (USAMRMC) providing them with status of research and performance improvement activities in all theater of operations. The deputy director assists investigators in developing protocols, processing their protocols through the theater approval, and submitting the protocols to scientific review and the IRB for approval. The deputy director acts as the main conduit of communication among the IRB, the US Army Institute of Surgical Research (USAISR), deployed researchers, and JC2RT members.

Healthcare providers and other professionals with research interest or backgrounds have the opportunity to serve on the JC2RT as researchers and research liaison officers. Depending on their experience and background, researchers serve as on-site principal investigators (PIs) for select protocols, assist with data collection efforts, and mentor other investigators in protocol writing and processing.* They work directly with the deputy director to develop, facilitate, and conduct research in the Joint Area of Operations. They facilitate communication among their PI counterparts, the director, and the deputy director during protocol development and review.

Although not technically a member of the JC2RT, the in-theater human protections administrator (HPA) plays an important role in overseeing research in theater and works very closely with the JC2RT. The position is held by a research scientist (PhD level) who is responsible for ensuring compliance with the Human Research Protection Program Management Plan for all research conducted in theater. The HPA reviews and screens protocols during development and implementation to ensure that they comply with applicable laws and regulations, and that PIs document their plans for human subject protection. The HPA audits studies conducted in theater and assists PIs to resolve and/or minimize adverse effects and protocol deviations.

Army nurses can serve on the JC2RT in any role. Since 2006, 37 Army Nurse Corps (ANC) officers have served in Iraq and/or Afghanistan in the following roles:

- Nine as deputy directors; six in the dual role of deputy directors and HPAs
- Five as senior researchers
- Twenty-three as researchers/data collectors

The nurse scientists and clinical experiences of Army nurses leverage the JC2RT's value by facilitating on-site medical research in the deployed theater. The nurse scientists who serve as deputy directors or senior

*The PI and assigned researchers must have current curriculum vitae and completed the human subject protection training of the University of Miami's online Collaborative Institutional Training Initiative (for information see http://it.med.miami.edu/x1654.xml).

researchers are Army nurses with a minimum of one year of postdoctoral and IRB experience. The skills set of nurse scientists are invaluable to facilitate a smooth approval process among both internal (deployed theater) and external (United States) customers. The ability to apply a knowledge of protocol development and evaluation of scientific rigor in the deployed setting ensures a high quality, realistic protocol implementation. Junior officer Army nurses who are interested in research serve as facilitators of protocols during various stages of the research approval process, and/or as data collectors in approved research protocols. These positions provide ANC officers opportunities to learn more about conducting research while performing data collection vital to the effort. The clinical expertise in various areas (eg, critical care, emergency room, medical-surgical, maternal child health, public health nursing, advanced practice) possessed by most nurses can be an important asset to investigators.

Appointment of Army nurses to the JC2RT involve both selective and nominative processes. The deputy director is selected by the nursing research consultant to The Surgeon General with concurrence from the officer's chain of command. All other Army nurses are selected for the JC2RT using the Army Medical Department Professional Officer Filler System. Army nurses must obtain written approval from their rater and all subsequent nursing leaders, and submit those approvals to the deputy commander for nursing or senior nurse executive who will forward recommendations for JC2RT membership to the regional nurse executive. The Commander, USAISR provides logistical and training support for the JC2RT, with operational support by the Command Surgeon, USCENTCOM. All JC2RT members may serve as deployed area PIs for researchers located in the United States. Additionally, team members spend approximately 20% of their time providing clinical care in the intensive care units, operating rooms, emergency rooms, clinics, and humanitarian outreach missions for the local Afghan people.

Table 1. Typical timeline to complete a research protocol.

| Step | Average Time |
|---|---|
| Develop and write protocol | Variable |
| PI/AIs completion of CITI/curriculum vitae | Variable |
| JC2RT Executive Steering Committee review | 3-7 days |
| Scientific review of protocol | 2 weeks* |
| Review by USCENTCOM MRMC IRB | 2-3 weeks† |
| 2nd-level review and start letter | 1-3 days |
| Approving Official Start letter | 1-3 days |
| Average total time required | 2-3 months‡ |

AI indicates assigned researcher.
CITI indicates Collaborative Institutional Training Initiative (University of Miami).
*Time spent in scientific review also dependent on the amount of time required for PI revisions.
†Review time dependent on the type of protocol, the IRB schedule, and the amount of time required for PI revisions.
‡Estimate, may be shorter or longer.

## JC2RT RESEARCH SUBMISSION PROCESS

The necessity and feasibility of conducting a study in a combat zone are cornerstones of research in theater. Clearly, if a study can be conducted in the United States, it should not be conducted in the theater of operations. The individual PI (on-site or in the United States) works with the JC2RT deputy director and/or assigned researcher to develop the protocol using applicable templates. Once a draft protocol is developed, the JC2RT director, the deputy director, and the HPA review all protocols with a focus on the feasibility. The review evaluates the following:

- Whether the study is medically feasible within the operational area.
- Whether the study could hinder combat operations or clinical support of combat operations.
- Whether the study can only be conducted in theater.
- Whether the study has the potential to improve healthcare.
- Whether there are any local or cultural factors that may affect execution of the protocol.

The HPA conducts a review of all protocols to ensure that investigators document plans for human subject protection. The HPA or the JC2RT deputy director obtains letters of support and institutional official signatures from the appropriate commanders on behalf of the PI. The deputy director forwards the protocol and supporting documents to the USAMRMC Office of Research Protection and the IRB for scientific and ethical review and approval.

The protocol is expected to adhere to sound research and scientific principles, the USCENTCOM Human Research Protection Program, and all Department of Defense (DoD) and other US regulatory requirements. Formal scientific reviews are managed through the USAISR and are conducted by subject matter experts throughout DoD. Upon passing scientific review, the protocol is referred to the IRB for ethical review. The IRB may review protocols via full board or expedited review. Once the IRB approves the protocol, the USCENTCOM institutional official issues the study start letter. Table 1 lists the steps and typical timeline for completing a research protocol. Table 2 presents the checklist of items for the PI to review prior to submitting a theater protocol.

Table 2. Example of a checklist used by a Principal Investigator to ensure that the proposed protocol meets all requirements.

| Complete | N/A | USAMRMC Institutional Review Board: Human Subjects Research Initial Protocol Application |
|---|---|---|
| | | **Protocol** |
| | | Prepared using the current version of the templates provided by RLNO |
| | | **Part A** |
| | | 1. Study Contacts: Principal Investigator, Onsite Investigator, Associate Investigator, Consultants, and (if needed) Medical Monitor |
| | | 2. Key Study Personnel: must provide all of the following information: names, addresses, rank & position, phone numbers, department work area, e-mail, unit, redeployment date |
| | | 3. Study Facilities |
| | | 4. Multisite Research |
| | | 5. Scientific Review |
| | | 6. Additional Approvals |
| | | 7. Funding Information |
| | | 8. Drugs, Dietary Supplements, Biologics, and Devices |
| | | 9. Clinical Trial Registration |
| | | 10. Target Population(s) |
| | | 11. Waiver/Alterations of the Informed Consent/Assent Process |
| | | 12. HIPAA Authorization |
| | | a. Request for HIPAA Waiver signed by principal investigator (if applicable) |
| | | b. Completed HIPAA Authorization for use and disclosure of protected health information |
| | | c. Completed HIPAA Application for Waiver |
| | | **Part B** |
| | | 1. Responsibilities of the Principal Investigator in Human Subjects |
| | | **Part C** |
| | | 1. Protocol Title |
| | | 2. Abstract |
| | | 3. Background and Significance |
| | | 4. Military Relevance |
| | | 5. Objectives/Specific Aims/Research Questions |
| | | 6. Research Design |
| | | 7. Research Plan/Human Subjects Protection |
| | | a. Clearly and comprehensively describes the database and how the data from the data collection measures are transferred into an electronic or hard copy database. Use of audio and/or visual tapes and their disposition is explained. |
| | | b. Describes what HIPAA identifiers that permit the association of the data with the individual are being collected. |
| | | c. Describes the method for maintenance of confidentiality and security. Clearly delineates measures for coding of measures so that individual subject data is not identified by name but by a coded system, the security of electronic data through use of password-protected and encrypted files, and the storage of paper records in locked file cabinets and rooms with access to only authorized personnel, both in theater and in transit. |
| | | d. Describes the method for transmission of data through use of password-protected and encrypted files. |
| | | e. Describes the status of data (ie, deletion of data) after completion of the research study. |
| | | f. Describes the risks and benefits from the study. If there were any identifiers collected, discusses how the risk to potential loss of privacy/confidentiality of data will be minimized. |
| | | g. If greater than minimal risk, Medical Monitor-identified. Cannot be a subordinate in the PI's rating chain. The IRB determines requirement. |
| | | 8. Risks/Benefits Assessment |
| | | 9. Adverse Events, Unanticipated Problems, and Deviations |
| | | a. Definition of adverse event |
| | | b. Reporting of unanticipated problems |
| | | c. Medical Monitor |
| | | 10. Withdrawal From Study Participation |

Table 2 continued on the following page.

Table 2 (continued). Example of a checklist used by a Principal Investigator to ensure that the proposed protocol meets all requirements.

| | | | |
|---|---|---|---|
| | | 11. | USAMRMC Volunteer Registry Database |
| | | 12. | References-Review of Literature |
| | | | a. Identified date of search, period searched, sources searched, and key words of search. |
| | | | b. Literature supports the theoretical framework of the study. |
| | | | c. Interventions are supported by the literature. |
| | | | d. Use of chosen measurements/instruments are documented/validated in the literature. |
| | | 13. | Time required to complete study (expected start and end dates) (including data analysis) |
| **Attachments** | | | |
| Signature Pages | | | |
| | | 1. | Signature block entered for all PI(s), AI(s), medical monitor, and unit Commander; use following example for format:<br>John Doe<br>MAJ, MC |
| | | 2. | Signed and dated by principal investigator, associate investigator(s), unit commander, FOB/COB/garrison commander |
| | | 3. | Theater signature page (to be completed by ESC) |
| | | 4. | Signed by all other individuals approving study |
| Consent Form | | | |
| | | 1. | Informed Consent Document, unless a waiver is requested in the protocol |
| HIPAA Form/Waiver | | | |
| | | 1. | HIPAA Form, unless a waiver is requested in the protocol |
| Appendices | | | |
| | | 1. | Recruitment Flyer/Email/Script |
| | | 2. | Study Instruments |
| | | 3. | Data Use Agreements |
| | | 4. | Product Information |
| | | 5. | Investigational Brochure |
| | | 6. | Device Manual |
| | | 7. | Database/Data Collection Sheets (how you will record your results) |
| | | 8. | Letter(s) of Support as appropriate |
| | | 9. | All applicable Impact Statements |
| CITI, CV, and COI | | | |
| | | 1. | Current Curriculum Vitae for each investigator (including Medical Monitor) |
| | | 2. | Documentation of CITI within the last 3 years for each investigator (including Medical Monitor) |
| | | 3. | Conflict of Interest form for each investigator (including Medical Monitor) |

## NURSING RESEARCH PROTOCOLS AND THEMES

The type and complexity of in-theater research has evolved since 2005 when studies were mainly retrospective reviews. Research now covers the span from simple retrospective chart reviews to prospective observational and/or interventional studies. Data is collected by the PI or a designated on-site PI, who could be a member of the JC2RT, or other medical personnel working at the combat support hospital. Approximately 173 protocols have been reviewed since 2006, with 153 receiving IRB and institutional official approval. As of this writing, 54 protocols remain open in ongoing or data analysis status. The JC2RT research priorities in the combat zone have evolved, but continue to focus on trauma care, concussion/traumatic brain injury, preventive medicine, and behavioral health.

Since the inception of DC2RT/JC2RT in 2006, 39 nursing research protocols have been submitted, representing 28% of the JC2RT protocols submitted as of this writing. Prior to the 2010 nursing research agenda,* many of the protocols focused on the nurse's area of interest or expertise and ability to conduct a feasible study in the combat zone based on the theater research priorities. The current nursing research agenda priorities set forth by the ANC include leadership, health promotion and

*The nursing research agenda is an annual priority listing derived by the ANC Corps Chief's Office Campaign Plan.[4] The priority list provides recognition of gaps in knowledge and the actions necessary to fill them. The policy outlines the plan to deliver evidence for decision making and formulation of solutions.

Table 3. Current ANC nursing research protocols of the Joint Combat Casualty Team.

| Protocol | ANC Research Priority | Status |
|---|---|---|
| Evaluating the presence of compassion fatigue among healthcare providers | High | Closed |
| Use of paralytic agents during helicopter aeromedical transport during Operation Iraqi Freedom | Medium | Closed |
| Perceived readiness of healthcare providers to deliver palliative care in a combat environment | Medium | Closed |
| Evaluating pain management by examining documentation of pain relief interventions in a combat support hospital | High | Closed |
| Evaluating hand hygiene compliance in a combat support hospital | High | Closed |
| Evaluating compliance of semirecumbent head of bed positioning in mechanically ventilated patients in a combat support hospital | Medium | Closed |
| Early detection of combat operational stress among deployed Soldiers | High | Closed |
| Chlorine exposure during Operation Iraqi Freedom | Low | Closed |
| Variables to consider in assessing deployment-related health of combat support hospital nurses who are unexpectedly extended | Medium | Closed |
| Army Nurse Corps officers' experience of nursing care and a nursing care evidence-base during deployment in support of combat operations | High | Closed |
| Medical-surgical nursing at a combat support hospital-Operation Iraqi Freedom | Medium | Closed |
| A women's health intervention to decrease gynecologic problems in the deployed environment | Medium | Closed |
| Carbon monoxide exposure | Low | Closed |
| Oral care practices for the deployed military critical care nurse in orally intubated Soldiers | Medium | Closed |
| Burnout: measurement in a deployed combat hospital setting | Medium | Closed |
| Compassion fatigue in nurses caring for detainees in a deployed environment | High | Closed |
| Deployment nursing research priorities in a mature battlefield: a Delphi study | Medium | Closed |
| Taking care of Iraqis: Army nurses' perception of nursing care for host nation patients at a combat support hospital | Medium | Closed |
| The use of a meditation intervention in deployed military medical personnel to decrease stress and anxiety and promote resilience: a pilot study | Medium | Closed |
| Dimensions of deployed nurses' experiences at a combat support hospital | Medium | Closed |
| Organizational properties of the self-concept: a cognitive vulnerability to PTSD symptoms in deployed military nursing personnel exposed to combat-related trauma and stressors | Medium | Open |
| Factors related to healthcare delivery among US military medical personnel at 3 different hospitals | High | Closed |
| Trauma team healthcare culture at Craig Joint Theater Hospital | Low | Closed |
| Arterial based and noninvasive functional hemodynamic indices in combat trauma resuscitation | Medium | Closed |
| Sleep disturbance in deployed Soldiers | Medium | Closed |
| Use of NIRS $S_tO_2$ to detect occult hypoperfusion under field conditions | Medium | Open |
| Military women's health and illness behaviors in deployed settings | Medium | Open |
| Iron status of deployed military members | Low | Open |
| Use of N.O. Xplode by service members deployed in support of Operation Enduring Freedom | Low | Open |
| Interpersonal safety of US military women in the deployed environment of Bagram, Afghanistan: a grounded theory approach | Medium | Open |
| US military nurses in Afghanistan: anticipatory concerns about returning home | High | Open |
| Descriptive analysis of resuscitation and early clinical outcomes as a function of aeromedical platform in Afghanistan | High | Open |
| The immediate effects of yoga on wounded warriors in a deployed setting: a pilot study | Medium | Closed |
| Assessment of fatigue in deployed critical care air transport team crews | Medium | Open |
| Sleep and the use of energy products in a combat environment | Medium | Open |
| Patient safety in en route care survey | Medium | Open |
| Readiness and resilience in National Guard Soldiers project | High | Open |

NIRS indicates near infrared spectroscopy.
$S_tO_2$ indicates skeletal muscle tissue oxygenation.

wellness, human capital, patient-centered and family-centered systems of care, deployment, anesthesiology, and informatics. Many of these research protocols fit into the 2010 ANC research agenda focusing on improving Warrior care from the point of injury to arrival at medical facilities in the United States. The predominant themes of the JC2RT nursing research protocols (Table 3) address 39 elements of military healthcare, with focus on Warrior care, in the numbers indicated:

Warrior Care

- Healthcare delivery (11)
- Soldier health (7)
- Trauma (3)
- Behavioral health (3)
- Nursing/healthcare professional issues (15)

## EFFECT OF JC2RT NURSING RESEARCH INITIATIVES AND LESSONS LEARNED

The effect of nurses serving on the JC2RT has been very beneficial for newly wounded Warriors. Some examples include improved delivery of fluid resuscitation of trauma patients, standardization of tourniquet use, damage control laparotomy, development and implementation of clinical practice guidelines (ie, burns, hypothermia, pelvic fractures, trauma airway management, vascular injury), and the development of 39 nursing-driven research initiatives affecting war-wounded in real time. Additional evidence-based practice and performance improvement projects were also initiated. Nursing-driven research initiatives include "back-to-basics" clinical practices such as oral care for ventilated patients, documentation of pain management, and hand hygiene in an austere environment. Other important aspects of nursing-driven research protocols are the experiences and outcomes of nurses providing care to both wounded Warriors and Afghan local nationals, including insurgents. These studies are rich in data from the perspective of asymmetric warfare in a generation of nurses who have no experience in any previous combat environments. However, as the war continues with multiple deployments, these studies provide knowledge as a platform from which nurses can further build current nursing knowledge and clinical practices.

Nursing practice in the combat zone has changed, reflecting advancements in Warrior care from research and performance improvement efforts. Numerous publications and presentations have been provided at national and international conferences. Many protocols are in data analysis, manuscript publication, or in-press phases. Innovations from JC2RT research protocols have had an effect on hemorrhage control, tourniquet use, damage control resuscitation, en route care during medical evacuation, critical care air transport, extremity care, and conversion of evidence into practice.[5]

## FUTURE COMBAT CASUALTY CARE NURSING RESEARCH PROTOCOLS

Nursing research to improve combat casualty care during Operations Iraqi Freedom, New Dawn, and Enduring Freedom is unprecedented. Future combat casualty care nursing research may include topics that have an effect on trauma care provided in real time prehospital phases, and to compare with and translate to the civilian sector. Nursing research should also stimulate longitudinal outcome studies that support Warrior care, leader development, human capital, and evidence-based care. Their recommendations should be prioritized by the ANC and Army Medical Department as the next steps in combat casualty care nursing research.

Table 4. Topics for future protocols of combat casualty care nursing research.

| |
|---|
| En route care provided for nurses |
| Critical care nurse for intratheater evacuation patient outcomes |
| Outcomes of evidence-based clinical practice guidelines |
| Combat nurse survey of required and sustained go-to-war skill sets |
| Hemorrhage resuscitation: nursing implications and care |
| Prevention, burn care implications for nursing, trauma |
| Trauma resuscitation: nursing implications and care |
| Damage control resuscitation and surgery nursing implications |
| Burn Flight Team: nursing care implications |
| Pressure ulcer prevention from point of injury to the United States |
| Incidence and distribution of decubitus ulcers in civilian versus global transport of combat wounded |
| Complex battle wound healing |
| Traumatic brain injury research |
| Outcomes evaluation of Joint Theater Trauma Registry clinical practice guidelines |
| Predeployment nursing training and preparation |
| Stresses of flight |
| Longitudinal and rehabilitation nursing outcomes |
| Behavioral health of the care provider and Warriors |
| Outcomes information that may be applicable to civilian trauma setting and improvement of combat casualty care |

Some of the future combat casualty care nursing research topics which have high or medium priority according to the nursing research agenda are listed in Table 4. Army nurses will continue to serve on the JC2RT in a variety of roles, significantly assisting combat casualty care. Army nurses will remain at the tip of the spear, leading the path for medical innovations in real time—remembering the past, engaging the present, and envisioning the future.

## REFERENCES


1. Haberman TM, Ziemer RE, Beck CS. *The Mayo Brothers' Heritage: Quotes and Pictures*. Rochester, MN: Mayo Clinic Scientific Press;20021:6.
2. Eastridge BJ, Costanzo G, Jenkins DM, et al. Impact of joint theater trauma system initiatives on battlefield injury outcomes. *Am J Surg.* 2009;198:852-857.
3. Brosch L, Holcomb J, Thompson J, et al. Establishing a human research protection program in a combatant command. *J Trauma*. 2008;64(suppl 2):S9-S13.

4. Clark S, Brewer R. Building the Army nursing campaign plan. *US Army Med Dept J*. October-December 2011: 10-17.

5. Bridges E, Biever K. Advancing critical care: joint combat casualty research team and joint theater trauma system. *AACN Adv Crit Care*. 2010;21(3):260-276.

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# Registered Nurses as Permanent Members of Medical Evacuation Crews: The Critical Link

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Aeromedical evacuation has been a staple in the patient care pathway since the US Army Air Corps began evacuating patients from North Africa during World War II, when Army Nurses first began escorting patients through the "chain of evacuation."[1] By 1945, the Army Air Corps evacuated 1.25 million patients by aircraft and some Army Nurses earned their in-flight caregiver wings on a portion of these evacuation missions.[2] It was not until the Vietnam conflict over 20 years later, however, that the chain of evacuation as we know it today—dedicated helicopters and enlisted flight medics—became the standard in the Army.[1]

Successful evacuation of patients throughout the ensuing interval of relative peace proved the concept of dedicated aircraft and reinforced the use of enlisted flight medics to attend to the evacuees. While indicators were present shortly after the first employment of forward surgical teams (FSTs) in Bosnia-Herzegovina and Kosovo in 1997,[1] the return of Army nurses to the chain of evacuation actually became a necessity as combat operations intensified in Operations Enduring Freedom and Iraqi Freedom. Advances in body armor and battlefield medicine, coupled with the capabilities of nearly ubiquitous FSTs, led to unprecedented survival rates. Patients transported by theater medical evacuation assets were more care-intensive, requiring titration of vasoactive medications, sedative infusions, and paralytic agents while manipulating mechanical ventilation. At times, resuscitation was required en route.[3] Clinicians with critical care experience became a requirement for these evacuations.

As the executive agent for medical evacuation in theater, the Army must ensure the standard of care provided to the Soldiers, Marines, Sailors, and Airmen is the best available. To fulfill this clinical requirement, the best option is to assign Army nurses to medical evacuation helicopter units as nonrated members* of flight crews. Army nurses on the crew will undoubtedly help to ensure evacuees receive the best care achievable in theater, from the point of injury to the combat support hospital.

*A nonrated member of a flight crew is an officer or enlisted Soldier who does not have the aeronautical rating of Army aviator or flight surgeon.[4]

## EN ROUTE CRITICAL CARE

Few statistics exist to demonstrate the need or effectiveness of intratheater critical care evacuation early in Operations Enduring Freedom and Iraqi Freedom. However, some information can be inferred from US Air Force intertheater data, which shows that from 2003 to 2006, the Air Force evacuated a total of 37,000 patients from the US Central Command area of operations. Of those, 6,800 were battle injuries and 500 required Air Force critical care air transport team involvement.[2] A logical extension of that data indicates that Army critical care nurses and physicians were likely involved in the intratheater evacuation of at least 500 critically ill evacuees.

Early in Operation Iraqi Freedom, medical leaders in the theater of operations recognized that patient conditions were well beyond the scope of the original medical evacuation concept, which allowed for patient attendance by a single emergency medical technician-trained medic, and put the critically ill patient at serious risk for potentially lethal complications.[1] To mitigate this unforeseen risk, critical care nurses and physicians with little knowledge of aeromedical operations augmented the medical evacuation crews, sporadically and unofficially, providing the care necessary to successfully transport the patient to the next level of care. By 2006, the Army developed the Joint En Route Care Course (JECC) to provide "concise, realistic, relevant, and current training on en route trauma transport to care providers involved in" medical evacuation operations.[1(p48)] Graduates of the JECC (generally experienced critical care or trauma nurses, physicians, and licensed practical nurses) were prepared to care for the critical patient in the cramped, noisy environment of a medical evacuation helicopter.

As critical care clinicians became more involved in the medical evacuation process, quality improvement measures and patient outcomes measures were implemented

to further understand the impact of this new role in the chain of evacuation. In October 2005, the 30th Medical Brigade began tracking medical evacuation statistics. As the senior medical command in Iraq, the brigade reported that 10% to 20% of all medical evacuation patients between October 2005 and October 2007 required some sort of in-flight emergency intervention.[1] The 62nd Medical Brigade and the 86th Combat Support Hospital gathered data on evacuations in Iraq from 2007 to 2009.[1] Over a 15-month period of time, over 700 patients required critical care escort during intratheater evacuation. Between September 2007 and September 2008, Army nurses provided en route care in approximately 60% of all medical evacuation missions.[5] In nearly 10 years, from the beginning of operations in Afghanistan and Iraq until 2010, the Army conducted more than 20,000 medical evacuation flights in support of combat operations.[1,3] Two-thirds of these flights were in support of "preoperative and postoperative resuscitation or surgery patients who had received care at a [FST] or combat support hospital."[3]

As combat operations in Iraq and Afghanistan continued, it became obvious that more patients were critically ill at the point of injury and required greater care during intratheater transport. In 2004, the US Army Institute of Surgical Research established a clinical practice guideline (CPG) that details the roles and responsibilities of personnel assigned to establish intratheater medical evacuation. According to the CPG, the goal of intratheater evacuation is to "provide every patient who is injured on the battlefield or in the AOR [area of operations], the optimal opportunity for survival and the maximum potential for a functional recovery."[6] The operational environment had changed over the years between the Vietnam conflict and Operation Iraqi Freedom. American military prowess could not be matched. The enemy, seeing no other recourse, adopted a guerilla-style warfare that hinged on the use of improvised explosive devices (IEDs) to injure the relatively well-protected American military member. The employment of IEDs resulted in types of polytrauma patients unseen in previous American conflicts who required a higher level of care than normally provided by medical evacuation teams of the past.[6] To account for this change in patient severity, the Army Medical Department (AMEDD) implemented changes to provide more appropriate care to evacuated patients, beginning at the point of injury (POI).

## PARAMEDIC CREW MEMBERS

Currently, all US Army flight medics are trained as an emergency medical technician-basic (EMT-B), which is supplemented by training in prehospital trauma life support. In 2011, Mabry and De Lorenzo posited that paramedic training would greatly enhance the role of the flight medic in providing initial care to those who suffer combat injuries. They proposed a 32-week training cycle that incorporated the flight medic course at Fort Rucker, Alabama, emergency medical technician-paramedic (EMT-P) training, and a ride-along program with civilian air ambulance services in the San Antonio area.[7] By September 2011, the Army had announced a $53 million plan to implement the Mabry and De Lorenzo concept, citing data which demonstrates that patients treated by Army National Guard flight medics, many of whom are also civilian flight paramedics, have a 66% higher survival rate.[8]

While the EMT-P program serves to fill the patient care gap identified by the AMEDD, and it provides a level of clinical education to match the combat experiences of current Army flight medics, some concerns arise about the efficacy of the Soldiers trained in this program. The civilian version of the EMT-B course is a 120-hour program focused on stabilization and transport. The civilian version of the EMT-P course is a 1,000-hour program that focuses on stabilizing medical and traumatic conditions as well as correcting the underlying clinical abnormalities. The Army National Guard flight medics who are civilian paramedics likely have several years of paramedic experience and would be well-versed in polytrauma critical care. Generally, to be hired as a civilian flight paramedic, one must demonstrate a significant amount of ground-based experience. For example, a recent employment announcement by Hahnemann University Hospital in Philadelphia for flight paramedics specified that applicants must have a minimum of 5 years experience as a paramedic for consideration of a job application.[9] According to the National Registry of Emergency Medical Technicians, "paramedics represent the highest licensure level of prehospital emergency care in most states."[10] Without this extensive experience, novice paramedics may question their skills or miss the minute indicators that can lead to a detrimental patient outcome if not addressed. Their experiences and the time it takes to develop their skills in the civilian sector cannot be replicated in an EMT-P program of the AMEDD Center and Schools. Therefore, that success rate is an inappropriate benchmark for the newly-minted, EMT-P certified Army flight medic.

As the pace of the operational environment slows and deployments decline, the EMT-P flight medics will have fewer opportunities to remain clinically prepared for combat medicine. In the United States, some EMT-P trained flight medics will have the opportunity to take part in evacuations from POI to a medical treatment facility because they are assigned to remote posts or to

training facilities. Most flight medics, however, are assigned to units or posts where civilian medical evacuation capabilities cover the region. In the majority of geographic locations of large US Army installations, it will be difficult for EMT-P flight medics will struggle to gain the requisite clinical experience through ride-alongs and emergency room exposures. In those metropolitan healthcare markets that allow the needed ride-along experience, many restrict the ability of the observer to medically interact with the patient due to medical-legal considerations, thereby limiting the usefulness of such a program. This may be mitigated somewhat by assigning the flight medic to the medical facility-based emergency medical service on the Army post as borrowed manpower, fulfilling an advanced life support role on the ambulance service. Even this experience, however, provides little comparable experience for the combat-oriented flight medic as the Army emergency medical service generally has less trauma-focused work than a civilian air ambulance service.

## REGISTERED NURSES ON EVACUATION CREWS

There is little question that the EMT-B trained flight medic is inadequately trained for today's combat medical environment. The EMT-B training does not meet the scope and depth of clinical practice required in today's environment.[1] Paramedic training helps fill this gap, but the limited clinical experience available to the new EMT-P flight medics and the difficulty of keeping their skills current prevents EMT-P flight medics from being the ideal answer. In 70% of en route care provided in Iraq from 2007 to 2009, nurses were required to perform critical care interventions that are beyond the experience level of EMT-P trained flight medics.[1] A position paper published by The Air and Surface Transport Nurses Association states:

> The Air & Surface Transport Nurses Association (ASTNA) believes that services providing critical care transport are functional extensions of hospital emergency departments, and specialty/critical care units. ASTNA further believes that staffing for these services minimally consist of at least one professional, registered nurse who has completed training specific to transport and possess extensive experience and expertise in caring for critically ill and injured patients. Finally, ASTNA believes that nurses employed by critical care transport services who respond to and transport patients from the scene of injury should have training in the unique aspects of prehospital care.[11]

Wirtz et al[12] published a study of civilian medical evacuation crews which compared the outcomes of nearly 1,200 patients cared for by nurse/nurse crews and nurse/paramedic crews (a paramedic/paramedic crew does not exist in the civilian sector and therefore was not included in the study). The study found no statistically significant difference in patient outcomes among the crews, reinforcing the paradigm that the typical flight crew should consist of at least one critical care or trauma trained registered nurse.

The seasoned Army critical care or trauma nurse (hereinafter referred to by their area of concentration designation 66HM5/8A) brings a level of clinical expertise rarely seen in a paramedic. The 66HM5/8A has undergone a 4-month course in emergency and/or critical care nursing and developed many of the clinical problem-solving skills that comes with being a registered nurse, in addition to the critical thinking skills gleaned through 4 years of undergraduate study. Critical care experience does not end with completion of the emergency and/or critical care course. After the course, 66HM5/8As are mentored for 6 months prior to being eligible for deployment. This ensures that most 66HM5/8As have nearly 2,000 hours of didactic and clinical experience before being deployed, and ensures that they have developed the instincts necessary to discern subtle changes in the back of a cramped, loud helicopter. Army Nurses who hold the 66HM5/8A designator serve in the critical care or emergency setting and maintain that clinical expertise on a daily basis. Seldom are they removed from the clinical mission for training purposes, counter to the reality that enlisted medics (EMT-B or EMT-P) experience on a daily basis. For nurses, daily clinical exposure is the norm, rather than the exception.

## IMPLEMENTATION/PROPOSAL

It is time for Army nurses to become permanent, non-rated members of Army medical evacuation crews. In today's Active Army, there are approximately 20 medical evacuation units staffed with EMT-B flight medics. To augment these units with the addition of one permanent 66HM5/8A per unit would require approximately 20 Army nurses from the AMEDD. The critical nature of patient care in the aircraft requires the daily presence of nursing expertise. This nurse, acting as the senior critical care expert in the medical evacuation unit, is a clinical expert who can provide an unparalleled level of care for the patient and may also serve as a clinical advisor to the unit.

Army nurses, by the nature of their profession, are educators. While the aviation flight surgeon assigned to the medical evacuation unit is available for staff education and patient care, he or she is often not as experienced in the care of critically ill patients. The flight surgeon is generally focused on maintaining the health of the medical evacuation crew. The 66HM5/8A would focus

on educating and training the flight medics, as well as facilitating a medical proficiency training program at the local medical treatment facility, in preparation for their clinical role on the crew. The 66HM5/8A, who would split their time between keeping their skills current in a medical treatment facility and maintaining their flight currency (just as other Army Forces Command (FORSCOM)-assigned Army nurses do already), has the ability to facilitate clinical experiences for the flight medics in the emergency department, the critical care units, and the operating room. These efforts alone could justify the assignment of a 66HM5/8A to the medical evacuation units.

Deployment in support of combat operations is mentally and physically taxing on even the most seasoned military members. A single 66HM5/8A in the medical evacuation unit would not be able to withstand the intensity of the situations that require medical evacuation. The permanent 66HM5/8A would need augmentation through the AMEDD Professional Filler System (PROFIS),* adding an additional 5 or 6 nurses per medical evacuation unit, which would provide for a rotation of the 66HM5/8A in shifts with the accompanying flight medics. To reduce the total flight nurse requirement, the flight nurses could be deployed at half of the total expected requirement. Medical evacuation helicopters tend to work in tandem, allowing one flight nurse per pair of aircraft, which would reduce the overall PROFIS assignment requirement. To prepare for their new assignment, these PROFIS 66HM5/8As must attend the Combat Casualty Care Course and the Joint En Route Care Course, just as the assigned FORSCOM nurse, prior to arriving at the unit. Most senior company grade nurses already attend these courses prior to deployment, so this would not require a new process or cost increases associated with training. Prior to deployment, the PROFIS 66HM5/8A would join the unit for rotations at the Combat Training Centers at Fort Irwin, California or Fort Polk, Louisiana, where they would become familiarized with the unit's standard operating procedures, equipment, and personnel. These rotations would help integrate the 66HM5/8A into the close-knit community of aviation medicine and allow flight crews to become familiar with the nurses' clinical capabilities.

Some may argue that Army nurses are not prepared to be a part of the medical evacuation flight crew, conducting patient care at the point of injury in a potentially hostile fire environment. Army Medical Department members receive extensive training throughout their careers in preparation for deployments to a combat zone. Once assigned to the position, to ensure their preparation for the medical evacuation mission, the 66HM5/8A should attend the Combat Casualty Care Course and the Joint En Route Care Course. The former is designed to give personnel the skills necessary to provide medical care under austere conditions. The latter provides attendees with a 2-week foundation in the fundamentals of operating in and around helicopters while also introducing experiential clinical learning based on the most current lessons learned from the CENTCOM theater of operations. Additionally, the 66HM5/8A will take part in multiple training exercises with the aircrew upon assignment to the team, gaining familiarity with the aircraft and the standard operating procedures of the crew.

With fewer deployments anticipated in the future, and budget constraints a persistent reality, the $53 million program to train EMT-P may be too costly to sustain. Use of the 66HM5/8A as a permanent member of the aircrew takes advantage of 3 programs of instruction already present in the AMEDD. In addition, because Army nurses are regularly involved in direct patient care, the skills and knowledge needed by a flight nurse are more easily sustainable than those required of a paramedic-trained flight medic. Furthermore, 66HM5/8A registered nurses who are assigned to medical evacuation units improve patient care throughout the unit by training the flight medics and fostering a team-based care environment.[1]

## SUMMARY

Medical evacuation has changed from the experiences of the past decade of combat operations. Much of the focus of medical support in the combat zone is now critical care during evacuation, which is, and will continue to be, a very successful, life-saving asset.[2] The assignment of Army critical care or trauma nurses to medical evacuation units is consistent with the recognition that the medical evacuation system is a truly vital asset in the success of today's American military. Our NATO allies, and our sister services, rely heavily on the availability, reliability, and especially the continuity of care of the Army medical evacuation system.[5,13] It is time to upgrade the system of evacuation and provide our Warriors with the greatest possibilities of survival. Army nurses trained in critical care and trauma nursing are best suited to provide that continuity of care.

*PROFIS predesignates qualified Active Duty health professionals serving in other units to fill Active Duty and early deploying and forward deployed units of Forces Command, Western Command, and the medical commands outside of the continental United States upon mobilization or upon the execution of a contingency operation.

## REFERENCES

1. Davis RS, Connelly LK. Nursing and en route care: history in time of war. *US Army Med Dep J.* October-December 2011:45-50.
2. Roedig E. Aeromedical evacuation. Technical evaluation report summarizing the proceedings at the NATO specialist meeting 157, 2-3 December 2008, in Sieburg, Germany. North Atlantic Treaty Organization; 2009. Available at: ftp://ftp.rta.nato.int//pubfulltext/rto/mp/rto-mp-hfm-157/. Accessed May 4, 2012.
3. Hudson TL, Morton R. Critical care transport in a combat environment: building tactical trauma transport teams before and during deployment. *Crit Care Nurse.* 2010;30:57-66.
4. *Army Regulation 600-106: Flying Status for Non-rated Army Aviation Personnel*. Washington, DC: US Dept of the Army; December 8, 1998:9.
5. Nagra, M. Optimizing wartime en route nursing care in Operation Iraqi Freedom. *US Army Med Dep J.* October-December 2011:51-58.
6. US Army Institute of Surgical Research. Intratheater Transfer and Transport of Level II and III Critical Care Trauma Patients. November 2008. Available at: http://www.usaisr.amedd.army.mil/assets/cpgs/Intratheater_Transfer_and_Transport_19_Nov_2008.pdf. Accessed May 4, 2012.
7. Mabry RL, De Lorenzo RA. Improving role I battlefield casualty care from point of injury to surgery. *US Army Med Dep J.* April-June 2011:92-100.
8. Zoroya G. Top-flight medics: Army training moves to next level. *USA Today.* September 6, 2011. Available at: http://www.usatoday.com/news/military/story/2011-09-06/Top-flight-medics-Army-training-moves-to-next-level/50286806/1. Accessed May 4, 2012.
9. Tenet Healthcare Corporation. Job Search: Flight paramedic–full time–med evac–841–7365-1205006939. Available at: https://tenet.taleo.net/careersection/10100/jobdetail.ftl. Accessed May 7, 2012.
10. National Registry of Emergency Medical Technicians. What is EMS?. https://www.nremt.org/nremt/about/What_is_EMS.asp. Accessed May 7, 2012.
11. Air & Surface Transport Nurses Association. Staffing of Critical Care Transport Services. 2010. Available at: http://www.astna.org/documents/STAFFINGOFCRITICALCARETRANSPORTSERVICES_000.pdf. Accessed May 7, 2012
12. Wirtz MH, Cayten CG, Kohrs DA, Atwater R, Larsen EA. Paramedic versus nurse crews in the helicopter transport of trauma patients. *Air Med J.* 2002;21(1):17-21.
13. Hartenstein I. Medical evacuation in Afghanistan. Technical evaluation report summarizing the proceedings at the NATO specialist meeting 157, 2-3 December 2008, in Sieburg, Germany. North Atlantic Treaty Organization; 2009. Available at: ftp://ftp.rta.nato.int//PubFullText/RTO/MP/RTO-MP-HFM-157/. Accessed May 4, 2012.

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# Clinical Nurse Leader: Emerging Role to Optimize Unit Level Performance

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Patient care delivery in complex healthcare delivery systems calls for emerging professional roles to navigate the labyrinth of quality and safety imperatives. The Clinical Nurse Leader® (CNL®) is one such emerging nursing role. This important role was developed by The American Association of the Colleges of Nursing (AACN) in collaboration with key nursing education leaders and stakeholders.[1] This article describes the CNL role as a means for achieving US Army Medical Department strategic outcomes, distinguish the CNL role from the Clinical Nurse Specialist role, give a case example, and recommend considerations for implementation in the US Army Medical Department. While others[2] have studied this new role in civilian settings, the unique contribution of this article is its application to the US Army setting.

## DEFINING THE CLINICAL NURSE LEADER

The CNL is a registered nurse with a master's degree from a CNL education program who serves as an advanced generalist clinician. The CNL provides oversight of care coordination and integration of care for a defined group of patients at the microsystem (unit) level. The CNL is in a pivotal leadership role to incorporate evidence-based practice, quality improvement, and patient safety initiatives to ensure the Institute of Medicine's[3] (IOM) quality aims are met. The IOM's 6 aims for improvement are focused on healthcare being (1) safe, (2) timely, (3) effective, (4) efficient, (5) equitable, and (6) patient-centered.

The AACN[1(p10)] lists the following fundamental aspects of the CNL role:

- Leadership in the care of patients in and across all environments.
- Design and provision of health promotion and risk reduction services for diverse populations.
- Provision of evidence-based practice.
- Population-appropriate health care to individuals, clinical groups/units, and communities.
- Clinical decision-making.
- Design and implementation of plans of care.
- Risk anticipation.
- Participation in identification and collection of care outcomes.
- Accountability for evaluation and improvement of point-of-care outcomes.
- Mass customization of care.
- Client and community advocacy.
- Education and information management.
- Delegation and oversight of care delivery and outcomes.
- Team management and collaboration with other health professional team members.
- Development and leveraging of human, environmental, and material resources.
- Management and use of client-care and information technology.
- Lateral integration of care for a specified group of patients.

## THE CNL ROLE IN RELATION TO OTHER NURSING ROLES IN THE CLINICAL MICROSYSTEM

The CNL is not an administrative or management role. The CNL partners with the administrative and management staff and is a vital member of the interprofessional healthcare team. The AACN highlights the similarities, differences, and shared characteristics of the CNL and nurse manager roles.[4] In collaboration, the CNL and the nurse manager focus on improving the quality of care delivered in the healthcare system. The CNL and Clinical Nurse Specialist (CNS) roles are also complementary and collaborative. The AACN published a working statement[5] comparing the CNL and CNS roles, highlighting the similarities, differences, and complementary characteristics. Table 1 summarizes these similarities and differences in terms of education, certification title, clinical practice area, and value.

Regardless of specialty and focus, the CNS incorporates both the microsystems and the macrosystem into the care of the patient, staff and organization as described in the AACN[6] synergy model spheres. This model includes

these interrelated systems: the client/patient, the personnel/staff, and the organization/system. The spheres are incorporated into each of the 5 main roles of the CNS: clinical expert, consultant, educator, researcher, and clinical leader. Whether the CNS functions as a licensed independent provider or blends into the team, he or she uses the focus, specialty, and spheres to provide holistic care to the end user, our patients. By way of contrast, the CNL is an advanced generalist in nursing who is prepared to be a direct care provider accountable for the care outcomes of a clinical population or a specified group of patients/clients in a healthcare system. The CNL provides for lateral integration at the point of care (bedside) that promotes quality care outcomes. The CNL master's level curriculum is offered in response to the profound changes in the increasingly complex healthcare system mandating change to improve quality of care while reducing costs, improving access, eliminating disparities, and promoting safe practice. The CNL oversees the care coordination of a distinct group of patients and actively provides direct care in complex situations. As an advanced generalist, the CNL incorporates evidence-based practice, patient safety, and quality improvement to optimize healthcare outcomes. The CNL provides leadership to assure safe, timely, efficient, effective, and equitable patient-centered care.

Table 1. Clinical nurse leader and clinical nurse specialist compared by education, practice, and value.

| | Clinical Nurse Leader | Clinical Nurse Specialist |
|---|---|---|
| Master's Prepared | Yes | Yes |
| Advanced Practice Registered Nurse | No | Yes |
| Advanced Generalist Clinician | Yes | No |
| Vital member of the interprofessional healthcare team | Yes | Yes |

Both roles require master's preparation and each role has a clear domain of influence and skills. The CNL and CNS roles are distinct in their respective preparation and collaborate in the mission to benefit the patient, staff, and system. In Thompson and Lulham's article,[7] these 2 master's degree-prepared roles have both demonstrated clear benefits. For example, the CNLs and CNSs who serve a cardiac population of patients within a university healthcare system together, have developed a collaborative relationship that benefits both staff and patients. Both worked together to differentiate role expectations, functions, and outcomes. In making patient care decisions, there are role similarities and overlaps, such as working with the multidisciplinary team, using advanced nursing skills for patient assessment, performing complex problem analysis, and supporting bedside staff. Despite these similarities, there are differences that reinforce the need for separate roles. The CNL manages a distinct population group through day-by-day management of clinical issues and decisions. The focus is on evaluating and supporting evidence-based decisions to ensure best possible outcomes. By contrast, the CNS aims to help staff deal with disease processes and treatments from a broader perspective, focusing on a group such as patients with cardiac diagnoses and solving problems at the macrosystem level. The CNLs directly assist staff to implement evidence-based or patient care changes with each individual patient at the microsystem level. The CNS may coordinate hospital-wide orientation programs and provide formal staff education, such as teaching new employees in the skills laboratories. The CNL assists with staff development and education but deals mainly with individual staff members at the bedside. According to Thompson and Lulham,[7] they collaborate to build staff nurses' skills and abilities, especially with regard to critical thinking and fostering patient education.

## PROGRAM OF STUDY

The CNS program of study focuses on one of several specialties: (1) medical-surgical, (2) critical care, (3) geriatric, (4) pediatric, (5) mental health, (6) oncology, or (7) community health nursing. Within these populations, the CNS may also focus on patients with a particular diagnosis or condition such as heart failure, wounds, or pain.

The CNL major at the School of Nursing, University of Texas Health Science Center at San Antonio was initiated during the fall of 2010. The CNL curriculum was developed using the CNL Essential Curriculum Elements[4] as a guide and is congruent with the AACN's Essentials of Masters Education.[8] The CNL major consists of 40 semester credit hours and 495 clinical practicum hours. Table 2 presents course names, numbers, respective semester credit hours, and clinical hours. During the last semester, and at the conclusion of the CNL capstone clinical experience, the student is eligible for the AACN Commission on Nurse Certification CNL credentialing examination to obtain national CNL certification.

## APPLICATION OF THE CNL ROLE IN THE US ARMY

The Clinical Nurse Leader (CNL) is key to meeting both the Army Medical Department (AMEDD) macrosystem objectives and the Army Medical Command's (MEDCOM) strategic objectives. The MEDCOM created a balanced scorecard (BSC) to align all Army medical organizations toward "achieving its overarching strategic objectives."[9] The BSC builds on the AMEDD's mission (why we exist), vision (where we want to be), and strategic themes ("pillars of excellence").[10(p7)] In 2009, the MEDCOM Chief of Strategic Planning noted that:

Table 2. Clinical nurse leader curriculum (required courses), School of Nursing, University of Texas Health Science Center, San Antonio.

| Theoretical Core Courses for all Graduate Students: | |
|---|---|
| NURS 5339 Leadership for Quality, Safety, and Health Policy | 3 semester credits |
| NURS 5306 Advanced Theory for the Practice of Nursing | 3 semester credits |
| NURS 5307 Using Research for the Practice of Nursing | 3 semester credits |
| NURS 5356 Financial and Economic Evidence in Healthcare | 3 semester credits |
| **Clinical Nurse Leader Major Courses** | |
| NURS 6317 Healthcare Information Systems and Patient Care Technology | 3 semester credits |
| NURS 6380 Foundations of Epidemiology | 3 semester credits |
| NURS 5338 Advanced Pathophysiology | 3 semester credits |
| NURS 6210 Advanced Health Assessment and Clinical Reasoning | 2 semester credits |
| NURS 6110 Advanced Health Assessment and Clinical Reasoning: Clinical Application | 1 semester credit 45 clinical hours |
| NURS 6302 Advanced Pharmacotherapeutics | 3 semester credits |
| NURS 6230 Clinical Nurse Leader (CNL) I: Role of the Advanced Generalist in Healthcare Microsystems | 2 semester credits |
| NURS 6233 Clinical Nurse Leader (CNL) I: Role of the Advanced Generalist in Healthcare Microsystems: Clinical Application | 2 semester credits 90 clinical hours |
| NURS 6120 Clinical Nurse Leader Role II: Seminar | 1 semester credit |
| NURS 6822 Clinical Nurse Leader Role (CNL) II:Clinical Application for the Advanced Nursing Generalist | 8 semester credits 360 clinical hours |
| **Total Semester Credit Hours: 40** | |
| **Total Clinical Hours: 495** | |

> The Surgeon General likes to use the muddy stream analogy: sometimes our organization can appear mired and moving in multiple, random directions. The balanced scorecard is our way of getting everyone moving in the same direction; gathering momentum as we go.[9]

The skills of a CNL can clear that "muddy water" at the individual hospital unit level while keeping the AMEDD's BSC in the forefront. The CNL can help focus the staff while implementing strategic objectives.

The AMEDD Balanced Scorecard was last updated in March of 2011 and states the AMEDD's vision is to "bring value and inspire trust."[10] Two strategic themes and desired results are particularly well-suited to the skills of the CNL: (1) maximize value in health services, and (2) balance innovation with standardization. The first, maximize value, seeks a result of "effectively and efficiently provide(ing) the right care at the right time"[10] which is a primary goal of the CNL. Units within the Department of Veterans Affairs that employ the use of a CNL reported that "integration of the CNL role in all areas of practice in every care setting has the promise of streamlining coordination of care"[11(p382)] which would lead to improved efficiency. The CNL can aid in the second strategic theme, balancing "innovation with standardization,"[11(p382)] by maximizing the use of best practices resulting in optimal patient outcomes, also in accordance with the MEDCOM BSC. The CNL is best positioned to implement evidence-based practices on the unit because "as a master's prepared nurse generalist, the CNL is prepared to deliver and direct evidence-based practice, evaluate patient outcomes, and assess risk, while improving the overall coordination and delivery of care for an individual/ group of patients at the microsystem level."[1] Upon review of the BSC, depicted in the Figure, the authors noted, by outlining in red, the ends, ways, and means of positive effect by CNLs.

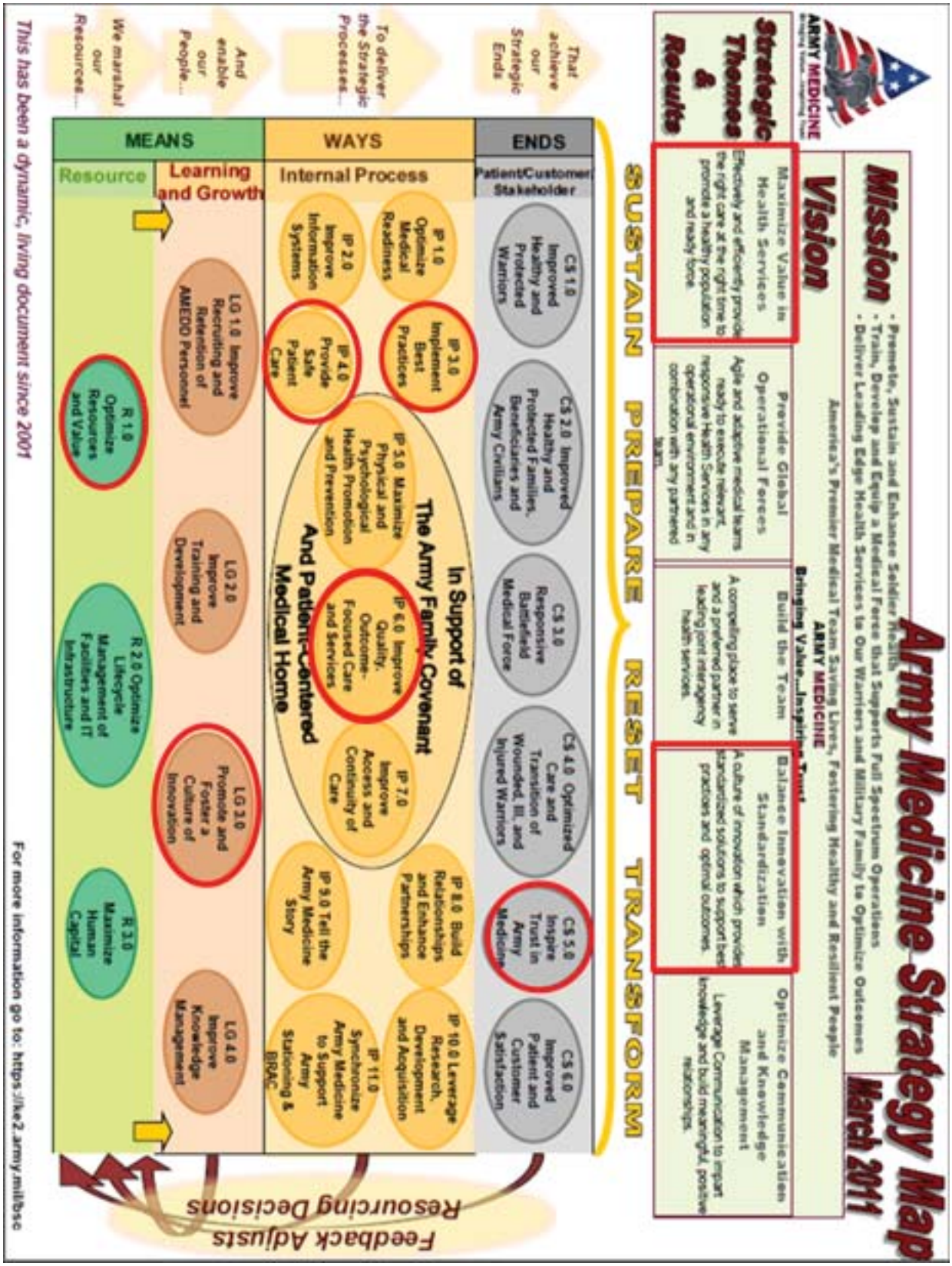
The military healthcare workforce faces a unique situation of scheduled transition into and out of its facilities. This creates challenges with continuity around which a CNL can navigate using evidence-based practice with care coordination improving overall patient satisfaction. The following case example illustrates pilot implementation of the CNL role by an Army Nurse Corps officer prior to formal graduate education. The example points out the importance of graduate education and appropriate structural decisions pertaining to the role.

## CASE EXAMPLE: IMPLEMENTING THE CNL ROLE

The Clinical Nurse Leader role was piloted on one nursing unit at William Beaumont Army Medical Center (WBAMC), Fort Bliss, Texas. The WBAMC is a Phase II site for the BG (R) Anna Mae Hays Clinical Nurse Transition Program (CNTP), which is designed to ensure the readiness of the Army's new registered nurses (RNs). From this program, the new RNs are assigned to Army military treatment facilities or medical centers.

The CNTP requires one year, combining didactic and clinical orientation for the novice RN. The program affords each new RN similar experiences and exposure to large numbers of diagnoses and patient volume. By planned preparation of the RN prior to moving to a potentially smaller duty station or a deployed setting, the training opportunities actually benefit the overall military healthcare system.

Once the 12-month program is complete, the nurse officer is eligible for a permanent change of station reassignment. This is a core difference in current Army Nurse




The Army Medicine Strategy Map. Source: US Army Medical Department, http://www.armymedicine.army.mil/news/scope/Summer_2011_Scope.pdf

Corps utilization policy compared with that prior to the CNTP. Historically, the RN may have been assigned for 1½ to 2½ years on a medical-surgical nursing unit. This allowed more time to fully progress from novice to (at least) advanced beginner. The secondary organizational benefit was additional time for staff to progress through more of Benner's novice to expert stages[12] while having access to staff at higher stages as mentors. While the Army provides no definite time line for progression through Benner's novice to expert stages, Kaminski reported that it takes approximately 5 years to move through the 5 stages, but also noted that not all novices become experts.[13]

The WBAMC medical surgical section is small in comparison to other major medical centers. The CNTP posed a challenge to the section because the program's new RNs arrive and depart in groups. On average, the program's RNs are at WBAMC for 15 months, since most leave 3 months after completing CNTP. Their presence results in less experienced RNs making up a larger percentage of the overall staff. Further, the staged rotation means that nurses who become the most knowledgeable leave and few remain to precept. These 2 circumstances decreased the effectiveness of the CNTP at WBAMC because there was less knowledge being passed to incoming nurses during preceptorship, and less expertise to access when clinical questions arose. WBAMC chose to fill this knowledge gap with the CNL.

For the CNL on the surgical nursing unit at WBAMC, the first task was role creation. The nurse researcher and section chief assisted with literature research, job description creation, and rating scheme development. At that time, there was not a long-term health education training opportunity to be a CNL, nor was the CNL incumbent master's prepared. Leaders selected the CNL based on clinical expertise and leadership ability. The CNL had 10 years RN experience within the medical, surgical, critical care, and teaching environments combined, and had just returned from a deployment to Operation Iraqi Freedom.

## OUTCOMES MEASUREMENT

The metrics for effectiveness will always be established by the facility. Some of these metrics are highlighted in this article. The metrics employed could be influenced by increasing communication and attention to the nursing process. The effective evaluation and implementation of the nursing process is essential to success as a CNL. The nursing process is the foundation for effective nursing care, and, by extension, improves the measurable metrics. For example, a thorough pain assessment with proper planning, implementation, and reassessment may decrease falls and length of stay while increasing patient satisfaction. The CNL provides expertise in each step of the process for the staff RNs.

To this end, the first performance improvement (PI) project at WBAMC assessed communication handoff and determined that reports were incomplete during the morning report and pertinent information was not being relayed. It also became clear that absence of communication was a measure of decreased understanding of the nursing process. The PI project used observational and descriptive cross-sectional analysis of communication data. Point measures were the communication of code status, assessment findings, vital signs, laboratory values, intravenous access points, and the plan of care. Data were collected one month before education and 3½ months after education. Increases in percentage points are shown in Table 3. Dramatic improvements were noted in all aspects of communication during patient care transitions. Those improvements were directly associated with CNL role implementation.

These improvements were a measurable function of the CNL working within the clinical microsystems, rounding on and interacting with patients, inquiring about the plan of care with the RN, and functioning as a clinical resource. The CNL is a generalist, but, at the same time, an expert—the "go to" person at the point of care when knowledge gaps are present. They bring the expert assessment to the bedside, help the staff create a plan, foster communication from that plan to the physician staff, and work to implement and reevaluate the patient care. Through these capabilities and actions, the CNL benefits the staff and the organization. They are the constant resource and an integral team member. The CNL role became a recognized success at WBAMC when the staff began to regularly ask for input and help. The phrases (from the staff) "can you explain this?" and "can you help me with…?" and "can you take a look at this patient with me?" became success measures.

Table 3. Improvements in communication during patient care transitions and handoffs associated with CNL role implementation at one military medical center.

| Metric | One Month Before Education | 3½ Months After Education | Increase in Percentage Points |
|---|---|---|---|
| Code status | 63% | 87% | +24 |
| Assessment | 79% | 94% | +15 |
| Vital signs | 73% | 82% | +9 |
| Lab values | 67% | 73% | +6 |
| Intravenous (IV) access and fluids | 20% | 95% | +75 |
| Plan of care | 60% | 93% | +33 |

## RECOMMENDATIONS

Due to the complex nature of changes within personnel proponency, planning for force structure integration of the CNL must begin immediately. The positions identified for the CNL should be filled with nurses who are master's prepared as CNLs, whether Department of the Army civilian or major or lieutenant colonel Army nurses.

For the CNL to be most effective within the individual units, we recommend that they work in partnership with, but are not rated by, the head nurse (HN). This arrangement could prevent "mission creep" in that the HN may want to assign workload to the CNL instead of working together toward a common goal while staying in their respective roles. The HN should be focused on future planning, organizational level goals, and employee ratings and awards. The CNL should focus on interdisciplinary collaboration, improvement science, and policy development. The delineation between the HN and the CNL will be of paramount importance, requiring education of the hospital staff on the appropriate role of the CNL. Without this, the CNL could be perceived as a "ghost" head nurse and spend his or her time attending inappropriate meetings in place of the HN. The section chief would be an appropriate choice as a rater given that some head nurses may be outranked by the CNL assigned to their unit. For a captain (promotable) or major, the senior rater must be at least a colonel. In most situations, the CNL should be rated by the section chief and senior rated by the assistant chief nurse, providing that person is a colonel. If the assistant chief nurse is not a colonel, then the chief nurse would be the appropriate senior rater.

To create the standardization that the BSC seeks, the AMEDD would have to adopt the goal of placing CNLs in at least the 5 major medical centers. If the positions are not delineated on the Table of Distribution and Allowances, they may be reabsorbed into the staff of a given unit. Annual meetings or conferences of all clinical nurse leaders assigned to medical centers, in person or via video teleconference, would decrease variability in role performance across the medical centers, and highlight any trends to misassign CNLs within the clinical environment.

The ratio of head nurses to CNLs in the medical center would be optimal at one to one. That is, a CNL on each nursing unit will be a force multiplier for every head nurse. The CNL would be an advocate and conduit for implementing best practices and evidence-based practice within the AMEDD facilities. To aid in this role, the CNL should have access to library databases such as EBSCO (EBSCO Information Services, Birmingham, Alabama). The introduction of any new role will have challenges. Decreasing confusion and role clarification must be priority one when implementing a CNL into the practice setting. The following are suggestions on initial implementation:

1. Clearly define the role and be completely comfortable articulating it. This communication is important up and down the chain of command. It is essential that senior leaders and RN staff know the CNL's role and goals.

2. Know everyone and become known in the clinical environment. As with any new job or facility, the incumbent in a new role must establish a baseline within the inner workings of the facility. Working with staff members as their mentor provides familiarity with all tasks, locations, code combinations, and processes within a unit or ward. Spending 2 day periods with several different members of the nursing staff, a combination of stronger and weaker nurses, is advisable. Thus, the CNL can begin to quietly evaluate the staff while showing an ability and willingness to "get my hands dirty" in the course of caring for patients. During CNL interactions with physicians, it is important to explain the CNL roles in care coordination, clinical improvement in care delivery, and enhanced communication between the physician and nursing staff.

3. The duty location of a CNL is in the nursing unit, at the bedside and overtly available to the staff. The CNL is their resource. The CNL's ability to act as such is diminished by absences from the care environment for meetings. While some may be necessary, most will not. Have the support of the senior leader to say no, and remain at the bedside.

In order for the CNL position to realize its potential as a valuable resource in the provision of healthcare within AMEDD, CNLs must be given the proper tools and responsibilities to demonstrate their value and effectiveness. Only then can they successfully educate the hospital staff, both leadership and those directly involved in patient care, about the important role of the CNL in their facility operations. With careful planning prior to implementation of the CNL positions, AMEDD will find that the CNL quickly becomes indispensable to meeting many of their strategic objectives.

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## REFERENCES


1. *White Paper on the Education and Role of the Clinical Nurse Leader*. Washington, DC: American Association of Colleges of Nursing; 2007. Available at: http://www.aacn.nche.edu/publications/whitepapers/ClinicalNurseLeader.pdf. Accessed June 21, 2012.
2. Moore L, Leahy C. Implementing the new clinical nurse leader role while gleaning insights from the past. *J Prof Nurs*. 2012;28(3):139-146.
3. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: The National Academies Press; 2001. Available at: http://www.nap.edu/books/0309072808/html/. Accessed June 21, 2012.
4. Ott KM, Haase-Herrick K. Working statement comparing the clinical nurse leader and nurse manager roles: similarities, differences and complementarities. [American Association of Colleges of Nursing website]. March 2006. Available at: http://apps.aacn.nche.edu/CNL/pdf/tk/roles3-06.pdf. Accessed June 21, 2012.
5. Spross JA, Hamric AB, Hall G, et al. Working statement comparing the clinical nurse leader and the clinical nurse specialist roles: similarities, differences and complementarities. [American Association of Colleges of Nursing website]. December 2004. Available at: http://apps.aacn.nche.edu/CNL/pdf/CNLCNSComparisonTable.pdf. Accessed June 21, 2012.
6. The AACN synergy model for patient care page. American Association of Critical-Care Nurses website. Available at: http://www.aacn.org/WD/Certifications/Content/synmodel.content?menu=Certification. Accessed June 23, 2012.
7. Thompson P, Lulham K. CNL and CNS role delineation in the acute care setting. *J Nurs Adm*. 2007;37(10):429-431.
8. *The Essentials of Master's Education in Nursing*. Washington, DC: American Association of Colleges of Nursing; 2011. Available at: http://www.aacn.nche.edu/education-resources/MastersEssentials11.pdf. Accessed June 21, 2012.
9. Aligned scorecards provide cohesive plan. *The Mercury*. March 2009. Available at: http://www.armymedicine.army.mil/news/mercury/09-03/BSC-cascade.cfm. Accessed November 10, 2011.
10. Pere S. Balanced scorecard, strategy focused. *The Army Medicine Scope*. Summer 2011:7. http://www.armymedicine.army.mil/news/scope/Summer_2011_Scope.pdf. Accessed November 10, 2011.
11. Ott KM, Walters SE, Haddock KS, et al. The clinical nurse leader: impact on practice outcomes in the Veteran's Health Administration. *Nur Econ*. 2009;27(6): 363-383.
12. Benner P, Tanner C, Chesla C. From beginner to expert: gaining a differentiated clinical world in critical care nursing. *ANS Adv Nurs Sci*. 1992;14(3):13-28.
13. Kaminski J. Theory applied to nursing informatics-novice to expert. *Can J Nurs Inform*. 2011;5(4):1-3. Available at: http://cjni.net/journal/?p=967. Accessed August 3, 2012.


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# Lessons Learned Small Unit Postdeployment Survey Results and Analysis

MAJ (Ret) David W. Cannon, MS, USA

ABSTRACT

The Army Medical Department Lessons Learned Division conducted a survey of small unit service members from July through September 2011 to obtain feedback on the challenges they faced during recent deployment operations. Personnel assigned to selected company-sized units, teams, and detachments that redeployed within the past 12 months were asked to complete an online survey of questions regarding their predeployment and operational experiences. The results revealed a number of variables such as respondents' service component, assigned unit, and geographic location that influenced views on the issues. The implications of the findings are discussed, along with recommendations for future work designed to collect small unit observations, insights, and lessons.

Small units of the Army Medical Department (AMEDD) play a vital role in providing combat health support within a theater of operations. For example, combat and operational stress control, forward surgical care, and preventive medicine functions are performed by teams that operate in remote locations such as forward and contingency operating bases. Despite the widespread use of these units on the battlefield, there is a paucity of after action reviews (AARs) and reports from operations and training exercises in the lessons learned databases. The small unit survey discussed herein was designed to fill this gap and provide unit members the opportunity to provide input on their deployment experiences.

## METHODS

The survey targeted small units such as preventive medicine teams, medical logistics companies, area support medical companies, dental companies, forward surgical teams, and other similar-sized units that redeployed from Operations New Dawn, Enduring Freedom, and Iraqi Freedom from July 2010 to July 2011. The survey questions were developed from the AMEDD Lessons Learned Division's postdeployment questionnaire used for end-of-tour AAR video teleconferences and information collections from other redeployed medical units. Over 100 small unit members completed the online survey. This number represented a completion rate of 10% of the total number of emails sent to small unit members via Army Knowledge Online group email accounts established on the basis of redeployment dates and unit identification codes.

Respondents provided anonymous demographic information including military rank, Army service component,* and other similar data, followed by a 22-item questionnaire. The questionnaire used a Likert-style format with a score point scale that ranged from 1 (strongly agree) to 5 (strongly disagree). The questions were designed to determine what operational challenges units faced during predeployment activities and deployment operations. The questions were reversed on some items so that a numerical low score of 1, indicating strong agreement, was sometimes associated with a positive view (for example, "our unit had adequate training") and other times with a negative view ("our unit had communications challenges"). In addition to the scaled questions, respondents could expand their answers and provide additional details about their training, preparations, and medical support experiences in free-text blocks.

## DATA ANALYSIS

The results of the correlation data analysis revealed several small but significant correlations at the 0.05 level between the independent variables and the respondents' answers on the questions. Higher military rank was negatively correlated to ratings on 3 questions indicating strong agreement with the following statements: "the medical supply process, including automation systems, posed challenges/difficulties"; "Advanced Leadership Course (ALC)/Senior Leadership Course (SLC) training prepared our NCOs† for the deployment," and "predeployment training for Soldiers was relevant to meet our needs."

Older respondents showed strong agreement with the statement "during the deployment our unit faced challenges in the area of life support." Time in service (TIS) produced 2 significant effects on respondents' answers. Those individuals with more TIS expressed strong

* Active Army, Army Reserve, National Guard, Active Guard/Reserve

† Noncommissioned officers

disagreement with the statements "predeployment training for professional filler system (PROFIS)* personnel was adequate for their roles and responsibilities" and "our unit utilized nonstandard (non-Department of Defense) automated equipment and/or commercial systems and programs for operations." Respondents who spent more months in theater were much more likely than those with fewer months to have favorable views of their units' predeployment training and the use of updated materials from lessons learned. Similarly, respondents with more months in theater held more positive views than those with fewer months of their units' ability to provide a wide range of coverage.

The analysis of variance data showed no significant differences in responses based on the respondents' deployment theaters. However, the results indicated that respondents' geographic/environmental location within the theater of operations had an effect on unit members' responses on a number of questions. The questions about the degree to which ALC/SLC training prepared the units' NCOs for deployment, whether or not the unit was correctly structured for its mission, the adequacy of the medical supply process, challenges with the Medical Communications for Combat Casualty Care (MC4) system, challenges with theater-provided equipment, and additional materiel and equipment needs to meet operational demands all produced F scores with high degrees of confidence. These results indicate that the geographic area to which the respondent was deployed was a key variable affecting his or her perceptions on these questions.

The type of unit with which the individuals were deployed was a key factor in respondents' answers on the following 2 areas of inquiry (questions paraphrased):

- Did unit predeployment training include both updated lessons learned and tactics, techniques, and procedures from deployed units?
- Was the unit correctly structured for its mission in terms of personnel and equipment and was it able to adapt to rapidly changing situations?

Respondents' answers on those 2 questions varied significantly, depending on the type of unit with which they deployed.

Individuals from the 4 Army service components responded with significant differences on the question of their unit's wide-range mission capability.

*PROFIS predesignates qualified Active Duty health professionals serving in other units to fill Active Duty and early deploying and forward deployed units of Forces Command, Western Command, and the medical commands outside of the continental United States upon mobilization or upon the execution of a contingency operation.

Respondents provided additional details to emphasize or expand answers to the survey. These responses highlighted issues with forward surgical team (FST) split-based operations, PROFIS, and medical refresher training. For example, MC4 was a significant concern for a number of the small unit members, and respondents provided comments about challenges associated with the system. Surveys reported issues with the network connectivity of the MC4 system and image version. While some respondents wrote they had useful MC4 training prior to deployment, the MC4 system's status often varied widely and went from operational to nonoperational throughout the deployment.

Other respondents noted that units operating on forward operating bases (FOBs) and contingency operating bases (COBs) had to improvise ways to receive medical supplies via MC4 and rely on resupply help from other units to accomplish the mission. One survey indicated that it took at least 60 days for supplies to arrive, and another recommended additional MC4-trained "super users" in theater since contract support for MC4 was limited to certain areas. Unreliable and slow internet connectivity exacerbated this issue because connectivity was dependent on each FOB`s signal capabilities. In some instances, this made MC4 virtually a standalone system with little support for ongoing system failures in remote areas. However, MC4 is designed to function as a standalone system in areas of low to no connectivity, ensuring continuous documentation of electronic medical recording with data transfers occurring when a unit gains internet connectivity. Patient transfer and accountability functions were hampered since paperwork often had to be re-created each time a patient was moved to a new facility due to system firewalls or lack of connectivity. A respondent who served in an FST wrote that MC4 information did not upload in real time to the Theater Medical Data Store or other higher level servers and noted that Role 3 medical treatment facilities could not review their records digitally. According to MC4, when internet connectivity is secured, data entered into MC4 flows to the Theater Medical Data Store every 2 to 3 minutes on average. Users indicated that MC4 was also inadequate in its current form for the documentation of anesthesia intraoperative reports, however; MC4 applications do provide this capability using a software workaround.

Post hoc multiple comparison test results on the data are available and may be requested from the author (210-221-6174).

## COMMENT

The data analysis provides an insightful view of AMEDD small units that redeployed over the past year and complements findings from recent Operation Enduring

Freedom medical task force AARs. The survey results indicate that higher ranking respondents rated their units as having difficulties with the medical supply process and believed that automation systems posed challenges and difficulties to their units. This finding is not surprising in light of free-text comments that reported deficiencies in application capabilities developed for the MC4 system. The MC4 challenges have been recognized in past AARs and changes are ongoing to resolve systemic issues in the current deployed environment. For example, MC4 has instituted training opportunities at the CONUS* Replacement Center, Fort Benning, Georgia, to ensure PROFIS personnel are trained prior to arriving in theater. The MC4 has also institutionalized classes at the AMEDD Center and School, injected system use in more than 50 annual exercises, and, to build system proficiency, installed it as a sick-call tool and train-as-you-fight mechanism at battalion aid stations and brigade medical supply offices in garrison. Additionally, MC4 has been added to various in-theater networks to enable remote technical support delivery to FOBs without contractor or organic support personnel. At the same time, the results indicate that respondents with higher rank believed that ALC/SLC training prepared their units' NCOs for deployment missions, and that Soldiers' predeployment training was relevant to meet the units' needs. These findings may reflect leadership beliefs that their unit personnel received the proper predeployment training and had the necessary skills and training to carry out their duties. Despite these overall positive attitudes of unit leadership about predeployment training, medical supply and automation systems remain concerns that warrant continued command emphasis and actions to facilitate small unit operations.

Age and TIS correlations produced mixed results. In general, respondents with more TIS were likely to view the predeployment training of their unit's PROFIS personnel as inadequate for their roles and responsibilities, but these respondents also have positive feelings and rate their units as not requiring nonstandard automation equipment or commercial systems and programs for operations. On the other hand, older respondents were more likely to rate their units as having greater challenges in the area of life support than were younger respondents.

The data produced several significant correlations between respondents' length of time in theater and their answers about predeployment training, including updated lessons learned materials and the ability of their units to provide a wide range of area coverage, including remote FOBs and COBs. The data suggest that the longer individuals stayed in theater, the more likely they were to develop positive views of the adequacy of predeployment training and the units' ability to meet challenges in providing support to remote locations.

The results show a significant difference based on type of unit to which respondents were assigned in their views on the question dealing with predeployment training and availability of lessons learned and tactics, techniques, and procedures from units already deployed. Follow-up action will ensure these materials are readily available for units prior to deployment. Respondents also differed significantly in perceptions of their unit's structure for its mission and ability to adapt rapidly to changes in mission. These differences may reflect the need to determine how to update small unit equipment and organizational structure to best meet the situational demands within a given theater, to ensure these units remain flexible and capable of accomplishing full spectrum operations.

Respondents' free-text comments about PROFIS, theater-provided equipment, and medical refresher training produced positive comments that showed how small unit personnel were proactive and worked through personnel and equipment shortages to support numerous FOBs and COBs, as well as detention facilities. To quote one respondent, "we arrived in theater with ten personnel; we successfully completed our mission with eight." There were challenges to overcome and issues that needed resolution, but units perservered through innovation and team effort to accomplish their missions.

This small unit survey represents a new initiative within the lessons learned collection process. The survey results along with other observations, insights, and lessons were entered into the AMEDD lessons learned database and shared with both combat and training developers. The free-text responses about the limitations of the FST conducting split-based operations were combined with other FST observations, insights, and lessons, and provided to Directorate of Combat and Doctrine Development (DCDD), FST Integrated Process Action Team (IPAT). The FST IPAT conducted a capabilities-based assessment designed to determine what doctrine, organizational, training, materiel, leadership, personnel, and facilities solutions were required to meet capability shortfalls.

The capabilities-based assessment identified 10 capability gaps that were primarily generated from the need to design a more flexible and scalable future capability that allows the FST to separate into 2 teams, each of which can effectively function independently. The recommendations identified that all of the capability gaps can be

*CONUS indicates continental United States

addressed with nonmaterial solutions. The proposed capability structure consists of a mission command element, 2 surgical elements, and 2 resuscitation elements, and remains within the current FST force structure level of 20 personnel. In this way, the FST survey responses and other deployment lessons were used to determine ways to improve the provision of forward surgery in the years 2016 through 2028.

The AMEDD Lessons Learned staff also participates in other DCDD IPATs, including telehealth, mild traumatic brain injury and concussion recovery care, advanced trauma management, prehospital medical informatics, battlefield oxygen requirements, and en route critical care. Recent issues like feral animal management rely on lessons learned to provide insights on animal control measures and command responsibility for animal control, and emphasis on the policies prohibiting pets or mascots. Failure to act on previous lessons has consequences and can lead to outbreaks of vector-borne and/or zoonotic diseases, especially rabies. Lessons collected through the survey process and operational AARs aid in current deployments by providing recommended practices, as well as to identify and fill gaps through the capabilities development process.

The Lessons Learned staff works with the DCDD Force Protection Branch to facilitate data collections through online surveys, setup assistance, and conducting in-person interviews during brigade combat team (BCT) umbrella week collections. The survey focus areas include nutritional intake from both military and civilian provided sources, feral animal control and rabies prevention, and mental health stability, including access to combat stress control teams. The surveys are disseminated to returning BCT personnel during the week-long collection activities that target all personnel within the BCT. Those surveys are compiled once by Lessons Learned and submitted to the Force Protection Branch for review and analysis.

## CONCLUSION

The author received an overwhelmingly positive response from leaders and unit members who participated in the survey, their willingness to share experiences, and desire to receive feedback on the results. The survey gave AMEDD small unit members a unique opportunity to express views on a range of important issues. A number of respondents indicated it was the first time anyone asked questions about their deployment experiences. The findings of small but significant correlations point to the need for further study to determine how variables such as rank, length of deployment, and time in service interact to affect both attitudes and responses on issues. The survey results indicate several strong effects of the unit's geographic location while deployed as a key factor in the survey responses, as well as the need to fine-tune a unit's predeployment training and overall organization and capabilities required for specific geographic locations.

The Lessons Learned Division recently published 2 guides to lessons learned that provide unit members with a wealth of information and advice on what does and does not work in various deployment settings; one guide for the combat support hospital and the other for the forward surgical team. A lessons learned guide for the brigade surgeon section is in development, and there are plans to publish guides for veterinary and dental units. The Lessons Learned Division has already integrated recommended practices into prepackaged lessons learned documents for brigade combat teams which are distributed through medical observers and controllers at the US Army Combat Training Centers. The collection process is being streamlined by identifying returning units and ensuring their lessons learned and reports are obtained in a timely manner to assist other small units in the deployment schedule. This will improve predeployment training and enhance a small unit's ability to conduct split-based operations in support of decisive action. Future initiatives will involve contacting small units prior to deployment and providing them with lessons learned and recommended practices based on similar units' deployment experiences. Follow-on surveys will focus on specific AMEDD small units with the goal of identifying ways to improve AMEDD battlefield capabilities.

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# SUBMISSION OF MANUSCRIPTS TO THE *ARMY MEDICAL DEPARTMENT JOURNAL*

The *United States Army Medical Department Journal* is published quarterly to expand knowledge of domestic and international military medical issues and technological advances; promote collaborative partnerships among the Services, components, Corps, and specialties; convey clinical and health service support information; and provide a professional, high quality, peer reviewed print medium to encourage dialogue concerning health care issues and initiatives.

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All manuscripts will be reviewed by the *AMEDD Journal*'s Editorial Review Board and, if required, forwarded to the appropriate subject matter expert for further review and assessment.

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