U.S. ARMY MEDICAL DEPARTMENT JOURNAL

October – December 2006

Featured Topic: Electronic Medical Records

U.S. ARMY MEDICAL DEPARTMENT

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Perspective

Major General Russell J. Czerw

I remain impressed with the distinct authorship and relevance of the articles published in our *AMEDD Journal*. You will find that this edition validates the *AMEDD Journal*'s continued success as a dynamic and relevant peer-reviewed publication.

We are fortunate to begin this edition with a reprint of a very timely article which previously appeared in an international military medical journal. COL Mike Roy, et al make an excellent case for a process to confer formal certification in military medicine, and how the elements of that skill set have wide applications in the civilian medical sector. Such certification would recognize the unique and challenging demands of medical care in combat environments, as well as result in a much better prepared and capable military medical professional charged with the care of our most precious resource, the combat Soldier.

Research is fundamental to the science of medicine. COL James Lamiell, a gifted medical researcher, and his team present a detailed picture of the AMEDD Clinical Investigation Program, the formal structure defining how clinical research is conducted within Army medicine. This interesting and informative article describes both the history and current status of the program, and discusses the rationale and strategic vision that frames these extremely important research efforts. The article not only reflects the AMEDD's considerable investment in and support of clinical investigation, but also underscores our unwavering commitment to maintaining the highest standards of medical expertise and practice.

As the AMEDD adapts to the long-term challenges of the new combat environment posed by the Global War on Terror, real world experiences are paramount in the generation of new ideas and the adaptation of existing methods and protocols. Three articles in this issue directly address efforts to ensure the delivery of quality health care during operational deployments. First, in their article, MAJ (P) Ed Yackel's group of highly experienced Nurse Practitioners (NP) present a very strong, thoughtful case for formalizing expanded roles of the NPs in deployed environments. For years the NP has been a vital element in the delivery of health care in the fixed facility environment, both providing primary care directly and serving in supervisory positions over clinics and departments. The experiences related in the article show that the exigencies of operations place NPs in the same roles while deployed. Unfortunately such assignments are not directly addressed in doctrine, leading to inconsistencies, confusion, and suboptimal use of vital resources. Next, in a similar look at resource utilization from the perspective of real-world experience, LTC Roman Bilynski's concise, thought-provoking article proposes a practical change in the doctrinal use of Neurologists in combat deployments. The third article looks at predeployment training in realistic combat environments. Such training is as absolutely important for medical units as it is for combat forces. COL James Henderson presents a detailed description of the planning, coordination, attention to detail, resources, and sheer hard work that is required to deliver the practical, intensive training necessary to thoroughly prepare a unit for imminent deployment. Units are completely immersed in realistic environments and intense situations which replicate as closely as possible the conditions they should expect. COL Henderson shows how training planners especially draw upon the experiences of those who have gone before to design and refine their training plans. This is an eye-opening portrayal of the too often overlooked efforts of dedicated training support professionals who work tirelessly to prepare our medical personnel for their critical role—saving the lives of our combat Soldiers.

The creative use of emerging technologies has long been a hallmark of the US military. Joel Reyes, et al give us a look at how a seemingly unrelated technology is being used with our medical applications and data to create another important tool for medical planners, especially in preventive medicine. Geographic information systems are rapidly becoming an indispensable part of medical planning for transportation, natural disasters, and epidemiological responses, to name a few. Recent events have greatly increased the importance of regional planning for mass casualty events, introducing the real possibility of unconventional threats—biological, chemical, and radiological—which could appear anywhere at any time. You will find that this article provides a good overview of how applications of this technology are being adapted by imaginative, energetic people, not only to plan for future, large scale events, but also to simplify existing, routine requirements.

The featured topic of this issue is focused on an evolving technological application which is already becoming indispensable in the delivery of health care in the US military, the electronic medical record (EMR). LTC Ron Moody and members of his AMEDD AHLTA implementation team have provided 3 very informative articles which describe the background of AHLTA, the development and deployment strategy, and its current status. These articles present excellent information as to the how, when, and (especially) why AHLTA has evolved as it has. All AMEDD professionals involved in healthcare delivery will find these articles extremely valuable in helping to further understand and appreciate the tool you use multiple times every day. In addition, LTC Moody has written an article emphasizing the importance of accuracy of the codes used in AHLTA records. His article explains the classification schemes, discusses the metrics used to assess the effectiveness of the coding, and explains the impact of accurate coding on outcomes and cost. He makes it clear that the full potential benefits of AHLTA will not be recognized unless practitioners carefully and diligently apply themselves to ensuring the accuracy of the entered information.

The last 2 articles expand the discussion of electronic medical information to the user level, including its value to and impact on the Soldier, how operational units have used it, and the benefits derived. LTC Ed Michaud and his coauthors present an easily readable, very informative discussion of their experiences using the tactical applications of the EMR. Their approach discusses both practical and theoretical considerations, covering benefits and disadvantages. This article provides an interesting perspective on our evolving EMR technology from perhaps the most important user, the battlefield medical staff. MAJ Mark Higdon then discusses the flow of digital medical data across the battlefield, out of theater, and ultimately into the Soldier's record. Writing from his experience while deployed, he carefully and clearly explains the Army's Theater Medical Information Program, its history, functionality, successes, and shortcomings in the operational environment.

As usual, this is another excellent edition of the *AMEDD Journal* that I hope all of you will take time to read. There is a nice variety of content and I am sure that you all remain as impressed as I am with what our great AMEDD Soldiers do every single day!

Certification in Military Medicine: The Time is Now

COL Michael J. Roy, MC, USA
COL Joseph Palma, MC, USAF
COL (Ret) Norman Rich, MC, USA

ABSTRACT

In recent years, military medical personnel in several nations have been working toward providing certification in military medicine. Reasons for certification include the identification and recognition of expertise, and the ability to match expertise with challenging assignments and missions. We review the literature, examine several options, and propose a new method for certification in military medicine. Our model features 2 levels of certification in military medicine, operational and expert, with the latter a potential basis for a master's degree in military medicine. Requirements would be completed through experience or coursework in each of 7 areas: leadership, preventive medicine, field experience, administrative healthcare, casualty and incident management, scholarly activities, and service and specialty specific requirements. Educational objectives and material should be developed, standardized, and incorporated into an educational program leading to certification. Existing courses and distance learning methods should be incorporated whenever possible. A certification exam is recommended.

INTRODUCTION

Over the past two decades, an increasing amount of attention has been paid to the training of military physicians in the operational realm—preparing them for combat-related and humanitarian deployments. Military unique curricula (MUC) have been published[1] and updated,[2] and various efforts have been made to try to implement instruction and skills training.[3,4] Pierce followed up the initial MUC with a recommendation that a department of military medicine be established at each of the US military's medical teaching centers,[5] but this has not occurred. We now examine subsequent efforts to enhance militarily relevant education, consider the benefits and costs of certification in military medicine, evaluate potential models for certification, and discuss measures that would be necessary to establish a meaningful certification program.

BACKGROUND

A review of the literature yields a number of thoughtful treatises touching upon the subject of certification in military medicine. Eiseman emphasized the need for physicians to engage in mass casualty planning, especially as it may apply to civilian settings.[6] He noted that mobilization from peacetime to a state of formal warfare or battle required weeks to months, with physicians involved in preparing for the type of casualties anticipated. However, he prophetically pointed out that terrorist attacks require a similar response from the medical community, with little or no lead-time to prepare. Physicians must therefore be trained to deal with a wide range of potential scenarios. A corollary is that military medical responses may well need to be different from standardized civilian responses, so that training normally unavailable in civilian training programs must be implemented in order to facilitate an appropriate medical response to these events.

Military physicians quickly recognize differences between war and peacetime medicine, but the lessons learned in battle have often been forgotten between wars, only to be painfully relearned by others. Bellamy comments that physicians have long ignored knowledge of military weaponry, believing the knowledge to have little therapeutic value. However, he asserts, only knowledgeable medical officers will understand the intricacies of war injuries resulting from battle.[7] For example, wounds from missiles of high velocity may require less exploration and

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debridement than those from projectiles that are designed to fragment upon impact and further disrupt tissues. Military physicians should also understand the different physical, physiological, and psychological impacts of wounds resulting from ammunition fired from firearms, the blast effect of explosives, and flame or incendiary munitions with the additional medical compromise of thermal injury. The significance of such issues highlights the need for specific medical and surgical training requirements and objectives beyond those that have traditionally encompassed training programs.

A series of articles in the journal *Military Medicine* in the early 1990s addressed the issue of whether military medicine, or some of its components, has unique qualities that augur a need to standardize the discipline, and, in turn, whether to certify those that complete the requirements. The purpose of certification would be to identify those with competence in their respective fields, facilitating the fielding of a capable medical force. Rignault in particular argued that "war surgery" should be considered a unique specialty.[8,9] He noted that since 1950, the peacetime practice of civilian and military surgery has been marked by increasing specialization, and that although the surgical management of wounds continues to require a solid foundation in general surgery training, additional specific training in wartime surgery, historically unavailable in either civilian or military peacetime training programs, is necessary to avoid the significant challenges surgeons face in treating and sustaining the war wounded. Rignault emphasizes several key differences between peacetime and wartime surgery. War surgery deals with emergencies, providing almost exclusively lifesaving surgery, to be followed by evacuation and further staged surgeries in different locations possessing increasing sophistication. Wartime surgical and medical care is primarily provided in an unsophisticated medical environment, with minimal or no advanced diagnostic equipment, such as CT scans, requiring greater reliance upon clinical diagnostic skills. War surgery, in large part, involves the need to sort large numbers of casualties simultaneously, requiring triage, stabilization (taken to a new level by the highly successful French Foreign Legion "reanimation" teams, whose purpose was to parachute in, stabilize casualties in far forward areas, and evacuate them to safer areas for definitive hospital care, dramatically reducing mortality in the 1970s), and evacuation to a higher level of care. The initial stabilization of war-injured patients is therefore incomplete. The military medical officer must exercise judgment based upon his or her knowledge of the mechanism of injury, the injury or injuries themselves, surgical procedure(s), natural history of the military injury or injuries, the logistics and sustainability of the military operation, and the medical evacuation chain and system capability and capacity. The outcome for a given patient is significantly influenced not only by the host (injured casualty) and the environment simultaneously, but also the lag time between the injury and arrival to initial medical or surgical care, the quality of the care, and level of care during transport.

War surgery is performed in sequential echelons (or levels of care). This implies that the medical officer on the front lines is responsible for initiating the sequence of care, but that definitive care will likely be performed at a rearward location with greater capabilities, after evacuation. Continuity of care is thus provided by the system, which standardizes medical and surgical care to the military environment, rather than by a single physician or team. The pathology of war is also different. Common surgical injuries include blast and crush injuries, missile injuries, and complex traumas of a magnitude and scope beyond that of the worst vehicular accidents. In addition, the diseases of war may differ from peacetime environments, with malaria, epidemic diarrhea, epidemic exposure injuries, and even biological or chemical warfare injuries. This poses greater challenges in training physicians for deployment. Unchecked in a fighting force, such conditions may result in defeat. Also of import to military physicians are the implementation of public health or preventive medicine measures that must be present to sustain the effectiveness of the fighting force. For example, Napoleon discovered that his mighty army could not capture Moscow because of the weather's impact on his force. Ultimately, surgical procedures and indications differ in the war environment, as do medical interventions, dictated by the available resources. One can therefore conclude that military medicine is indeed a unique discipline, warranting standardization of education, training, and certification.[6-10]

Pories asserts that military surgery is already a specialty and outlines its components.[11] In his opinion, certification is long overdue. Fifty years ago, general surgeons treated cancer and performed gastrectomies, Whipple procedures, pediatric and cardiac surgery, and orthopedic procedures. Today, increased technology and specialization has resulted in each of these functions being performed by subspecialists, not general surgeons. In the United States, The Accreditation Council for Graduate Medical Education (ACGME) recognizes and defines subspecialties as areas of graduate medical education which have a prerequisite for enrollment, and require the completion of an accredited residency and/or certification in a discipline in which there is a primary or conjoint American Board of Medical Specialties (ABMS) board. Military surgeons, and other medical officers, complete their primary residencies and become board eligible or certified and are then eligible for subspecialty training and education. The ACGME also requires that a subspecialty have a unique body of scientific medical knowledge sufficient for education in a clinical field, not simply limited to learning a procedure or other more circumscribed objective. In this respect, military medicine also qualifies since competence in military medicine is not just a matter of learning a single new procedure. For example, Pories points out that during the Vietnam War, the surgical work of field-experienced surgeons was readily distinguishable from that of newly arrived surgeons applying surgical skills and standards learned for an exclusively civilian practice. The latter resulted in significantly poorer outcomes due to the lack of knowledge of the intricacies of war casualty treatment and management.[11]

Efforts To Establish A Military Unique Curriculum

In response to the Department of Defense efforts to establish a military unique curriculum, some US military training programs have incorporated elements of an MUC. The family medicine residency program at Fort Benning, Georgia, designed an innovative program of rotations through pertinent aspects of military medicine for their residents. The program features 12 garrison (ie, peacetime) medicine modules of instruction ranging from management of a troop clinic to nuclear and chemical surety programs. There is extensive coverage of predeployment planning and issues, deployment topics including activation, logistics, unit movement, patient stabilization and evacuation, and redeployment issues and concerns.[12] The Department of Medicine at Walter Reed Army Medical Center (Washington, DC) implemented a military unique curriculum in which internal medicine residents experience didactic education in operationally relevant aspects of subspecialty areas such as cardiology, infectious diseases, and emergency medicine, as well as participating in an operational rotation with a field unit.[3,4] More recently, the 6 US Army medical centers banded together to establish a military unique curriculum of 18 online modules that all Army interns, in every specialty, must complete. The family medicine program at Madigan Army Medical Center (Fort Lewis, Washington) is also working to establish a military unique curriculum for family medicine physicians.

The Diploma In The Medical Care Of Catastrophes

The British have established what we believe to be a particularly valuable model for certification in military medicine. In 1993, the Society of Apothecaries of London (incorporated by King James I in 1617) initiated the Diploma in the Medical Care of Catastrophes, which includes many of the elements of competence required of military physicians. The purpose is to identify expertise in unique aspects of contingency response, for both civilian and military physicians interested in providing medical and surgical care in major manmade or natural disasters. Requirements for certification are divided into 7 areas[13]:

1. **Survival** — Satisfied through completion of a 5-day Disaster Relief Operations Course (DROC), or another equivalent course.
2. **Field Team Training** — The DROC or an equivalent course also provides credit for this element.
3. **Multiple Casualty Management** — Can be completed through a number of different courses, averaging 3 days in length.
4. **Trauma Life Support** — Satisfied through completion of any of a variety of courses such as advanced cardiac life support or advanced trauma life support.
5. **Preventive Medicine** — Also covered in DROC, or with a separate 2-day course.
6. **Written Dissertation** — Focused on an aspect of medical care in catastrophes, up to 100 pages in length.

7. **Supplementary Module** — This features a pick-list of topics, with completion of any two required (Note: Medical practice and/or training in a field often confers credit.):
   - War medicine or surgery
   - Psychological workshop
   - General practice workshop
   - Tropical medicine
   - Intensive care
   - Accident and emergency medicine
   - Forensic medicine
   - Pediatric medicine

DEFINITION OF MILITARY MEDICINE

In 2002, we convened an expert panel to consider the development of a program for certification in military medicine. Prior to those deliberations, the panel agreed upon the following working definition for military medicine:

> Military medicine represents the knowledge, skills, and attitudes inherent in the practice of medicine in austere and/or militarily unique environments, cognizant of the roles and capabilities of the military, and the means for coordinating with other organizations.

ACADEMIC FOUNDATION

While there are variations between branches of the service, between specialties, and between nations, we believe that there is a body of knowledge that is pertinent to all military physicians. The Military Unique Curricula documents have outlined this body of knowledge, and the vast Textbook of Military Medicine series* provides considerable detail. There is also an ever-expanding body of military medical literature, particularly embodied in, but not limited to, the archives of the journals *Military Medicine* and *International Review of the Armed Forces Medical Services*. There is also a range of military medical courses such as the Combined Humanitarian Assistance Response Teams (CHART) course,[†] the Medical Management of Chemical and Biological Casualties (MMCBC) course,[‡] and the Medical Effects of Ionizing Radiation (MEIR) course,[§] which cover specific aspects of military medicine. More than 20 nations have programs in tropical medicine and health,** many of which have significant components of military relevance.

ADVANTAGES OF CERTIFICATION

Potential advantages include the following:

- Recognition of achievement, experience, and/or expertise
- Academic recognition, similar to board certification
- Basis for financial rewards such as bonus payment
- Advantage for promotion
- Identification of a cadre of experts that can be called upon in a time of need, or to impart their knowledge and skills to others
- To qualify individuals for particular assignments or positions of leadership within military medicine

The form that certification takes can have a significant influence upon which of the above goals are achieved. As such, it is important to consider prioritization of these advantages in determining the mode of certification settled upon. We believe that each advantage has importance, but in our minds the most significant goal of certification is to recognize the expertise and experience of physicians who have taken it upon themselves to establish unambiguous proficiency in operational medicine. There are also potential obstacles to the establishment of certification in military medicine that must be taken into account. First, certification must be inexpensive—ideally, cost-neutral—since military medical budgets are already thinly stretched, and a program that is costly to either individuals or the military healthcare system is unlikely to achieve implementation. Second, there must be a certifying authority, someone that will examine credentials and determine or judge eligibility for certification, as well as recertification.

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*Available from the Borden Institute at: http://www.bordeninstitute.army.mil

[†]Available at: http://coe-dmha.org/course_chart.htm

[‡]Available at: https://ccc.apgea.army.mil/courses/in_house/brochureMCBC.htm

[§]Available at: http://www.afrri.usuhs.mil/www/outreach/meir/meir.htm

**List available at: http://www.astmh.org/oppor/training.html

Analyzing The Alternative Models For Certification

One prominent model for certification is the board certification system for physicians. At the present time, the American Board of Medical Specialties (ABMS) has 24 member specialty boards, ranging from Allergy and Immunology to Urology. Certification is an arduous and expensive process for physicians, but is widely recognized as a well-established, well-defined, and rigorous process that often increases the comfort level that patients have with physicians they select for care. A military medicine certification process that would commensurately increase the confidence of line service members with the physicians that are deployed with them is a desirable goal. However, it must also be recognized that military physicians already typically maintain board certification within their respective specialties, requiring significant investments of time and money. In addition, the body of knowledge of military relevance that is important for a specialist to master, but is unique from that covered in the specialty-specific certification process, may not be large enough to warrant following a board certification model. There are also many more certification bodies that are not recognized by the ABMS, frequently providing an easier path to claim certification in the eyes of a confused public, but failing to meet the rigor of the ABMS. While it may be difficult to achieve certification in military medicine through the ABMS, the Department of Defense (DoD) could establish an independent certifying body, but the creation of a meaningful certification process would have difficulty surviving the twin obstacles of cost and resources required for its establishment and maintenance.

Another model is the previously described Diploma in the Medical Care of Catastrophes (DMCC). Upon completion of the 7 modules outlined above, a prospective diplomate must then sit for a two-part examination. The first part is an oral examination of the material covered in the modules before a board of examiners. The second features an oral presentation and discussion of the dissertation. In addition to strong support for the program within the British military, the examination is also provided at the Uniformed Services University of the Health Sciences (USUHS), Bethesda, Maryland, where a large number of faculty are diplomates and serve as examiners. Moreover, the DMCC is now required of military physicians in both the United Kingdom and the Netherlands. The broad scope and modular nature of the DMCC are particularly useful characteristics to incorporate into plans for certification in military medicine. There is a book that codifies a corresponding body of knowledge.[14] However, it can be argued that the orientation of the DMCC is not as specific to military medicine as desired, which is perhaps not surprising since civilians are eligible for the diploma, and the orientation is more geared towards disaster and humanitarian care rather than the combat environment.

Another consideration as a model is more specifically geared toward the goal of recognition—rather than providing a certificate per se, providing a ribbon, patch, or other emblem to be worn on the military uniform. This is not necessarily mutually exclusive of bona fide certification, and in fact could be provided in conjunction with certification, but the level of infrastructure and rigor required to institute a more classical certification program would not necessarily be required for award-type recognition. Simplification of the process, at least initially, might facilitate more prompt implementation, while still achieving to some degree the goals of providing recognition and earning greater respect in the eyes of the line. If, on the other hand, a certain degree of rigor is not incorporated in the process, placement of an emblem on the uniform might generate more resentment than respect, especially if recipients of recognition such as the Expert Field Medical Badge view this as a cheaper path than what they accomplished to earn a symbol on their uniforms.

Alternatively, a more robust approach to certification might go so far as to confer a master's degree in military medicine. This could entail as much as one or two years of in residence, a course of shorter duration in conjunction with a set of courses currently available to military physicians (eg, Medical Management of Chemical and Biological Casualties, Medical Effects of Ionizing Radiation, etc.), or courses taken part-time or via distance learning methods over a less restricted timeframe. This approach would be the most ambitious and potentially expensive, but would achieve a greater degree of control over content and more effectively ensure mastery of the targeted content than any other method. There are several models, albeit of lesser scope, that provide onsite and distance learning alternatives to achieve the same goal. One is the Good Clinical Practice training for scientific researchers, which may be completed at a multiday course, or completed with self-paced, web-based courses that provide instruction followed by examinations. The Army provides 2 different alternatives. First, the Officer Advanced Course requires completion of a series of self-paced minicourses and examinations, followed by several months in residence at the US Army Medical Department Center and School at Fort Sam Houston, Texas. In addition, the next level of officer training is the Command and General Staff Officer Course, which can be completed through a year in residence at the Command and General Staff College, Fort Leavenworth, Kansas, or in a self-paced series of courses, examinations, and written essays, over as much as 2 years. A broad range of alternatives, from entirely onsite education to completely self-paced distance learning, best meets the range of motivations, learning preferences, and schedules of active military clinicians. In addition, providing credit for completion of other courses that fulfill some of the requirements for a master's degree helps to avoid needless repetition and unnecessary expense.

While establishment of a master's degree program in military medicine is the ultimate goal, we recognize that this may take time to establish, and that an interim "bridge" to the degree is a sensible beginning. We propose the provision of 2 levels of certification in operational medicine, an operational level and an expert level, with the latter, supplemented by a research project, forming the basis for the master's program. Completion of requirements through experience or coursework in 7 different areas (presented in the Table on the following pages) would be necessary. In addition, there would be a requirement for 3 letters of recommendation from supervisors or colleagues to describe experience and qualifications for certification. A certifying board would review credentials and award certification. A university would be a logical certifying authority if a master's degree is planned or implemented, with USUHS or another military institution most sensible. Other alternatives would be a military society such as the Association of Military Surgeons of the United States (AMSUS) or the International Committee of Military Medicine (ICMM), depending upon the format that is chosen. The duration of certification, and the process of recertification, will also need to be determined in the future.

A New Model for Certification in Military Medicine

Based on the academic foundations of military medicine and medical experiences and lessons learned from wars over the past century, we identified key curricular elements, relevant military courses, and field experiences with particular utility to military healthcare professionals. We incorporated the selected elements into 7 modules, which are modified from the DMCC program (see the Table). It should be noted that many of the examples that are provided represent options within the United States, and that there are many other opportunities available in other nations that would fulfill the requirements. Corresponding detailed educational objectives and material must be developed, standardized, and incorporated into any educational program leading to certification. We propose the recognition of 2 levels of expertise, which we define as operational (basic) and expert. A certification exam should follow the completion of all modules. We favor the development of a standardized, comprehensive bank of questions to be used for certifying examinations.

Educational Models

The most rigorous of a range of potential educational models is the establishment of an organized, dedicated program similar to the service schools, which require the military member to move to a specific location and school for prolonged dedicated study and pertinent experiences. At the other extreme, less disruptive to one's career and duty status, is a modular approach to learning such as the DMCC, or the distance learning courses services use in other professional military education courses. Overall, we believe the latter is more realistic, given the many conflicting demands facing military health professionals. However, it is important to note that Australia established a master's program in military medicine that began in June 2004, and both the United Kingdom and the Netherlands anticipate the commencement of degree-granting programs in military medicine in the near future.

Distance Learning. The most likely to be cost-effective and most expedient initial effort is the distance learning model, which requires significant costs for initial development, but after that, only low-cost maintenance is needed. We believe that military societies such as AMSUS, with the assistance of the

Categories of requirements for certification in military medicine, with proposed examples that would fulfill each requirement.

1. **Leadership**

Operational

Coursework – Army officer advanced course, Air Force squadron officer school, joint task force (JTF) surgeon course, or equivalent

Experience – Small unit team leader (eg, service chief at nonteaching military hospital, brigade surgeon)

Expert

Coursework – Army Command and General Staff College or equivalent service-specific course

Experience – Large unit team leader (eg, department chief at nonteaching military hospital, service chief at teaching military hospital, division surgeon, or unit commander)

2. **Preventive Medicine**

Operational

Coursework – Tropical medicine course, CHART or humanitarian assistance course, USARIEM environmental medicine course, Navy Environmental Health Command operational preventive medicine course, or Air Force aerospace medicine primary course or equivalent

Experience – Small unit preventive medicine responsibility for field sanitation in field exercise or deployment (eg, Army brigade surgeon, Air Force squadron medical officer, Marine battalion surgeon), or deployment in combat stress control

Expert

Coursework – Master's degree in public health or residency training in preventive medicine, public health, or occupational health

Experience – Responsibility for care in large refugee camp, joint task force operations, or combat

3. **Field Experience**

Operational

Coursework/Exercises – Completion of training at Joint Readiness Training Center (JRTC, Fort Polk, Louisiana), National Training Center (NTC, Fort Irwin, California), or other field training exercise (FTX); C4, military contingency medicine (MCM), air assault, or survival training course

Experience – Deployment of less than 3 months

Expert

Coursework – Advanced field course

Experience – Position of responsibility on joint deployment for more than 3 months

Categories of requirements for certification in military medicine, with proposed examples that would fulfill each requirement (continued)

4. **Administrative Healthcare**

Operational

Coursework – Flight surgeon course, commander's courses, risk communication course

Experience – Department chief at nonteaching military hospital, service chief at teaching military hospital, or Division Surgeon; knowledge and conduct of service-specific medical regulations and standards

Expert

Experience – Oversight responsibility for service-specific and/or joint regulations and standards, or responsible position at major command, CINC Surgeon, service headquarters staff, deputy commander for clinical services, or hospital commander

5. **Casualty & Incident Management**

Operational

Coursework – C4, air-evacuation course, MCM, MEIR, ACLS, ATLS, or equivalent

Experience – Operational leader, planner, or key provider for mass casualty (MASCAL) exercise, medical staff for JRTC, NTC, or FTX

Expert

Coursework – Joint task force surgeon's course or emergency preparedness course, emergency medicine residency or other pertinent specialty training such as surgery or critical care/pulmonary medicine

Experience – Operational leader or key provider for real-life mass casualty incident; operational leader or key provider on humanitarian mission or combat deployment

6. **Scholarly Activities' Certification Requirements**

Operational

Short analytic paper on topic relevant to military and operational medicine, or contributing author to a militarily relevant publication in the medical literature

Expert

Primary author of publication of substantive scholarly work in the peer-reviewed medical literature, or completion of a dissertation relevant to military medicine

Develop and provide a course or lecture series relevant to military medicine, or author a chapter in a militarily relevant textbook

7. **Service And Specialty Specific Certification Requirements**

Operational

Demonstrated ability to manage elements of field care outside of usual peacetime scope of practice

Expert

Specialty board certification and demonstrated capability to manage the full spectrum of the medical field system, such as successful experiences as JTF medical commander, CINC surgeon, UN peacekeeping force surgeon, NATO or joint operation or national medical liaisons during deployments and/or contingency operations military medicine community, most notably the Uniformed Services University of the Health Sciences, could provide this service. This option requires development of the curriculum and the distance learning tools (website, CDROMs, standards development, quality review, online testing, etc), compiling of course materials (Textbook of Military Medicine, military medicine curricular elements from USUHS, service-specific and DoD-level military medicine curricular material) and development and maintenance of a standard bank of questions.

Distance and In-Residence Learning. A more desirable model includes the above distance learning element followed by a 2-week in-residence requirement, which we believe can be sufficient to provide practice in the field.

In-Residence Learning. A small capability should be developed for a full in-residence program of one year, equivalent to the Intermediate Service School model for a select group of outstanding individuals. Selection should be by service at promotion, similar to selection for other military schools, and should fulfill the pertinent professional medical education requirement. It should not be necessary for senior personnel and is not intended to replace the unique opportunity to attend the Senior Service Schools (Air Force, Navy, Army War Colleges or National Defense University).

IMPLEMENTATION PROCESS

Implementation of certification could be done in 2 stages, the first to be implemented in the short term, which we call Stage I. The second we call Stage II. A more formalized process should, however, be sought by the establishment of a formal education program in this discipline.

Stage I

- Application accompanied by letters of recommendation
- Successful completion of the requirements outlined in the modules noted above
- Review of application/credentials by a formally appointed "board" or certifying body
- Certifying body will issue a certificate. A nonaffiliated body with substantial knowledge of competence in these areas such as AMSUS or ICMM is recommended as the most appropriate certifying body.

Stage II. Establish a formal educational program such as a master's degree level curriculum.

FUTURE IMPLICATIONS

The development of a certification examination will be required to accomplish the goal of certifying competence in this discipline. The examination should be based on the currently available body of knowledge in military medicine. A recertification process will also be necessary. We recommend the establishment of a master's degree level program as a vehicle to standardize the knowledge, skills, and attitudes required for competence and certification in military medicine as a capstone opportunity for selected military medical officers designated as experts in their profession.

REFERENCES

1. *Military Unique Curricula: Instructional Objectives for Military Physicians and Graduate Medical Education Programs*. 1989, Uniformed Services University of the Health Sciences, Bethesda, MD.
2. *Military Unique Curricula*. 1999, Uniformed Services University of the Health Sciences, Bethesda, MD.
3. Roy MJ, Perkins JG, Bolan CD, Phillips YY. Operational experiences during medical residency: perspectives from the Walter Reed Army Medical Center Department of Medicine. *Mil Med*. 2001;166:1038-1045.
4. Roy MJ, Brietzke S, Hemmer P, Pangaro L, Goldstein R. Teaching military medicine: enhancing military relevance within the fabric of current medical training. *Mil Med*. 2002;167:277-280.
5. Pierce JR, Brennan M, Campbell J, McClurkan M, Morgan JL, Stracner CE. The Department of Military Medicine—a graduate medical education idea whose time has come. *Mil Med*. 1989;154:536-537.
6. Eiseman B. Casualty care planning. *J Trauma*. 1979;19:848-851.
7. Bellamy RF, Zajtchuk R. The weapons of conventional land warfare. In: Zajtchuk R, Jenkins DP, Bellamy RF, Quick CM, eds. *Textbook of Military Medicine: Conventional Warfare; Ballistics, Blast and Burn Injuries*. Washington, DC: US Dept of the Army, Office of the Surgeon General; 1991:1-52.

8. Rignault DP. Is war surgery a specialty? Part I. *Mil Med*. 1990;155:91-97.
9. Rignault DP. How to train war specialists. Part II. *Mil Med*. 1990;155:143-147.
10. Smith AM, Hazen SJ. What makes war surgery different? *Mil Med*. 1991;156:33-35.
11. Pories WJ. Military surgery: certification is long overdue. *Mil Med*. 1995;160:100-103.
12. Goodell TP, Jones RJ. Curriculum design: operational medicine. *Mil Med*. 1989;154:36-37.
13. The Society of Apothecaries of London. *Examination Regulations and Syllabus Relating to the Diploma in the Medical Care of Catastrophes*. March 2004/6. Available at: http://www.apothecaries.co.uk/index.php?page=26.
14. Lumley JSP, Ryan JM, Baxter PJ, Kirby N. *Handbook of the Medical Care of Catastrophes*. London: Royal Society of Medicine Press, 1996.

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US Army Clinical Investigation

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INTRODUCTION

Most definitions of research are general. For example, *DoD Directive 3216.2* defines human research as any systematic investigation, including research, development, testing, and evaluation, designed to develop or contribute to generalizable knowledge.[1] Research may be medical or nonmedical. Medical research can be clinical or nonclinical. Nonclinical medical research studies include bench, in vitro, animal, and engineering studies. Clinical research (or clinical investigation) studies include patient-oriented, epidemiologic and behavioral outcomes, and health services studies. Patient-oriented studies generally include studies of human disease mechanisms, therapeutic interventions, clinical trials, and technology development. Clinical research can be more difficult than preclinical or basic research for the following reasons:

- Subjects are more variable.
- Measurements are less precise and accurate.
- There is less control over study conditions.
- Ethical issues are more common and complex.
- There is limited ability to discern disease mechanisms.
- Study design errors tend to be more common.
- Study design and analysis require greater vigor.
- Study review and approval bureaucracy is more burdensome.

Overcoming these challenges tends to make clinical research more rewarding and relevant. The fundamental Army Medical Department (AMEDD) philosophy has always incorporated 3 interrelated goals: provide quality healthcare, train to provide healthcare, and conduct healthcare research. Herein, we describe Army clinical investigation within the AMEDD Clinical Investigation Program (CIP). We describe the rationale, history, current status, impact, and strategic vision of the CIP. We plan to publish future articles describing US Army Medical Research and Materiel Command (USAMRMC) clinical investigations, Multinational Corps – Iraq clinical investigations, the US Army human subjects' protection program, and a practical guide to conducting medical research in the US Army.

AMEDD CLINICAL INVESTIGATION PROGRAM

DoD Directive 6000.8 clearly describes the fundamental CIP rationale, ie, the CIP is an essential component of medical care and teaching intended to

- improve patient care quality,
- support graduate medical education (GME) programs,
- generate an atmosphere of inquiry responsive to the dynamic nature of medicine, and
- promote high professional standing and GME program accreditation.[2]

Army Regulation (AR) 40-38 is the only US Army CIP-specific regulation.[3] *AR 40-38* defines the CIP as incorporating that medical research conducted at active Army fixed medical treatment facilities (MTFs). *AR 40-38* requires that a headquarters level office coordinate and monitor CIP activity, and serve as a point of contact for relevant policies and regulations. This office is now known as the Clinical Investigation Regulatory Office (CIRO), and it is part of the AMEDD Center and School (AMEDDCS) special staff. CIRO maintains the CIP records that are the source of most of the CIP descriptive information contained herein.

Early CIRO records are incomplete, but available documentation indicates that a distinct Research and Development Program commenced at Madigan General Hospital in 1963, a Research and Development Service was established at Tripler Army Medical Center (TAMC) in 1967, and a Clinical

Research Service was established at Brooke General Hospital in 1971. These entities were the forerunners of the current Army Medical Center (AMC) Departments of Clinical Investigation (DCIs), and their creation roughly coincides with the initial 1971 publication of *AR 40-38*. However, numerous clinical research studies (eg, MAJ Walter Reed conducted yellow fever studies in 1900 and the Medical Research Division was established within the Chemical Warfare Service in 1922) were conducted at Army MTFs prior to 1963. The US Army Medical Research and Development Command (USAMRDC) was established in 1958, and the initial version of *AR 70-25*, the governing Army regulation entitled *Use of Volunteers as Subjects of Research* was published in 1962.[4] The Human Use Review Office (HURO) was established within USAMRDC at Fort Detrick, Maryland in 1973. In 1978, the Clinical Investigations Program Division of HURO was transferred to the Health Services Command in San Antonio, Texas. When the Health Services Command transformed into the US Army Medical Command, the Clinical Investigations Program Division moved to the AMEDDCS to become CIRO (Clinical Investigation Regulatory Office).

A database (known as the Clinical Investigation Research System or CIRS) of CIP research study characteristics is derived from the written descriptions of CIP studies (protocols) received at CIRO. Most of these CIP protocols are from AMC DCIs, including Walter Reed AMC (WRAMC), Eisenhower AMC (EAMC), Brooke AMC (BAMC), William Beaumont AMC (WBAMC), Fitzsimmons AMC, Letterman AMC, Madigan AMC (MAMC), and TAMC.

Regular entry of CIP study protocol information into CIRS commenced about 1980. There are currently CIRS records for almost 18,700 CIP studies. Figure 1 shows the number of new and ongoing studies (for each fiscal year) recorded in CIRS since its 1978 inception. CIRO stopped receiving new studies from Letterman AMC in 1992 and from Fitzsimmons AMC in 1997. CIRS record accrual is now relatively stable with about 700 new studies per year and about 1,700 ongoing studies.

We were interested in current CIP study characteristics. Therefore, we queried CIRS for studies active on 1 December 2005, and identified 1,764 studies. Table 1 shows the general types of these active CIP studies. About 95% of the studies involve humans and 5% involve animals.

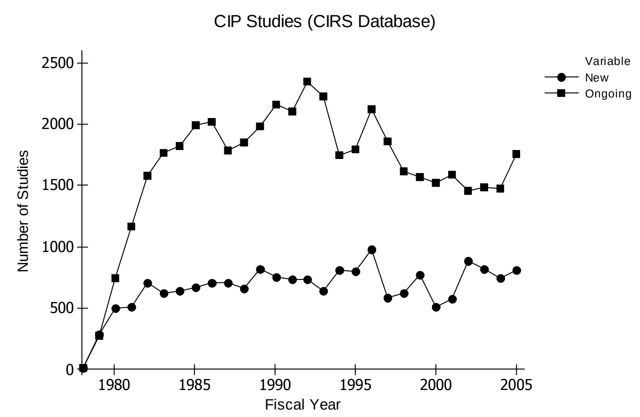

Figure 1. New and ongoing CIP studies (for each fiscal year) recorded in CIRS since its 1978 inception.

Table 1. Types of Active CIP Studies

Study Type	Number	Percent
More than minimal risk	1,060	60%
Minimal risk	597	34%
Animal	95	5%
Exempt	12	1%
Total	1,764	100%

Table 2 shows the class of subjects enrolled in the active CIP studies. About 9% of the studies involve children. Pediatric studies are unique in that there should be intent to benefit all subjects in accordance with Section 980 of Title 10, United States Code.

Table 2. Classification of Subjects of Active CIP Studies

Subject Classification	Number	Percent
Adult	1,477	84%
Other	129	7%
Adult/Child	87	5%
Child	71	4%
Total	1,764	100%

Table 3 shows the gender of subjects enrolled in the active CIP studies. About 17% of the studies involve only female subjects while about 10% involve only male subjects.

Table 3. Gender of Subjects of Active CIP Studies

Subject Gender	Number	Percent
Both	1,132	64%
Female	302	17%
Male	175	10%
Other	155	9%
Total	1,764	100%

Table 4 shows the source of subjects enrolled in the active CIP studies. About 70% of the studies involve patients. We observed that 686 of the 1,764 active CIP studies (39%) involve at least one drug, while 81 of the 1,764 active CIP studies (5%) involve at least one medical device.

Table 4. Source of Subjects of Active CIP Studies

Subject Source	Number	Percent
Patient	1,240	70%
Other	384	22%
Healthy/normal	140	8%
Total	1,764	100%

Table 5 shows another active CIP study classification. Importantly, about 32% of these studies involve oncology research wherein there is significant overlap between research and patient care. The only way to obtain promising but as yet unproven treatments for some malignancies is through participation in clinical research. Of course, these emerging therapies may be no better than conventional or no therapy at all (by the null hypothesis), which is why they are the subject of rigorous scientific examination.

Table 6 shows the funding for the active CIP studies. At least 53% of CIP study funding comes from sources outside the MTF conducting the study. CIRO was granted cooperative research and development agreement (CRADA) approval authority in 1994. CRADAs provide a study-specific legal mechanism enabling CIP staff to collaborate with nonfederal partners (eg, pharmaceutical companies) to conduct CIP studies. Since 1995, CIRO has negotiated and approved 923 CRADAs potentially worth almost $88 million.

Table 5. Classification of Active CIP Studies

Study Classification	Number	Percent
Other	1,165	66.0%
Oncology	560	31.8%
Behavioral/psychosocial	34	1.9%
Radioisotope	3	0.2%
Alcohol/drug	2	0.1%
Total	1,764	100%

Table 6. Distribution of Funding Sources of Active CIP Studies

Funding Source	Number	Percent
Other	646	36%
NIH	452	26%
CRADA	360	20%
Local	187	11%
USAMRMC	68	4%
Grant	51	3%
Total	1,764	100%

Table 7 shows the active CIP studies sites. The 3 busiest CIP sites account for about 75% of active CIP studies while overall the AMCs account for 97% of them.

Table 8 shows the principal (PI) and associate investigator (AI) status for the active CIP studies. About 80% of all CIP study investigators are active duty military personnel, while the rest are civilian government employees.

Table 7. Active CIP Study Sites

Military Treatment Facility	Number	Percent
WRAMC	665	37.70%
BAMC	356	20.18%
MAMC	287	16.27%
TAMC	208	11.79%
EAMC	116	6.58%
WBAMC	48	2.72%
WAMC	32	1.81%
West Point	26	1.47%
Ft Hood	11	0.62%
Ft Carson	4	0.23%
Ft Benning	2	0.11%
Ft Polk	2	0.11%
Ft Sill	2	0.11%
Ft Irwin	1	0.06%
Ft Stewart	1	0.06%
Heidelberg	1	0.06%
Landstuhl RMC	1	0.06%
Wurzburg	1	0.06%
Total	1,764	100%

Table 8. Professional Status of Active CIP Study Investigators

Status	PI*	AI†	Total	Percent of Total
USA	1,587	2,997	4,584	78.03%
Civilian	136	1,015	1,151	19.59%
USN	31	74	105	1.79%
USAF	10	24	34	0.58%
USPHS	0	1	1	0.02%
Total	1,764	4,111	5,875	100.00%

*Principal Investigator
†Associate Investigator

Table 9 shows the respective professional corps affiliations of the military investigators for the active CIP studies. Note that 1,446 of 1,764 PIs (82%) are Medical Corps (MC) officers. We found that 1,283 individual Army MC officers were investigators (PI or AI) on 1,555 of the 1,764 active CIP studies, ie, Army MC officers are directly involved with 88% of active CIP studies. Table 10 shows the ranks of investigators for 1,725 of the 1,764 active CIP studies.

Table 9. Professional Corps Affiliation of Military Investigators in Active CIP Studies

Corps	PI[a]	AI[b]	Total	Percent of Total
MC[c]	1,446	2,717	4,163	88.1%
MS[d]/MSC[e]/BSC[f]	47	162	209	4.4%
AN[g]/NC[h]	75	111	186	3.9%
SP[i]	19	39	58	1.2%
DC[j]	18	34	52	1.1%
VC[k]	22	18	40	0.9%
EN[l]	0	12	12	0.3%
Other	1	3	4	0.1%
Total	1,628	3,096	4,724	100.0%

a. Principal Investigator
b. Associate Investigator
c. Medical Corps (Army, Navy, Air Force)
d. Medical Service Corps (Army)
e. Medical Service Corps (Navy, Air Force)
f. Biomedical Sciences Corps (Air Force)
g. Nurse Corps (Army)
h. Nurse Corps (Navy, Air Force)
i. Medical Specialist Corps (Army)
j. Dental Corps (Army, Navy, Air Force)
k. Veterinary Corps (Army)
l. AMEDD Enlisted Corps (Army)

The number of investigators per active CIP study are depicted in Figure 2. Every study has at least one investigator (PI), and the greatest number of investigators per active CIP study is 19. The distribution is skewed, but there is an average of 3.3 investigators per study with a standard deviation of 2.1 investigators.

Conversely, we examined the number of active CIP studies per investigator. Figure 3 displays the number of active CIP studies per PI. Twelve investigators are the PI for more than 18 different CIP studies, and the greatest number of studies per individual PI is 71. Generally, oncology investigators are PIs for multiple studies, many of which are open only for subject followup and closed to new subject accrual, or are quiescent since they concern very rare malignancies. The distribution is skewed, but there is an average of 2.3 CIP studies per PI with a standard deviation of 5.4 studies.

The number of active CIP studies per AI is shown in Figure 4. Twelve investigators are the AI for more than 20 CIP studies, and the greatest number of studies per individual AI is 67. As is the case for PIs, oncology investigators are usually AIs for multiple studies. The distribution is skewed, but there is an average of 2.2 CIP studies per AI with a standard deviation of 3.4 studies.

Table 10. Rank Distribution of Active CIP Study Investigators

Investigator Rank	PI*	AI†	Total	Percent of Total
MAJ/LCDR (O4)	473	1,122	1,595	30%
LTC/CDR/LtCol (O5)	529	833	1,362	26%
COL/CAPT (O6)	363	589	952	18%
CPT/LT/Capt (O3)	255	521	776	14%
PhD (civilian)	60	235	295	6%
MD (civilian)	45	249	294	6%
Total	1,725	3,549	5,274	100%

*Principal Investigator
†Associate Investigator

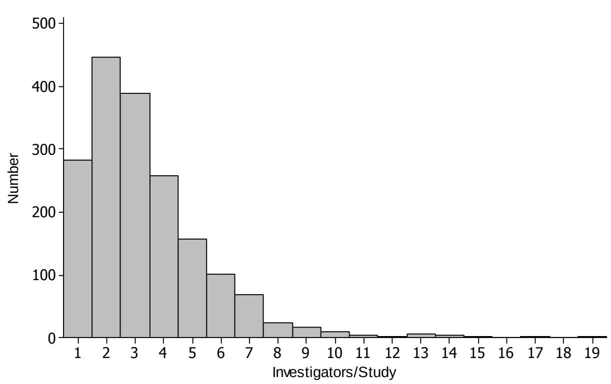

Figure 2. Number of investigators per active CIP study.

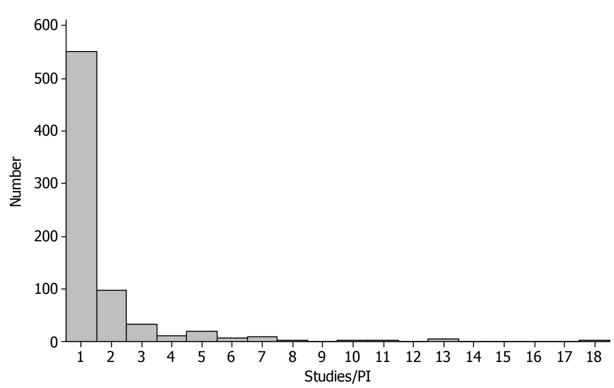

Figure 3. Number of active CIP studies per principal investigator.

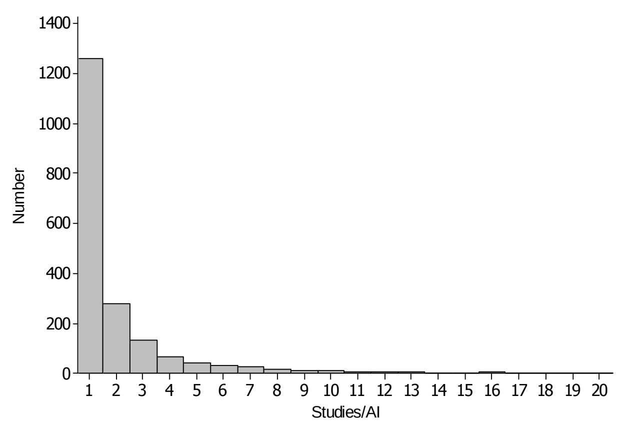

Figure 4. Number of active CIP studies per associate investigator.

Figure 5 depicts the duration of currently active CIP studies. One study has been active for almost 27 years (the age of CIRS). Generally, oncology treatment studies are the most persistent, closing to accrual of new subjects while remaining open and active for enrolled subject followup. The distribution is skewed, but there is an average of 3.7 years per CIP study with a standard deviation of 3.9 years.

Table 11 shows the involvement of 4,221 currently active Army MC officers with CIP studies. A roster of active MC officers was obtained from the Medical Operational Data Systems (MODS) on 1 December 2005. The Table 11 cross tabulation was generated by comparing the MODS-derived active MC Officer roster

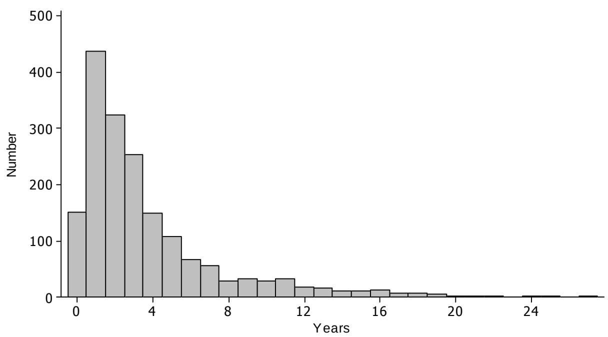

Figure 5. Duration of active CIP studies.

with a CIRS-derived CIP study investigator roster. Note that 1,824 of 4,221 (43%) currently serving Army MC officers have been a CIP study PI or AI some time during their active duty service. An analysis by rank shows that 413 of 1,729 MC captains (24%), 642 of 1,299 MC majors (49%), 410 of 664 MC lieutenant colonels (62%), and 359 of 529 MC colonels (68%) have been a CIP study PI or AI some time during their active duty service.

Table 11. Distribution of Active Army MC Officer Involvement in CIP Studies

PI*	AI†	CPT	MAJ	LTC	COL	Total
No	No	1,316	657	254	170	2,397
Yes	Yes	93	266	204	209	772
No	Yes	154	206	120	102	582
Yes	No	166	170	86	48	470
Total		1,729	1,299	664	529	4,221

*Principal Investigator
†Associate Investigator

It is difficult to compare US Army military physicians to non-Army physicians with respect to clinical research participation. One group queried graduates of the 1985 through 1995 classes of the Pennsylvania State College of Medicine.[5] Questionnaires we sent to all graduates (n=1,013), and there were responses from 42% (n=428). Among the Pennsylvania State respondents (ie, physicians in practice for 10 to 20 years), 34% claimed to be currently participating in clinical research. It is unclear how many of the Penn State respondents were on active duty in the Army. Nevertheless, this group is comparable to the Army cohort of MAJ – COL, in which 1,411 of 2,492 (57%) have participated in research (Table 11).

Clinical research is an essential part of graduate medical education (GME).[6] No Army GME program has ever failed accreditation because of insufficient or inadequate clinical research. The Clinical Investigation Regulatory Office has tracked the annual number of published manuscripts, abstracts and presentations generated by the CIP since 1994. A graph of this academic achievement is shown in Figure 6.

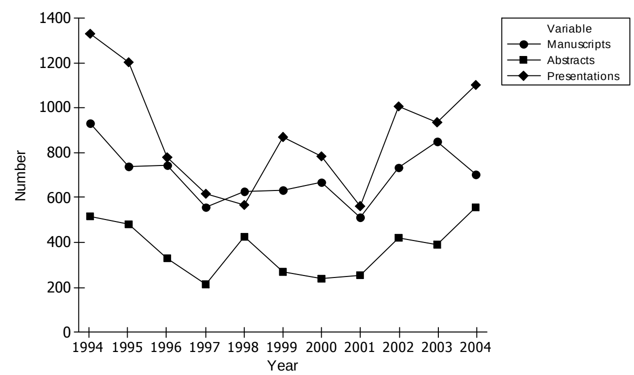

Figure 6. Annual number of published manuscripts, abstracts and presentations generated by the CIP since 1994.

In FY 2004 the entire CIP was funded with $11.8 million from Defense Health Program funds (as allocated by MTF commanders, including DCI staff wages) and $25.5 million from non-MTF funds (including $13 million from cooperative research and development agreements). The FY 2004 CIP DCI staff included 29 officer, 28 enlisted, and 121 civilian personnel. In total, the FY 2004 CIP was funded with $37.8 million and a dedicated support staff of 178 people.

CONCLUSIONS

Clinical Investigation Program research studies are usually greater than minimal risk (60%), and they usually involve adult patients (70%). Drugs are frequently involved in CIP studies (39%). The most common class of CIP studies is oncology (32%). At least 53% of CIP study funding comes from non-MTF sources. Most CIP research is conducted at AMCs (97%). Most CIP principal investigators are MC officers (82%), and MC officers are directly involved in 88% of CIP studies. A typical CIP study has 3 investigators, and lasts about 2 years. The Army CIP contributes significantly to the Army mission. The CIP improves Soldier healthcare, provides DoD beneficiary healthcare, and trains healthcare providers. The CIP provides an important component of AMEDD officer development. At least 42% of all current active MC officers have been involved in a CIP study. Furthermore, CIP involvement is continuous for MC officers so that at least 24% of current captains have been involved in CIP studies while at least 68% of MC colonels have been involved in CIP studies. This compares favorably to estimated non-Army physician clinical investigation (CI) involvement. CI exposure is important for AMEDD officer professional education because it fosters and develops

- critical thinking,
- attention to detail,
- scholarship,
- inquisitiveness,
- skepticism,
- creativity, and
- tenacity.

AMEDD officer CI experience also helps develop skills to better perform these critical functions:

1. Formulate questions
2. Use data to answer questions
3. Accurately collect and analyze data
4. Concisely describe a study with a protocol
5. Organize scarce resources to conduct studies
6. Present and defend studies to committees
7. Ethically deal with people (subjects) outside the provider-patient relationship
8. Present and defend study results
9. Assess and assimilate others' research results into medical practice

It is common for AMEDD officers to have long-term, fulfilling, and meaningful clinical research experiences.[7]

Our CIP strategy for the future is primarily directed toward enhancing collaboration between the CIP and USAMRMC. To this end, we intend to update *AR 40-38* and *AR 70-25* as one regulation, and we will exchange and cross-train CIP DCI and USAMRMC staff as much as possible.

REFERENCES

1. *DoD Directive 3216.2, Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research*. Washington, DC: US Dept of Defense; March 25, 2002.
2. *DoD Directive 6000.8, Funding and Administration of Clinical Investigation Programs*. Washington, DC: US Dept of Defense; November 3, 1999.
3. *Army Regulation 40-38, Clinical Investigation Program*. Washington, DC: US Dept of the Army; September 1, 1989.
4. *Army Regulation 70-25, Use of Volunteers as Subjects of Research*. Washington, DC: US Dept of the Army; January 25, 1990.
5. Lloyd T, Phillips BR, Aber RC. Factors that influence doctors' participation in clinical research. *Med Educ*. 2004;38:848-851.
6. Lamiell JM. Research for graduate medical education. *Mil Med*. 1994;159:698-704.
7. Lamiell JM. Army clinical investigation of von Hippel-Lindau disease. 1977-2000. *Mil Med*. 2001;166:839-842.

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Expanding the Role of the Nurse Practitioner in the Deployed Setting

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ABSTRACT

Today's military is experiencing rapid advances in technology and manpower utilization. The Army Medical Department is redesigning the structure and function of deployable hospital systems as part of this effort. A critical analysis of manpower use necessitates that an examination of the role function of assigned personnel be undertaken to optimize the employment of each Soldier-medic. This article discusses the use of Nurse Practitioners as primary care providers during deployment. The real world experiences of 5 Nurse Practitioners deployed to Operation Iraqi Freedom are presented. Data gathered during the deployment and an analysis of the literature clearly support the rationale for expanded and legitimized roles for these healthcare professionals in future conflicts and peacekeeping operations.

INTRODUCTION

Operation Iraqi Freedom has resulted in a paradigm shift away from the concept of traditional war and peacekeeping operations to that of combating terrorism directly and urban warfare. The US Army is transforming itself into a Future Force capable of rapidly projecting scalable and modular combined arms formations, tailored in force capability packages to meet the requirements of diverse contingencies.[1] The Army Medical Department (AMEDD) is also undergoing transformation by redesigning theater hospital assets into modular medical elements capable of 24-hour operations with reduced administrative overhead, a smaller footprint in the area of operations, and greater mobility to perform specific battlefield functions as required by the mission.[1] In light of the future AMEDD transformation, careful deliberation must be given to expanding the primary care role of the deployed advanced practice nurse (APN). The advanced educational training, clinical expertise, and ability to offer primary healthcare make the APN an invaluable resource to deployed military healthcare teams.[2]

The nurse practitioner (NP), an APN, is educated to make independent decisions and synthesize theoretical, scientific, and contemporary clinical knowledge for health promotion and the assessment, management, and diagnoses of illness and health states.[2-4] A master's degree is required for entry level practice. The professional role of an NP is primary care provider who practices in ambulatory, acute and long-term care settings.[4,5] Nurse practitioners are able to order and interpret diagnostic and laboratory tests, as well as prescribe pharmaceuticals. The American Nurses Association supports the role of NPs as advocates of health promotion and disease prevention with an established record of providing excellent primary care in diverse settings.[6] It is the ability of NPs to provide primary care to a diverse population that enables them to work in a variety of practice settings. One such practice setting is the military healthcare system. *Army Regulation (AR) 40-68* authorizes NPs to provide medical healthcare for diverse populations in primary, acute, and long-term healthcare settings.[5] The role of the NP as a primary care provider in peacetime healthcare has been well established, however, the role of the NP in wartime medical care has yet to be defined. Notably absent from *AR 40-68* is any mention of NPs as primary care providers in deployed settings. The roles and experiences of 5 NPs deployed to OIF are presented below to provide a better understanding of the contributions NPs can make in providing primary care in an austere wartime environment.

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NURSE PRACTITIONER ROLES & EXPERIENCES

All the authors of this article deployed to Operation Iraqi Freedom (OIF) with the 28th Combat Support Hospital (CSH), a 296-bed corps level facility staffed by an interdisciplinary healthcare team of 500 military healthcare professionals. The 28th CSH had the capability to provide Level III combat care and offered the following services:

- Emergency/trauma
- Operating and recovery room
- Intensive care nursing
- Medical/surgical nursing
- Physical therapy
- Outpatient/sick call
- Radiology
- Laboratory
- Pharmacy
- Medical maintenance
- Combat stress care
- Chaplain
- Patient administration

Nurse practitioners are traditionally assigned to work as medical/surgical nurses in a CSH, however, the changing operational requirements of OIF necessitated the use of these primary care specialists in a variety of positions. Changing operational requirements and phase of deployment were primary determinates of role assignment for NPs.

The warning order to deploy the 28th CSH was issued in February 2003. The predeployment phase of operations readied personnel physically and militarily for the impending mission. A nurse practitioner, assigned as the primary care provider for the 28th CSH, served as the commander's advisor on medical issues and was responsible for the physical readiness of all personnel assigned to the unit. The NP prepared personnel for deployment by reviewing medical records and facilitated medical care for individuals with outstanding medical problems by coordinating healthcare with the local military medical treatment facility. The NP also served as the immunization coordinator after completing an online didactic module and a real-time, hands-on, certification program supervised by an immunologist. As a direct result of having an immunization coordinator available within the organization, over 500 28th CSH Soldiers were screened for the immunizations necessary to protect them against biological warfare agents. Furthermore, the ability to field an immunization coordinator enhanced the flexibility of the 28th CSH in accepting similar missions in the deployment phase of operations. The 28th CSH arrived at Camp Doha, Kuwait in increments in the period March 8–10, and was billeted in warehouses while awaiting mission orders. A tasking from higher medical headquarters directed that the 28th CSH send mobile immunization treatment teams (MITT) to staging areas on the Iraqi border to inoculate troops against smallpox and anthrax. The NP, as immunization coordinator, assembled and educated 4 MITTs comprised of physicians, nurses, and medics which inoculated over 2,000 troops. The immunization mission continued as the 28th CSH moved to its staging area at Camp Victory, Kuwait on March 24 and assumed an outpatient troop medical clinic mission.

Camp Victory was a holding camp for troops awaiting orders for movement into Iraq. At the time the 28th CSH arrived, Camp Victory was in a state of brisk construction. Medical support was exceedingly limited, consisting of an ambulance squad with 4 medics and 2 field ambulances. The medics provided triage and treatment for minor illnesses out of their sleeping tent. Patients with acute/urgent medical needs were transported to a nearby Air Force hospital for advanced care. It soon became apparent that the rapid influx of troops created the need for the definitive, on-site medical care that could be ably provided by the healthcare professionals of the 28th CSH, along with the newly arrived 21st CSH. The 21st CSH, with a full medical complement, was also awaiting movement orders into Iraq.

Two senior NPs assigned to the 28th CSH were selected to organize, equip, and staff an outpatient troop medical clinic (TMC) as Officer-in-Charge (OIC) and Assistant OIC. The NPs obtained permission to establish an interim TMC through close coordination with the leadership of Camp Victory, the 28th CSH, and the 21st CSH. An 8-section tent with lights and air conditioning was rapidly assembled. It contained a waiting area, screening section (with a pharmaceutical distribution point), and treatment area with 6 cots/beds. The TMC was open 7 days a week, 24 hours a day, with sick call each morning and an immunization period each afternoon. The OIC and

Assistant OIC made staffing decisions for the TMC with responsibility for coordinating the work schedules of physicians (family practice, internal medicine, and general surgery), NPs, registered nurses (RN), medics, a physical therapist, psychiatric nurse, pharmacist, and administrative personnel. Qualified staff members were able to suture lacerations, drain simple infections, dress wounds, tape ankle sprains, provide intravenous rehydration, and diagnose simple acute problems such as upper respiratory infections, gastroenteritis, and conjunctivitis. The 8 NPs who deployed with the 28th CSH were an integral part of the healthcare team that provided excellent primary care services at the Camp Victory TMC. Tables 1 and 2 illustrate the variety of patient care and workload data documented during a 9-day period at the TMC. Note that many of the diagnoses/illnesses listed in Table 2 are common in both peacetime and wartime primary healthcare settings. The ability of NPs to treat these common illnesses in peacetime reinforces the continued employment of NPs as primary care providers during deployment.

Table 1. Distribution of Diagnoses of Patients at the Camp Victory Troop Medical Clinic

Diagnosis	3-12 April 2003	30-Day Total
Psychiatric (all reasons)	8	24
Dermatologic	54	162
GI, infectious	60	180
Gynecologic	24	72
Heat/cold	25	75
Injury, rec/sports	2	6
Injury, MVA	1	3
Injury, work/training	43	129
Injury, other	2	6
Ophthalmologic	44	132
Respiratory	111	333
STDs	2	6
Fever (unexplained)	0	0
All other medical/surgical	182	546
Dental*	17	51
Misc/admin/followup†	59	177
Viral illnesses	10	30
Chem-bio casualties	0	0
Medical evacuations‡	8	24
Total	652	1,956

*Dental patients were sent to the local Dental Clinic at Au Al Salem
† Primarily "other" orthopedic diagnoses and special prescription refills
‡ Air and Ground Evacuation

Note: 30-day total is estimated.

The two NPs who led the Camp Victory TMC were experienced professionals who demonstrated their expert abilities and experience as primary care providers and leaders in that successful effort. The NPs not only supervised clinic operations, but also treated patients daily, coordinated with higher command and the medical regulating officer on evacuation issues, and procured medical and administrative supplies for the TMC. Advanced knowledge of pathophysiology and pharmacology enabled the NPs to teach critical thinking skills and a systems approach to assessment, management, and diagnosis of common illnesses to medics and RNs working in the primary care setting. The success of the Camp Victory TMC is a telling example of the benefits inherent in having experienced, senior NPs in the deployed environment.

Flexibility in accepting role assignments enabled all the NPs in the 28th CSH to make valuable contributions in each phase of operations. For example, the NP assigned as the immunization

Table 2. Patient Data at the Camp Victory Troop Medical Clinic

	3-12 April 2003	30-Day Total
Total Number of Patients Seen in Clinic	520	1,560
Anthrax immunizations	132	396
Smallpox immunizations	40	120
Prescriptions filled in clinic	206	618
Prescriptions sent out for next day pick-up	142	426

Note: 30-day total is estimated.

coordinator in the predeployment phase of operations was reassigned as a primary care provider at Camp Victory. Upon deployment into Iraq, this NP was then employed as an evening/night supervisor and worked in the emergency medical treatment section of the hospital providing primary care.

The movement of the 28th CSH from Camp Victory into Iraq required role reassignments of the NPs because operational orders directed the 28th CSH to reconfigure from a 296-bed CSH into 2 separate autonomous and functional hospital units. The first increment of the 28th CSH entered Iraq as a 42-bed package designated as the Rapid Mobile Surgical Hospital (RMS). The mission of the RMS was to provide emergency, surgical, and intensive care services wherever and whenever mission requirements dictated. The 28th RMS deployed into Iraq on March 29, 2003, traveling through the war-torn country to arrive at their final destination of Forward Logistics Base Dogwood on April 6, 2003. Two NPs deployed forward with the RMS. One of the NPs had extensive experience as a critical care nurse and demonstrated leadership ability. Therefore, she was selected as the head nurse of a busy intensive care unit (ICU) that cared for wounded US Soldiers, coalition personnel, Iraqi civilians (including women and children), and enemy prisoners of war. A second NP, who had experience in emergency nursing, worked in the emergency medical treatment area, providing acute and primary care not only as a clinical staff nurse, but also as an NP. The advantage of assigning an NP as an ICU head nurse was the ability of this primary care provider to collaborate between nursing and physician staff with regard to patient admission, discharge, clinical care, and evacuation issues. In this situation, the NP assisted physicians in writing admission and discharge orders during rapid influxes of casualties.

An additional benefit of employing an NP in the ICU environment was the presence of a healthcare provider who can communicate advanced clinical knowledge and skills to others. The NP was the lead educator for ICU nurses and medics and taught critical topics such as Advanced Physical Assessment and Care of the Pediatric Patient. The opportunity to learn advanced assessment skills was exceptionally important for the relatively inexperienced ICU staff that cared for a large number of critically injured patients with a variety of injuries, including blast injuries, gunshot wounds, burns, fractures, blunt trauma, and psychiatric illness. The versatile clinical skills and leadership possessed by the NP were tremendous assets to a medical team that was challenged to identify and overcome barriers to patient care in the midst of war.

Advanced education and the critical thinking skills of a primary care provider make NPs a valuable resource that can be employed in a variety of practice settings. For example, an NP from the 28th CSH was directed to exchange positions with a pediatrician assigned to the 549th Area Support Medical Company (ASMC). The ASMC had a need for a primary care provider and the 28 CSH needed a specialist to care for critically ill and injured Iraqi children. Tacit recognition of the NP's ability to provide primary care resulted in an equal exchange of qualified personnel to accomplish both organizations' missions.

The NP quickly became an integral member of the 549th ASMC primary care team. The ASMC was responsible for providing basic field medical care (outpatient services) and relied on the 28th CSH for specialty care. Limited diagnostic equipment dictated that ASMC clinicians use astute physical exam and assessment skills to arrive at diagnoses and treatment options to return Soldiers to duty as quickly as possible. An outbreak of gastroenteritis in the early summer months of 2003 resulted in over 100 patients being treated at the 549th ASMC every day. It was estimated that 85% of patients treated for gastroenteritis were returned to duty within 48 hours of presenting symptoms. Expert primary care knowledge and assessment skills equipped the NP assigned to the 549 ASMC with the expertise necessary to diagnose and treat patients with gastroenteritis and other illnesses.

In June 2003, the 28th CSH was tasked to deploy a 32-bed surgical hospital to Tikrit in support the 4th Infantry Division. Nurse practitioners were once again tasked to lead the primary care mission for the organization. The newly established hospital in Tikrit ventured into unfamiliar territory whenit created an acute care clinic to meet an expanded mission of providing primary care sick call for active duty troops. The acute care clinic was situated adjacent to the emergency medical treatment (EMT) section and contained orthopedic, physical therapy, and comprehensive medical/surgical sick call capabilities.

Two senior NPs were assigned as the primary care providers for the clinic. One NP served in the additional capacity as OIC. The acute care clinic served as the gateway into the hospital system for patients with nonemergency illnesses and injuries. Redirecting an estimated 800 patients a month through the acute care clinic created the flexibility needed within the hospital to concentrate on truly emergency cases in the EMT. The employment of NPs as primary care providers had a measurable effect on the organization's ability to provide expanded medical services.

DISCUSSION

Military tactical and technical preparedness were essential elements in assisting NPs to transition from the predeployment phase of operations to the deployed environment. Soldiers of the 28th CSH were required to qualify with their assigned weapons, practice wearing the protective (gas) mask and chemical protective overgarments, and perform self-decontamination procedures. Participation in hospital equipment and tent assembly training and orientation to standard operating procedures assisted Soldiers in becoming technically proficient in their assigned roles. Clinical preparedness was another important element in the deployment process. NPs listed Advanced Cardiac Life Support, Advanced Trauma Life Support, and the Field Medical Chemical Biological Courses as important adjuncts to building a knowledge base essential to deployment. The simulated war environment created at the Joint Readiness Training Center (JRTC), Fort Polk, Louisiana, presented an opportunity for two of the NPs to integrate their clinical, tactical, and technical skills. The NPs considered their JRTC experience as a pivotal training event in preparation to go to war.

The role of the NP as a primary care provider has been well established in the literature,[4,6] however, *Army Regulation 40-68* does not address the role of the NP in a deployed combat setting.[5] It should be noted that combat medical units have positions designated for advanced practice nurses (APN) working in the operating room, but not for APNs working in primary care. The failure of regulation and doctrine to define the wartime role of the primary care NP directly influences role assignments in the combat medical unit. Nurse practitioners deploy as medical/surgical RNs and are often assigned as a staff nurse, nurse administrator, or head nurse, depending on the needs within the organization. In comparing doctrine and the freshly experienced realities of war, several questions regarding the use of NPs in a traditional RN role are relevant:

- Do the primary care skills of NPs degrade over time during extended deployments?
- If data show that skills do degrade over time, what impact does this have when NPs resume their peacetime primary care mission?
- Are NPs able to transition from a primary care role to the RN role in a seamless manner, or is reeducation needed?

Seven of the NPs assigned to the 28th CSH were tasked as primary care providers in at least one phase of the deployment. Slotting NPs in a primary care provider role required subtle shifts in staffing to accommodate role reassignments. Perhaps fewer staffing shifts would have been necessary had several NP slots been designated on the unit's staffing matrix prior to deployment. A careful analysis must be conducted to reevaluate the requirements of NPs on the battlefield, the staffing plan for deployable hospitals, and the requisite number of primary care slots for NPs in deployed medical organizations.

When analyzing future staffing plans for deployable medical organizations, it is important to consider the interchangeable nature of the physician assistant (PA) and NP roles in peace and war. Both PAs and NPs are intermediate or midlevel care providers. The differentiation between the two groups is that PAs are typically assigned to units located near the front lines of battle, whereas NPs are typically placed in rear-echelon medical units such as a CSH.[7] The unprecedented transformation of the Army into a Future Force necessitates a reexamination of previously assigned roles for NPs in peacetime and wartime for validity and applicability in today's world. *Army Regulation 601-280* envisions the Future Force as an organization that is flexible, proactive, and responsive, with management and support processes to take care of the Soldier.[8] Recent academic initiatives at the Uniformed Services University of the Health Sciences are transforming the Future Force vision into a reality. The graduate nursing faculty has developed a comprehensive program of practicums and specialty rotations in suturing, orthopedics, podiatry, dermatology, emergency and burn care which provides NP students with the additional skill sets necessary for employment as midlevel providers in deployable medical organizations. The proactive and responsive addition of skill sets to the NP program has given the Army Medical Department the flexibility to consider substituting NPs for PAs in future deployments. Working together, NPs and PAs have a rare opportunity to shape the future of medical care for deployed Soldiers. Validation of the interchangeable nature/roles of PAs and NPs must be analyzed in terms of clinical outcome criteria and warrants further study.

The versatility of the NPs assigned to the 28th CSH was clearly demonstrated by their ability to function in such critical roles as head nurse, primary care provider, OIC, and evening/night supervisor. Nurse practitioners selected clinical acumen and experience level as important predictors of their ability to perform these critical roles. The real-world experience and proven performance of deployed nurse practitioners are true to the historic reputation of Army nurses:

ALWAYS ABLE TO GET THE MISSION DONE

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REFERENCES

1. Army Concept Branch, Concept Development Division, Concepts & Experimentation Directorate, TRADOC Futures Center. *Army Concept Summaries;* 2004.
2. Davis U, Scherr D, Parsons T. Meeting women's needs during deployments: A case for the increased use of APN. *US Army Med Dept J.* July-August 1997; PB 8-97-7/8.
3. Mezey MD, MCGivern DO. *Nurses, nurse practitioners: Evolution to advanced practice.* 3 ed. Philadelphia, PA: W.B. Saunders; 1998.
4. American Academy of Nurse Practitioners. Nurse practitioners as an advanced practice nurse role position statement; 2002. Available at: www.aanp.org.
5. *Army Regulation 40-68. Medical Services: Clinical Quality Management*. Washington, DC: US Dept of the Army; February 2004; 26-30.
6. American Nurses Association. Advanced Practice Nursing: A new age in health care. *Nursing Facts.* 1995; Item PR-li. Available at: www.nursingworld.org.
7. Knopper, M. For clinician's who practice in uniform: Are traditional roles changing?. *Clinician News.* 2004; 8: No. 2: 18-19.
8. *Army Regulation 601-280. Personnel Procurement: Army Retention Program*. Washington, DC: US Dept of the Army; 31 March 1999; 1-137.

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Forward Deployed Neurologists? But That's Where The Troops Are!

LTC Roman Bilynsky, MC, USA

The role of the neurologist in the deployed military force has typically been limited. A Combat Support Hospital (CSH) deployed to a theater is often augmented with a Neuro Detachment. This consists of two neurosurgeons and a neurologist to provide forward neurosurgical care. The neurologist functions to support both pre- and postoperative neurosurgical patients if needed and to provide primary neurological consultation. I do not propose any changes to the current configuration or utilization of this unit. It is important to note that all combat support hospitals do not have such augmentation. In Iraq, the detachment is collocated with a CSH element in Baghdad. Due to hostile conditions and distances involved, the actual effective sphere of routine consultative referral is restricted.

Neurologists can provide important consultative services for the deployed force. Their expertise is evaluation and/or treatment of Soldiers presenting with headaches, migraines, concussions, seizures, syncope, epilepsy, nonsurgical neck or back pain, chronic pain syndromes, and vague neuropsychiatric complaints. Such expertise closer to the line would minimize the risks of transporting Soldiers to distant consultants within or outside the theater. It would prioritize Soldiers with medical conditions who need additional neurophysiological and/or neuroimaging evaluations. If local national facilities are available, the neurologist's expertise in interpreting neuroimagery of magnetic resonance imaging or CT computerized tomography scans of the brain and spinal cord can be effectively utilized. This would drastically reduce the need for patient evacuation for routine or rule-out studies. Most importantly, location of neurologists in closer proximity to combat units obviously supports the Army’s overall goal of maintaining critical combat and manpower resources as far forward as possible. Neurologists can also be invaluable for consultation when rendering humanitarian aid. Based on my deployment experience with the 4th Infantry Division in Tikrit, I determined that there is a clear need for specialty neurological consultation far below theater level.

I submit the following implementation options for consideration:

Division Level. There has been an emphasis on forward mental health over the last 10 years that has resulted in the formation of Combat Stress Control teams and provision for a psychiatrist at division level for consultative services. A similar emphasis on providing forward neurological care could be initiated relatively simply by assigning a neurologist to fill one of the Professional Filler System (PROFIS) slots at the level two main support battalion or divisional aid station. This would enable the neurologist in the division support area, visited by supported units for logistical and other purposes, to provide neurological consultation services in a convenient location.

Brigade Level. The neurologist can deploy as a PROFIS physician provider at the level two forward support battalion aid station. This is a convenient location because logistical elements from supported units in the brigade regularly travel to the brigade support area for supplies enabling convenient access for consultation purposes. The determining factor as to whether all 3 or 4 brigades or just 1 or 2 brigades in a division need an assigned neurologist would be the overall disposition of the supported and adjoining units. The brigade located near the division support area would probably be the best location for a single provider. My experience as a neurologist during deployment is based on this model of staffing.

Battalion Level. Neurologists can deploy as the primary PROFIS physician providing general medical officer level one care at the battalion (infantry, armor, etc) and concurrently be available for neurological consultation. This type of provider positioning would be optimal only if collocated with other units or if it is along a main supply route. Consultation is only feasible if patients have relatively easy access to the consultant. If the provider is located at a nontransit point, transportation of the patient to the point of care will obviously be costly in terms of man-hours and vehicles.

The current trend in operational deployments and future requirements of the large number troops in Iraq (and Afghanistan) makes a compelling argument for moving neurological specialty care forward. Manpower shortages and requirements to provide personnel for guard duty, details, convoy duty, and provision for rest and relaxation and mid-tour leave make this a necessity. Substitution of a neurologist for another physician providing level one care does not change overall deployed medical personnel strength and does not necessitate changes in tables of organization.

Iraq and Afghanistan are combat theaters of operation within which deployment along traditional combat front lines is not feasible. They represent the new, modern battlefield. Travel between forward operating bases is hazardous because of exposure to attacks from small arms and/or improvised explosive devices. Transportation of a patient to one location in a large theater of operations involves one to several convoys, helicopters, and/or aircraft. Consequently, routine priority patients and accompanying personnel are unnecessarily exposed to increased risk. Locating neurologists at key transit points would be a major step in the reduction of this safety risk and an additional factor in the Army's goal to maximize care for all of our Soldiers. Forward deployment of neurologists is forward thinking for the dynamic, fluid battlefield of the future.

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CORRECTION

In the July – September 2006 issue of the *AMEDD Journal*, CPT David Admire, the author of the article "Thumb Opposition Restoration: A Case Study," was incorrectly identified as a Physical Therapist. He is an Occupational Therapist. The *Journal* regrets the error.

Theater Immersion: Training a Medical Task Force for Operations in Iraq

COL James B. Henderson, USA

> The purpose of Theater Immersion is to rapidly build combat ready formations led by competent and confident leaders who see first, understand first, and act first, and are manned by battle proofed Soldiers inculcated with the Warrior Ethos.*

Theater immersion is not a new concept for the Army. For decades the Army's Combat Training Centers have employed the practice of "…placing leaders, Soldiers, and units…into an environment analogous to what they will encounter in combat."* The critical tenet of theater immersion is the deliberate, constant, and practical study of the contemporary operating environment. Successfully replicating the contemporary operating environment requires a training environment that is flexible and adaptable to the current conditions into which our Army's forces will deploy. From 21 March to 30 May 2005 the Soldiers and leaders of the 344th Combat Support Hospital (Task Force 344 Med) trained in such an environment at Fort McCoy, Wisconsin.

The ability of the training team at Fort McCoy to replicate the operating environment into which Task Force 344 would deploy was the critical element in the successful preparation for its complex mission in Iraq. Without question, the immersion of Task Force 344 Med in a tough, realistic, and demanding training environment prepared its Soldiers to execute its mission essential tasks to a rigorous standard. This training environment also prepared them mentally for the tough challenges that they would face during their one-year mission. The combination of mental toughness and superb task execution created in all task force Soldiers a sense of confidence that they did not have when they arrived at Fort McCoy in late March. This self-confidence will greatly help the Soldiers of Task Force 344 Med as they conduct a difficult and demanding mission, namely, the provision of world class healthcare to detainees at the Abu Ghraib and Camp Bucca detention facilities.

Studying the Mission Environment

In late February 2005, the First US Army and the US Army Reserve Command notified leaders of the 2nd Brigade, 85th Division (Training Support) and the Regional Training Site–Medical (RTS-Med), Fort McCoy, that approximately 300 Soldiers of the 344th Combat Support Hospital would mobilize and train at Fort McCoy. The Soldiers of Task Force 344 Med were due to arrive at Fort McCoy on 21 March and were scheduled for an early June deployment to Iraq. The 2nd Brigade and RTS-Med planning team immediately initiated a study of the Task Force 344 mission and the environment within which it would provide detainee healthcare. Members of 2nd Brigade successfully established contact with key leaders and staff of Task Force 115 Med, the hospital unit from Fort Polk, Louisiana, that was presently providing detainee healthcare at Abu Ghraib prison and the Camp Bucca detention facility. 2nd Brigade planners also established contact with members of Task Force 115 Med who had recently redeployed to Fort Polk. Mission critical information soon began to flow into the Fort McCoy training team (2nd Brigade and RTS-Med) that would lay the groundwork for the replication of the mission environment in Wisconsin.

The McCoy training team began to envision and understand the Task Force 344 Med training environment that the team must establish at Fort

*LTG Russell L Honore and COL Daniel L Zajac. *Theater Immersion: Post-mobilization Training in the First Army*. First US Army Pamphlet; 2005.

McCoy. The 2nd Brigade S2 served as the conduit for information between the McCoy training team, Task Force 115 Med, and 44th Medical Command (the forward deployed command for Task Force 115 Med). Task Force 115 Med provided 2nd Brigade with updated standard operating procedures for hospital and detainee healthcare operations, its force protection missions, and its report formats and submission requirements. Members of the Task Force 115 staff answered dozens of requests for information. The Brigade S2 harvested information from classified web sites of Forward Operating Base–Abu Ghraib and the tactical units that operated in the vicinity of Abu Ghraib. The training team studied satellite imagery of the Abu Ghraib prison complex to better understand the forward operating base layout. Trainers reviewed and war-gamed recent insurgent attack patterns against the prison and against coalition forces in the area and main supply routes adjacent to Abu Ghraib. The S2 and the training team conducted the same kind of environmental analysis for Camp Bucca and its surrounding area. The training team now had enough information to establish the physical and the mission-specific training environment at Fort McCoy. By the second week of March, Fort McCoy installation workers had broken ground on the Task Force 344 Med Forward Operating Base (FOB) training sites, and the training team was fully engaged in developing dozens of training scenarios tailored to the task force mission.

BUILDING THE MISSION ENVIRONMENT

It was necessary for the training team to leverage existing Fort McCoy training sites due to the limited time available to prepare the sites for early-April occupation by Task Force 344 Med. 2nd Brigade planners worked with RTS-Med and the installation staff on the construction of 2 base camps that would simultaneously serve as training sites and life support areas. The RTS-Med training site on Fort McCoy was the obvious location for the main life support area and training site. This site offered adequate space for construction of a temporary life support area (LSA) for 300 Soldiers. The LSA consisted of 4 large contracted general purpose (GP) tents, a dining facility trailer for food service and a mess tent, a tent that served as a training site for up to 100 Soldiers, field showers linked to an installation water source and sewer line, a trailer housing the S4 and unit supply room, and a motor park. Installation workers moved observation towers and bunkers from other training sites on Fort McCoy to the FOB, and helped 2nd Brigade Soldiers set up an entry control point into the operating base. The Army-Air Force Exchange Service established an exchange at the site that was open to Soldiers in the evenings. The McCoy gym staff created a workout area for the Soldiers. The entire site was enclosed in privacy fencing to give the Soldiers the continuous illusion of being in a walled compound.

The main training site also contained an RTS-Med managed field hospital that would serve as the Task Force 344 Med hospital at “FOB Abu Ghraib.” The RTS-Med site administrators coordinated delivery of medical equipment that was unique to the Task Force 344 Med healthcare mission, or in some cases was in use by Task Force 115 Med in Iraq. The RTS-Med staff provided a building adjacent to the hospital for the Task Force Tactical Operations Center (TOC). Personnel from the McCoy Directorate of Information Management laid more phone lines and computer network cable into the building. Through this effort the TOC and the hospital staff were able to communicate, quickly coordinate operations, and send or receive mission specific reports.

The McCoy training team also developed a smaller, more austere “Camp Bucca” training site on the south side of Fort McCoy approximately 5 miles from the Abu Ghraib site. This site consisted of 3 trailers that served as work space for about 60 Soldiers and the task force’s Camp Bucca staff, rudimentary field hygiene facilities, and a temporary field hospital that RTS-Med erected at the site. The Soldiers working in shifts at Camp Bucca returned to the main LSA on the north side of Fort McCoy in order to take showers and sleep in the GP tents. This procedure saved the installation money and did nothing to detract from the Soldiers’ theater immersion.

The 2nd Brigade training team needed a training site at which the task force medics could conduct detainee sick call and wound care, and administer daily doses of prescribed medication to the detainees. Fort McCoy’s Enemy Prisoner of War training compound served as a perfectly analogous site at which Abu Ghraib and Camp Bucca medic teams could execute these tasks. This site was within a mile of the Abu Ghraib FOB, and was less than a 10-minute drive from the Camp Bucca training site. Tents served as work areas for the medical teams, and 2 tents provided holding areas for detainee role players. While the site was not very robust, the fenced compound did give the medical teams the illusion of being "inside the wire" at their respective detention facility.

The 2nd Brigade established an exercise control center (ECC) for the Task Force 344 Med collective training phases. A small cell of Soldiers in the ECC replicated the 44th MEDCOM staff and served as the Base Operations Center (BOC) staff for both FOB Abu Ghraib and Camp Bucca. Radio and phone communication systems provided the primary means of command and control between these notional headquarters and Task Force 344 Med. Email also served as a means by which the medical task force provided routine reports to the exercise "44th MEDCOM" and the BOC staffs. A parking lot adjacent to the ECC served as the linkup point for daily convoys that departed FOB Abu Ghraib or Camp Bucca, the same linkup procedure used at both sites in Iraq. While the ECC staff primarily administered command and control over all of the training aids and role players used to support Task Force 344 Med collective training, the control center's BOC/44th MEDCOM staff did a superb job of exercising the Task Force 344 Med reporting and staff planning processes. The Task Force 344 Med staff used the same report formats during collective training that it would use for reporting to 44th MEDCOM and the BOC once deployed. Replicating the command and control procedures and using the actual task force report formats contributed significantly to the theater immersion of the task force and its staff.

Development of realistic and relevant training exercise scenarios was also critical to Task Force 344 Med's successful theater immersion training. In early March, the 2nd Brigade exercise planners assembled healthcare subject matter experts from the First Army Command Surgeon's office, the McCoy RTS-Med staff, and key staff members of the Fort McCoy Troop Medical Clinic. Their purpose was to develop medical training scenarios to replicate the kind of care that the medical task force would perform in theater. The planning team assembled each week to develop and refine situations that applied to Task Force 344 Med's unique mission. The team scripted over 120 different medical scenarios that addressed various aspects of detainee healthcare, Level III/IV care for coalition forces, and emergency care for local Iraqi civilians wounded during US combat operations. These scenarios ranged from routine care that clinical staff provided each day in the hospital, such as physical therapy sessions for injured detainees, to a mass casualty type event of 8 to 12 wounded detainees or coalition forces.

The complexity of this effort was compounded by the need for detainees who received treatment to have a medical history. This required the scenario development team to craft over 150 unique medical records that hospital personnel would use when treating detainee patients. The planning team was able to establish the frequency and type of medical scenarios by studying Task Force 115 Med daily medical situation reports submitted to the 44th MEDCOM. The exercise planning team then used the scenarios to develop a list of required training aids and role players, the time required to execute the scenario, and the need for any special preparation such as application of moulage to a casualty or detainee. While the McCoy RTS-Med planners provided some scenarios that they use to train traditional combat support hospitals, the unique mission of Task Force 344 required dozens of scripted events, presenting training not routinely provided to a standard combat support hospital at an Army Combat Training Center.* The medical planning team was extremely successful in developing rigorous, realistic, and very relevant medical training scenarios that fully supported the theater immersion of Task Force 344 Med.

A force protection training team consisting primarily of 2nd Brigade planners and trainers worked in parallel to the medical planning team. The team gathered and assimilated information that was relevant to the security and defense of in theater FOB Abu Ghraib and Camp Bucca. Some sources of information included FOB perimeter tower crew transcripts, the Task Force Med life support area defense plans, and Task Force 115 Med staff responses to various requests for information. Armed with this information, the brigade's exercise planners and trainers developed a Task Force Med Base Defense Plan that was similar to the plan that the unit would have to execute once it deployed. The plan replicated the same number of

*Based on discussions between the author and members of the Joint Readiness Training Center (JRTC) Echelon Above Corps medical training team during a site visit at Fort Polk in early March 2005. The detainee care training provided at the JRTC is not analogous to the care that Task Force 115 or 344 Med provided to detainees at Abu Ghraib and Camp Bucca.

static battle positions that Task Force 344 Med would occupy as part of its base defense responsibilities. It also required the task force to form a Quick Reaction Force capable of executing the same force protection duties and responsibilities as the Task Force 115 Quick Reaction Force. The exercise planners and trainers then arrayed bunker positions and emplaced observation towers in the FOB Abu Ghraib training site that were similar to the actual in theater layout of those positions relative to the hospital and the Soldiers' life support area.

The planning team's interviews with recently redeployed Task Force 115 Med Soldiers also provided key information on how the task force plans and executes its movement operations from FOB Abu Ghraib to other locations, and the weekly rhythm of these movements. The team then built scenarios and resource lists from this information that trainers would use to execute ground assault convoy training for Task Force 344 Med. The training team had to designate Soldiers and vehicles that would also participate in Task Force 344 Med convoys during situational training exercises and the task force Mission Readiness Exercise, since the medical task force always moves as part of a larger convoy in theater. By providing these resources to Task Force 344 Med during its training, the 2nd Brigade was able to ensure that the task force would train like it would operate once deployed. Having a unit "train like it will fight" is the purpose of theater immersion.

TRAINING IN THE MISSION ENVIRONMENT

The theater immersion training scheme for Task Force 344 Med started almost immediately upon arrival at Fort McCoy. Individual and leader training established a basis for collective training conducted later in the training scheme. Soldiers attended training on Improvised Explosive Devices at the end of their first week at McCoy. All Soldiers attended cultural awareness training, and a team of instructors from the Defense Language Institute provided the majority of the Soldiers who work in the hospital with several days of language immersion training. Former Iraqi nationals now living in the United States and under contract at the mobilization station as interpreters during post-mobilization training continued to work with members of the hospital on their language skills. They would do so throughout the remainder of the task force's training. A Mobile Training Team of subject matter experts from the Army Military Police School and the Army's Disciplinary Barracks at Fort Leavenworth provided superb instruction on detainee operations, handling, healthcare, and the impact of these tasks on the Soldiers who would execute this critical and stressful mission.

The task force moved into the FOB on 8 April and would live, eat, and work there for the next 53 days. Upon arrival at the FOB, they received instruction from 1st Battalion, 338th Regiment trainers on several battle drills that are fundamental to all operations in Iraq: react to indirect fire, react to direct fire, individual movement techniques, and establishing personnel accountability after an attack on the unit. Select Soldiers in the task force received training on manning an observation post/tower, operating an entry control point, and Quick Reaction Force operations.

The 2nd Brigade's ground assault convoy (GAC) training team and GAC live fire team provided superb training on this critical mission to all members of the task force. Training scenarios forced the Soldiers to execute their GAC missions using the same tactics, techniques, and procedures that they would use in Iraq. Contracted and military role players portrayed civilians on the battlefield and insurgent forces, thereby making the unit's GAC missions much more complex and realistic. Opposing forces attacked the convoys with direct fire and improvised explosive devices. The unit had to treat and evacuate "casualties" or Soldiers who were "killed in action." Soldiers had to conduct hasty recovery of disabled vehicles and tow them to a rally point. Role players tried to interfere with the unit's convoys. Civilian vehicles attempted to share the road with the convoy and infiltrate into the convoy march unit. These scenarios forced the Soldiers to employ a series of actions and graduated responses that are part of the rules of engagement the unit would employ in Iraq. This type of training is theater immersion in full force.

By early May, Task Force 344 Med was ready for a progressive series of collective situational training exercises (STX) that would further train and demonstrate the unit's proficiency in its medical and force protection missions. During the 2 series of medical STX, the unit trained on all of the activities it would perform inside the walls of the hospital at both the Abu Ghraib and Camp Bucca sites. The task force operated a tactical operations center to command and control its operation and to report to its higher headquarters, 44th MEDCOM, on the daily status of medical operations. Inside the hospital, the Soldiers executed medical scenarios that closely replicated their future mission tempo and tasks in Iraq. They provided medical and dental sick call for US Soldiers around the clock. They sent medical teams daily to the detention center to conduct in-processing physicals, sick call, medication pass, monthly health assessments, and wound care for detainees. Additionally, they received detainees in the hospitals daily for physical therapy and occupational therapy, radiology, and dental exams, and any other care that the medics at the detention camp could not perform. Numerous scenarios also required the unit to execute collective missions it would likely perform in Iraq. Several times the task force had to react to an increased casualty load caused by detainee riots, Soldiers injured due to combat actions, and civilian casualties resulting from combat action in urban areas. The task force successfully accomplished these tasks and then progressed into the next phase of training, the Force Protection Field Training Exercise (FTX).

During the Force Protection FTX, the unit trained and executed all of the actions it would perform as a tenant unit of FOB Abu Ghraib and Camp Bucca. This phase of immersion training included the unit's responsibilities at the FOB's different Readiness Condition levels, reporting to the base operations center, GAC operations to "Baghdad International Airport" and "Camp Buehring," sucker sanitation truck (SST) movement security operations, and reaction to direct and indirect fires. This phase of the training also enabled the unit to practice its internal standard operating procedures (SOPs), identify strengths and weaknesses, and make adjustments in its SOPs prior to the Mission Readiness Exercise.

The Mission Readiness Exercise (MRE) was the culminating event of Task Force 344 Med's 70 days of training at Fort McCoy. During the MRE the task force simultaneously performed its medical tasks and force protection responsibilities in a split-base configuration; one element at FOB Abu Ghraib and another, smaller element at Camp Bucca. This phase was 5 days long and the task force conducted continuous, 24-hour operations throughout the entire exercise. During the MRE, the unit was required to submit all required daily reports to its higher headquarters and the Base Operations Center at each FOB, and it conducted daily medical and force protection operations similar to those that it would execute during its upcoming mission.

The unit conducted tactical operations center and daily staff operations, public affairs operations with 3 live interviews, force protection operations at both FOBs, ground assault convoy and SST escort missions, and detainee and coalition force medical support operations. Over 100 role players supported this phase of training. Role players served as detainee security forces in the hospitals, other units in the daily GACs, SST drivers, detainees, coalition casualties, contracted workers on the FOB, and other FOB quick reaction and security forces. Contracted former Iraqi nationals served as interpreters on the hospital wards. Throughout the MRE's 5 days, Task Force 344 Med in-processed 80 detainees, conducted sick call for 120 detainees, provided medications to 250 detainees, treated wounds on 80 detainees, and conducted a monthly physical assessment of 30 detainees. The complexity, tempo, and continuous operations of the exercise stressed all of the task force's systems and mission areas. The realism of the mission scenarios provided the task force an indication of how well it would operate under the most trying circumstances. The total theater immersion of the task force into its mission environment prepared the unit well for its rigorous, demanding mission.

Conclusion

Theater immersion works extremely well in preparing units to conduct operations in theaters around the globe. Task Force 344 Med was immersed in a replica of its operating environment at FOB Abu Ghraib for 53 days of tough training. The ability of the Fort McCoy training team to develop a replica of Task Force 344 Med's mission environment required a deliberate analysis and study of the contemporary operating environment in Iraq at Abu Ghraib and Camp Bucca. Establishing contact with Task Force 115 Med and bringing mission-related information from Iraq to Fort McCoy was critical to the development of training venues and training scenarios for Task Force 344 Med. The successful training of the task force was due largely to the skill of the Fort McCoy training and garrison support team and what it was able to do with the information provided by Task

Force 115 Med. The Fort McCoy team quickly developed a training environment that was a physical and procedural imitation of what the unit would face when deployed in Iraq. The demanding training environment allowed Task Force 344 Med to conduct operations across the full spectrum of its healthcare and force protection mission set. The result of this kind of demanding and rigorous training is a task force that is well skilled in its missions, mentally tough, and extremely confident. This result is the goal of any training program, and theater immersion is the means to that end.

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COL Henderson, an Armor officer, was Commander, 2nd Brigade, 85th Division (Training Support), Fort McCoy, Wisconsin, at the time this article was written.

85th Division (Training Support)
"Custer Division"

Application of Geographic Information System Technology to Preventive Medicine Interventions

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Introduction

Geographic information system (GIS) is a term used to describe a software technology that relates various databases to common feature geography. Specifically, a GIS is composed of an integrated system of computer software and hardware that allows users to rapidly create customized maps and models that capture only those features or objects that meet particular selection criteria. GIS has already made a positive impact on healthcare in the public, private, and military sectors. Many public health departments, both in the US and throughout the world, have applied GIS in various ways, including the identification of nearby medical facilities for ambulance services, improved epidemiological response following weather-related disasters, and hospital preparedness for unconventional casualty events, to name a few.[1-3]

Health service professionals in military installations have used GIS to improve their understanding of health issues. For example, an epidemiological study of sexually transmitted diseases (STD) at Fort Bragg, North Carolina, used GIS to track occurrences of selected STDs in space and time, thus allowing Preventive Medicine personnel to develop interventions for the Fort Bragg population.[4] In 1993, the US Army Center for Health Promotion and Preventive Medicine (CHPPM) used GIS to integrate the unit location registry database to track and map troop locations relative to smoke from oil well fires ignited during the first Gulf War. Since 1995, CHPPM has expanded this system to track troop exposures to other potential environmental hazards from specific operational events. Future plans call for mapping exposures to potential operational hazards such as depleted uranium, ballistic missile impacts, and other demolition activities.[5]

A current mission of the Department of Preventive Medicine (DPM) at William Beaumont Army Medical Center, Fort Bliss, Texas, is to integrate GIS capability into the different health and environmental services it performs. For example, the Environmental Health Service (EHS) currently enters water laboratory data, West Nile virus mosquito sampling results, monthly dining facility inspection findings, hazardous materials locations, and other information into a GIS (ArcView, registered trademark of Environmental Systems Research Institute, Inc. [ESRI], Redlands CA, 909-793-2853), which can instantly generate maps displaying trends of these features in space and time. Similarly, the Industrial Hygiene Service uses GIS for plotting biological, chemical, physical, and radiological data that are collected as part of scheduled sampling or for emergency response. In addition, DPM has used GIS in simulations of hospital preparedness for various scenarios involving chemical, biological, radiological, nuclear, and explosive (CBRNE) events, thus providing important information to hospital decision makers.

Discussion

West Nile Virus and GIS

West Nile virus (WNV) is a relatively new yet serious health concern first documented in Texas in 2002.[6] Statistics compiled by both the Texas Department of Health and the Centers for Disease Control and Prevention (CDC) show a total of 58 human deaths in Texas alone since 2002.[6,7] This virus causes mild to severe infections in humans, typically through the bite of a mosquito that has acquired the virus by feeding on an infected bird. According to the El Paso City-County Health and Environmental District, WNV cases typically occur from August to October, which correlates with migrating bird populations for the region. The incubation period for WNV ranges from 3 to 14 days and symptoms generally last 3 to 6 days.[8] The mild form of WNV infection is described as a febrile illness of sudden onset often accompanied by malaise, headache, anorexia, myalgia, nausea, rash, vomiting, lymphadenopathy, and eye pain. Approximately 1 in 150 WNV infections are severe, including fever and even death. The CDC reports that the most significant risk factor is advanced age, but the sick and young are also vulnerable. El Paso City-County had numerous human cases of WNV infections, including fatalities, in 2004. Fortunately, in 2005, although mosquitoes and humans tested positive for the infection, no deaths were reported.

In April 2005, CHPPM published specific guidelines with regard to how Army programs should georeference West Nile virus surveillance data:

- Data must be in a format allowing it to be integrated into a GIS.
- GIS data should be combined with local, state, and national data for a more comprehensive assessment of WNV.
- Accurately map local sites in GIS to develop optimal sampling plans and best allocation of resources.

The EHS at WBAMC is currently in full compliance with this CHPPM guidance, effectively using the GIS to plot mosquito trap locations and associated laboratory results in space and time. As an example, Figure 1 was generated in GIS using 2004 Fort Bliss mosquito trap information to show trap locations within the Fort Bliss golf course (an identified "hot spot" for WNV mosquitoes[9]) which captured WNV positive mosquitoes. Also highlighted on the map are facilities with at-risk populations in the vicinity of these traps, such as an elementary school and a youth center in proximity to the golf course. Since 2004, the EHS has been producing these maps to effectively target positive WNV mosquito locations with fogging intervention, education, and training of the at-risk populations, along with other measures.

An agreement was recently established between the El Paso City-County Environmental and Health District and Preventive Medicine at WBAMC to provide timely exchange of WNV information, including exact locations of mosquito traps and laboratory results, and the presentation of this data on a county map. Before this agreement was formalized, these entities did not share information regarding mosquito trap locations, laboratory results, or sampling strategies. Figure 2 is a GIS-generated map showing locations of mosquito traps which captured positive WNV mosquitoes in 2004 using data derived from the combined El Paso City-County and Fort Bliss databases.

Implementing a GIS-Based Emergency System

Numerous emergency services agencies (police, fire, medical facilities, emergency shelters) in the US and abroad have already established GIS-based emergency systems as part of readiness programs for responding to natural and non-natural disasters. GIS was an important tool in the response, rescue, and recovery efforts in the attacks of both September 11, 2001 (9/11) in New York City, and the London bombings in July 2005.[10-12] A GIS application can plot the location of all mobile and landline callers on a digital map, giving first responders the ability to find the site, routes involving shortest distances, and shortest travel times for ambulances, thus reducing emergency response time by a critical 2 minutes.[12]

Hospitals and health systems have a tremendous stake in a community's preparedness for any mass casualty scenario related to a CBRNE attack. Since 9/11, many hospitals have drafted plans for responses to such events and other mass terror attacks.[13] While hospitals are fairly adept at scaling up for a predictable event, most hospitals are not well prepared to respond to an unexpected large-scale event such as an epidemic, the release of a biological agent, or a terrorist attack.[14] For hospitals to respond promptly to these events, it is crucial to have information of personnel and patients in a medical facility readily available within minutes. The Loma Linda University Medical Center in Loma Linda, California, has integrated GIS in the management of care networks and for hospital strategic planning, to include mass casualty events. They have merged GIS with digital floor plans of the hospital, real-time patient data, physician in-care of a specific patient relationships, and occupied and empty bed information. Using this integrated GIS database, new patients can be easily allocated to suitable beds with matching roommates based on their condition and the attending physician.[15] The system can also be queried for patients being treated by one particular doctor, and provide a doctor with a floor plan map to all his or her patients.

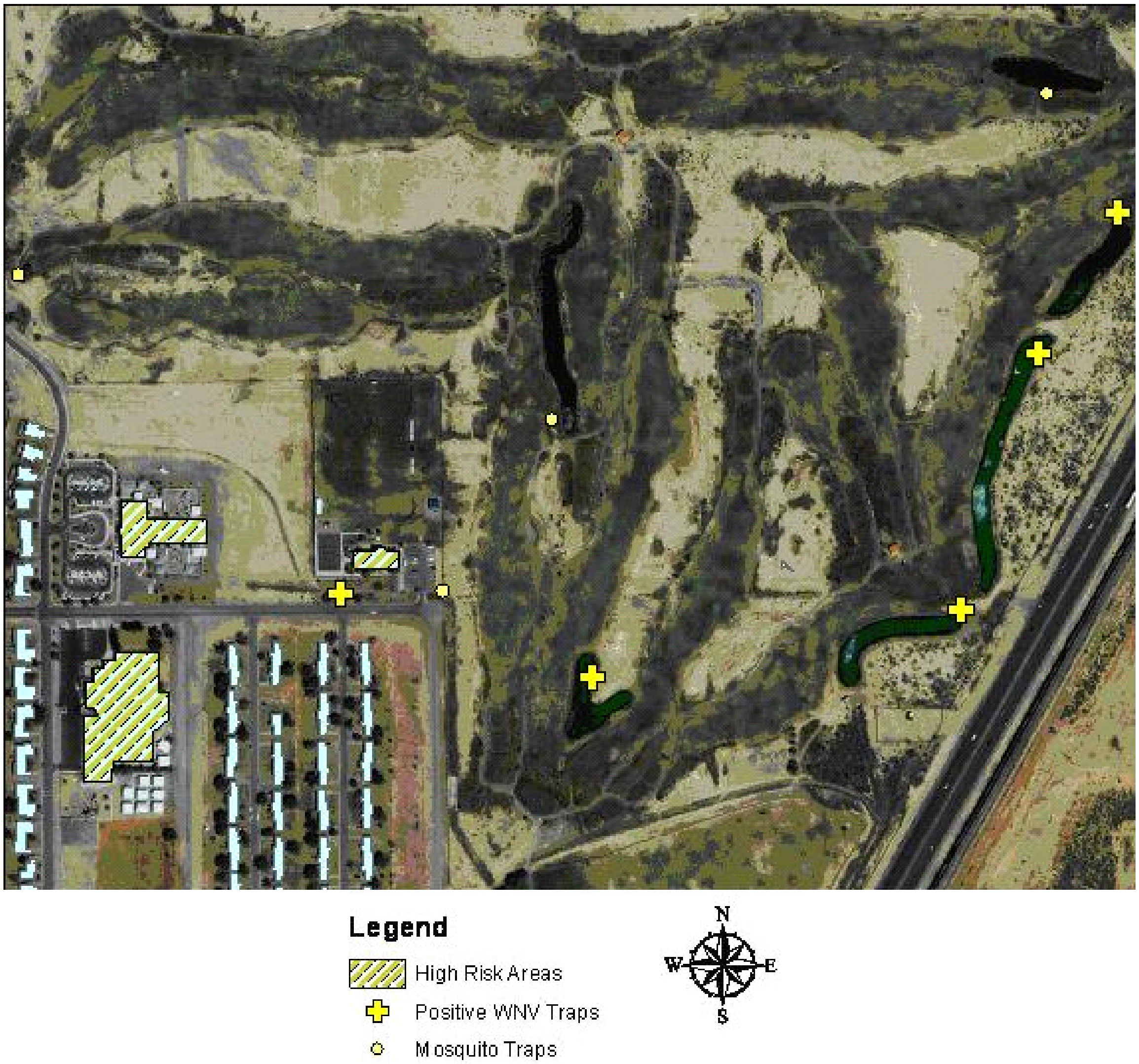

Figure 1. Map of Fort Bliss Golf Course and mosquito trap locations generated by GIS (Note: Some GIS layers provided by the Fort Bliss Directorate of Environment through a file-sharing agreement with the Department of Preventive Medicine)

The capability to predict damage and analyze consequences from a CBRNE attack is an increasingly important responsibility of the WBAMC Department of Preventive Medicine (DPM), which is developing a GIS-based model that predicts hospital capabilities and readiness in the event of a CBRNE event in the proximity of the Fort Bliss military base. For this model, complete hospital floor plans have already been incorporated into GIS. DPM has generated maps showing exact bed locations for the hospital during normal capacity, expansion of hospital capacity under the emergency management and excess surge capacity plans, and has even modeled bed locations with hypothetical conditions of having increased isolation wards for infectious patients or a contagious disease outbreak facility (Figure 3). By taking into account baseline patient bed occupancy and staffing levels, DPM has modeled scenarios in which hospital resources are either adequate and inadequate in space and time for patient arrival surges from a CBRNE event. Among other important information, these models even reveal where process bottlenecks are likely to occur during the triage process. This information may assist hospital decision makers and

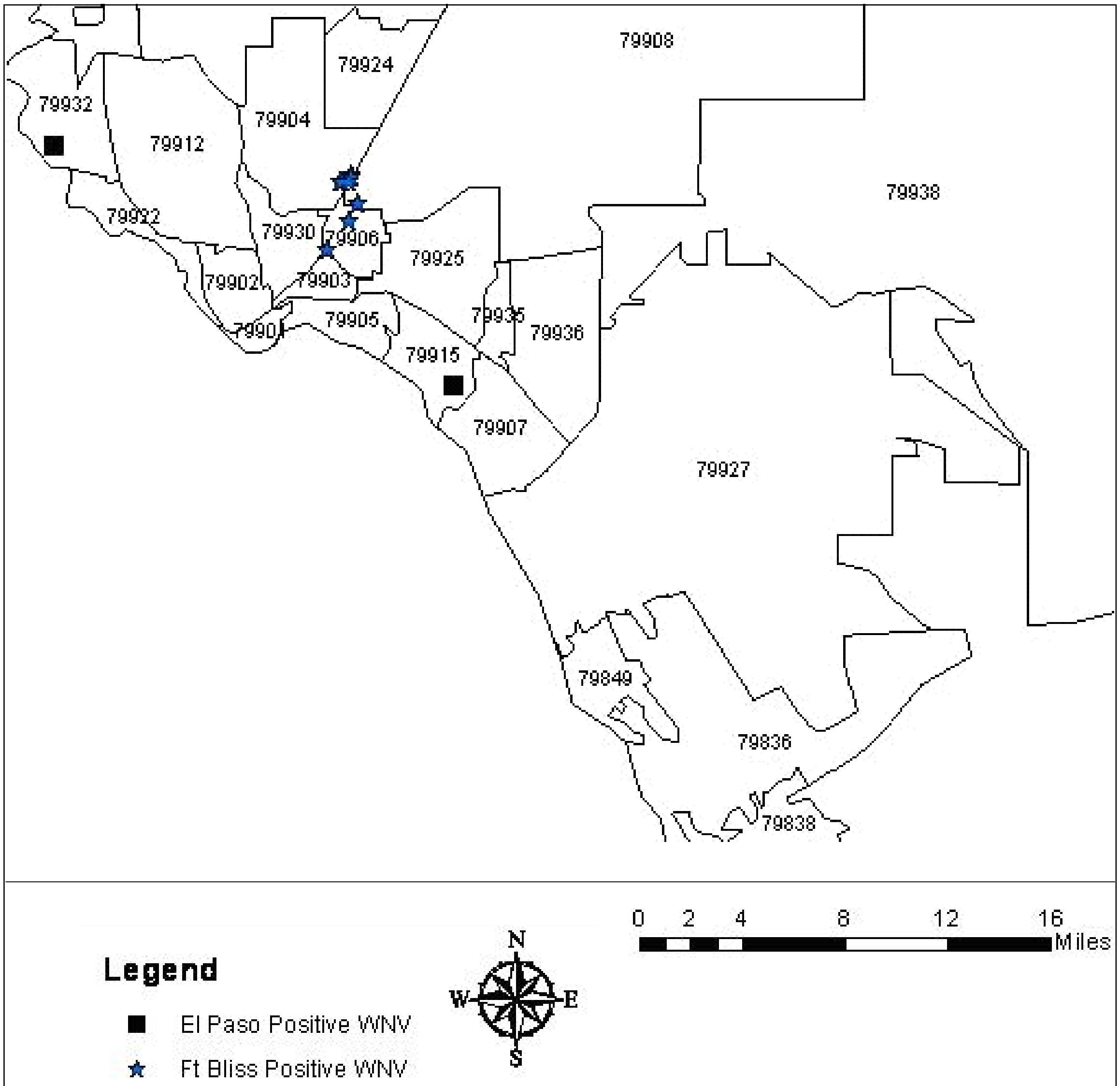

Figure 2. Positive WNV mosquito locations in 2004 generated by GIS from merged databases between Fort Bliss and the El Paso City-County.

reduce some of the disorder likely to occur during a CBRNE event.

CONCLUSION

The Department of Preventive Medicine at WBAMC has established a GIS platform with many beneficial capabilities. Maps generated by GIS using integrated databases showing mosquito sampling locations and lab results for WNV, as well as the start of a GIS collaboration between the El Paso City-County and Fort Bliss communities, have already helped mitigate the health risks from WNV by allowing more focused interventions against the virus. Additional data-sharing applications between El Paso City-County and Fort Bliss are being evaluated. DPM is in the early stages of using GIS to plan for a CBRNE attack as well as prepare basic vulnerability assessments. By integrating a GIS-based emergency system into a hospital readiness program and the Emergency Operations Center, WBAMC may have a more rapid response allowing the immediate and effective use of personnel, ambulance, and equipment resources to save lives during a CBRNE attack. In such situations, even a few minutes can make the difference between life and death. GIS information may provide those minutes.

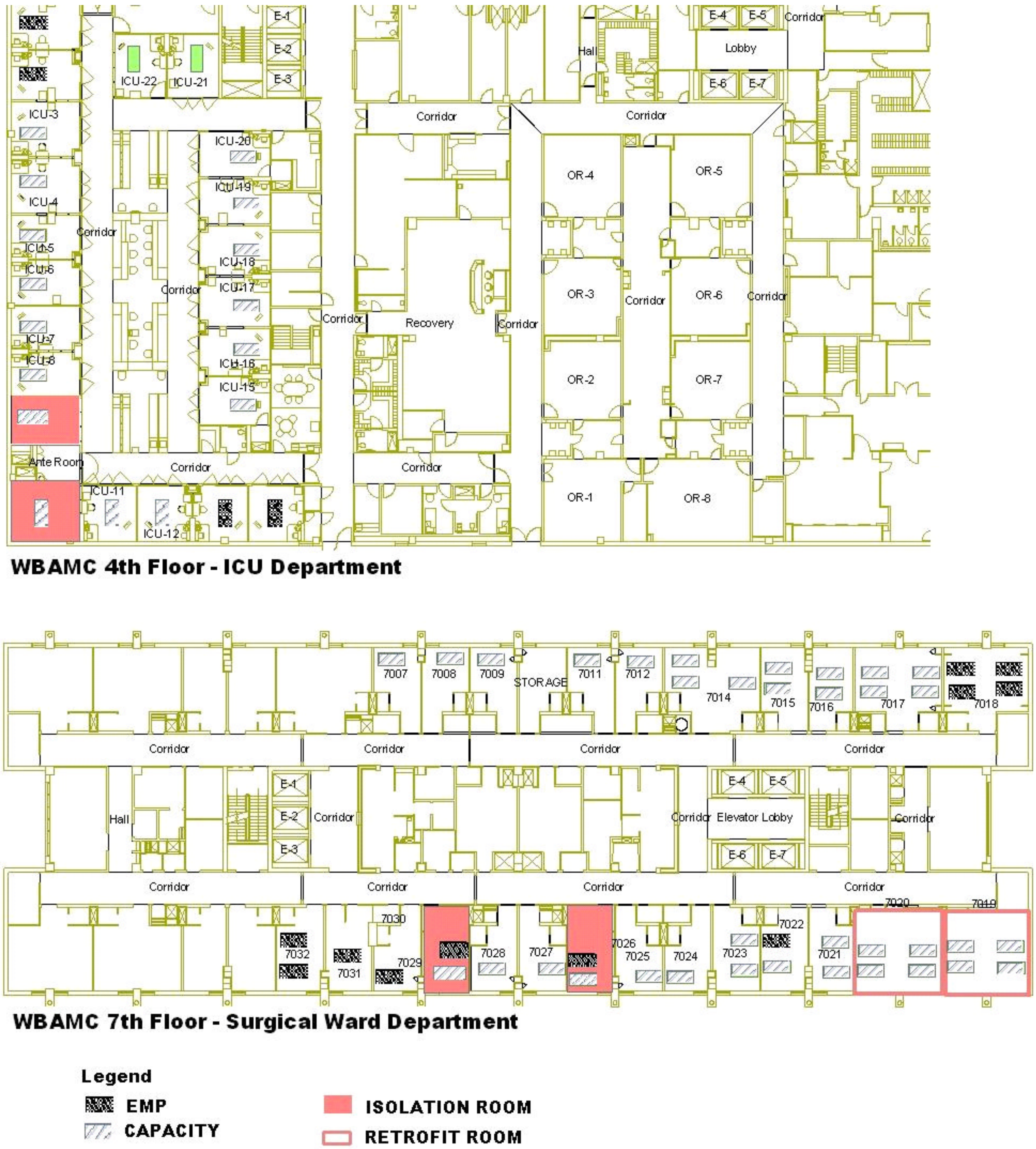

Figure 3. GIS map of the WBAMC 4th floor Intensive Care Unit (ICU) and 7th floor surgical ward showing patient bed locations under normal capacity (Capacity), emergency management plan (EMP) capacity, as well as negative pressure isolation rooms and retrofitted isolation rooms.

REFERENCES

1. Peleg K, Pliskin JS. A geographic information system simulation model of EMS: reducing ambulance response time. *Am J Emerg Med*. 2004;22;No. 3:164-170.
2. Waring SC, Zakos-Feliberti A, Padgett PM, Stone M., Wood R. The utility of geographic information systems (GIS) in rapid epidemiological assessments following weather-related disasters: methodological issues based on the Tropical Storm Allison experience. *Int J Hyg Environ Health*. 2005;208:109-116.
3. Schreiber S, Yoeli N, Paz G, Barbash GI, Varssano D, Fertel N, Hassner A, Drory M, Halpern P. Hospital preparedness for possible nonconventional casualties: an Israeli experience. *Gen Hosp Psychiatry*. 2004;26;No. 5:359-366.
4. Zenilman JM, Glass G, Shields T, Jenkins PR, Baydos JC, McKee KT. Geographic epidemiology of gonorrheoea and chlamydia on a large military installation: application of a GIS system. *Sex Transm Infect.* 2002;78:40-44.
5. Brame L. Current status of Army's position on evidence of exposure to chemical agents in the Gulf War: evidence of exposure to chemical agents in the Gulf War. Desert Storm Veterans Association. 1997. Available at: http://www.desertstormvets.org/health/index.cfm.
6. *State Health Experts Urge Personal Protection Against West Nile Virus*. [Video News Release]. Austin, TX: Texas Department of Health; May, 2003. Available at: http://www.tdh.state.tx.us/news/wnv_script.htm.
7. Centers for Disease Control and Prevention. West Nile virus homepage. Available at: http://www.cdc.gov/ncidod/dvbid/westnile/index.htm.
8. Centers for Disease Control and Prevention. West Nile virus infection: information for clinicians. Available at: http://www.cdc.gov/ncidod/dvbid/westnile/resources/fact_sheet_clinician.htm.
9. Reyes J, Neu R, Bell L, Leyva E, Everett MA, Magaña JC, Sobieraj JA, Harris MD. Preventing West Nile virus in El Paso using geographic information systems models for El Paso County and Fort Bliss communities. *El Paso Physician J*. In press.
10. Kevany MJ. GIS in the World Trade Center attack- trial by fire. *Comput Environ Urban*. 2003;27;No. 6:571-583.
11. Lockey DJ, MacKenzie R, Redhead J, Wise D, Harris T, Weaver A, Hines K, Davies GE. London bombings July 2005: the immediate pre-hospital medical response. *Resuscitation*. 2005;66:9-12.
12. London Ambulance Service-GIS experience: geographical information systems - case studies. *Bus Comput World*. February 1998:50-54
13. Morse A. Bioterrorism preparedness for local health departments. *J Commun Health Nurs*. 2002;19:203-209.
14. Davenhall W. Preparing for large-scale events. *ArcUser* [online]. October – December 2003. Available at: http://www.esri.com/news/arcuser/1003/largescale1of2.html.
15. City University London, School for Informatics. Overview of GIS for health organizations. *Health Geomatics* [online]. December, 2000. Available at: http://www.geog.ubc.ca/courses/geog471/notes/health/Overview_GIS_Health.htm.

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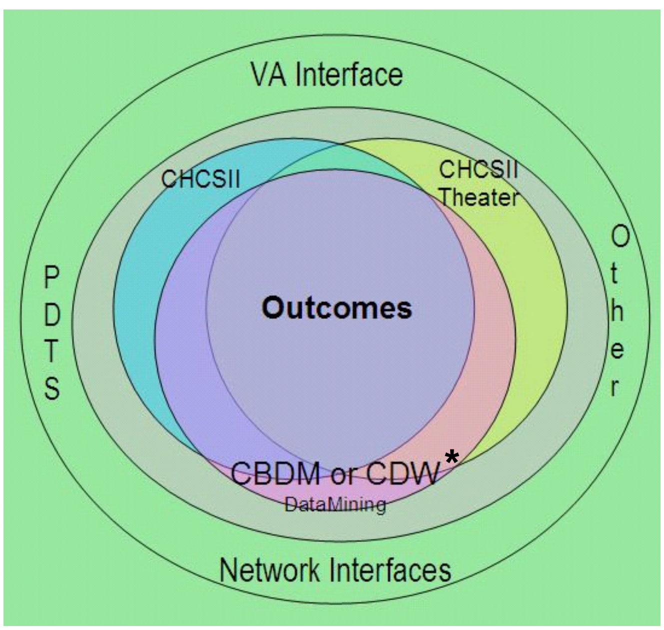
William Beaumont Army Medical Center

The New Name of the Military Electronic Medical Record

LTC Ron Moody, MC, USA
David Freeman

The military health system recently changed the name of its electronic medical record to AHLTA. The name change is more than just a symbolic gesture. It reflects an understanding and emphasis on the composition and intended utility of the military health system's global electronic medical record (EMR). The name change is also part of a greater effort to speed integration of all the subcomponents of the system.

Many people think of AHLTA as the computer in their office or exam room. While acknowledging the "record" is kept in a large database in Montgomery, Alabama, the global nature and the multiple systems that compose AHLTA were not reflected in the name Composite Healthcare System (CHCS) II. As portrayed in the Figure, AHLTA includes CHCS, CHCS II, CHCS II-T, and clinical data mining capabilities. AHLTA also includes interfaces with and information from the US Department of Veterans Affairs EMR (Veterans Health Information Systems and Technology Architecture) as well as other growing network interfaces such as the Pharmacy Data Transaction System (PDTS). The other reason for the name change is an acknowledgement that management of these subcomponents and interfaces must be collaborative and in unison. Changes to or delays in any part impact the utility of the other components. The complexity of the largest EMR in the world and the need to continually enhance it demands great coordination at all levels, from the clinic to the enterprise management office.



AHLTA Global View
*CBDM – Clinical Business Data Mart
CDW – Clinical Data Warehouse

The name change did not signal a belief that AHLTA was a completed product. Throughout its deployment, it has been clear that use of AHLTA required changes in the clinical work process. It is equally true that necessary changes were identified by clinical teams using the system. This has created a continual cycle of evolution and improvement based upon real clinical care. No EMR will ever be perfected in the lab; it requires real-world use and feedback. During the first 2 years of full deployment, users recommended many changes to AHLTA which have been funded.†

The list of impending improvements is impressive. The changes will require the continued cultural and clinical business changes in the Army Medical Department (AMEDD). The provided capabilities offer many improvements in clinical care, decision support, and efficiency. The AMEDD realizes that even these improvements will not complete the EMR. Great innovations and recommendations for improvement are occurring everywhere. To harness this energy and entrepreneurial effort, the AMEDD has developed a process to help capture, develop, and share ideas and best practices.

System Change Request and Best Practices

Individuals and groups can submit system change requests to the AMEDD AHLTA Program Office or to their regional representatives on the AMEDD EMR Collaboration and Communication Board (CCB). The AMEDD AHLTA system change request form is available at the AHLTA website.† The person or group submitting the request is asked to clearly define the outcome that the suggested change will allow. This will help the AMEDD staff develop the idea with the submitter. More often than not, the AMEDD staff is able to let the requestor know the status on an earlier similar request. The CCB, which meets twice monthly, consists of representatives from each regional medical command and other areas. It was chartered as a committee of the AMEDD Information Management Guidance Council to facilitate collection and review of information from the field for improving AHLTA. The group was also chartered to help improve the sharing of best practices and use of AHLTA. In addition, the CCB develops standardized reports so that every military medical treatment facility does not "reinvent the wheel." Users are encouraged to contact their CCB representatives. CCB representatives communicate changes and solicit feedback on improving the AMEDD's electronic medical record, AHLTA.

MEDCIN® Terms

The structured language that is the "note writer" in AHLTA is MEDCIN, a commercial product developed by Medicomp Systems, Inc. (14500 Avion Parkway, Chantilly, VA, 703-803-8080) which is in use in many civilian EMRs. Individuals and groups can request additions and changes to the MEDCIN vocabulary through the AMEDD AHLTA website.[†] A spreadsheet to capture the requested changes to MEDCIN and instructions on submitting changes are available on that website. The requested changes are compiled and submitted to Medicomp. Of course there is no guarantee that the changes will be accepted. However, it is guaranteed that changes will not occur if requests are not made. In general, it takes about 6 months for an accepted term to be released in AHLTA. The AMEDD has had great success in getting clinical, readiness, and administrative terms added. The consultants in the Office of The Surgeon General (Army) are asked to review and consolidate requested changes to MEDCIN vocabulary for their areas. The consultants can also assist in consolidating feedback to forward to the AMEDD AHLTA program office as system change requests.

Sustainment Trainers

The AMEDD AHLTA program office has a network of sustainment trainers to help with ongoing training, the collection and dissemination of best practices, and troubleshooting AHLTA issues. This collaborative network allows the quick identification and resolution of training issues. It also has helped develop and evolve system change requests into better ideas. The sustainment trainers keep the medical treatment facilities informed of changes through newsletters and a growing list of training documents and frequently asked questions. A list of these training documents can be found on the AHLTA website.[†]

[†]The AMEDD AHLTA website is accessible through the Army Knowledge Online (AKO) system (authorized users only). Enter the AKO homepage, select Groups, enter AHLTA, select Homepage. Or, from the AKO homepage, enter https://www.us.army.mil/suite/page/406.

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A Global Electronic Medical Record, Today's Reality

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David Blair, MD

Although full deployment of AHLTA was approved in January 2004,* the military health system (MHS) has been deploying an electronic medical record since early 1980. The deployment and use of the Composite Health Care System (CHCS) helped overcome many issues. For example, computerized physician order entry (CPOE) continues to be a stumbling block for organizations trying to implement an electronic medical record. The resistance to this change has persisted for over 20 years despite the evidence that CPOE improves patient safety by preventing medical errors. Indeed, physician resistance to ordering medication and labs through computers was present within the Army Medical Department (AMEDD). However, over time many users grew dependent on the CPOE capabilities of CHCS.

> What we call "progress" is the exchange of one nuisance for another nuisance.
> *Havelock Ellis*

The early years of CHCS deployment and use were not without problems and controversy. The key complaints about CHCS were that it was slow, not user-friendly, resulted in lost productivity, and interfered with physician-patient interaction. The complaints are virtually identical to those heard about AHLTA. Some of these issues surfaced because each of these systems pushed the technology envelope of their time. The issues also occurred because the systems were designed for global use and were not customized to any single location or practice pattern. However, most of the issues are closely related to the impact that the electronic medical record has on the "culture of medicine." Like CHCS before it, AHLTA has created a fundamental need to change clinical-business practices while not changing the high-quality of care that is provided. The switch to the next generation of TRICARE contracts has also created the need to change practices. A great move has occurred from counting visits to relative value units. The acceptance of change in technology follows a predictable pattern. Gartner[1] defined the new technology implementation cycle:

- **Technology Trigger.** A breakthrough, public demonstration, product launch, or other event that generates significant press and industry interest.
- **Peak of Inflated Expectations.** During this phase of over-enthusiasm and unrealistic projections, a flurry of well publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
- **Trough of Disillusionment.** Because the technology does not meet its over-inflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
- **Slope of Enlightenment.** Focused experimentation and solid hard work by an increasingly diverse range of organizations leads to a true understanding of the technology's applicability, risks, and benefits. commercial off-the-shelf methodologies and tools ease the development process.
- **Plateau of Productivity.** The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations.

> A good plan executed today is better than a perfect plan executed at some indefinite point in the future.
> *General George S. Patton, Jr*

It has been shown that success in a time of cultural change requires a clear vision and commitment to achieve stated goals. The AMEDD deployment of

*See related article on page 40.

AHLTA has been focused on the goals of improving both the health of beneficiaries and the healthcare systems. In 2001, an Institute of Medicine study[2] detailed a significant issue with the US healthcare system. The following statement from the study summarizes the issue:

> In its current form, habits, and environment, American health care is incapable of providing the public with the quality of health care it expects and deserves.

In a more recent study by the RAND Corporation, it was estimated that implementation of health information technology and electronic medical records would improve clinical care and operational efficiency. The study revealed that properly implemented health information technology would save money and significantly improve quality. The total annual savings was estimated to be as high as $162 billion. Savings would come from increased efficiency ($77 billion), reduced occurrence of adverse drug events ($4 billion), and improved condition management and preventive care ($81 billion).

The AMEDD's success with AHLTA implementation has occurred because deployment continued despite challenges. By focusing on the vision of improved healthcare, AMEDD helped field and create solutions to those challenges. The past and future successes of AHLTA require a continued effort to learn how to use and teach the uses of the application. Success also requires both a plan and the evolution of that plan through continued learning. Other efforts at large-scale EMR implementation have met with similar challenges. The United Kingdom's effort to implement a national EMR has been hindered by delayed delivery of critical software. These delays have increased cost.

> In preparing for battle I have always found that plans are useless, but planning is indispensable.
>
> *Dwight D. Eisenhower*

The AMEDD strategy for implementing AHLTA can best be represented in 5 phases:

Phase 1

Deploy AHLTA to all sites so there is a common EMR available

Block 1 – Medical (February 2004 to July 2006)

Block 2 – Dental and Spectacle Request Transition System II (August 2006 to finish)

Phase 2

Increase utilization by all sites and deploy AHLTA to all medical area locations (theater, battalion aid stations, Soldier readiness processing sites, community based healthcare organizations) (January 2005 to December 2006)

- Better training and tools
- Preventive Health Reminders
- Clinical Data Mart – Initial deployment
- Shared Solutions from the field

Phase 3

Improve the Quality of Care by gathering and utilizing Evidence-Based Care and Best Practices (January 2006 to finish)

- Deploy Clinical Decision Support/Automation of Clinical Practice Guideline/Registry/Outcome tool
- Enhanced Clinical Data Manager and eventual Clinical Data Warehouse
- Regulation and Policy Changes

Phase 4

Improve outcomes while decreasing costs as a consequence of the above actions being successfully accomplished (July 2006 to finish)

Phase 5

Prepare for inpatient success (July 2006 to finish)

Although depicted as phases, the activities are occurring in parallel with great overlap. Completing each phase will provide the base and infrastructure to more rapidly achieve the next phase.

Presently the AMEDD AHLTA Program office is managing new implementation and lifecycle equipment management based on an established program management plan. This plan continues to evolve from lessons learned and feedback from users as illustrated in the Figure.

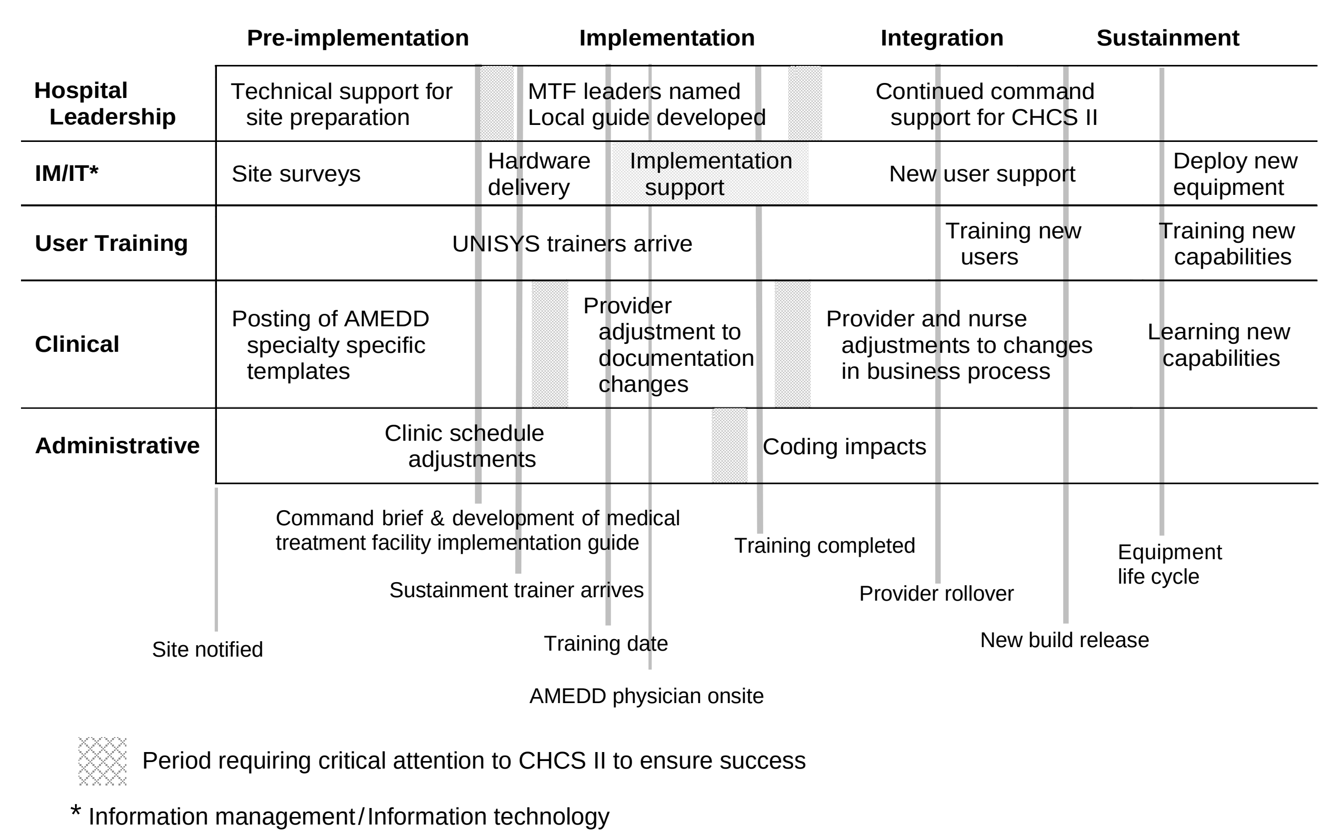
> Victory belongs to the most persevering.
>
> *Napoleon Bonaparte*

Finally, success was not easy. As of July 2006, all AMEDD medical treatment facilities have access to the same patient record. This was accomplished with hard work and effort from everyone involved. AHLTA has created additional stress in everyone's day as the AMEDD goes through its present transformation and the cultural change of moving from a paper-based system to a fully electronic medical record. The stress on the system has been and will continue to be for the singular goal of improving healthcare quality. The cultural transformation is not over and AHLTA will continue to evolve as the clinical care team finds better ways to use this tool and demands more of it.

CORPORATE SUCCESS STRATEGY

Success in the continued pursuit of improving healthcare requires a corporate vision, strategy, and leadership. Organization as well as local success demands commitment to and public support of the strategy in all leadership actions. The success of the AMEDD in this endeavor has been accelerated by the action of senior AMEDD leadership and ongoing review of strategy and goals. The AMEDD held 3 electronic medical record summits attended by all of its senior leadership to ensure the successful deployment of AHLTA. The focus of future summits is no longer the electronic medical record, but the improvement of healthcare now that a universal system is in place. The following are key steps for corporate success:

- Establish a clear vision and goals for use of the electronic medical record.
- Develop strategy for information management and technology to support the vision.
- Acknowledge the difficulty of medical change without compromising the vision.
- Develop and communicate an implementation strategy.
- Revise, do not abandon, the implementation strategy. Acceptance of new technology normally requires 12 to 18 months.
- Don't let **perfect** be the enemy of **good**. Remember: electronic medical records are not perfected in the laboratory.



The Army Medical Department Strategic Plan Overview for AHLTA Implementation

- Establish well-defined feedback loops with developers and give users a reasonable expectation of what modifications are possible.
  - User must provide an objective evaluation of clinical and business outcomes of any changes desired.
  - Do not design the system to perpetuate non-evidence-based actions.
  - Avoid letting personal preferences dictate corporate preferences.
- Finally, remember that **Leaders** must **LEAD**.

Final Thoughts

Success remains an attitude. That attitude has the AMEDD pushing for an accelerated implementation of an inpatient electronic medical record. It also has AMEDD policy increasing focusing on outcomes. This includes changes in point of care information feedback, performance-based reward for improvements, and increasing efforts to centralize medical monitoring to allow medical treatment facilities to focus on outcomes.

References

1. Gartner, Incorporated, 56 Top Gallant Road, Stamford, Connecticut 06902-7700 203-964-0096.
2. Institute of Medicine of the National Academies. *Crossing the Quality Chasm: A New Health System for the 21st Century*. 2001. Available at: http://www.iom.edu/CMS/8089/5432.aspx.
3. RAND Corporation. Health information technology: can HIT lower costs and improve quality? 2005. Available at: http://www.rand.org/pubs/research_briefs/RB9136/index1.html.

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The Focus Must Be On Healthcare Improvement, Not Electronic Medical Record Implementation.

AHLTA Deployment Status and Development Strategy

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Deployment Review

AHLTA, the military health system's (MHS) enterprise electronic medical record (EMR), was approved for worldwide deployment in January 2004.* All US Army Medical Department (AMEDD) medical treatment facilities (MTFs) completed Block 1 (outpatient EMR deployment) in August 2006. During that short, 32-month time frame, the system was deployed across the globe and is now used for over 80% of all AMEDD outpatient visits. It is the largest employment of any EMR in the world. The AMEDD role in the success of AHLTA is undisputed. The last two Army Surgeons General set the AMEDD's course for successful AHLTA deployment and use. However, the AMEDD held its first EMR summit to consolidate its vision and strategy only relatively recently in March 2005. It was at this initial summit where the vision of AHLTA as the single enterprise EMR was clearly established. At the AMEDD's second EMR summit in November 2005, the interrelated nature of CHCS (Composite Health Care System), AHLTA, CHCS II-T and the Clinical Data Mart/Warehouse was discussed. The fact that the MHS EMR is dependent on the aggregation of these systems is part of what motivated the name change from CHCS II to AHLTA. The third AMEDD EMR summit, held in April 2006, was attended by the Army Surgeon General, the Deputy Surgeon General, and all Regional Medical Commanders, along with other AMEDD general officers. The summit produced the plan to have all future summits focus not just on the EMR, but on Healthcare Improvement, which is the fundamental basis for deployment of the EMR. A summary of this event is available on the AMEDD AHLTA website.†

The AMEDD success at deploying AHLTA notwithstanding, it is clear that AHLTA is not perfect. No computer or information system is, particularly not one as new and complex as AHLTA. The Surgeon General's directive was to field the system, use it, and improve it. It had become clear that the system would not be perfected in the laboratory. The strategy was successful as the AMEDD and its end users have guided much of the system's evolution since deployment. This has included improvements in speed, stability, vocabulary, and functionality. Process lessons have also been learned. For example, in the early days, sometimes the preference of a single user submitted as a System Change Request (SCR) and incorporated into the system would subsequently require removal, and the system returned to the original state (or a third state) once further feedback was received. SCRs are now processed using broader user input and increased vetting, and additional routes such as the AMEDD-unique SCR process have been put into place. The AMEDD AHLTA Office and the AMEDD Information Management Office will continue to interact with the Tricare Management Activity in tri-service prioritization and execution, and continue to emphasize AMEDD-defined priorities. The AMEDD has placed an emphasis on fielding critical functionality at the earliest practical opportunity. These processes maximize the AMEDD's ability to select, refine, support, and/or fund system improvements that deliver maximum benefit to all, especially the patient.

AHLTA, while necessitating some changes in how care is delivered, does support outpatient specialty use in its current form. However, there are specialties for

*See related article on page 40.

†Accessible through the Army Knowledge Online (AKO) system (authorized users only). Enter the AKO homepage, select Groups, enter AHLTA, select Homepage. Or, from the AKO homepage, enter https://www.us.army.mil/suite/page/406.

which clear shortcomings exist. Planned improvements to AHLTA will benefit most, if not all, specialties. What is often debated is the fastest, most economical, and best overall approach to delivering specialty-specific functionality. A commonly suggested approach is the purchase and integration of existing commercial off-the-shelf (COTS) into AHLTA. The following discussion explains the MHS and AMEDD approach to AHLTA enhancements.

COTS Software

There is considerable overlap in needed and requested functionality for AHLTA among subspecialties, and in the requests of subspecialties as compared wth those of primary care specialties. The return on investment that the AMEDD and MHS are seeking is not in any given specialty, but across the clinical spectrum or the patient, available to all system users in a standardized format. The overarching goal is improvement in the use and reuse of patient data across the continuum of care. The main beneficiary is the patient, who will have a unified, comprehensive medical record, allowing improved outcomes and more effective clinical management. For example, the Emergency Department needs a flowsheet capability, as does obstetrics/gynecology (OB/GYN). If a COTS electronic medical record for the emergency department is integrated with all its costs for interfaces and data integrity, purchase of the flowsheet capability for OB/GYN would still be necessary. Further, pulmonary, urology, physical therapy, and others can also benefit from a flowsheet. If a separate application were bought for each area, it would be too expensive to map data across the systems. Each area would be left with its own silo of information to view. This would be similar to one patient safety issue present with CHCS—a patient's allergies and medications could not be viewed by other MTFs. The patient record would be difficult to keep complete. The choice facing the military health system: build a core capability that is robust enough to meet enterprise needs, or buy multiple EMRs specific for every specialty area and then attempt to keep them integrated. Unfortunately, the commercial EMR industry limits standards in design and architecture. Therefore, not only is the use of multiple COTS products a more costly initial approach, but the long-term cost is higher as each new COTS change would require changes to all integrated systems. While a given COTS product may initially provide somewhat smoother functionality for one clinical area than an application developed with the overarching goals in mind, the additional cost and effort to integrate such products with the existing backbone is considerable. If specialty products were purchased for every clinical area, the redundancy in capability would be huge. Further, at this point full data integration would essentially be unaffordable. It is important to appreciate that currently these applications are not "plug and play." Although sales professionals often represent otherwise, true integration remains challenging and very expensive. AHLTA commonly faces integration challenges now, just with the various COTS products already involved in AHLTA, including those from Microsoft, Secured Services, Oracle, 3M, SAIC, and others.

The short-term cost of COTS applications and integration is initially higher because many of the purchased capabilities are redundant. All EMR products have basic functions, such as demographics, check-in, test display, and encounter documentation, as well as numerous overlapping specialty functions. All of these areas must be mapped across all applications so that data can be shared. The only alternative is a system that does not cross-reference its own data. Consider a system that does not use a common demographic identifier for patients, allowing overlapping and/or redundant records on the same patient. In fact, as the legacy CHCS host data is rolled into the AHLTA central data repository, we see exactly this scenario as multiple local records on a single individual from various hosts are aggregated into the common database, necessitating complex patient merge processes. Imagine that this necessity was an ongoing, accepted process—a clinician would not even know the location of the patient's data. This problem can be extrapolated to include any other data element, and is of particular concern when the loss of clinical meaning is considered. Systems that store information of an encounter note in a "picture" format are not truly integrated. A system based on this approach would turn AHLTA into a very expensive filing cabinet, a step backward in the evolution of our EMR. Such sharing of note images only affords the convenience of availability of the chart for human review and interpretation of content. It fails to capitalize on the inherent data processing power of information technologies. This prevents the healthcare system from taking advantage of the automated tools that the Institute of Medicine has reported will improve healthcare.

POTENTIAL FOR ERRORS

As the complexity of system integration rises, the risk of errors also increases. Interface and integration work is required for each of the disparate subsystems, rather than to the master application. Mapping and integration of pulse oximeter data, for example, is required for not only the COTS emergency department product, but also to the pulmonary, pediatrics, family practice, and other subapplications. Failure to complete this work would likely result in the presentation of erroneous data to the healthcare team.

The bottom line: COTS software may satisfy users in a given specialty, but it is not the best choice for the patient, nor is it the best choice for the military health system and AMEDD's users as a whole. The Tricare Management Activity's efforts have been directed towards fielding an EMR that serves the entire spectrum of patient healthcare, with the needed functionality provided within—not external to, or partially integrated into—AHLTA. Given time, the needs of all specialties will be met through iterative development.

STATUS OF CURRENT ENHANCEMENTS

As discussed above, the current strategy is to use incremental, stepwise improvements in existing functionality, based on current applications and architecture. The following is a summary of major current efforts, especially with regard to the emergency department and ophthalmology. These subspecialties have requested many capabilities that are desired by others.

Emergency Department – Front End (Graphical User Interface/GUI) vs. Application. Over the past 5 years the Tricare Management Activity (TMA) has held at least 3 requirements sessions with emergency department (ED) consultants from all 3 military services in efforts to define the functional capabilities needed for the ED. These capabilities are sometimes collectively called a module, but this is a misnomer. The capabilities needed in the ED overlap with much of what the current AHLTA system does, as well as what is needed by other clinical areas. A separate ED module might benefit the ED, but would likely be duplicative in some areas of functionality, as well as limiting availability of some of that functionality to other clinical areas which share the needs. Even if the MHS moves to the use of an ED electronic medical record module that is part of an inpatient EMR, the work done as part of the EMR will benefit other areas. Additionally, in this case, like the inpatient module, the ED module would essentially become part of AHLTA.

The tri-service ED capabilities list was created to allow vendors to bid on the inpatient capabilities contract with ED functionality included. This functionality goes well beyond a whiteboard and a flowsheet, and TMA's current acquisition timeline is for 2010 or beyond. The Army Surgeon General has asked TMA to evaluate ways to accelerate inpatient EMR deployment. AHLTA development work is currently underway to deliver essential ED capability, including a patient tracking "whiteboard" function which could be used by all clinics. It also includes improvements for flowsheet use.

Ophthalmology – MEDCIN® Vocabulary. Due to direct feedback from eye specialists, over 170 new eye terms have been added to MEDCIN, and its developer, Medicomp Systems, Inc. (14500 Avion Parkway, Chantilly, VA, 703-803-8080), is prepared to add more. This vendor has also considered user feedback and AMEDD requests in the design of improvements to their COTS product. A common complaint is that MEDCIN does not adequately support the standard ophthalmology clinical documentation process. That concern and other feedback has been provided to Medicomp which is evaluating how to refine the product for this specialty requirement. A solid functional relationship has been developed with this company which is of great assistance in meeting AMEDD's needs. Getting complete subject matter expert agreement on what vocabulary is truly "needed and correct" is very difficult. The use of free text will remain as an avenue by which to modify structured terms to provide clarity and detail.

Drawing Tool. A capability requested by many areas, the initial AHLTA drawing tool consists of basic images, the ability to import images of choice from your desktop, and the ability to import pictures from elsewhere. The user will be able to write freehand on these images in color. The basic images can be "copy forwarded" into the patient's next visit for update. The tool will provide several features useful to all specialties. The images will now be structured, allowing a structured note to be composed while drawing on the picture. The "drawing" can also be a chart of results so that a paper-like input and output chart of numbers can be entered and the notes will print looking like the chart. The potential of this tool is tremendous. The assistance of providers in all specialties is needed to create an expanded library of mapped images to meet clinical needs. The integration of the advanced drawing tool into AHLTA will probably begin in late 2006.

Note Writing Choices. Currently, a note can be entered by use of templates and Alternate Input Method (AIM) forms. This capability will soon be augmented, first by the Advanced AIM (A3) form and then with the drawing tool discussed above. Templates have the advantage of local development to individual preferences. AIM forms have the advantage that developers can incorporate decision support capabilities into them. This is a feature that is just beginning to be used. The AIM forms are more like paper and are designed by specialists in those areas. Direct feedback can be given to the designer by clicking on the "?" on the last tab of the AIM form for your specialty area. The addition of the basic drawing tool, the A3 form, and the advanced drawing tool will provide more choices to meet the individual desires of thousands of AMEDD healthcare professionals.

Tablet PCs and Equipment Changes. The AMEDD has also changed the deployment concept of operations for computers. Tablet personal computers are now part of the hardware package deployed for providers. This will permit easier drawing, the use of handwriting recognition for free text comments, and facilitate the move to wireless at some point in the future. Draw pads and scanners are also being fielded to all sites as a result of field input.

Equipment Integration/Interface. Interfacing simple external devices such as vitals machines is not difficult; the challenge is that there is little uniformity of equipment across the AMEDD and our MTFs, and interfacing each and every piece of equipment is not feasible. That said, work is proceeding on the initial device interfaces, and an overarching plan has become one of the top 10 end-of-year items. Again, the goal is to import mapped data, as opposed to relatively meaningless, purely text documentation that must be interpreted by human review. The generic interface currently under design will allow the provider to see the information at the time of the visit, and further allow that information to be digested into structured data for later use.

Document/Letter Writing Capability and Standard Form Completion. AMEDD has funded projects to enable both the production of standard forms (SF, DD, DA) and the ability to create letters and documents. Again, these forms will be mapped and intelligent, as opposed to simple text fields. Fielding is expected in 2006. The SF tool will be capable of generating any Standard Form (though mapping will be necessary for creation), and the document capability will allow creation of any form that the patient needs, for signature, a note for work, or an overprint of information for minor edits in the preparation of a letter. As we have done with the obstetric summary sheet, pertinent patient data can be pulled into a defined note for a summary letter or specialty referral letters.

Point of Care Decision Support. One of the key advantages of a global EMR with a common data set is that decision support is available at the point of care. Without the standardized data set, such decision support is not possible because the system does not know how to interpret its data elements. Initially the capability will become available in AHLTA as the USPSTF*/individual reminders, and will be greatly expanded in the patient registry and outcome tool, often called the ACPG† project. This tool will allow patient-centric data to be displayed at the point of care as defined by the medical conditions, status, medications, lab results, and the clinic providing the care.

Refractive Surgery Information System (RSIS). The AMEDD RSIS was recently reviewed by the Army Surgeon General's Chief Information Officer and the AMEDD AHLTA Implementation and Clinical Integration Office. It was determined that the RSIS duplicates functionality provided in AHLTA, with the exception of specialized decision support. A method to achieve that function in AHLTA has been defined and will be accomplished as an AMEDD initiative. The

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*United States Preventive Services Task Force
†Automation of Clinical Practice Guideline

development effort will provide decision support by keeping all the patient information in a single longitudinal and searchable database.

Future Plans

The Surgeon General's directive from the AMEDD EMR summits has been to use AHLTA for all outpatient encounters once training is complete. Like any system, AHLTA is not perfect, nor does it provide exactly what every clinician or specialty wants today. For example, AHLTA started worldwide deployment without a pediatric growth chart, but the fact is that currently the system is widely used in both the pediatric and family medicine specialties despite this glaring deficiency. Growth charts will be available in the next few months, and, as time passes, all of our clinical needs will be met. AHLTA use by the AMEDD has helped improve the system, and created better understanding of how the clinical business processes must change. Despite its problems, the existing system is usable in almost every outpatient specialty. The current metric for AHLTA utilization is 95% of all encounters at a medical treatment facility.

Epilogue

Many clinical areas forward requests to the AMEDD AHLTA program office for the review of specialty-specific COTS products. Based on the preceding discussion, several important questions are always pertinent:

- Where would the integration of specialty EMR products stop?
- Who decides that an area is so much more unique than other areas that it deserves a custom EMR, penalizing the safety and further development of the total system for all users due to the long-term requirements of integration of that custom product?
- Most importantly, from the patient's (not the provider's) perspective, what is the best course of action to take?

Finally, it is a given that consensus on what constitutes the "best" system is hard to achieve. This is particularly true in view of the global and tri-service nature of our EMR. Even with all the money, effort, and subject matter expert time that were spent on other interim applications fielded by the AMEDD, none were completely accepted by all users. It is the hope of AMEDD leadership that all users can work synergistically for rapid improvement in AHLTA. Such cooperative and collegial effort will speed improvement so that we do not waste limited resources in pursuits that are duplicative cause delay in effective deployment and utilization of an EMR.

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Electronic Medical Records, Medical Coding, and Outcome Improvement

LTC Ron Moody, MC, USA

Are We Measuring the Correct Metrics?

The Army Medical Department (AMEDD) and other healthcare organizations expend much time and effort on coding. This investment of personnel, time, and money includes significant efforts to monitor coding. Often, the stated goal of these efforts is to improve coding “accuracy.” Unfortunately, as with many other healthcare organizations, the AMEDD has not shown continued improvement in coding accuracy, despite substantial investment in personnel, time, education, and monitoring of this metric. The healthcare team may have little understanding of the relationship between coding accuracy and outcome, or may question if such a relationship even exists. Therefore, the following questions must be asked:

- Are we monitoring the correct coding metrics?
- What is the desired outcome of monitoring these metrics?
- Can monitoring these metrics improve the desired outcomes?
- Are current metrics adequate for monitoring Lean Six Sigma business improvement processes currently emphasized by AMEDD leadership?
- In order to address these questions, it is important to be aware of the history of medical coding.

Coding Classification History

The International Classification of Diseases (ICD) was designed to promote international comparability in the collection, processing, classification, and presentation of morbidity and mortality statistics.[1] The name and history of the modern day coding system indicate that the system was designed to do what computerized medical record databases can now do to even greater levels.

In 1893, a French physician, Jacques Bertillon, introduced the Bertillon Classification of Causes of Death at the International Statistical Institute in Chicago. A number of countries adopted Dr Bertillon’s system, and in 1898, the American Public Health Association (APHA) recommended that the registrars of Canada, Mexico, and the United States also adopt it. The APHA also recommended revising the system every 10 years to ensure the system remained current with medical practice advances. As a result, the first international conference to revise the International Classification of Causes of Death convened in 1900, with recurring sessions every 10 years thereafter. At that time the classification system was contained in one book which included an alphabetic index and a tabular list. Indeed, the book was small compared with current classification texts.

The revisions that followed contained minor changes, until the sixth revision of the classification system. With the sixth revision, the classification system expanded to 2 volumes. The sixth revision included morbidity and mortality conditions, and its title was modified to reflect the changes: *Manual of International Statistical Classification of Diseases, Injuries and Causes of Death (ICD)*. In 1948, the World Health Organization (WHO) became the organization responsible for developing and publishing revisions to the ICD. In this capacity, the WHO revised and published the seventh and eighth revisions in 1957 and 1968, respectively. The ninth revision of the ICD (ICD-9) was published in 1978. The US Public Health Service made modifications to meet the needs of American hospitals and called it *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM).* This remains the edition used for outpatient care in the United States. Work began on ICD-10 in 1983 and was completed in 1992. ICD-10 expands the number of classifications to 10 times that found in ICD-9.

This expansion of classification has occurred far more rapidly than the expansion of medical diagnosis. ICD-10, although reported to “simplify” coding, not only increases the number of classification codes, but also the number of alphanumeric codes needed to report them. The Rand Corporation has estimated that the cost in the US to switch to ICD-10 could be as high as $1.2 billion.[2] The constant changes necessary in the healthcare system to meet the continuing changes to the ICD classification system represents another hidden healthcare cost. Adoption of ICD-10 classification was relatively swift in most of the world, but not in the United States. Since 1988, US law requires use of ICD-9-CM codes for Medicare and Medicaid claims. With the passage of this legal requirement, most of the rest of the American medical industry followed suit.

Despite an extensive literature search, no detailed information could be found on either the portion of healthcare expenses related to medical coding or the total cost of coding in the US from 1980-2000. The review was undertaken to compare the impact of the 1988 mandate to use ICD-9 codes for medical billing on healthcare cost.

ICD coding is a disease classification system that has become tied to medical reimbursement as a result of legislative actions. This disease classification system is not always synonymous with clinical diagnosis. As presently conducted, coding adds to the administrative cost of providing medical care. Though initiated as a classification system through which to record and analyze disease prevalence and outcome, the system has grown in complexity and cost. The utilization of electronic medical records which use structured data entry—and continually updated coding tables and algorithms—may allow easier and less expensive data sources to analyze disease prevalence and outcome. The relational databases of the electronic medical record will likely provide greater opportunities to determine causation. Unfortunately, the continued complexity and expansion of ICD-10 will probably result in continued issues with compliance and accuracy, without improving outcomes.

Coding Metrics

As previously discussed, one of the primary metrics used to assess coding is often termed "accuracy." Accuracy is defined by Webster's as "freedom from mistake or error; conformity to truth or to a standard or model; degree of conformity of a measure to a standard or a true value." The military healthcare system also monitors compliance or completion by timeliness and adherence to regulation and guidance. Coding accuracy is often defined as a reproducible conclusion based on the clinical information. An evaluation and management (E&M) code is considered to be accurate if the E&M level chosen by the person (or computer) is the same as the one the auditor would select. The auditor may have more coding knowledge but is applying the same set of rules. Studies of "coding accuracy" using this method have shown poor coding by providers and poor agreement between coding agencies.[3,4] Reports of higher coding accuracy likely indicate higher intercoder reliability or consistency, which may or may not reflect greater accuracy. Therefore, the reproducibility of coding is really what is measured, rather than accuracy.

Studies comparing electronic medical record (EMR) coding accuracy to human coding accuracy have shown promise.[5] An EMR that involves creation of an encounter note by using structured data allows the direct capture and reporting of the work performed. The healthcare performed can be processed using software algorithms to directly record procedures and to deduce an evaluation and management code for the visit. The computer-based algorithm provides a highly reproducible code.

A potentially more useful metric for monitoring E&M level usage is "appropriateness" and the use of statistically relevant measurements of variation. The metric of appropriateness evaluates whether a proper E&M code level was selected. This depends on patient status, type of service, and level of care provided. Variation looks at the pattern of coding to indicate possible trends indicating up- or down-coding. Calculated results can be easily represented graphically, with E&M code distributions displayed by clinic and individual. This result can be compared to national norms. If a standard distribution is present, then E&M accuracy is likely present. Also, an audit could simply analyze the variation of code between originally documented codes and the audited codes to determine the number of encounters coded one level higher and lower. The standard deviation could be reported using statistical methods, allowing the determination of any variation that may be statistically significant. The E&M code is influenced by multiple factors, the most common being patient status, setting of care, service type, and exam type. The selection of the appropriate group can significantly alter reimbursement as demonstrated in the Table. EMRs can quickly reconfigure coding information using these parameters based upon user action or automatically based upon specific criteria. The reporting of appropriateness allows for process improvement to occur on specific E&M coding behaviors. For example, the typical well-woman exam or well-child visit should be coded with preventive medicine E&M codes. If this is not occurring, the evaluation of coding appropriateness would suggest that process improvement measures are necessary to evaluate and correct the clinic or healthcare team process.

Relative value units for types of service, illustrating the impact of service classification on reimbursement.

E&M* Code	Description	Relative Value Unit
99201	New Patient Focused Problem	0.45
99202	New Patient Expanded Problem	0.88
99203	New Patient Detailed Problem	1.34
99204	New Patient Comprehensive Problem	2.00
99205	New Patient Comprehensive – High Problem	2.67
99211	Established Patient Focused Problem	0.17
99212	Established Patient Expanded Problem	0.45
99213	Established Patient Detailed Problem	0.67
99214	Established Patient Comprehensive Problem	1.11
99215	New Patient Comprehensive – High Problem	1.17
99241	Consultation Patient Focused Problem	0.64
99242	Consultation Patient Expanded Problem	1.29
99243	Consultation Patient Detailed Problem	1.72
99244	Consultation Patient Comprehensive Problem	2.58
99245	Consultation Patient Comprehensive – High Problem	3.42

*Evaluation and management

A second aspect of evaluating coding is the use of Current Procedural Terminology (CPT) and Health Care Financing Administration Common Procedure Coding System (HCPCS) codes. These codes impact relative value units and reimbursement. Reports on the use of CPT and HCPCS codes are also often reported based on accuracy. Accuracy does not indicate the nature or cause of any "inaccuracy." Potential alternative metrics to help improve coding would be reports on the following data, which specifies behavior that can be monitored and corrected:

- Percent of all charts with failure to document CPT code
- Percent of all charts with the wrong CPT code
- Percent of all charts with failure to document HCPCS code
- Percent of all charts with the wrong HCPCS code

A final aspect of coding that is often addressed under the rubric of accuracy can simply be labeled as "other." This is the body of rules that make coding an art. These rules are detailed in the 1995 and 1997 CPT Manuals. The existence of 2 sets of rules that can define accuracy further complicates medical coding. Regulations cover many aspects of how codes are assigned, such as the correct prioritization of listed ICD-9 codes, the association of CPT/ICD-9, and other rules that impact the selection of the classification term which does not impact the medical diagnosis. The latter group is pertinent to this discussion. Current coding guidelines state that a "fifth-level code should be utilized…" The guidelines further state that rarely should a 3-digit code be utilized. The reason cited is to give a more accurate diagnosis. This is a false assertion because, as previously stated, ICD-9 is a classification system and not a diagnostic system. The coding of many encounters is listed as inaccurate, even though the correct diagnosis is listed. The inaccuracy is based on the need to meet ICD-9 classification system guidelines, not diagnostic accuracy. It is unclear if a more detailed reporting of classification has resulted in better population healthcare outcomes or lower total healthcare cost. This is another area where EMRs provide a powerful advantage. The use of classification systems arose prior to the creation of structured databases. An EMR using a structured database allows the patient's condition to be documented and stratified in greater detail based upon symptoms, physical findings, diagnostic test results, and other coexistent disease processes. EMRs can facilitate truly standardized reporting of clinical and business data. The use of structured data and databases allows the automatic creation of registries along with direct monitoring of outcomes. Structured notes also permit the billing of E&M levels based on recorded interventions and actions in a way that is measurable and reproducible.

EMRs, Coding, and the Business of Medicine

With such potential benefits to improve medical care and business management along with potentially reducing spiraling healthcare costs, it seems odd that EMRs are not rapidly being adopted. This is particularly true when the advocacy for EMR use is reviewed. President Bush has called for universal utilization of EMRs by 2014. A recent RAND Corporation report estimates that $182 billion could be saved annually from medical IT adoption.[2] Although financial savings are important, the improvement of health outcomes is the true core business of medicine.

In 1999, the Institute of Medicine (IOM) released a study titled To Err is Human.[6] The report emphasizes that the healthcare system should be safe, timely, efficient, effective, patient-centered, and equitable. Subsequently, in 2001 the IOM released *Crossing the Quality Chasm*,[7] which concludes that:

> In its current form, habits, and environment, American health care is incapable of providing the public with the quality of health care it expects and deserves.

Neither study states that the individuals on the healthcare team are incapable of delivering better or more cost-effective care. The reports also do not indicate that a higher volume of care is what is needed. The issue is clearly one of effectiveness of healthcare and not productivity, as measured by number of encounters. This is why it is critical to establish an accurate and reproducible method for reporting the value of healthcare delivered (measured by relative value units) as the United States moves toward the possibility of performance-based payment systems.

Despite the evidence supporting the role of the EMR in helping to improve healthcare outcomes, the cost of automation is often stated as a barrier to implementation. Changes to business practice must occur with use of an EMR for full financial benefit.[8,9] To facilitate a rapid move to better healthcare outcomes and decreased healthcare costs, clinical-business reorganization should align changes in billing/reimbursement with the use of EMRs.

Recommendations

1. Focus coding monitoring on metrics that provide actionable data:
   a. E&M coding variation from coder/auditor review:
      i. Percent of codes consistent with coder.
      ii. Percent of codes one level higher.
      iii. Percent of codes one level lower.
      iv. Percent of codes 2 or more levels higher.
      v. Percent of codes 2 or more levels lower.
   b. Incorrect E&M class based upon inappropriate use of service type, patient status, location of care, or type of exam listed. Metric: Number of records with wrong E&M class/total records reviewed.
   c. Modifier(s) required but not used. Metric: Number of charts requiring modifier/total charts reviewed.
   d. Diagnosis codes:
      i. ICD-9 use: Wrong ICD-9 code assigned for the diagnosis entered on the chart (code and description mismatch). Metric: Percentage of ICD-9 codes that match between the written record and record of billing for all records reviewed.
      ii. V codes: Failure to use V codes when appropriate. Metric: Number of records with failure to use V codes/total AHLTA*-coded records.
      iii. Sequencing of ICD-9 codes. Metric: Percent of incorrect sequencing/total records reviewed.
   e. Procedure Codes:
      i. Failure to include CPT code when action was documented. Metric: Percent of records missing CPT code.

*See related article on page 40.

ii. Wrong CPT code chosen for procedure documented. Metric: Percentage of records with incorrect CPT code.

iii. Failure to use HCPCS Level II codes when appropriate. Metric: Percentage of encounters missing HCPCS code when documentation supports their use.

2. Establish process improvement measures to use the above metrics to improve the system.
3. Evaluate the role of coders with use of the EMR. The wide adoption of the EMR will result in changes in the role of coders. Human coding skills may be needed more in the highly complex and procedure-oriented clinical areas. There may also be a transition to the roles of auditor, process improvement, and consultants to the clinical team.
4. Legislative Changes: Legislative changes should be considered that allow direct electronic Medicare billing when invoices are sent from approved EMRs that use structured-text entry. This will give direct financial incentive to adopt use of EMRs by negating the healthcare practitioner's current financial burden of continuing to fund coding infrastructure with EMR implementation. The switch to structured-entry-based EMRs should provide a more reliable and consistent report of actual healthcare work. The transition will be facilitated in the same manner that the 1987 legislative action moved the United States healthcare system to the use of ICD codes for reimbursement.

CONCLUSION

The transition to and use of EMRs that use structured-data entry will help to improve healthcare outcomes and decrease cost. The transition must be coupled to clinical and business process changes, such as coding/billing to expedite national EMR integration and usage. This transition, which could be aided by legislative changes, could also help achieve the original intent of ICD use—more reliable reporting of disease classification and more standardized billing practices.

REFERENCES

1. *History of ICD*. World Health Organization. Avaliable at: http://www.who.int/classifications/icd/en/HistoryOfICD.pdf.
2. Libicki M, Brahmakuiam I. The costs and benefits of moving to the ICD-10 code sets. TR-132-DHHS. RAND Corporation. March 2004. Available at: http://www.rand.org/pubs/technical_reports/2004/RAND_TR132.pdf.
3. King MS, Sharp L, Lipsky MS. Accuracy of CPT evaluation and management coding by family physicians. *J Am Board Fam Pract*. 2001;14:184-192.
4. Bentley P, Wilson A, Derwin M, Scodellaro R, Jackson R. Reliability of assigning current procedural terminology-4 E/M codes. *Ann Emerg Med*. 2002;40(3):269-274.
5. Morris W, et al. Assessing the Accuracy of Automated Coding Systems in Emergency Medicine. *Proceedings of the AMIA 2000 Annual Symposium.* November 2000. American Medical Informatics Association. Available at: http://www.alifemedical.com/documents/LifeCodeEMPerformanceAMIA2000.pdf.
6. Institute of Medicine of the National Academies. *To Err is Human*. 1999. Available at: http://www.iom.edu/CMS/8089/5575.aspx.
7. Institute of Medicine of the National Academies. *Crossing the Quality Chasm: A new health system for the 21st century*. 2001. Available at: http://www.iom.edu/CMS/8089/5432.aspx.
8. Wong S, et al. A cost-benefit analysis of electronic medical records in primary care. *Am J Med*. April 2003;14(5):397-403.
9. Ebell M. Integrating information technology into clinical practice. *Clinics in Fam Med*. December 2003:5(4):1027.

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The Tactical Electronic Medical Record: The Key to Medical Transformation

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INTRODUCTION

As a nation at war we must leverage information for victory. Army transformation is bringing information into action. Health transformation involves reducing cost and improving care by optimizing the potential uses of medical information systems. Army medicine has made significant progress in transformation of many areas of information management, from medical readiness to continuity of care. Fort Lewis, with its transforming units and highly digitized medical center, is a convergence of the overall Army's transformation with Army medical transformation. An objective integrated system, however, remains a distant goal. This report describes the tactical requirements, the progress of the Stryker Brigade Combat Teams (SBCTs), and the process and systems involved in achieving a functional tactical electronic medical record.

MEDICAL READINESS

The Department of Defense (DoD) defines medical readiness as the ability to mobilize, deploy, and sustain field medical services and support for any operation requiring military services; to maintain and project the continuum of healthcare resources required to provide for the health of the force; and to operate in conjunction with beneficiary healthcare.[1] Medical readiness can be further broken down into Soldier health readiness, individual medical training, unit level medical training, medical equipment maintenance and logistics, and the Soldier's family health readiness.

Soldier health readiness tracks measures of the individual Soldier's health. Some measures, such as dental readiness, are required for deployment. Other measures must be met prior to attending schools, such as the periodic physical. In recent years, cardiovascular health, combat stress injury prevention, and physical injury prevention have been recognized as important measures for screening a Soldier's health readiness. An ideal health readiness system would be integrated with the tactical electronic medical record so that medical screenings, diagnostics, and interventions would be entered as they are performed. Such a system would allow the medical histories to be easily accessible by a medical advisor who could analyze and present data to ensure that the command knows the current health status of their Soldiers.

A well-trained force has been recognized as critical to the success of an army since the wars of the Prussian king, Fredrick the Great (1740–1778). The US Army recognizes the importance of a well-trained medical force and continues to improve its training. Command surgeons must track and supervise all medical training in their unit. For an operational unit this includes the 91W (medic) transition and sustainment training, Combat Life Saver Program, Field Sanitation Team training, training for low density military occupational specialties like lab and radiology technicians, physician assistants, and Professional Filler System physician training. An integrated information system allows tracking of that and any additional training a unit may mandate, such as tactical trauma training. Medical unit training is also important, ensuring that medical platoons, medical companies, and echelon above brigade units are trained to standards outlined in their Army Training Plans. That training must also be tracked and monitored.

The real time sustainment of medical forces is very important for medical readiness. An integrated information management system should provide visualization of current data and enhance coordination for tactical medical care. Planners at all levels must know not only the status of individual patients, but the status of evacuation assets, cot/bed status, medical equipment operability, class VIII, and blood. An integrated system should allow supply requests to be generated automatically as supplies are used or parts are needed.

The health of a Soldier's family is also a critical piece of our Army's overall medical readiness. World class healthcare provided to our Soldier's spouse, children, and other dependents allows our Soldiers to execute their mission, assured that their families are well cared for in the Military Health System. Family advocacy efforts are important, not just because caring for our Soldiers' families is the right thing to do, it also makes the Army family stronger. An objective system would allow a unit's command surgeon to track family health issues and advise his commander of identified needs, thereby improving the units' medical readiness.

CONTINUITY OF CARE

Electronic access to patient medical information clearly improves the overall quality of care. Military health providers appreciate the importance of medical record documentation. However, the current method of recording and storing on paper the medical record information of our Soldiers, civilians, contractors, and detainees is inadequate in that documentation is rarely available for review at the point of care. The Government Accounting Office reports that the state of current medical documentation within the DoD, although variable, is generally very poor.[2] Providers need documentation of prior encounters to properly care for a patient. Information such as the differential diagnosis, treatment plan, procedures performed, and patient exposures are examples of critical information that, when absent, can adversely affect quality care. Often Soldiers neglect to tell the caregiver significant aspects of their past medical history. The treating provider must have the ability to obtain information from past encounters, such as laboratory results, x-rays, and other relevant clinical information. To be effective, the electronic medical record must provide that historical clinical documentation for review by the caregiver wherever and whenever required.

The availability of information within the direct sequence of a Soldier's military caregivers is not the only capability of the electronic medical record. As part of the concept of "health information exchange" advocated by the Institute of Medicine, clinical care information must also move across traditional business boundaries.[3] To that end, our objective system must not only accept information from a variety of different sources, but also be accessible to a variety of different organizations, eg, civilian facilities to which a Soldier may be referred or present for emergency care. A system that does not allow such capability is not acceptable.

CONFIDENTIAL VS SECRET

When considering the most effective use of electronic information in combat situations, it is important to consider the confidentiality of patient information and the operational security of tactical information. Patient confidentiality was formalized in the *Health Insurance Portability and Accountability Act of 1996* (HIPAA)[4] which codified confidentiality requirements for medical practice. HIPAA created the impetus for many physicians to adopt the electronic medical record to simplify compliance with the confidentiality requirements for billing and other medically related records.

In today's combat units, most information is transmitted on secret networks. Attempts have been made to use such networks for the exchange of digitized medical information. The major impediment to this is that medical information is classified as confidential, not secret. Most providers cannot access secret networks, so medical personnel can neither enter the data, nor retrieve it from the network. Further, if deployed providers were granted access to secret networks for exchanging medical data, providers in US fixed facilities would still not have access to that data. Continuity of care would therefore be compromised as a Soldier's physician in the US would have limited or no access to information entered into the system during deployment.

Tactical electronic medical information obviously has the greatest utility and value when all providers have access to it. Therefore, medical information must be entered into a system which is accessible by healthcare providers who need it quickly at different locations. A web-based system seems to be the most logical vehicle as providers potentially could access it from both aid stations and hospitals in the US. However, operational security requirements dictate that information which may be of value to the enemy must be safeguarded with restricted access. Certainly there are instances in which certain aggregate medical summaries should be classified as secret, eg, casualties from a given unit or location on a given date, or the amount of class VIII requirements from a unit. Access to this type of data must be limited and made available only on the secret internet.

Medical Surveillance and Health Outcomes

Medical surveillance is important for maintenance of the health of any population. In the military, a unit commander has special responsibility for the health of his Soldiers. The military also has several unique advantages in maintaining and improving population health. Those advantages include a population which is normally localized and motivated for improved health, and prescribed periodic opportunities to effect change in individual and group health, such as regular physical examinations, mandatory briefs, and Soldier Readiness Processing events. As the commander's advisor and his instrument for population health management, the unit surgeon must have the ability to track injuries and diseases to identify and analyze trends, and advise the commander on the optimum approach to keep his force healthy. The unit surgeon will then take the lead in implementing those efforts.

Health outcomes (benefits performance metrics) is a much sought after feature of the electronic medical record.[5] Practice improvements in the operational environment (training and deployed) would greatly expand with a comprehensive tactical electronic medical record. Such improvements would extend as far forward as healthcare is delivered and documented. As scientists, we have the responsibility to demonstrate that our efforts to effect change in population health are, in fact, effective. The ideal electronic record would be able to track ICD-9 diagnoses, lab results including abnormal cultures, x-rays, and medications. Easily accessible common information would allow the surgeon's section to track injuries, infections, combat stress, and many other metrics. Early detection of trends could allow early intervention and avoidance of similar problems for other Soldiers. Outcomes of those interventions could themselves be tracked to measure their effectiveness.

Medical Regulation

Medics, commanders, and Soldier's families are all concerned about tracking Soldiers on the battlefield. An ideal system would allow the tracking of Soldiers throughout the medical system as outpatients, inpatients, and during evacuation anywhere in the world. For example, Federal Express and United Parcel Service can track packages in their custody anywhere in the world. In contrast, more often than not we have difficulty responding to a First Sergeant's inquiry about whether or not a Soldier was seen at sick call on a given morning. An ideal system would allow any medical provider or support staff to quickly determine where, when, and by whom a Soldier was seen. It should also be able to track the disposition at each level of care, ie, returned to duty, kept for observation, or evacuated, and note the time of disposition. It should also track patients as they pass through various military hospitals around the world, and give accurate medical status and prognostic information. Doctrinally, evacuated Soldiers are no longer the responsibility of their unit. This, of course, makes no sense to the family member at Fort Lewis who attempts to obtain information about their Soldier's condition from a rear detachment commander, who is dependent on information from the main body of his unit, primarily the surgeon's section.

The US Transportation Command implemented the Regulation and Command & Control Evacuation System, a separate web-based system used to track patients on medical transportation flights from departure to destination. Although this system is a good tool, but it does not track intratheater movement of patients nor onward movement from the patient's destination facility. It also does not provide specific information to a Soldier's unit as to his treatment and prognosis.

Vertical and Horizontal Movement of Information

The information available in the tactical electronic medical record system should include a unit's medical readiness statistics, medical surveillance, medical regulation, and healthcare logistics information and needs to be shared both vertically and horizontally. Individuals and units down to the lowest level in the chain of command should receive certain information but also have access to additional sources as needed. Higher echelons should have access to detailed information from subordinate units in remote locations. Higher commands may have a requirement to collect data from large segments of a population to conduct theater-wide population health research or syndromic surveillance. Horizontal sharing of information between battlefield operating systems is important. Medical and personnel staff must have the ability to compare notes with regard to casualties, and must share information on physical exams, dental exams, and permanent profile restrictions. Far too little information is currently shared between medical and personnel sections. Flow of pertinent nonconfidential information to the Electronic Military Personnel Office is important. Military medical organizations must design a system to share information effectively and efficiently. Medical information must also be shared among the services, with DoD, the Veterans Administration, and some other government and civilian systems to adequately care for Soldiers and to support commanders.

TRAIN AS YOU FIGHT

There are many challenges involved in the adoption of systems which are used only during deployment. The biggest challenge is ensuring that Soldiers maintain a level of proficiency on such a system while in garrison. System maintenance is another major concern. The system must work when needed. Therefore, an ideal system for the military environment would be used both in garrison and in the field for the care of our patients. Such a system will support the same daily business at aid stations, Troop Medical Clinics (TMCs), and hospital clinics, and require the same training for all environments. Both garrison and field care would be documented into and retrievable from the same system.

CONNECTIVITY IS KEY

There are many available off-the-shelf medical programs that could be adapted to meet the tactical needs of our medics and providers. The key is not the program, but connectivity. If internet connectivity is available, a tactical electronic medical record should be available for use. Although the system should be flexible enough for use on a standalone basis for those times when connectivity is not available, planning for regular and reliable connectivity is critical. Early planning, supporting doctrine, and inclusion of personnel and equipment assets in the Modified Table of Equipment to support medical information systems will ensure availability of connectivity and functionality wherever a unit may be deployed.

ADDITIONAL BENEFITS OF MEDICAL CONNECTIVITY

There is currently a high level of communications capabilities existing within the medical chain of concern. Contact with CONUS for medical consultation is available at the Battalion Aid Station Level. This may be as simple as an e-mail or a picture to a specialist at the provider's medical center of choice, or as sophisticated as a video-teleconference. Those medical reports which are not classified secret, eg, Medical Surveillance Reports (the weekly Disease Non-Battle Injury status of a unit), Medical Regulation (the status of individual patients wherever they are in the world), most Class VIII requisition and maintenance requests, etc., can now be moved up and down the medical chain of concern via the Army Knowledge Online system. Access to continuity records and web-based medical resources are just two of many possibilities available through connectivity within the tactical healthcare system down to the aid station level. As a side benefit, internet access is an undeniable, no cost morale boost for our patients and medics during periods of low volume use.

HISTORICAL SYSTEMS

Historically, Army medical documentation systems have been comparable to civilian counterparts, specifically black ink on Standard Form (SF) 600s. In the field we also use the SF 600 for most documentation. These records are usually kept in the file drawer of a field desk. In an ideal world these records are sent to CONUS or redeployed with a unit and filed in the Soldier's permanent medical record on redeployment. In practice, these records are rarely joined with a patient's permanent record. There are many explanations for this discrepancy. Soldiers receiving care come from many different units and are examined in different clinics around the battlefield. Soldiers often redeploy at different times or to posts different from their supporting medical units. For these and a variety of other combinations of circumstances and occurrences, there are simply too many opportunities to lose field records, despite the very best intentions and efforts.

The electronic transfer of medical data made its debut in Bosnia. Telemedicine was used there on a limited basis. Teleradiology was more successfully employed in Bosnia where x-rays imaged in Tusla were routinely read by radiologists at Landstuhl Regional Medical Center in Germany. Although this was effective and very exciting, it was also a very limited capability. Very few sites could send or receive electronic x-rays.

Computer scarcity and bandwidth constraints imposed limitations on both availability and speed. Fortunately this has changed. Currently, plain films, CT scans, and ultrasounds are stored and read within 24 hours by the radiologist covering Bosnia and Kosovo from one of the three Army Hospitals in Europe, Landstuhl, Heidelberg, or Wurzburg.

Medical Communications for Combat Casualty Care

In the Stryker Brigades we pioneered the early Medical Communications for Combat Casualty Care (MC4) systems in 2001-2002. The MC4 hardware included handheld computers (PDAs) used by medics to enter patient care information, and laptops used by physician assistants (PAs) and physicians to expand the medics' notes and complete patient documentation. The software for the MC4 system included early versions provided by the Theater Medical Information Program. These programs included Mobile Medical Data that was used by the medics on their PDAs, and CHCS2-T (Composite Health Computer System II Tactical) used by the PAs and physicians on laptop computers. The patient record entered into the PDAs using Mobile Medical Data could be synchronized using a physical interface with the provider's laptop for continued use. Notes and other patient information could either be printed or written to removable storage for transportation with the patient to the brigade surgeon, or the next level of care. This first attempt to electronically facilitate patient documentation was very awkward and had many limitations. After upgrades and extensive training, the system was finally used successfully during the medical platoon exercise and evaluation in the fall of 2002. Notes for simulated patients were generated, documenting patient care from point of injury through the Battalion Aid Station. However, the limitations to the system were obvious. As mentioned earlier, the electronic record had to be either printed or written to a disk and then transported across the battlefield with the patient to his next echelon of care. In addition, a separate copy of the record had to be transported to the brigade surgeon for medical surveillance and consolidation of records. The information used by all of the other battlefield functional areas was moved around the battlefield and exchanged with CONUS electronically.

Battlefield Medical Information System – Tactical

In the spring of 2003 we attempted several innovations for the movement of medical information around the battlefield in a training environment at Fort Lewis. We used new equipment from the Army Medical Department, which included the Personal Information Carrier (PIC) and a new program for handheld computers called the Battlefield Medical Information System–Tactical (BMIS-T). Both were provided to the Stryker Brigades by the Telemedicine and Advanced Technology Research Center at Fort Detrick, Maryland.[6] The software on the handheld computers presented a more user-friendly interface for our medics, and the PIC is a device to keep the Soldier's electronic medical information with his dog tags to move with him across the battlefield. Our medics entered patient data using the BMIS-T programs and

A Case in Point

While training at JRTC a command sergeant major suffered acute abdominal pain which induced diaphoresis and took him to his knees. He was taken to the emergency room of the Baynes-Jones Army Community Hospital where his daunting history of a chain of abdominal surgeries and complications made his diagnosis and management extremely challenging. Initial evaluation, including a CT scan of the abdomen, revealed a mild transaminitis but was otherwise unremarkable. The emergency room physicians and consulted internist were having difficulty developing a diagnosis and disposition for this complex patient. Fortunately, we were able to access past surgical notes, CT scans, laboratory results, etc, in the Integrated Clinical Data Base at the Madigan Army Medical Center from the Baynes-Jones Hospital emergency room. This made initial and subsequent management much easier and eliminated the requirement to evacuate this Soldier. The diagnosis of acute pancreatitis became clear on the following day. He was managed conservatively and improved quickly. He was able to complete his training and lead his unit's deployment to Iraq. It should be noted that the physical therapy note for his low back pain which bad been entered 2 weeks prior at JRTC was retrievable during his admission. It was included in the information stored in the Madigan database at Fort Lewis, Washington.

transferred the data to the PICs. The PICs were then used to transfer data to a laptop and from which it was downloaded into CHCS2-T.

We attempted to use the upper tactical internet as a backbone for moving medical information around the battlefield. The upper tactical internet consisted of a near term digital radio (NTDR) that moved planning and tracking information between tactical operation centers (TOCs) on the battlefield. Our attempt to move information from one TOC to another met with some success, but only basic information was transferred, not the entire medical note. Not only was this extremely awkward but there were other limitations. Access to an NTDR, typically at a battalion TOC, is required. The sender must have the specific technical expertise to use the NTDR and negotiate the interface. Further, data transmitted through the NTDR enters the networks at the secret level of classification. Medical information is not secret, so NTDR transmission needlessly places the data in a higher security environment, adding a significant level of complexity to the process.

With considerable assistance of the signal corps and the mission support training facility, we explored use of a Tactical Local Area Network (TACLAN) to scramble the information transmitted by the NTDR and descramble it using another TACLAN upon reception. The TACLAN is used by logisticians who also work with sensitive (not secret) information sent over the upper tactical network. Unfortunately, personnel were unable to obtain adequate training on the equipment, interfaces, and protocols, so the brigade's unfamiliarity proved a significant limitation to conducting a valid test of concept.

Use of BMIS-T to move confidential patient information into and out of the PIC and into CHCS2-T is a proven capability which is the keystone into expanding the capabilities of electronic medical records in the tactical environment.[6] At the present time, even the limited capability offered by that approach is the best way to move medical information around the battlefield, given the complexity of transmission systems, limitations of accessibility to those systems by providers, and the technical expertise required to use them.

HEALTH-E-FORCES/INTEGRATED CLINICAL DATABASE

While the innovative work described above was ongoing, the Madigan Army Medical Center (MAMC) at Fort Lewis made the successful transition to the electronic medical record. Since CHCS II was not deployable, in 2002 MAMC implemented the Integrated Clinical Data Base (ICDB). ICDB was initially developed by the Air Force as a framework built on CHCS which integrated information from CHCS and other programs to enable rapid access to clinical information. ICDB was adapted for the Army at the Walter Reed Army Medical Center (WRAMC) and implemented in 2002 at MAMC and WRAMC. The Stryker Brigades were brought online by MAMC, receiving new computers and information management support to ensure adequate bandwidth in all of our troop medical clinics and aid stations. MAMC further provided informatics support, rapidly making changes to the system in response to our feedback. The electronic medical record was fully implemented at Fort Lewis by 2003. The system has significantly augmented medical care for our Soldiers since all patient notes entered at the aid stations and troop medical clinics are accessible by specialists at MAMC, and notes from specialists are accessible by providers within the brigades.

During this time, MEDBASE II was being developed by the Great Plains Regional Medical Command at Fort Sam Houston, Texas. Its predecessor, MEDBASE I, was a very successful medical readiness program which provided units at Fort Lewis a highly functional, web-based, operationally oriented database for medical readiness needs. MEDBASE II presented the potential to not only track all medical readiness, but also Soldiers' profiles (the actual electronic profiles themselves) and electronic medical records with automatic International Classification of Diseases, Ninth Revision, diagnosis coding. With our feedback, they included the capability to track field sanitation and combat lifesaver training as well. In the interest of moving toward a single system, the Central, Western, Southeast, and North Atlantic Regional Medical Commands agreed to unify the systems. The new Health-E-Forces system is still recognizable to the users of the ICDB but includes links and features from other systems.

The first full scale implementation of this system was accomplished in the spring of 2004 at the Joint Regional Training Center (JRTC) at Fort Polk, Louisiana. During the reception, staging, onward movement, and integration phase of the 1st Brigade, 25th Infantry Division Stryker Brigade Combat Team's (1/25th SBCT) deployment to JRTC, healthcare was provided as usual from Troop Medical Clinic 4 on North Fort Polk. Fortunately, the 62nd Medical Brigade from Fort Lewis was deployed in support along with their providers from MAMC. We used our limited internet access to initiate communication of patient care notes via MAMC's website directly from the troop medical clinic. This included not only sick call visits but also physical therapy and mental healthcare. We established internet connectivity for our battalion aid stations scattered throughout JRTC, first at our brigade TOC, and then at the battalion TOCs. This was accomplished as each battalion TOC set up their communications links. We then worked with each battalion S6 to establish a link, either in the form of running a landline or establishing a tactical wireless internet, to connect the Brigade Support Battalion TOC to the Treatment and Holding tents which were located more than a kilometer away. Once the links were established, we were able to access Soldiers' electronic medical records from MAMC, and enter our notes from sick call, our physical therapy treatments, and the brigade psychologist.

CURRENT VERSIONS OF THE TACTICAL ELECTRONIC MEDICAL RECORD

The current tactical electronic medical record in use by the 1/25th SBCT in Iraq is the Health-e-Forces/ICDB system. Its use in Iraq was pioneered by 3rd Brigade, 2nd Infantry Division SBCT (3/2nd SBCT) which used ICDB to document patient care in Iraq. Unfortunately, its use was not widespread because of the limited availability of internet connectivity for the providers. Access to the internet has continued to be a difficult problem. This difficulty is not because of any structural fault in programming or design, but primarily due to unreliable connectivity and NIPRNET* access. The lack of a system solely dedicated to the medical community renders access to internet communications tenuous at best. Currently, medical connectivity competes with unit operations and morale, welfare, and recreation needs. As a result, NIPRNET access is extremely slow, and file transfer is extremely difficult. The lack of a constant internet protocol address hinders access to MAMC and consumes a significant amount of time in setup. Also, use of handheld computers by line medics has proven to be very difficult, primarily due to the austere environment and pace of operations.

*Nonclassified Internet Protocol Router Network

In spite of these complications, it is obvious that the Army is on the right track in developing digital systems for the medical community. For example, the 1st Battalion, 5th Infantry has been extremely successful in documenting patient care on the handheld device, starting with care during ground evacuation and completion of the digital record by a provider at the battalion aid station. While deployed, the 3/2nd SBCT stored over 800 notes which have since been merged with permanent medical records at MAMC. The 1/25th SBCT had advantages in many aspects of medical operations by using the excellent lessons learned from 3/2nd SBCT. The 1/25th SBCT also had the advantage of the previously discussed training in the use of the tactical electronic medical record in garrison and for field training exercises. When 1/25th SBCT deployed, their medics, PAs, and physicians were accustomed to using these systems in garrison, and had trained on these systems at Fort Lewis and later at JRTC. As of March 2005, they had filed over 3,200 clinical notes from Iraq.

Unquestionably, access to medical information and contact with specialty providers at MAMC has been invaluable. A good example is that of a Soldier who was somehow deployed shortly after being diagnosed with a new onset of epileptic seizures. He was deployed shortly after being prescribed new epileptic medications. Access to his medical historical records and communications with the physician that treated him allowed adequate care of this Soldier in an environment that, until recently, would have necessitated his immediate return. This is just one of many examples of the extremely high contribution to readiness represented by continued, real time access to medical information of all Soldiers.

The Fort Lewis medical community could not have realized theses successes on its own. The signal section trained and prepared with us. They and the command of 1/25th SBCT understood the importance of the electronic medical record and supported its use. Dedicated medical connectivity for each aid station would be a major step toward ensuring our patients receive the best in medical care. Such a capability would make the difference between a system which can work, and a system that does work.

FUTURE SYSTEMS

The Department of Defense has chosen CHCS II as the objective system to which all DoD medical systems will migrate. The system has been under development for a long time and promises much of what is required in an objective tactical electronic medical record. Unfortunately, the current, cumbersome acquisition process is not responsive enough to keep pace with the rapidly growing field of medical informatics and is in large measure responsible for the delayed deployment of CHCS II.[7] Agility and responsiveness must be incorporated into software development and acquisition in order to leverage technical solutions for end user requirements in a timely manner. Enterprise solutions will be most effective when core applications are shaped by local development that is iterative in nature, and delivers timely results to end users. Those solutions must be scalable for local, regional, and service specific use, as well as applicability across the entire military health system. CHCS II holds promise to be a worldwide, web-based electronic medical record data management system which meets the requirements of providers, hospital administrators, and tactical medical providers.

The Veterans Administration (VA) Computerized Patient Record System is another enviable approach to medical information management. The VA chose a different path from DoD for their congressionally mandated electronic medical record. They built on their Veterans Health Information Systems and Technology Architecture and created an integrated web-based system for their medical providers which has been used very effectively for several years now.[8] Since the VA centrally manages and supports this system throughout their structure of locations and providers, they have made tremendous strides in reacting to direct feedback from providers and molding a system which literally makes patient information available with the touch of a finger by the provider who needs it. The option still exists for the Army to adapt this superior system to our needs, rapidly, and at a very modest price. This would of course have the added advantage of improved continuity of care for many patients who move among the military, VA, and civilian healthcare systems. Another option is the incorporation of free information flow between systems, which is actively under development in an ongoing DoD/VA project involving the MAMC and the Puget Sound VA system.[9]

CONCLUSION

An ideal system is responsive to the needs of its internal and external customers, with a focus on patients and providers. A system may be able to generate beautiful spreadsheets, but if it is not user friendly, no amount of command influence will make it successful. The system must share information between planners, providers, logisticians, and administrators. The system must provide health providers access to the full spectrum of medical information from any healthcare system. The key requirement for a tactical electronic medical record is the ability, at the point of care, to access a comprehensive medical record and to document observations, treatment, and care. Implementation of a tactical electronic medical record will facilitate improved care throughout a Soldier’s career and into retirement care in any medical system. Use of the same system in garrison and the field ensures ease of use, continuity of care, and a force trained and equipped to document care and retrieve documentation in all situations and environments. One complex omnifunctional system would, of course, be a major improvement, but it may not be the ideal solution. A modular concept of seamlessly integrated multiple systems to meet the requirements could be preferable, because of the innate flexibility and maintainability such an approach offers. We are truly an Army in transformation to meet the requirements of a nation at war. As an integral part of that effort, Army Medicine must make a transformation as well, and, as part of that effort, take the lead in transforming military medical information management.

REFERENCES

1. *DoD Medical Readiness Strategic Plan, 1995–2001*. Washington, DC: US Dept of Defense, Office of the Assistant Secretary of Defense for Health Affairs; 20 March 1995.
2. Curtin NP. *Defense Health Care, DoD Needs to Improve Force Health Protection and Surveillance Processes*. Washington, DC: US General Accounting Office; October 16, 2003. Publication GAO-04-158-T.

3. Hersh W. Health care information technology. *JAMA*. 2004;292(18):2273-2274.

4. *Public Law 104-191 Health Insurance Portability and Accountability Act of 1996*. Aug 21, 1996: Available at: http://aspe.hhs.gov/admnsimp/pl104191.htm.

5. Randell CL, Bero CN, Weidman L. Benefits of worldwide government computer-based patient record framework. *J Health Care Infor Manage*. 1998;12 (4):39-51.

6. Onley DS. Electronic medical records go into combat. *Govt Comput News* [online]. Nov 22, 2004. Available at: http://www.gcn.com/print/23_33/27923-1.html.

7. Riley DL. Business models for cost effective use of health information technologies: lessons learned in the CHCS II project. *Stud Health Technol Inform*. 2003;92:157-165.

8. Fletcher RD, Dayhoff RE, Wu CM, Graves A, Jones RE. Computerized medical records in the Department of Veterans Affairs. *Cancer*. 2001;91:1603-1606.

9. McKaughan J. Computer-based patient records. *Mil Med Tech* [online] August 1, 2004;8(5): Available at: http://www.military-medical-technology.com/article.cfm?DocID=562.

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Implementation of the Theater Medical Information Program During Operation Iraqi Freedom IV

MAJ Mark L. Higdon, MC, USA

In 1999, congress mandated that the Department of Defense (DoD) develop a computerized means to collect, store, and tabulate medical data for all service personnel into an electronic medical record (EMR). Recent advances in computer technology have enabled the DoD to create the EMR currently used in most fixed facilities within the United States, commonly called the Composite Health Care System II (CHCS2).* Beginning in 2003, a similar version of that military EMR, commonly referred to as CHCS2-T (Theater), was introduced into the battlefields of Operations Enduring Freedom and Iraqi Freedom.

Modern combat operations expose Soldiers to many potential environmental health hazards, as well as the possibility of weaponized chemical, biological, or nuclear hazards. The effects of exposure during combat operations may not be immediately apparent, as evidenced by Agent Orange exposure during the Vietnam War or the many complaints attributed to Gulf War Syndrome. History has taught us that comprehensive health surveillance is necessary to mitigate the loss of combat effectiveness due to nonbattle injuries or illness. Quality assurance studies demonstrate that Soldiers who are treated in forward locations utilizing handwritten records rarely have their permanent records updated to reflect the care rendered. The goal of CHCS2-T is to provide the medical surveillance and monitoring needed by commanders to evaluate their Force Health Protection needs. The arrival of CHCS2-T on the battlefield provides a comprehensive, historical, durable medical record encompassing all medical encounters for each warfighter.

The EMR fielded by the US Army was included in a system called the Theater Medical Information Program (TMIP). The TMIP is not a single system, rather, it encompasses several computerized models designed to create an EMR and transfer pertinent medical treatment information from the point of injury on the battlefield to the service member's permanent health record. Starting in 2003 during Operations Enduring Freedom and Iraqi Freedom, TMIP was fielded at various levels of the combat theater. This paper outlines my unit's experience (as a newly deployed transformation-based sustainment brigade) with the TMIP system integration during Operation Iraq Freedom IV, 2005–2006. The 4 key components of the TMIP system are discussed and feedback regarding each component is presented.

Overall improvement of both Force Health Protection and real-time health surveillance lies at the core of TMIP development. Success of the Army's EMR is paramount to reaching the end state of a seamless, durable electronic health record for each warfighter that accurately captures, tabulates, and monitors healthcare throughout a military career. TMIP is the military's answer to provide a fully computerized medical health record for all service members that is comprehensive and easily transferable from peacetime to combat operations.

Components of the Theater Medical Information Program

The primary goal of TMIP is the capture of a service member's medical history in a useable database format. When captured in a database, the medical information can be analyzed to determine trends and identify potential hazards for all personnel allowing preemptive actions such as immunizations and prophylaxis treatments. TMIP, when fully implemented, integrates 4 core data systems from a rewriteable data card worn on Soldier's dog tags to a mainframe computer server in order to capture and store medical information. It is helpful when discussing the various systems to link them to the echelon of care for which each is used as shown in the Table.

*Now known as AHLTA. See related article on page 40.

As shown in the illustration, the various computer systems of TMIP are designed to seamlessly communicate with one another. The basic system includes a rewriteable electronic information carrier (EIC)—also known as the personal information carrier—in a durable card designed to be worn on the dog tag chain of each Soldier. Personal historical and administrative medical data is preloaded onto the EIC and carried at all times. When a Soldier is treated in either garrison or combat operations, the EIC is scanned to load a patient's medical history and administrative data into the processing system. The scanning device commonly used to extract data from the EIC is the medic's handheld, wireless computer known as the Battlefield Medical Information System-Telemedicine (BMIS-T). Scanning the EIC with the BMIS-T eliminates the time spent entering administrative data for each Soldier. The medic uses the BMIS-T device to enter data during sick call visits and to document information that would routinely be entered onto a field medical card.

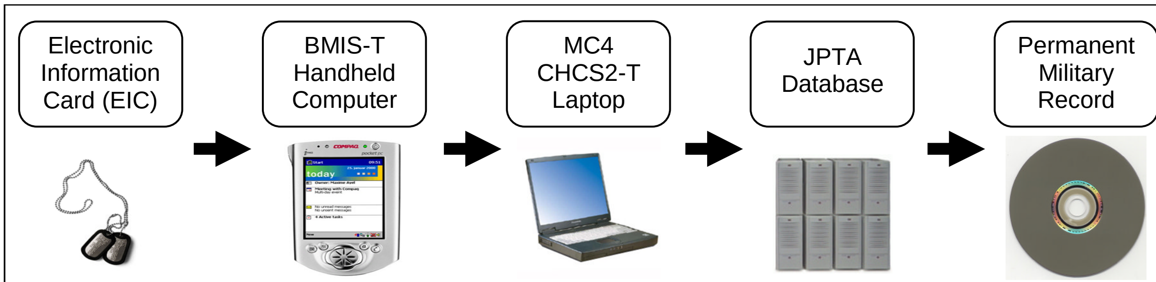
The four core data handling systems of the Theater Medical Information Program, the device involved for each, and the echelon of medical care at which each system is used.

TMIP System	Data Processing Device	Medical Echelon
Electronic/Personal Information Carrier	Dog tag card with data chip	Echelons 1, 2
Battlefield Medical Information System-Telemedicine	iPAQ Pocket PC*	Echelons 1, 2
Medical Communications for Combat Casualty Care System	Laptop computer	Echelons 1, 3
Joint Patient Tracking Application	Centralized servers	Echelon 4

*Product of the Hewlett-Packard Company 3000 Hanover Street, Palo Alto, CA

Data from the handhelds downloads to the next TMIP step, a laptop computer system often referred to as the Medical Care for Combat Casualty Care (MC4) computer. This data transfer most often occurs at the battalion aid station using the HotSync© (Palm Inc, 950 West Maude Avenue, Sunnyvale, CA) function common to most handhelds. The MC4 computer then transmits medical information to the Joint Patient Tracking Application (JPTA) database across a standard NIPRNET (nonsecure internet protocol router network) connection. If possible, a local network of a unit's CHCS2-T MC4 computers is established within a battalion aid station to allow information sharing. If networking is not possible, information is simply stored on the laptop or handheld until conditions allow transfer of data to the JPTA database.

The JPTA is a web-based tracking and information management tool that reports data on compiled JPTA data can be accessed by anyone with a NIPRNET



Basic flow of a Soldier's medical information through the various systems comprising the Theater Medical Information Program.

account and an assigned password, allowing access for treatment of Soldiers in forward operating areas. Passwords for the JPTA database can be obtained via an online registration form (normal 48-hour response time following password request). Commanders, physicians, and other healthcare providers can use the JPTA data in the design and application of force health protection measures. Ultimately, the medical data captured by both BMIS-T and CHCS2-T is applied to update the Soldier's permanent medical record. This capability eliminates the problem of lost records and saves that time spent entering purely administrative data onto multiple handwritten documents, with a corresponding improvement in accuracy and reliability of the data. The compiled data in JPTA enhances the ability of field surgeons to track patients during the casualty evacuation process and to review tabulations of DNBI (disease, nonbattle injury) data to help identify possible trends of illness or exposure. The powerful JPTA database also improves response times for command inquiries' regarding the health status of injured or evacuated warfighters.

TMIP captures all information related to a service member's healthcare and eventually inserts that data into their permanent record. Redundancy is built into the system by having multiple levels of information capture that could be used to update any of the lower tiers of medical data collection. Increasing use of the system by all units will greatly enhance research activities and development of preventive medicine techniques. Army-wide implementation of the TMIP is now planned for completion prior to 2007.

4th Sustainment Brigade Implementation of TMIP During Operation Iraqi Freedom IV

The 4th Sustainment Brigade deployed in support of Operation Iraqi Freedom IV in September 2005. With the exception of EICs, all major components of the TMIP system were received prior to deployment. Unfortunately, the lack of EICs prevented optimal use of the handheld as a replacement for the field medical card. All initial echelon 1 treatment notes (if completed in forward locations) were handwritten using the field medical card. A big challenge for the BMIS-T is its inability to wirelessly transmit data to the laptop (MC4) computers due to the nonsecure nature of the Bluetooth® (Bluetooth SIG, Inc, 500 108th Avenue NE, Suite 250, Bellevue, WA) technology. Currently, data transfer from the handheld to other TMIP systems requires a cable connection using HotSync. At echelon 1, most medics did not fully use the features available with BMIS-T; most simply used their handhelds to follow treatment algorithms during sick call. A secure, wireless Bluetooth capability is required before medics can use BMIS-T as a universal replacement for the standard field medical card.

Basically the MC4 computers functioned as designed, albeit painfully slow due to limited memory. The Alternate Input Method (AIM) forms capability, fully available in the CHCS2 software used in the United States, is not included in the CHCS2-T software. AIM forms provide a familiar format for entering medical notes that is similar to the traditional paper chart. The template-based entry method used by the CHCS2-T software is difficult to learn and time consuming to use. AIM forms help standardize treatment for common illnesses, allowing more rapid documentation. Given the inherent training difficulties that accompany fielding a new product, we recommend that future upgrades of the CHCS2-T software include the AIM form capability, as soon a possible. Also, increased internal memory for each laptop (MC4) computer will improve processing speeds. Open expansion slots are available on each laptop currently in use.

Although also an extremely slow process, transfer of medical data from the MC4 laptops to the JPTA database presented no other problems. It took several hours for a completed note to appear on the JPTA website, but the information was accurate and complete. Most often, the delay in updating a note to the JPTA server (>3 hours) resulted in the field surgeons calling various medical facilities to obtain real-time casualty information.

Recommendations

1. The capability to organize casualty data for each unit on the JPTA site, including a summary screen presenting a snapshot of information concerning the status of Soldiers for commanders, would greatly enhance the system. The summary screen should be customizable for each unit.

2. A virtual private network* (VPN) could increase the depth of review available with JPTA. Currently JPTA data is limited to the theater of operations. By using a VPN, home station medical databases could be accessed, providing important medical information, such as medical profile information and historical radiologic studies, to forward stations.
3. A medical readiness module to track medical profiles in both garrison and combat environments would eliminate the need for Soldiers to possess a copy of their profile. Additionally, field surgeons and commanders could more accurately track and review medical profiles as the data would instantly be available to anyone having NIPRNET access to the JPTA.
4. TMIP technical support was available to the 4th Sustainment Brigade's location on Forward Operating Base Taji, but it usually took several days for the technician to arrive and troubleshoot networking problems. Success of any new system is directly related to full functionality. Several of the delays experienced with TMIP could have been eliminated with increased availability of technical support.

Conclusion

Full integration of the TMIP system is critical for the continued successes Army medicine has experienced in the decrease of combat mortality. Expeditious fielding of complete TMIP systems and continued software enhancements are necessary to meet the requirements in support of the modern Soldier, before, during, and after deployment. The ability to compile accurate medical data quickly and efficiently is necessary for all commanders to maximize combat effectiveness. The 4th Sustainment Brigade's medics and healthcare providers quickly became reliant upon the data management provided by the electronic health record (CHCS2-T). Overall, TMIP is an outstanding concept that will eliminate the previous inconsistency and fragmented data common with handwritten records. Continued efforts should be focused on seamless integration of both inpatient and outpatient data into and within the TMIP system. Army-wide implementation of the electronic health record both in the garrison environment and during combat operations offers the mobility necessary to substantially enhance force health protection. The electronic health record is vital to the commanders' full medical situational awareness and offers a myriad of reporting and tracking capabilities concerning health surveillance. The 1999 congressional mandate was only the impetus and the beginning. Continued refinement of the durable electronic health record and TMIP is essential to the support of today's warfighters.

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*A virtual private network (VPN) is a private network that uses a public network (usually the internet) to connect remote sites (local networks) or users together. Instead of using a dedicated, real world connection such as a direct cable or leased line, a VPN uses virtual connections routed through the internet among the various isolated local networks and further into central servers. A VPN involves parts: the protected or "inside" network that provides physical security and administrative security sufficient to protect transmission, and a less trustworthy or "outside" network or segment (eg, internet). Secure VPNs use cryptographic tunneling protocols to provide the necessary confidentiality, sender authentication, and message integrity to achieve the security required. When properly chosen, implemented, and used, such techniques can provide secure communications over unsecured networks.

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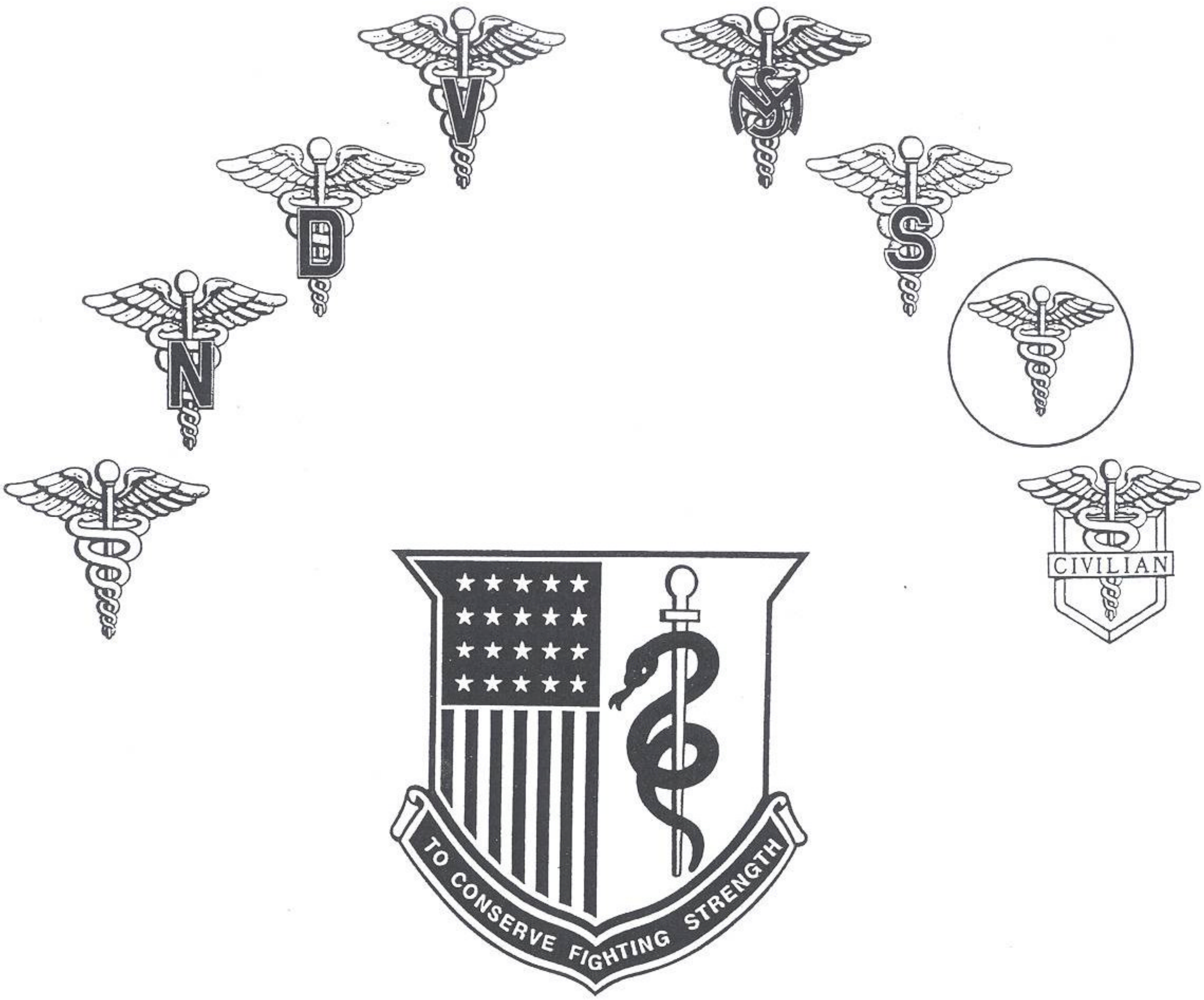

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