The Military Builds an Enterprise View

Trailblazing efforts by the military aim to make PACS and the EMR ubiquitous

BY DANA HINESLY

One of the hottest topics in medicine today is the promise of an accurate, portable, accessible electronic medical record (EMR). For the past 2 years, the US government has, through the President's Health Information Technology Plan, injected millions of dollars into the the health care industry in an attempt to improve the infrastructures and networks of today's health care community.

Once in place, this type of comprehensive EMR would be a dream for clinicians who currently rely on patients to provide a correct and complete history.

The US Department of Defense (DOD) is well on its way to turning concept into reality for its staff of medical professionals who care for more than 9.2 million beneficiaries, including all retired and active-duty military personnel and their dependents.

Ahead of the Pack

Long before PACS, EMR, and teleradiology were part of health care's common vernacular, the DOD was blazing the trail with its original EMR, known as the Composite Health Care System (CHCS). By the mid-1990s, the system was serving more than 500 Army, Navy, and Air Force hospitals and clinics.

The second rendition of the health record system, simply dubbed CHCS II, is an infrastructure now known as the Armed Forces Health Longitudinal Technology Application (AHLTA). AHLTA is a secure, patient-centric system that supports about 2.1 million prescriptions, 1.8 million outpatient encounters, and 19,500 inpatient admissions in an average week.

Phasing in the $1.2 billion system began in January 2004 and, according to the Hon William Winkenwerder, Jr, MD, MBA, the assistant secretary of defense for Health Affairs, it provides a longitudinal record of care for service members in the field, shipboard, and at home.

MAJ Jeff Hirsch, MD, works at the QC station of the multislice CT in a combat area support hospital (CSH) in Baghdad.

This is of particular importance for a patient base that is, by its nature, very mobile. An active-duty service member can be treated at any one of 70 military hospitals or in more than 800 medical and dental clinics. In its final form, AHLTA will be image-enabled and will make a patient's record available to health care providers in any of those sites.

"One of the key AHLTA initiatives is to build a registry that allows us to relate large images, which are normally stored in a PACS, to a patient, no matter where the images are within the enterprise," says COL David G. Gilbertson, Medical Service Corps, Army, and program manager of AHLTA. "It also would give us some options on how to move those images so that they can be available at the time of care."

The registry would most likely happen in the form of separate repositories that hold large image files until a search is conducted for a specific patient. At that time, patient images would be "married" with the EMR, and a complete medical history would be delivered to any clinician with an AHLTA account.

For the system to function in a timely manner, it must be able to predict when and where images will be needed so they can be transmitted at a time when the bandwidth is available.

"'Prime time' in a clinic is probably the busiest time for most of our networks, and that's not the time to be moving large files," Gilbertson says. "So we want to have logic built-in that will let us anticipate when to move images and where to move them. We need to do it in such a way that the information is available at the time of care."

Before that can be realized, considerable technological hurdles must be navigated. Every day, more than 100,000 patient encounters occur, with a considerable portion of those visits including images. Leveraging existing PACS and digital imaging infrastructures in place at the hospitals and clinics lowers the capital investment required and will speed the process.

Instead of rewiring the entire enterprise, the location of each image can be recorded, and the system will have the ability to "fetch" it at the appropriate time. Some new capabilities will be required, however.

"We recognize that besides traditional PACs images, other types of images, including movies, videos, photographs, and drawings, are taken during the clinical encounter," Gilbertson says. "There will be a requirement to store those types of things as a digitized image associated with a clinical record."

Making It Happen

The first phase of AHLTA—called AHLTA Block I—has been successfully implemented already. This deployment makes it possible to document outpatient encounters in 130 hospitals and more than 400 clinics worldwide. Block II, which is currently in beta testing, will merge dental records with medical histories. Once testing is complete and the system is approved,

installations could begin as early as this summer and will take at least 2 years to complete.

"This will give us an electronic, lifelong, longitudinal dental record to go along with the longitudinal medical record, which is really important at the time of care," Gilbertson says. "Oftentimes, our dentists don't have all of the medical information about patients. This helps not only the patient, but also the provider."

Block III includes replacing legacy systems in the laboratory, pharmacy, and radiology departments. These services are still working with CHCS, so the outdated infrastructure will be replaced with commercial, off-the-shelf, best-of-breed technology.

SPC Cynthia Alley works with the Medweb middleware product.

Among its other benefits, AHLTA also makes it possible for administrators to more easily perform medical surveillance: collecting, analyzing, and compiling statistics about the population in its care.

"With it, we can forecast and see trends in disease across an enterprise, before you would notice it otherwise. Beyond that, maintaining that longitudinal record electronically is critical to maintaining continuity of care in the military," says Charles C. Hume, deputy chief information officer for the Military Health System and chief of program analysis and evaluation in the Directorate of Information Management, Technology and Re-engineering for the TRICARE Management Activity. "It allows us, when an individual leaves the service, to have a record that we can readily transfer to the Veterans Administration so as to maintain the continuity of their care postmilitary service."

Clinicians in the DOD's system are eager to make use of the EMR and provide constant feedback to the AHLTA team in terms of what they need the system to do. Developers use this input to tailor the software accordingly.

"One of the objectives of AHLTA was that ability to support medical surveillance, so there is a requirement to capture structured documentation, not just free text," Hume explains. "And we're learning what the right balance is: how much structured documentation is needed to accomplish the medical-surveillance mission, and how much free text is needed to be what our providers are used to in terms of narrative notes."

Beyond functionality, the network's speed and performance also are on the top of the list for care providers. "Our physicians understand the value of the electronic health record, and they want to be part of that evolution. They also know that with this new technology, and the fact that the DOD is really leading the nation in this technology, there are going to be some ups and downs," Gilbertson says. "Their main concern right now is performance and reliability, because in terms of functionality, the system today can do what most of them need to be able to do in their clinical practice. And what we're looking for is how do to advance their clinical practice with capabilities we are building and will be releasing this year."

Improvements scheduled for the most immediate distribution are focused on the specialty documentation areas and streamlining AHLTA to accommodate all of the different clinical practices that happen between specialties.

Interpreting Across the Wild Blue Yonder

As the DOD improves its technology and builds a system capable of handling millions of patient records, all branches of service are ramping up their infrastructures as well.

For its part, the Air Force recently put a Synapse PACS from FUJIFILM Medical Systems USA, Stamford, Conn, in place that covers 64 million square miles of Pacific Ocean and nine bases in three countries: Korea, Japan, and the United States.

Completed on schedule in January 2006, the network allows the rapid interpretation of imaging studies for military personnel throughout the region. Fourteen new CR readers and upgrades were put into place through a contract between the Air Force and Fuji.

In addition to installing new systems, about 300,000 studies were transferred from the existing PACS to new archives. The Synapse PACS chosen by the Air Force makes it possible for a radiologist in Alaska to cover for a colleague who is stationed in Korea.

"Our regional medical commands must deliver their diagnostic expertise across vast distances with fewer radiologists than ever," says Lt Col Grant Tibbetts, the radiology consultant for Pacific Air Force Command (PACAF). "Synapse provides the telediagnostic and multisite reading capabilities we need to quickly and effectively treat our personnel and their dependents."

The system's CommonView technology provides radiologists with access to every exam performed on a patient across multiple facilities, even though those exams are segregated in different databases.

In addition to enabling teleradiology services, PACAF provides a built-in disaster-recovery plan. Even if one of the PACAF sites where data is archived was completely disabled, teleradiology could continue because of the system's ability to provide universal access to examinations.

Fuji will continue to work with the military. The manufacturer recently inked a deal with the Naval Medical Center in Portsmouth, Va, to provide PACS, CR, and other medical-imaging modalities for the facility.

An Army of One, a PACS for All

For a number of health care organizations across the country, selecting, installing, and operating with a PACS tops the agenda. For the US Army, that "to do" item has been marked off, with fine-tuning well under way.

"As of 2006, the Army is 100%

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—COL David G. Gilbertson
AHLTA

deployed with PACS," says Ronald R. Richardson, Jr, project manager, Army PACS Program Management Office, Fort Detrick, MD, who notes that the only modality yet to migrate to digital is mammography. "All of our fixed medical treatment facilities have digital imaging in place, and all are tied together on a regional basis."

SGT Shandy Kimball changes a plate in a CSH in Baghdad.

Making this a reality was no small task. As a global entity, the Army has divided its treatment facilities by location, with each care center falling into one of six regional command areas.

Every region has at least one, sometimes two, major medical centers that serve varying numbers of clinics providing consultation, backup support, and teleradiology to neighboring communities. For the past several years, the Army has been working to install a central archive for each region.

"We have a heterogeneous environment in terms of our PACS vendors," Richardson explains. "Each region basically is standardized on a single PACS vendor, but not all regions are on the same PACS vendor." For example, the North Atlantic and Southeast regions use Impax from Agfa HealthCare, Greenville, SC; the Great Plains region uses PowerPACS from IBM, White Plains, NY; the Brooke Army Medical Center (part of the Great Plains region), the Western region, and the Korea/Pacific Rim region use Centricity from GE Healthcare Integrated IT Solutions, Barrington, Ill; and the Europe region uses Sienet Magic from Siemens Medical Solutions, Malvern, Pa.

Ultimately, each facility within a region will maintain some intermediate storage to support local workflow with a depth of 2 to 3 years. Beyond that, images will be stored at its major medical center, which serves as a regional archive.

The first step in the process is to designate a "go-forward" point at which archived images are routed to the centralized repository instead of one at the local facility. Moving the hundreds of thousands of images takes more work.

"Migrating the legacy studies is a significant effort, particularly at our sites that were early adopters, where we're looking at 12-plus years of data," Richardson says. "In some cases, depending on the PACS vendor and the specific architecture of the system, we migrated the database but maintained the pointers to the image data in the legacy archive."

In addition to literally transferring each and every file, the job required cross-referencing patient images that were originally stored using very different—and sometimes nonstandard—protocol; as well as restoring and repairing archives and physical storage media that had been corrupted due to years of storage.

"In the end, we were able to, in most instances, migrate about 99.9% of the legacy data and were left with only a few thousand exams that were not recoverable," Richardson says. "Which is still better than with film, where lost film rates of 5% to 7% were generally considered very good."

At press time, all of the regions were in the process of transitioning to regional archives, with the Great Plains region as the last—and one of the biggest—to get under way. The goal is to have the project completed by 2008.

Taking Technology to the Front Lines

How advanced medical networking ensures the best care for troops in the fight

Combat medics recently added another tool to their field bags: a handheld electronic device that allows them to document the nature of a soldier's injury, specific wounds received, and any treatments administered before the patient arrives at a hospital.

Employing the same technology used for PDAs around the world, these mobile devices—manufactured by Hewlett-Packard—are part of the Theater Medical Information Program (TMIP).

A "system of systems," TMIP is designed to create a permanent health record consisting of a soldier's entire health care history—from routine appoints to battlefield injuries—regardless of where they receive treatment.

"AHLTA Theater is a core component of TMIP, which took the electronic medical record used in our fixed facilities and designed it to operate in a theater environment, where you can't necessarily rely on robust communications," says Charles C. Hume, deputy chief information officer for the Military Health System and chief of program analysis and evaluation in the Directorate of Information Management, Technology and Re-engineering for the TRICARE Management Activity. The AHLTA Mobile device also includes a complete paramedical reference library. "The primary device is known as the 'Special Forces Medic Handbook,' and it is organized as a quick-reference tool for front-line medics," Hume explains.

Medics also can enter demographic information for each member of their unit into the device so, in

the event of an injury, they can search the patient's record for any allergies or other pertinent information.

For the past 2 years, the TMIP proprietary software has been available to all branches of service. The software is used primarily by the Army due to its large number of deployed service members, and to date, about 12,000 AHLTA mobile units have been issued. Marines also are making use of the technology.

As with any form of software, regular updates are distributed to increase the functionality of the system. The latest releases in the AHLTA are incorporated into the releases for AHLTA Theater.

"AHLTA Theater is a compilation of the relevant garrison systems, so each component of TMIP has a parent application that stems from our fixed facilities," Hume says. "The whole point is that our providers work in our fixed facilities when they're not deployed; this way, when they deploy, they essentially use the same systems."

Future enhancements include modifying the device so it can be voice activated.

"It is very difficult to use the device when you're seeing a patient in a battlefield environment," says Evan Williams, deputy program manager for the TMIP. "So we're testing right now to make it capable of accepting the medical record without the medic having to manually enter the information."

PACS/CT Make Their Way to the Desert

Similar to what the Air Force has accomplished with PACAF (see "Interpreting Across the Wild Blue Yonder" on page 35), the Army also has a fully deployed teleradiology system serving soldiers from the front lines to the home front. Currently, 15 PACS solutions are deployed that support the theater of operations in Iraq, Kuwait, and Afghanistan—all of which are capable of transmitting and receiving files from the imaging modalities in place.

"The systems within the theater of operations are deployed in an echelon scenario, so sites that have radiology equipment but don't have a radiologist are connected to a site that does have a radiologist," says Ronald R. Richardson, Jr, project manager, Army PACS Program Management Office, Fort Detrick, Md. Those images are sent either to one of the clinicians in the area of operations or to physicians in Europe or the United States. "All of those sites have reach-back capabilities, and exams are pushed as needed and as patients are evacuated. So, if the radiologist in Baghdad wants a consult from a subspecialist at Walter Reed [in Washington, DC], for instance, they can push those exams back to those facilities for interpretation."

PFC Matthew Hill monitors CT QC in a Baghdad CSH.

As is the case with many civilian health care organizations, in some instances, the Army is working with systems that do not allow the medical professionals to make full use of the technology. These modalities, deployed prior to the installation of any type of PACS or mini-PACS solution, are not equipped with all the necessary DICOM services for full integration with the deployable teleradiology system (DTRS).

"When the Army first started pushing CR readers out to our deployed units, we didn't have the DTRS, so we were installing stand-alone CRs with printers," Richardson says. The long-range plan is to replace or upgrade those units; until that time, systems from Medweb, San Francisco, are deployed as an interim solution. "We are getting ready to deploy the objective system for DTRS, and that will be prospectively, proactively deployed to every level 2 and level 3 medical-treatment facility in the inventory."

Army radiologists are making use of the current infrastructure, moving thousands of images every month across the network. Part of the deluge of information comes from the multislice CT scanners that were installed late last year. A 16-slice system was distributed to Afghanistan; and five additional multislice scanners are in use in Baghdad, Balad, Mosul, and two other towns. An estimated 100 CT exams are being performed every day in Baghdad alone.

"The three primary tertiary care facilities are busier than any inner-city emergency department in the United States, and about 90% of the patients being treated are local nationals, not US forces," Richardson says. "We are practicing standard-of-care medicine there, so if practice guidelines would steer you toward a CT scan, that is what the patient gets."

The sheer volume of scans also is playing a major role in reviving a familiar problem for the military's medical professionals: the lack of available bandwidth. A couple of years ago, the problem of painfully slow data transmissions was successfully addressed through the use of robust satellite networks. While not ideal, the uplinks allowed for almost real-time referrals and consults. Since then, medical communications have been transferred to terrestrial wide-area networks.

"The downside is those are shared networks with the embassy, administrative, and Morale, Welfare, and Recreation (MWR) functions," Richardson says. The Army's MWR provides, in part, e-mail and Internet access to deployed service members. "It is so heavily used that we have actually lost throughput, compared to what we had with the dedicated satellite links, to the extent that during peak times it may take as much as 8 hours to send an 800-slice CT scan."

Discussions currently are under way to identify a fix to this problem. Whether it be priority on the shared, terrestrial networks or a return to satellite links, Richardson is eager to see a solution that is not specific only to the current operation.

"We need to design a solution that is independent of the environment we happen to be operating in today," he says. "If, in the future, we are required to be out in the Pacific Rim, a solution designed solely for Iraq won't fit, so our efforts are focused on finding a solution that will work in any environment."

—D. Hinesly

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—Ronald R. Richardson, Jr
Army PACS Program Management Office

A Bird's Eye View

However complicated, the task is vital to the Army's ability to manage the flow of information not only among facilities in a specific locale, but also from a higher-level, administrative view.

"Because we have this regional command and control infrastructure, and we have regional business processes and workflow in place, we are able to aggregate the work to the regional hub—which is easier to control," Richardson says. Connectivity between regions currently is possible through the use of the Medweb middleware product from Medweb, San Francisco, which is the same product that provides radiology support to many deployed locations. "Because of this, we decided to standardize on a regional basis on a single PACS vendor, in order to facilitate that interoperability within the region."

The aggregate data also is employed in research by a number of government medical research and development organizations—such as the United States Army Institute of Surgical Research and the Armed Forces Institute of Pathology—to make improvements to body armor and to develop new or improved treatment protocols. This makes the goal of merging a patient's images with his or her appropriate records all the more important.

Tying It All Together

For the Army, and other services performing similar processes with their health care assets, the final stage will be to tie information—including both images and reports—from the regional PACS to AHLTA.

"The integration and effort is continuous and ongoing to improve the existing workflow," Richardson says. "We are constantly looking at our ability to perform teleradiology and to have a regional view and, ultimately, an Army-enterprise view of the electronic medical images." This comprehensive view makes it possible for AHLTA to search the system, finding all images and reports for one soldier—regardless of where that medical procedure was performed. "It's all one health care system today," he says, "carrying information from the front lines all the way back to the major medical centers." **MI**

Dana Hinesly is a contributing writer for Medical Imaging. *For more information, contact mdi@ascendmedia.com.*

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