THE ASSISTANT SECRETARY OF DEFENSE

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HEALTH AFFAIRS

JAN 26 2006

The Honorable John W. Warner
Chairman, Committee on Armed Services
United States Senate
Washington, DC 20510-6050

Dear Mr. Chairman:

This letter provides a report to Congress on the requirement for a Department of Defense (DoD) report on In-Theater Medical Tracking and Health Surveillance, as directed by 10 U.S.C. Section 1074, as added by Section 734 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005.

The report describes DoD's medical tracking and surveillance systems for detecting deployment-related health problems, addresses scientific findings regarding the effectiveness and timing of pre- and post-deployment blood sampling procedures, and recommends improvements in the DoD medical tracking and surveillance systems. It is important to note the critical improvements in deployment health assessment products and processes, including automation of the assessment forms and the added protection afforded by the post-deployment health reassessment. Our in-theater health surveillance capabilities have also significantly improved with fielding of the Joint Medical Work Station and the Joint Patient Tracking Application, while the Deployment Occupational and Environmental Health Surveillance program greatly facilitates the reporting, tracking, and archiving of data on potentially hazardous exposures.

I remain committed to ensuring that the Department's deployment health surveillance programs protect the well being of our military personnel in all theaters of operation.

Thank you for your continued support of the Military Health System.

Sincerely,

William Winkenwerder, Jr., MD

Enclosure:
As stated

cc:
Senator Carl Levin

Report on:

Department of Defense In-Theater Medical Tracking and Health Surveillance

October 2005

Prepared by:

Office of the Assistant Secretary of Defense
for Health Affairs
(Force Health Protection and Readiness)

In Response to:

Ronald Reagan National Defense Authorization Act
for Fiscal Year 2005, Section 734
Medical Care & Tracking in the Theater of Operations
October 28, 2004

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DoD In-Theater Medical Tracking and Health Surveillance
Report to Congress
October 2005

BACKGROUND

Disease and non-battle injuries (DNBI) have been problematic throughout the history of military campaigns, reducing the effectiveness of military units and affecting the outcomes of conflicts. The occurrence of DNBI has consistently exceeded combat-related injuries in every major U.S. military operation and costs field commanders the overwhelming majority of lost personnel from deployed forces. The importance of health surveillance cannot be overstated; timely monitoring has the potential to identify health hazards that could impact mission readiness and allow for early intervention. Such surveillance also provides essential data regarding new health threats that may emerge while deployed or at some point after returning home.

INTRODUCTION

Section 1074f of title 10, United States Code, requires the Secretary of Defense to establish a system to assess the medical condition of members of the Armed Forces (including Reserve Components) who are deployed outside the US or its territories or possessions as part of a contingency operation (including humanitarian, peacekeeping or similar operations) or a combat operation. The major components of this medical tracking and health surveillance system include pre-deployment health assessments, a variety of in-theater health event and exposure data collection systems, and post-deployment health assessments. Section 734 of the Fiscal Year 2005 National Defense Authorization Act (NDAA) requires the Department of Defense (DoD) to provide a report to Congress addressing the strengths, weaknesses, and efficacy of these systems, as well as any recommended changes to improve in-theater medical tracking and health surveillance. This report responds to that requirement and is organized along the following major topic headings:

- Pre-Deployment Health Assessments
- In-Theater Health Surveillance
  - Outpatient Care
  - Inpatient care
  - Patient Movement and Tracking
  - Occupational and Environmental Exposures
  - Special Registries
- Post-Deployment Health Assessments and Reassessments
- Blood Sampling Procedures
- Evolving Deployment Health Surveillance Technology
- Recommendations

PRE-DEPLOYMENT HEALTH ASSESSMENTS

The DoD performs pre-deployment health assessments to ensure that only medically fit military personnel deploy in support of contingency operations. The assessment confirms and documents a Service member's health readiness status and identifies any need for additional clinical evaluation prior to deploying. The Assistant Secretary of Defense (Health Affairs) mandated pre-deployment health assessments and use of the associated DD Form 2795 in a October 6, 1998 policy memorandum. Key components of pre-deployment assessments include:

- Assessments are accomplished within 30 days of deployment to verify:
  - Medical record documentation of good health
  - Any recent changes in health status as reported via the DD Form 2795
  - Receipt of needed immunizations and protective medications
  - Completion of screening (hearing, dental status, TB skin test, pregnancy)
  - Performance of required laboratory tests (HIV, DNA, blood type)
  - Need for additional specialty consultative evaluations or testing, if any
- Assessment forms are placed in the servicemembers' medical records and in the central electronic database of the Defense Medical Surveillance System (DMSS).
- Pre-deployment blood specimens are drawn and archived in the DoD Serum Repository.

From an operational standpoint, this system is performing well. Service members preparing for deployment have completed approximately 1,150,000 pre-deployment health assessments over the period October 2002 through August 2005. Compliance with pre-deployment surveillance requirements is monitored both by the individual Services and the DoD (Health Affairs) Deployment Health Support Directorate (DHSD).

Results from reviews in Calendar Year (CY) 2004 showed marked variability in a sample of approximately 400 OIF/OEF veterans from four military installations (one each Army, Navy, Air Force, and Marine Corps). A completed DD Form 2795 was found in only 3 percent of the records reviewed at one installation, while the forms were present in 75 percent, 95 percent, and 97 percent at the other three installations. However, there were always fewer forms found in the central DMSS database when compared to what was present in the medical records. The Services were directed to institute electronic DD Form 2795 reporting in 2004 to eliminate the loss of physical forms sent from the installations to DMSS. Since January 2005, the Army and Air Force have implemented such systems and are providing nearly all such forms electronically, while the Navy and Marines are in the midst of deploying their electronic solution. Compliance with pre-deployment serum sampling requirements ranged from 71 percent to 94 percent. Additional details regarding results from the ongoing DoD deployment health quality assurance (QA) program are available in the annual (2004) Force Health Protection QA report, submitted to Congress in April 2005.

IN-THEATER HEALTH SURVEILLANCE

The term "DNBI" is typically associated with the identification of acute health problems in the field environment, whereas the more appropriate term is "health surveillance." This change in terminology is not merely cosmetic, but rather reflective of an increasing emphasis on surveillance

that is more comprehensive, including not only outpatient "sick call" health events that have traditionally been the source of DNBI estimates, but also patient movements, hospitalizations (both within in and out of theater), occupational and environmental exposure monitoring, and post-deployment surveillance to identify subsequent problems. Although outpatient data is important, it should also be recognized that there are many other data sources available that should be used to the fullest extent. This change in focus is partially in response to the problems identified in responding to the poorly-defined "Gulf War Illness," as well as more robust technology being fielded at all levels of the operational spectrum, allowing access to more and better data with regard to health events. With this increased healthcare data capture comes the ability to extract more specific, detailed information about each encounter and to perform increasingly sophisticated analyses and surveillance.

Health surveillance encompasses multiple health and administrative data sources that exist for tracking military medical encounters and transport through the different levels of care, both in and out of theater. This makes accurate and timely collection, integration and analysis of deployment health data difficult. Many Service-specific data systems have evolved over time, often varying by functionality, structure, completeness, accuracy and coding practices. Efforts are underway to eliminate duplicative reporting requirements and improve data quality.

Medical staff at different levels of the operational spectrum, preventive medicine consultants, and policy makers have long debated the subject of deployment health surveillance systems and their utility, particularly their ability to provide actionable data. Some of this debate reflects differing interests and capabilities. For example, a public health officer might be more interested in Reportable Medical Events (RME) that reflect preventable communicable disease issues, whereas a division surgeon might want to know more about the status of patients who have been medically evacuated from theater, and a treating physician may just want an update on his or her patient. It is difficult to design a single system to meet these divergent needs.

Traditionally, battle injury (BI) reporting occurs through personnel channels, while DNBI reporting is accomplished through medical channels. Variations in the operational definitions of BI (hostile casualties) and DNBI (non-hostile casualties) between the personnel, safety, and medical communities can result in contradictory output, calling into question the reliability of each source. This means an injury may be classified as NBI when it may in fact be BI and vice versa. For example, incidents in which a BI resulted in a delayed presentation, such as noise-induced hearing loss or traumatic brain injuries, may be initially categorized as NBI.

In-theater health surveillance data are divided into several general categories: outpatient (ambulatory care), inpatient (hospitalized care), patient movement, special registries (injury and mortality), and occupational or environmental exposures. The following sections provide an overview of the available or expected deployment health surveillance systems for each category.

Outpatient Care (Levels I-III)

Recently, the need for more specific, individual-focused data for patient encounters has been recognized. The old "stubby pencil" method fails to provide enough detail on diagnosis, demographics, and other epidemiologic data of significance. Militaries throughout the world have

been evolving toward electronic Patient Encounter Modules (PEMs) with individual data and international classification of disease (ICD-9) codes for each health encounter. However, current limitations with these systems in-theater include inaccessibility of the PEMs to some medics and medical providers at the lower levels of care (Levels I and II) and inconsistent connectivity to the Internet (particularly secure classified Internet access).

There are two types of outpatient data available from the theater. One type consists of simple counts of health events that are manually assigned by medics to one of eighteen Joint Chiefs of Staff (JCS) broad-based DNBI categories. These counts are aggregated on a weekly basis for a given population and do not include any information about specific diagnoses or individuals. The other type of medical data consists of individual electronic health records as captured in theater PEMs, such as the Global Expeditionary Medical System (GEMS), the Composite Health Care System II– Theater (CHCSII-T), and the SNAP Automated Medical System (SAMS). Providers assign ICD-9 codes to each health event as part of the electronic documentation process. The PEMs then forward these records to various centralized databases. Once received, these PEM data are automatically mapped into JCS-directed DNBI categories.

Analysts actively integrate outpatient data received from Level I-III patient encounters in-theater into classified weekly DNBI reports, component reports, sub-geographic reports, and combatant command-specific DNBI weekly reports, which are disseminated to staff at DoD Health Affairs, the Combatant Command Surgeons, and the Service Surgeons General. Current DNBI reports are accessible only through the classified Secret Internet Protocol Router Network (SIPRNET) system. Unclassified historical DNBI reports and cumulative rate reports are also generated.

Both the health event count and PEM data are then summarized by unit and Service and matched with estimates of the population at risk (PAR) provided by the Combined Forces Land Component Command (CFLCC) in order to generate DNBI rates. The longitudinal data provide the basis for assessing short and long-term trends with tailored alert systems specific to trending. Current analytical methods determine alerts for short term trending based on counts greater than 3 standard deviations above the previous 4-week mean, while long-term (e.g., seasonal) alerts are based on the previous 25-week mean. These alerts serve to warn Combatant Command Surgeons and preventive medicine personnel of potential problems that they can investigate further.

Below are descriptions of outpatient health information systems currently used in-theater:

Joint Medical Work Station (JMEWS). JMEWS was implemented in 2003 as a means of archiving deployment health surveillance data from the multiple and noncompatible Service-specific systems currently in-theater. The system was also designed with the ability to run ad hoc queries and summary reports. JMEWS is part of the joint Theater Medical Information Program (TMIP). An upgraded version, JMEWS II, which interfaces with the DoD centralized Clinical Data Repository (CDR) and enables symptom-based medical surveillance, has just been deployed. Like its predecessor, JMEWS II permits diagnosis-based medical surveillance capability.

JMEWS has the advantage of being theater-wide with secured exchange of information through SIPRNET connections. It is also widely accessible at high levels and allows rapid, expert data analysis. However, difficulties exist from an analysis perspective as the data reside on a

classified system, thereby requiring that analyses and results remain on a classified, need-to-know status. It is also difficult to access JMEWS at lower levels of care (e.g., the battalion level and below) where connectivity may be difficult to initiate and maintain.

Any system is only as good as the data it receives. Records currently received through JMEWS are often incomplete, data categorization can be imprecise, and denominator (e.g., deployed population at risk) estimates are poor. Many of these limitations may be due in part to lack of training prior to deployment, since current front-end users—particularly Reserve and Guard members—have limited experience working with military data systems such as the PEMs that feed data into JMEWS.

Composite Health Care System II–Theater (CHCS II-T). CHCS II-T is a modified form of the AHLTA (formerly called CHCS II) application that is used in garrison. The system collects individual and aggregate information on health status and population health issues for all individuals treated as outpatients, and includes basic service member demographic information and clinical data including structured symptom and physical finding data as well as ICD-9 codes for each outpatient visit. For medical surveillance purposes, the structured symptom and physical finding data are much more significant that ICD-9 codes.

CHCS II-T is the joint in-theater PEM for entry of outpatient encounters at Levels I-III, though some land-based Naval units are using it. Because the application resides on laptops, it is often not accessible at lower levels of care, such as that provided by first responders and field medics at Level I. Therefore, these encounters are typically entered first into hand-held devices, such as the Battlefield Medical Information System Tactical–Joint, and then synchronized with the CHCSII-T application. CHCS II-T data can be sent directly to JMEWS. From JMEWS CHCS II-T data is sent to CDR.

An adjunct to the CHCS II-T is the CHCS New Technology (CHCS-NT), which primarily supports collection of Level III inpatient and ancillary data such as lab and radiology. Its laboratory modules can also be used to support outpatient care. This system is currently stand-alone and not compatible with the CHCS II-T; however, plans are underway to integrate these systems with new releases of the software.

An in-theater survey is underway to determine current access to and use of CHCS II-T and NT by individual sites. Presently, it is difficult to determine completeness of data capture. Compliance with use is also difficult to monitor due to the problems encountered with inadequate JMEWS joining and closing reports. Some sites are opting to use patient tracking applications to input this data rather than using one of the PEMs.

Global Expeditionary Medical System (GEMS). GEMS is currently used by Air Force expeditionary medical (EMEDS) units for documenting in-theater outpatient care from Level III and below. Due to system electronic interface issues, GEMS does not directly feed into JMEWS. Instead, data are routed to the Air Force Institute for Operational Health (AFIOH) and the Air Combat Command (ACC) through secured, encrypted Unclassified but Sensitive Internet Protocol Router Network for unclassified electronic mail. ACC reformats the GEMS data and sends it to JMEWS. Completeness of GEMS data, like that of the other PEMs, is sometimes suspect, especially

regarding certain fields such as service affiliation. GEMS remains in use and a new fourth generation version is under development.

SNAP Automated Medical System (SAMS). SAMS is available on Navy ships and at some shore facilities. It has limited DNBI data, technological infrastructure, and reporting capabilities. The data generated by SAMS can be sent directly to JMEWS and to the National Maritime Intelligence Center. DNBI data from land units using SAMS can also be sent to JMEWS via CHCS II-T at selected sites.

Outpatient Data Collection and Reporting Processes. There are some limitations with the current DNBI data collection and reporting processes. Data quality and reporting practices differ substantially by Service and by unit, and there is often a lack of coordination among Services. A common problem is inconsistent naming of sites and limited continuity with the rotation of local personnel. An additional limitation that is common to all PEMs is the lack of cause coding for injury-related visits. Other issues limit analytical and response capabilities. For example, the current DNBI reporting strategy consolidates health outcomes into 18 broad categories. This scheme limits the ability to identify certain types of health events and outbreaks. Many of the current DNBI categories are rarely used and have little operational significance. Additionally, consideration needs to be given to revising or deleting the established response thresholds, which often overestimate or underestimate the true expected disease burden, depending on the category. Furthermore, the existence of such thresholds leads to continued reliance on them as a "standard," with many not realizing that rates vary considerably with the type of operational activity and deployment location. Instead, guidelines should be given on how to create thresholds that are specific for a given deployment or COCOM, based in part on unit and location history, pre-existing data, and operational impact.

Inpatient Care (Levels III-V)

Health data capture and reporting procedures at Level IV medical centers (e.g., Landstuhl Regional Medical Center in Germany) and Level V Continental US facilities (e.g., Walter Reed Army Medical Center and Bethesda Naval Medical Center) are fairly well developed and understood. There are long-standing procedures for documenting care in these facilities and the health surveillance infrastructure is well established. These data can be analyzed along with other post-deployment data, such as that collected on the post-deployment health assessments and reassessments, to facilitate determination of post-deployment health outcomes.

Level III hospitalization data collection occurs in the theater and is subject to various operational hurdles. The CHCS-NT software, which provides laboratory, radiology, and pharmacy capabilities, supports both outpatient and inpatient care. It was developed primarily to support Level III combat support hospitals (CSH), providing clinical inpatient functionality in addition to the ancillary services mentioned. To date this software has had limited utility in terms of DNBI analysis because it is unable to interface with CHCS II-T or other PEM software. CHCS-NT does interface with JMEWS and the Joint Patient Tracking Application (JPTA, see below). Some inpatient data reach JMEWS from GEMS and SAMS. However, there is no way to separate inpatient from outpatient records in GEMS (which was designed primarily for use in the outpatient

setting) and SAMS is rarely used to transmit data from the theater. CHCS II-T (Block 2) will combine both inpatient and outpatient functionality.

The Army's Patient Administration System and Biostatistics Activity (PASBA) currently extracts Standard Inpatient Data Records (SIDRs) for Level III Army hospitals using a separate system known as the Patient Accounting & Reporting Real-time Tracking System (PARRTS), which tracks patient movement through inpatient and outpatient care facilities. Data from non-Army medical facilities in-theater are not included in this database, a major limitation. The inpatient portion of the data is transformed into SIDR data after receipt of abbreviated medical encounter data, which are provided quarterly through in-theater Patient Administration Division (PAD) record submissions. These records are then updated upon receipt of hard copies of the patients' medical records. There is a significant lag (up to 6 months or more) in the finalization of data entry since these records are not available until the deployed units redeploy, at which point the hard copy medical record is shipped to PASBA for manual data entry. Because of the obvious delays and separate reporting chain, these data are currently excluded from the routine DNBI analysis performed by AFIOH. The PAD tool used in the Central Command theater of operations has now been replaced by the JPTA.

Patient Movement and Tracking

A number of DoD health information systems track patient movement through the levels of care in both the theater and garrison settings. These systems offer potential value as sources of data for health surveillance and DNBI analysis, since they offer more timely and complete access to information regarding patient encounters and health outcomes, including movement dates, textual summary information on the patient's condition, and ICD9 codes. There are some limitations with these systems, since they were not designed primarily for health surveillance.

US Transportation Command Regulating and Command and Control Evacuation System (TRAC^{2}ES). TRAC^{2}ES became operational as a DoD global tracking system in 2001. It was designed as a single system for peacetime, contingency, and wartime operations, providing an interface for all phases of patient movement, from the initial movement request through arrival at a required medical treatment facility. For most combatant command areas of responsibility, these movements are predominantly air transport via fixed-wing aircraft from Level III to Level IV facilities (i.e., out of theater as opposed to movements within the theater of operations). Because the timeliness and completeness of the TRAC^{2}ES data are reasonably good, and because the system operates primarily in the unclassified environment, TRAC^{2}ES has been utilized extensively for DNBI analysis. Additionally, the textual patient history field provides an opportunity to explore potential causes of injury. There are some limitations in using the TRAC^{2}ES tracking data for this purpose, such as multiple entries per patient and diagnosis changes with each movement.

Joint Patient Tracking Application (JPTA). JPTA was developed by the Landstuhl Regional Medical Center (LRMC) in Germany to track patients entering and leaving LRMC from the theater of operations. JPTA supports the TMIP and access accounts can be acquired through the DoD Force Health Protection portal. The application functions as a theater-level central data registry, capturing medical information from CHCS2-T, CHCS-NT, GEMS, TRAC^{2}ES, and other systems. As a data source, JPTA provides better granularity for both individual and aggregate

patient data. Through JPTA, providers at all levels of care now have visibility on their patients' status both up and down the medical transportation chain. Because JPTA offers identical functionality for tracking special category patients, it may replace PARRTS. JPTA is also able to interface with both TRAC^{2}ES and PARRTS, thereby facilitating information sharing between these systems and eliminating some duplicate data entry. There has been resistance to using JPTA in the field because duplicate data entry is often necessary as many of the in-theater health information systems are unable to intercommunicate and share data. Some theater sites have adapted JPTA for documentation of outpatient and inpatient data rather than the established PEMs and CHCS-NT software. This may be problematic from a surveillance standpoint because data captured by JPTA is less detailed than that captured in an electronic PEM health record, nor are surveillance algorithms run against the data.

Patient Accounting & Reporting Real-time Tracking System. PARRTS is a patient tracking system managed by the Army's Patient Administration System and Biostatistics Activity. It tracks movement of special interest patients through inpatient and outpatient care facilities. Personnel hospitalized in an area of operations are to be entered into the system within 24 hours of admission. Outpatient entries are required only for General Officer visits for potentially career threatening conditions. PARRTS routinely provides casualty location and medical condition information, and more detailed individualized data may also be obtained through arrangements with PASBA. However, the data are restricted to medical care in Army facilities. As previously mentioned, the PARRTS database is populated by PAD tool submissions, which then serve as the initial data source for PASBA inpatient data extractions. Delays may be encountered since this information is not fully translated into the Standard Inpatient Data Record until the hard copy medical record is received. Data captured by PARRTS alone may provide a timelier, albeit less complete, source for hospitalization and outpatient data for personnel tracked through this system.

Occupational and Environmental Exposures

Questions continue to arise regarding potential exposures that might influence DNBI surveillance, including disease vectors, occupational exposures, environmental contaminants, and exposure to local populations (including animal populations). Integration of such exposure data with health outcomes data is needed to provide a crucial link towards performing comprehensive health surveillance and developing appropriate prevention campaigns.

The DoD TMIP office is working to integrate the Defense Occupational and Environmental Health Readiness System (DOEHRS) currently used in garrison into the deployed setting, to enable the capture of exposure data in theater. The DOEHRS system is expected to include specific data-like environmental sampling, water surveys, and entomological surveillance. The first environmental health capability is projected to be released for Service field-testing in 2006. Current surveillance data are very site specific and the completeness of sampling data collected is variable.

The Deployment Environmental Surveillance Program (DESP) within the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) currently serves as the DoD archive for Defense Occupational and Environmental Health Surveillance (DOEHS) data, both classified and unclassified. DESP is also working to transfer veterinary surveillance data that currently

exists in Lotus Notes format to CHPPM for data archival. Most of the DESP data are collected through sanitary surveys and various other reporting systems. Such data are site-specific with unknown analytical potential.

Identifying and Tracking Deployment Related Exposures. DoD stands by its commitment to monitor, evaluate, document, retain, and report on any potentially hazardous deployment-related occupational and environmental exposures. The Department has implemented a comprehensive program for DOEHS, administered through the USACHPPM, to identify potential health hazards, mitigate adverse impact from exposures, and report and archive all relevant deployment-related occupational and environmental health surveillance data. The most current USACHPPM summary report on occupational and environmental monitoring for Operations Iraqi and Enduring Freedom, covering the period January 2003 through April 2005, contains results and analyses of nearly 3,900 air, water, and soil samples taken at over 300 locations. Complementing that data, the USACHPPM maintains approximately 10,000 additional environmental surveillance and preventive medicine documents from the US Central Command area of responsibility. Collectively, these occupational and environmental health surveillance documents give the Department a clear look at the operational environments in which our servicemembers are deployed.

Processes for identifying, reporting, and tracking deployment-related occupational and environmental exposures are in place and operating effectively. The following exposure incidents were included in the department's report to Congress on Force Health Protection Quality Assurance (dated September 29, 2005):

- **Al Samawah Railroad Repair Facility**. Concerns about possible exposure to depleted uranium among 167 soldiers of the 442nd Military Police Company deployed to Iraq in the spring of 2003.
- **Qarmat Ali Water Treatment Plant.** Concerns about possible chemical contamination at that location, including sodium dichromate, polychlorinated biphenyls (PCBs), and chlorine, which was leaking from gas cylinders.
- **Baghdad Sarin Exposure.** Two US military explosive ordnance disposal experts were exposed to Sarin, a chemical warfare nerve agent, from an improvised explosive device.
- **Al Mishraq Sulfur Plant.** US military personnel, along with Iraqi firefighters and civilians, were exposed to various combustion products (including sulfur dioxide and hydrogen sulfide) that exceeded civilian (EPA) and military guidelines, while fighting a fire over a two-month period in 2003.

In all cases, incident-specific information on occupational and environmental exposures is being placed in the medical records of individual Service members. Rosters of Service members involved in specific incidents were also developed to facilitate future contact for treatment or evaluation by DoD, as well as claims adjudication or clinical case management by the Department of Veterans Affairs. With the possible exception of exposures from the sulfur mine fire at Al Mishraq, for which follow-up evaluations continue to be monitored by the USACHPPM, there are no indications of any significant long-term adverse health effects for US Service members. Ongoing clinical follow-up for identified individuals and cohorts is accomplished at the installation level with additional support available from the Deployment Health Clinical Center

(DHCC), located at the Walter Reed Army Medical Center in Washington, DC, for cases involving special exposures such as individuals with embedded metal fragments (e.g., depleted uranium).

Special Registries

Trauma Registries. The Joint Theater Trauma Registry (JTTR) and the Navy-Marine Corps Combat Trauma Registry (NCTR) consolidate and expand upon deployment health surveillance data specific to traumatic injuries.

The JTTR assimilates inpatient data gathered at deployed Army hospitals, TRAC2ES data, and casualty data from the Defense Casualty Information Processing System (DCIPS) attributable to traumatic injury. Registrants are evaluated further to determine the primary cause of injury. The bulk of the data collected through the JTTR is of limited use to overall DNBI surveillance because it is biased towards traumatic injuries requiring hospitalization. It does not address illnesses and omits less severe injuries treated as outpatients. There are also significant delays in data capture due to problems (previously noted) with Level III inpatient data collection and reporting.

The NCTR began collecting similar information in 2004, but the information extends to illness and covers both inpatient and outpatient visits, primarily to Marines involved in land-based operations. The NCTR data are fairly complete for fields related to injury and personal protective equipment worn. However, much of the data received is in hard copy format, though the amount coming in electronically is increasing.

Mortality Registry. The Armed Forces Institute of Pathology (AFIP) performs full autopsies on every US Service member who dies in theater. This results in extensive information regarding the cause(s) of death, injury patterns, the role of protective equipment, and emerging infectious diseases.

Applicability to Future Research on Health Issues. The DoD trauma registries and mortality registry are rich sources of research data for developing protective equipment and tactics. The other deployment health surveillance systems all have potential value in helping to identify the most appropriate preventive measures for various operational environments, but current limitations in the quality of the data prevent immediate use for this purpose.

POST-DEPLOYMENT HEALTH ASSESSMENTS AND REASSESSMENTS

The Department of Defense requires returning Service members to undergo post-deployment health assessments (PDHA) to document current health status, experiences, environmental exposures, and health concerns related to their military service while deployed. These assessments enable health care providers to promptly refer those needing medical evaluation and care. The Assistant Secretary of Defense (Health Affairs) mandated post-deployment health assessments and the associated DD Form 2796 in an October 1998 policy memo. Key components of the post-deployment assessment process include:

- The DD Form 2796 (Post-Deployment Health Assessment) is completed within five days of redeployment from the theater to the Service member's home station.

- A health care provider reviews the form, interviews the Service member, and recommends additional clinical evaluation or treatment as needed.
- Copies of the DD Form 2796 are placed in the Service member's medical record and the central electronic database of the Defense Medical Surveillance System.
- Registered health care providers can access electronic copies of the DD Forms 2796 via TRICARE Online.
- Additional post-deployment testing, such as serum samples or tuberculosis skin testing, occurs at specified intervals following redeployment.
- Post-deployment blood specimens are collected within 30 days of redeployment to produce serum that is frozen and archived in the DoD Serum Repository.
- A post-deployment health reassessment (PDHRA) (using the DD Form 2900) occurs within 90-180 days following redeployment. (This is a new requirement with full-scale implementation expected in early 2006.)

Between January 2003 and August 29, 2005, redeploying Service members completed over 1,000,000 Post-Deployment Health Assessment forms. This equates to approximately 750,000 unique Service members, some of who have deployed more than once. Compliance with post-deployment health surveillance requirements is monitored both by the individual Services and the DoD Deployment Health Support Directorate. Results from reviews in CY2004 showed consistently good performance. During four installation audits by the General Accounting Office in 2003, only 65 percent of DD Form 2796s were found in health records and 44 percent in the central DMSS database. However, during three of the four DHSD joint installation visits in 2004, DD Form 2796 compliance rates were 94 percent in health records and 84 percent in the central database respectively—a marked improvement.

As with the pre-deployment health assessments, conversion to an electronic data entry process was seen as a critical step to improving the effectiveness of this program. Since January 2005, the Army and Air Force have provided virtually all DD Form 2796s electronically. The Navy and Marines are in the midst of deploying their solution and expect to have a totally electronic system in use soon.

Responsiveness to post-deployment health concerns was determined through analysis of Service member and health care provider information on the DD Form 2796. As part of the post-deployment health assessment process, health care providers conduct face-to-face interviews with returning servicemembers and document any existing concerns about their general health, mental health, and any exposures or events during the deployment that they think may affect their future health. The central DMSS database was queried to determine positive responses to any of the above three post-deployment questions, along with responses to four mental health-related questions in the servicemember self-completion section of the assessment questionnaire. DMSS data was also collected on provider-recommended referrals for additional evaluation, as well as the number and timeliness of Service members seen for post-deployment follow-up care in the military health system.

Key findings and observations from a review of 138,332 Service members who redeployed in CY2004 were provided in the Department's interim report to Congress on Force Health Protection quality assurance (April 2005) and include the following:

- Approximately 53 percent (73,817) of the Service members indicated no post-deployment health concerns, per negative responses to the seven questions previously noted from the DD Form 2796, Post Deployment Health Assessment.
- Service members were more likely to indicate post-deployment concerns about their mental health (36 percent) than about general health (19 percent) or exposures (21 percent).
- Service members for whom referrals were indicated received follow-up care within 90 days in the military health system at a slightly greater rate for general health or exposure concerns (89 percent) than for mental health concerns (80 percent). It should be noted that a 100 percent referral completion rate is highly unlikely, due to improvements in health status or individuals changing their minds. This could more likely be the case for mental health concerns, where there are alternative sources of counseling and support such as clergy, respected relatives, or close friends. Conversely, the results can be lower because of unwillingness to seek follow-up care for a variety of reasons, including stigma. However, we would expect that Service members who were willing to answer the questions positively and discuss them with the reviewing health care provider during the post-deployment process probably would not be as concerned about perceived stigma.
- The Marine Corps has been analyzing and aggressively addressing the relatively low rate for completion of follow-up referrals. Many of these referrals are for minor medical conditions typically treated at Battalion Aid Stations, which often lack the capability of capturing encounter data in automated information systems. At this time, gaining an accurate picture of the Marine Corps referral completion rate would require a manual review of the physical medical records of all Marines who deployed. Although not feasible for the entire Corps, individual medical records are reviewed during on-site deployment health QA visits, and results have been considerably higher than those found within central electronic databases. For example, during a recent review at Camp Pendleton, the referral completion rate was 90 percent (140 medical records reviewed, 29 with referral recommended, and 26 of 29 with appropriate referral documented in the medical record).
- Compliance for post-deployment serum sampling was consistently high across all the Services, ranging from 95 percent to 98 percent.

The post-deployment health assessment process begins while the Service member is still deployed. Individuals complete the self-reporting tool (DD Form 2796) and interact with a health care provider within five days of leaving the theater. Any clinically urgent referrals are accomplished before the individual embarks, while routine referrals are accomplished after the individual returns to home station or demobilization site. This process is well established and working well. However, there is the possibility that some conditions will not manifest until weeks to months after the individual has returned home. Examples of such conditions include visceral leishmaniasis, malaria, or post-traumatic stress disorder. In order to better identify these conditions and offer appropriate care, DoD has implemented a post-deployment health reassessment program. Accomplished between three and six months after returning from deployment, the purpose is to provide early identification and treatment for deployment-related health concerns that might not otherwise come to the attention of the healthcare community.

The PDHRA process is similar to the PDHA process. The DD Form 2900 is the PDHRA self-reporting tool and contains many of the same questions about general health, mental health,

and exposure concerns that are found on the DD Form 2796. This facilitates comparisons over time for each individual. The DD Form 2900 has been designed to be used as an electronic form from the beginning, thereby eliminating the problem of lost hard copies encountered with the DD Forms 2795 and 2796 (see above). The Department has already contracted for an independent study of the validity and effectiveness of the DD Form 2900 as a health assessment tool. This study will assess the data collected after the program is fully implemented in late 2005.

BLOOD SAMPLING PROCEDURES

DoD has collected pre- and post-deployment serum samples for years. Upwards of 37 million samples are currently archived in the DoD Serum Repository, the largest such repository in the world. The Department asked both the Centers for Disease Control and Prevention (CDC) and the Armed Forces Epidemiology Board (AFEB) to render opinions regarding the value of such a repository and the optimal timing for obtaining the samples before and after deploying. DoD's questions and the responses from these two nationally recognized bodies are as follows:

- *Is there an evidenced-based reason for DoD to continue to routinely collect and store pre- and post-deployment serum specimens?* Both bodies agreed that there was good evidence of the value of such specimens for clinical use (diagnosing specific clinical and subclinical infections), public health surveillance (monitoring the incidence of various infectious diseases and possibly for chemical exposures), and research purposes.
- *Are there medically recognized biological media that DoD should be collecting?* For most purposes, the collection of serum with white blood cells before and after deployment is adequate. In order to assess chemical exposures, serum and urine samples would need to be collected as soon as possible (within hours or at most a few days after the exposure event) rather than waiting until after returning from the theater.
- *What is the appropriate time frame for sampling, should samples be obtained on all deployed forces, or only for a statistically significant cohort?* Pre-deployment collection within one year of the deployment and post-deployment collection within 30 days of return is adequate. Given the diverse potential uses for samples, it is more efficient to sample the total deployment population rather than to identify statistically significant cohorts.

EVOLVING DEPLOYMENT HEALTH SURVEILLANCE TECHNOLOGY

Efforts to revolutionize DoD deployment health surveillance systems are ongoing. The Deployment Health Support Directorate (DHSD) is the lead agent in this endeavor and is making significant progress. DHSD has successfully established a JMEWS data feed into the Clinical Data Repository (CDR). This will facilitate transfer of health information to the central DMSS database for permanent archival that, in turn, will expedite linkage of electronic data streams throughout a Service member's deployment cycle and enable longitudinal assessments of potential long-term post-deployment health outcomes. Currently estimates indicate that complete inpatient data capture testing will be available as of May 2007, at which point initial laboratory and radiology data capture testing will begin; however, the lab component testing is not estimated to reach complete testing phases until May 2008 and May 2009.

An additional and evolving data tool for the capture of denominator (population at risk) data in theater is the Deployed Theater Accountability Software developed by the Army Human Resources Command. The system just started collecting individual personnel data such as SSN, demographics, base camp, arrival date, and unit identification code. The data are estimated to be about 80 percent complete for Army and Marine Corp forces, and about 20 percent complete for Navy and Air Force personnel. The system itself is classified (Secret) and can only be accessed via the SIPRNET, although data are transferrable to the unclassified Joint Patient Tracking Application.

SUMMARY

DoD has improved medical tracking and health surveillance systems, programs, and processes across the spectrum of deployment-related activities. Automation of the pre- and post-deployment health assessment forms is a major step toward full data capture and retention, while implementation of the post-deployment health reassessment better ensures early identification and treatment of emerging health concerns. Both the Joint Medical Work Station (JMEWS) and the Joint Patient Tracking Application (JPTA) have proven instrumental in integrating data from multiple, often incompatible sources and generating vital health surveillance information. Systems like CHCS II-T and Battlefield Medical Information System Tactical – Joint (BMIST – J) jointly collect deployment health information on individuals and populations across all distinct operational levels of care. Potentially hazardous exposure data are reported, tracked, and archived through the comprehensive Deployment Occupational and Environmental Health Surveillance system. The Department has also obtained guidance on deployment blood sampling procedures from two nationally recognized professional entities, and is working diligently to improve capabilities for determining deployment denominator data.

RECOMMENDATIONS

These recommendations are under consideration regarding DoD medical tracking and health surveillance systems:

- Expand use of CHCS II-T as the standard theater health information system to all Services.
    - CHCS II-T (Block 2) development, testing, and fielding should be accelerated to eliminate the need for Service-specific PEMS, reduce duplicate data entry, provide consistent data collection, and consolidate both outpatient and inpatient medical information into a single system.
    - While awaiting full deployment of CHCS II-T (Block II), pursue interim use/adaptation of available systems (i.e. CHCS II-T Block I, GEMS, SAMS, PARRTS, and JPTA) for real-time monitoring of inpatient conditions in-theater.
- Integrate health event and exposure data to create longitudinal health surveillance.
- The accuracy, completeness, and timeliness of in-theater denominator data (of deployed Service members) should be improved.
- JMEWS should continue to be used to track and monitor DNBI.
- Current DNBI reporting categories and thresholds should be re-evaluated. Models such as those used by the Electronic Surveillance System for Early Notification of Community-based Epidemics (ESSENCE) should be explored.

- Reconcile BI and NBI definitions among personnel, safety, and medical reporting systems.
- Routine in-garrison analysis of outpatient and inpatient events using DNBI categories would facilitate training across the Services and establish baseline in-garrison DNBI rates for comparison purposes.
- Continue expanding the Force Health Protection QA program to ensure consistent and effective monitoring of medical tracking and health surveillance programs.
- Complete the transition to a fully electronic reporting system for the three deployment health assessment tools (DD Forms 2795, 2796, and 2900).
- Pursue formal validation of the post-deployment health assessment tool (DD Form 2796) and complete validation of the post-deployment health reassessment tool (DD Form 2900).