

## Deployment Health Surveillance

**Anthony D. DeNicola**

Deployment Health Support Directorate  
5113 Leesburg Pike, Suite 901  
Falls Church, Virginia 22041  
USA

[Tony.denicola@deploymenthealth.osd.mil](mailto:Tony.denicola@deploymenthealth.osd.mil)

### **ABSTRACT**

*The Gulf War drove home the need for a comprehensive deployment health surveillance system. Gulf War health questions have resulted in controversy over potentially hazardous exposures during the deployment, the possibility of adverse affects from preventive health measures, and the role of stress in causing chronic illness. The lack of comprehensive deployment health surveillance has made it difficult to determine possible causes of adverse health effects reported by Gulf War veterans.*

*In response, the military health system has undergone a fundamental reorientation. Today, a bold deployment health surveillance initiative, called the Theater Medical Information Program (TMIP), is part of a layered force health protection system. TMIP is a very large information system that will integrate several service medical information systems to ensure interoperable support for rapid mobilization, deployment, and sustainment of all theater medical services in support of any mission.*

*TMIP is being implemented incrementally, and one of the first elements to be fielded is the Joint Medical Workstation (JMeWS), which was deployed in January 2003 to support Operation Iraqi Freedom. JMeWS is a Web based application that allows commanders and medical planners to monitor the physical well being of their service members and theater medical treatment facilities capabilities. JMeWS provides the capability to view information at the theatre level or to drill down to patient records. Information collected can also be analyzed for health trends, which has already proven to be effective: Early last spring, the JMeWS system showed a sharp upward trend in service members in the Iraq theatre who were treated for combat stress. Commanders reacted by quickly sending combat stress specialists into the field to help troops cope with the stress.*

*TMIP development will continue through incremental deployments of subsystems like JMeWS until full TMIP implementation is achieved.*

### **1.0 INTRODUCTION**

The need for a deployment health surveillance system emerged in 1990 during Operations Desert Shield and Desert Storm. The need was reiterated a few years later when Gulf War veterans began reporting fatigue, joint pain, sleep problems and other symptoms that have not been definitively explained. Gulf War health questions have resulted in controversy over potentially hazardous exposures during the deployment, the possibility of adverse affects from preventive health measures, and the role of stress in causing chronic illness.

*Paper presented at the RTO HFM Symposium on "NATO Medical Surveillance and Response, Research and Technology Opportunities and Options", held in Budapest, Hungary, 19-21 April 2004, and published in RTO-MP-HFM-108.*

# Report Documentation Page

Form Approved  
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE <b>00 JUN 2004</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>Deployment Health Surveillance</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Deployment Health Support Directorate 5113 Leesburg Pike, Suite 901 Falls Church, Virginia 22041 USA</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM001747, RTO-MP-HFM-108, NATO Medical Surveillance and Response, Research and Technology Opportunities and Options (La surveillance médicale et les réponses au sein de IOTAN: les possibilités et les options pour la recherche et la technologie)., The original document contains color images.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>UU</b>	18. NUMBER OF PAGES <b>10</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

## **Deployment Health Surveillance**

---

- The coordination of a joint force attack and threat of chemical and biological warfare agents emphasized the need for a common operational picture to support medical decision-making on the battlefield.
- The importance of a robust deployment health surveillance system and the myriad problems of not having one became even more apparent as the Department of Defense began investigating the possible causes of Gulf War Illnesses.
- Inconsistent patient encounter record keeping in theater, limited data on battlefield and occupational environmental exposures, and lack of pre- and post-deployment baselines made it difficult to determine the cause of adverse health effects reported by Gulf War veterans.

### **1.1 Deployment Health Surveillance, Part of a Layered Force Health Protection System**

In response to health questions following the Gulf War and the increasing demands of a series of hazardous deployments, the military health system has undergone a fundamental reorientation.

Lessons learned from the Gulf War have driven changes in the approach the U.S. Department of Defense takes to protect the health of military forces. Today, deployment health surveillance is part of a layered force health protection system, which is a continuum of programs to maintain the health and provide multiple layers of protection to service members and their families throughout their military service.

Force health protection covers three broad areas:

- Fitness and Health;
- Protection and Prevention;
- Treatment and Care.

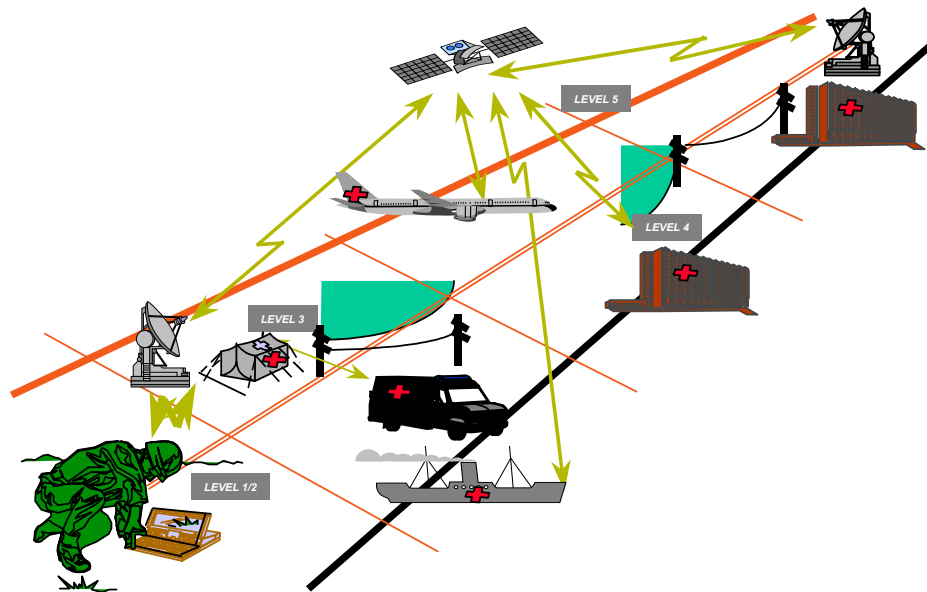
Medical surveillance is part of Protection and Prevention, which provides an array of medical technologies and capabilities to protect service members, including:

- Individual protective suits, masks and boots;
- Chemical and biological detection systems to alert if an agent is in the environment;
- Medical surveillance systems that provide near-real-time theater-wide information on environmental hazards, blood supply, antibiotic supply, and availability of other medical equipment.

### **1.2 Theater Medical Information Program (TMIP)**

At the center of the U.S. Department of Defense's medical surveillance initiative is the Theater Medical Information Program, commonly called TMIP. TMIP will integrate several service medical information systems to ensure precise, interoperable support for rapid mobilization, deployment, and sustainment of all theater medical services in support of any mission.

TMIP is a very large information system, which is being fielded incrementally. Components of the system are put into service as soon as they are ready, without waiting for the entire system to be finished. When the system is complete, theater commanders will be able to track trends, take preventive action, and keep their forces fit through the TMIP's ability to collect, analyze, and use collective medical information across the services throughout the theater in near real-time. Using TMIP, commanders will be able to determine the location and health status of injured warfighters anywhere in the theater.



**Figure 1: Medical information will be captured from lowest levels of care and will move with the patient and, in most cases, ahead of the patient through levels of care in the theater.**

TMIP addresses specific deficiencies in:

- Limited health care data collection for post-operational analysis (e.g., Gulf War Illnesses);
- Insufficient interoperability between the services' medical operational forces;
- Inadequate automation for medical situational awareness;
- Lack of patient visibility (where is PFC Smith and how is he doing?).

### 1.3 Joint Medical Workstation (JMeWS)

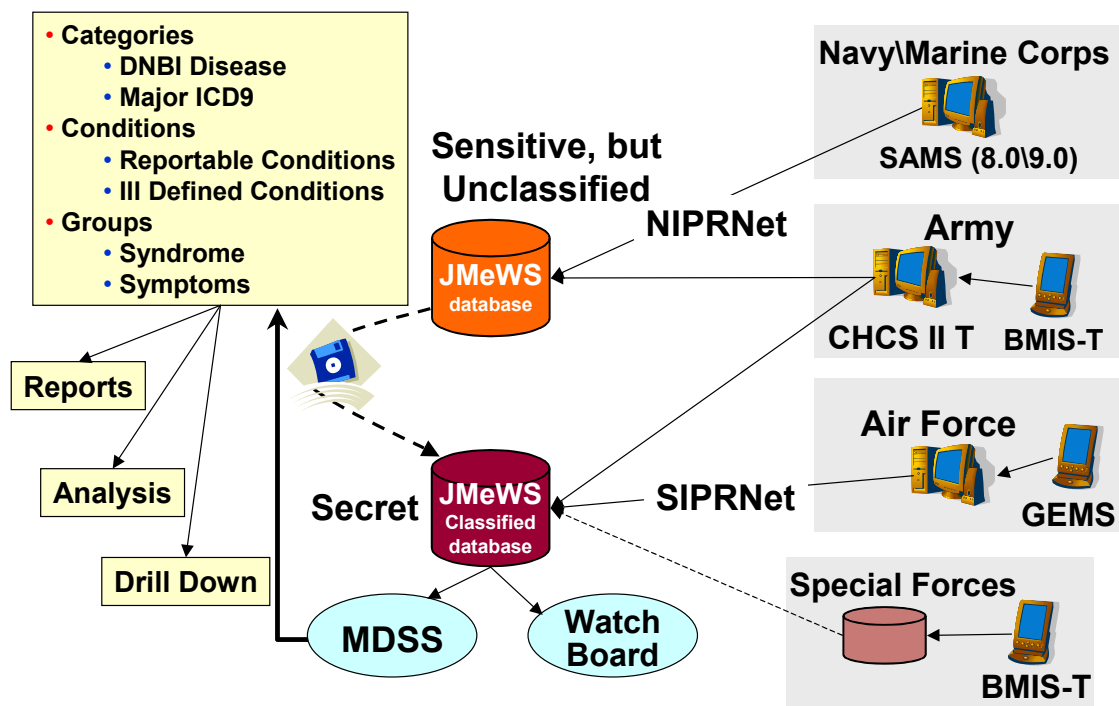
The Joint Medical Workstation, called JMeWS, is an element of TMIP that was deployed in January 2003 to provide to commanders online, near-real-time medical situational awareness for forward-deployed forces during Operation Iraqi Freedom.

Information from four military medical surveillance systems is sent to JMeWS databases, where it is integrated and made widely available through classified and unclassified Internet to theater commanders, medical planners, and others who need the information.

## Deployment Health Surveillance

Four applications running on the JMeWS system provide reporting, analysis and drill-down capabilities:

- Watchboard and Medical Common Operating Picture (MedCOP) provide graphical user interface to view and drill down into medical logistics and operational information;
- Medical Data Surveillance System (MDSS) and the Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE) provides information on chemical, biological, or radiological exposures, disease and non-battle injuries, and major ICD-9 Code reporting and analysis capability.



**Figure2: JMeWS integrates medical surveillance information from four service systems. Applications running on JMeWS, such as MDSS and Watchboard, provide reporting, analysis, and drill-down capability.**

### 1.3.1 JMeWS Secure Web-Based Access

The JMeWS applications suite is accessed through the Deployment Health Support Directorate's Force Health Protection portal, which is an unclassified web site accessible through the Non-Classified Routing Network (NIPERNet), that acts as a gateway to sensitive or classified information that military medical planners use in performing their mission. Access to the unclassified-but-restricted JMeWS system is made through the Force Health Protection portal's home page. Only computers operating in the dot-mil domain can see the home page, and a login and password are required to go beyond the home page. Users must register to obtain a login and password.

The classified JMeWS web site can only be accessed through the U.S. Department of Defense's Secret Internet Protocol (SIPERNet), which requires the user to have an account and special equipment.

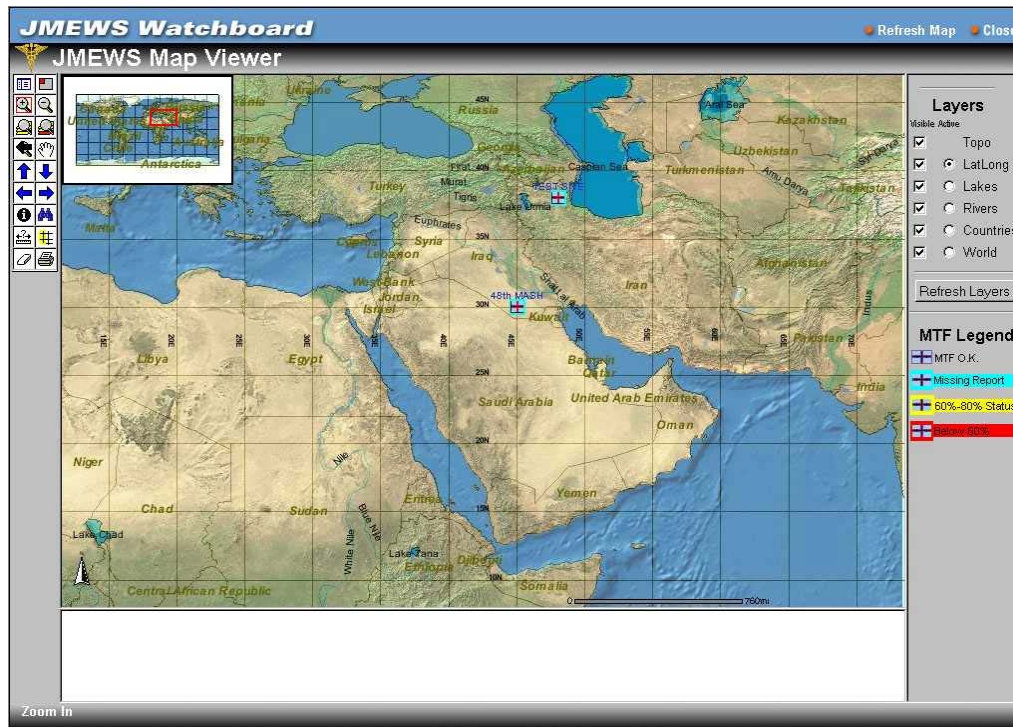
### 1.3.2 JMeWS Principal Functions

JMeWS two principal functions are command and control and real-time medical surveillance.

#### 1.3.2.1 Command and Control

When a medical treatment facility is established, designated personnel submit a joining report and various capability reports to the system through the JMeWS online reporting application. These reports include information such as location, equipment, supplies, blood, and personnel. Medical Treatment Facilities update these reports every day.

Once the report is updated, the Medical Treatment Facility has literally placed itself on the map. Theater commanders and medical planners can see where treatment facilities are located on the JMeWS map viewer, and by clicking on a facility icon, they can get an overview of the current status and capability of that facility.



**Figure 3: The JMeWS Watchboard provides a graphical interface for Military Treatment Facility operational status and capability.**

The status of capabilities is color-coded, so commanders and medical planners can get a status overview with a quick glance. With a click, users can drill down further and get detailed reports on the specific capabilities of each facility, such as the number of operating rooms, x-ray machines, and ground ambulances, or they can drill down further and get a report showing how much of each type of blood is on hand. The Watchboard also provides the capability of taking a macro view at the Theater, Component, Joint Task Force, or other command and control level, or the user can conduct a custom search for information.

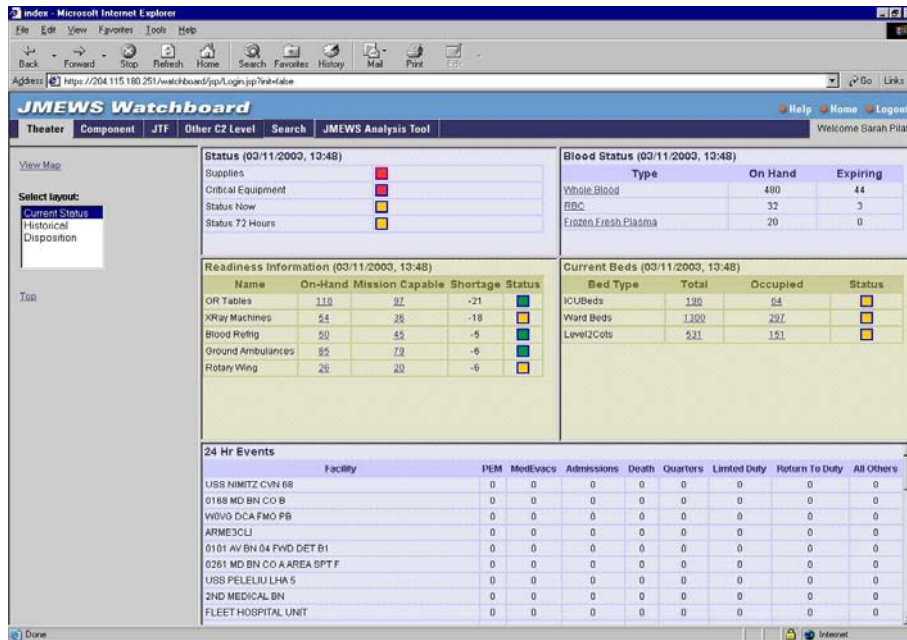


Figure 4: Medical Treatment Facility status and capability of can be viewed from the Theater down to the individual facility.

1.3.2.2 Real-Time Medical Surveillance

The second principal function of JMeWS is medical surveillance. When a patient visits a treatment facility, an electronic copy of his or her record is submitted to the JMeWS system. That, in turn, provides JMeWS with the ability to show real-time patient status. So, with a click of a button, a theater surgeon can see how many patients were treated at his facilities and what their dispositions are. The system also provides users with the ability to drill down to individual patient records.

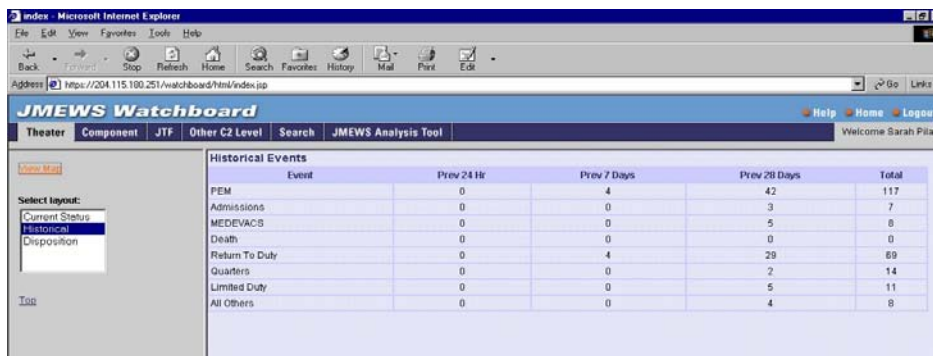
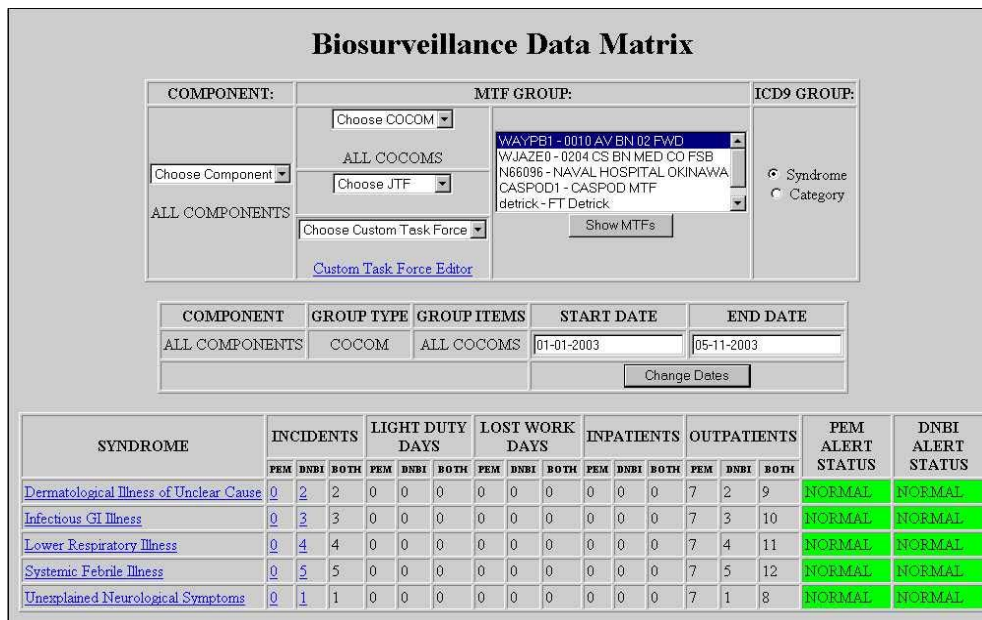


Figure 5: Patient records are uploaded to JMeWS in real time. Through the JMeWS Watchboard a theatre surgeon can get both a real-time and a historical update of patient care at his facilities.

Treatment facilities without the ability to submit the entire patient record to JMeWS use a Disease and Non-Battle Injury report, commonly called a DNBI report, to indicate the number of patient visits to that particular facility.

### 1.3.3 Analysis Capability

Several JMeWS applications analyze data derived from patient records and DNBI reports looking for abnormalities. These applications use historical data in the JMeWS system to establish a baseline. When new data comes in it is compared to the baseline to determine if the new data shows an abnormal trend. If the new data is beyond parameters established for the normal range, the system will issue an alert.



**Figure 6: If new data is above parameters set for the normal range, the system will issue an alert. The JMeWS system posted an alert because of an increase in the number of reported combat stress of at the end of fighting in Iraq last spring, which prompted commanders to dispatch combat stress specialists to the theatre to treat service members affected by combat stress.**

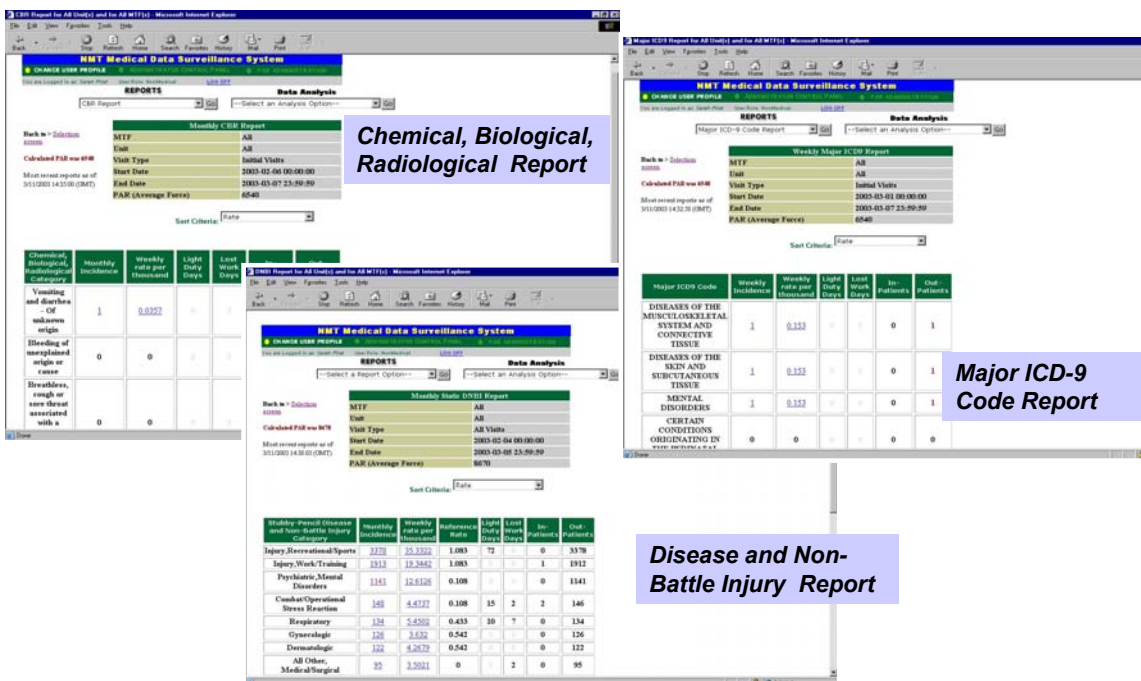
If the JMeWS surveillance tools alert for spikes in particular areas, the command surgeon can investigate the possible causes of the spike by searching the database for patients with particular symptoms. If the spike was caused by an environmental exposure, the information in patient records may determine where or how an exposure occurred.

Additional reports provide users with the capability to drill down even further, to get details behind reports such as the Chemical, Biological and Radiological, DNBI, and the Major ICD-9 Code Reports.



# Deployment Health Surveillance

Events				Demographics							
MTF	Disposition	Date	Event Type	SSN:	565921202	LastName:	BACALL				
MISAWA AFB	RETURNED_TO_DUTY	2003-03-07 09:00:00.0	PEM	FirstName:	LAUREN	MiddleName:	M				
				Branch:	USAF	Rank:					
				Unit:	35 MDOS	UIC:					
				Gender:	Male	DOB:	02/17/2001				
				Current Age:			1				
Last Name:		BACALL		SSN:	565921202	UNIT:	35 MDOS				
Facility:				GPS Location:		Provider:	Status: Finalized				
Encounter Date:		03/07/2003 0900		Report Date:	03/07/2003 1650						
Disposition:		RETURNED_TO_DUTY		Disposition Duration:	0	Lost Days:	0 Lite Days: 0				
Duty Limitations:				Referred/Evac Mode:		Other Dispositions:					
Referred/Evac Location:				Circumstance:	Unknown	Prognosis:	Initial Visit: FollowUp				
DNBI:		MISC/ADMIN/FOLLOW-UP									
ICD9 Code				Diagnosis							
V20.2				Well baby exam							
Major		Minor		Duration		Duration Unit					
GENERAL		HEAD CIR: 45 cm									
Height:		Weight:		Tobacco Use:		Alcohol Use:					
Vitals Date	BP Systolic	BP Diastolic	BP Location	BP Position	Temperature	Temp Method	Pulse Rate	Resp Rate	Pulse Rhythm	Pulse Character	Pulse OX pct
03/08/2003 0045				Sitting	98.7		110	22			



**Chemical, Biological, Radiological Report**

Chemical, Biological, Radiological Category	Monthly Incidence	Weekly rate per thousand	Light Duty Days	Lost Work Days
Vomiting and diarrhea - Of unknown origin	1	0.0352		
Bleeding of unexplained origin or cause	0	0		
Breastlumps, lumps or sore throat associated with a	0	0		

**Major ICD-9 Code Report**

Major ICD9 Code	Weekly Incidence	Weekly rate per thousand	Light Duty Days	Lost Work Days	In Patients	Out Patients
DISEASES OF THE MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE	1	0.153			0	1
DISEASES OF THE SKIN AND SUBCUTANEOUS TISSUE	1	0.152			0	1
MENTAL DISORDERS	1	0.152			0	1
CERTAIN CONDITIONS ORIGINATING IN THE PERINATAL PERIOD	0	0			0	0

**Disease and Non-Battle Injury Report**

Stability - Period Observed and Non-Battle Injury Category	Monthly Incidence	Weekly rate per thousand	Reference Rate	Light Duty Days	Lost Work Days	In Patients	Out Patients
Injury, Recreational/Sports	2272	35.2352	1.083	72		0	3378
Injury, Work/Training	1912	29.2652	1.083			1	1912
Psychiatric/Mental Disorders	1141	17.6126	0.108			0	1141
Combat/Operational Stress Reactions	149	4.4727	0.108	15	2	2	146
Respiratory	134	5.4502	0.433	10	7	0	134
Gynaecologic	126	3.632	0.542			0	126
Dermatologic	122	4.2672	0.542			0	122
All Other, Medical/Surgical	95	3.5011	0		2	0	95

Figure 7: Individual patient records and other reports provide information for further analysis into the possible causes of alerts.

## **2.0 NEXT STEPS**

We are planning for transition and implementation of JMeWS into the full TMIP suite while simultaneously accelerating the incremental implementation of TMIP applications like JMeWS. And to ensure the continuous flow of information while the system is in development, care must be taken to maintain interfaces with current Service systems until the TMIP system is fully implemented.

There will be a considerable information influx as the systems that form TMIP evolve. An impact study must be conducted to ensure that the system's ability to handle data evolves in concert with the growth in data.

## SYMPOSIA DISCUSSION - PAPER 9

**Authors Name: Mr Denicola (US)**

**Discussor's Name: Capt (RNL)Hovens (NL)**

**Question:**

Are there programs where Non-US nationalities can join because peace keeping/ peace enforcing operations consist of multi-nationalities? They will cause "blind spots" if not joined.

**Author's Reply:**

There are systems in development that will be able to collect this data.

**Authors Name: Mr Denicola (US)**

**Discussor's Name: Prof. Dr Von Restorff (GE)**

**Question:**

- 1) How long does it take to enter all the information into the system?
- 2) Would that time be taken away from the patient-care-time or do you need additional personnel?

**Author's Reply:**

- 1) The patient encounters are not a problem with system speed.
- 2) The web pages can be a problem, based on bandwidth.

**Authors Name: Mr Denicola (US)**

**Discussor's Name: Prof. Dr von Restorff (GE)**

**Question:**

How much effort did you put into the software – ergonomics of your system?

**Author's Reply:**

The user testing defined the screens so there has been no formal operational testing for human factors to date.