

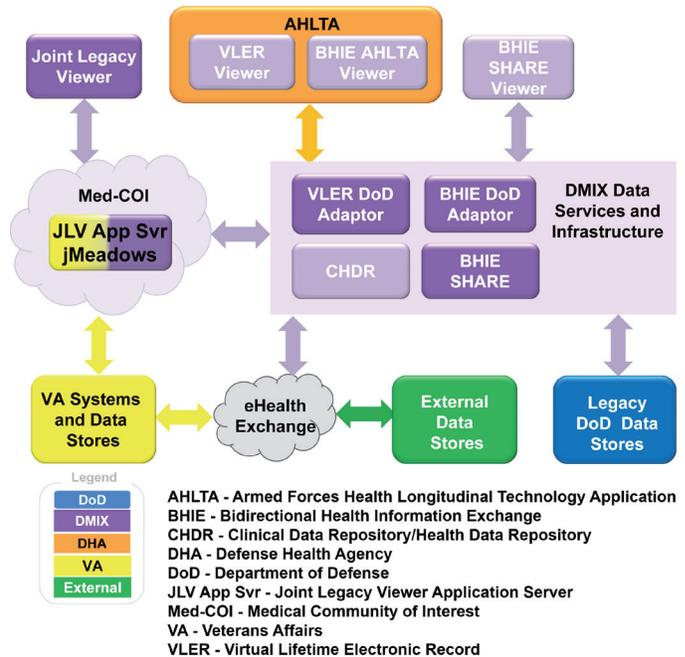
# Defense Medical Information Exchange (DMIX)

## Executive Summary

- In January 2014, the USD(AT&L) directed the Program Executive Officer (PEO) for DOD Healthcare Management Systems (DHMS) to align all health data and interoperability programs, projects, and initiatives between DOD and external organizations under a single program and develop a Health Data Sharing and Interoperability Roadmap that includes an acquisition and technical strategy based on functional requirements.
- PEO DHMS created an Automated Information System called Defense Medical Information Exchange (DMIX). The DMIX program provides the infrastructure and services to support the integrated sharing of standardized health data among the DOD Healthcare Management System Modernization (DHMSM) system, DOD legacy systems, the Department of Veterans Affairs (VA), other Federal agencies, and private sector healthcare providers.
- The DOD is acquiring DHMSM to replace DOD legacy healthcare systems including the Armed Forces Health Longitudinal Technology Application (AHLTA), the Composite Health Care System, and the Electronic Health Record (EHR) component of the Theater Medical Information Program – Joint program. Together, DHMSM and DMIX are intended to modernize the Military Health System to enhance sustainability, flexibility, and interoperability, for improved continuity of care.
- The DOD is developing DMIX incrementally, delivering upgrades to capabilities that have already been fielded. During FY14, three major capabilities were upgraded:
  - Data Federation
  - Virtual Lifetime Electronic Record (VLER)
  - Integrated Electronic Health Record (iEHR).

## Data Federation

- The 2014 National Defense Authorization Act required that all healthcare data contained in the DOD’s AHLTA and the VA’s Veterans Health Information Systems and Technology Architecture (VistA) systems be computable in real time and in compliance with national standards by October 1, 2014. The DOD and VA created clinical terminology maps to associate health data from AHLTA and VistA to a common set of terms based upon the Health Data Dictionary. The DOD and VA delivered terminology maps for seven clinical domains in November 2013 to support Data Federation Release 0 (DF R0). The DMIX Program Management Office (PMO) loaded the clinical terminology maps into a multiple mapping table in DF R0 to associate over 64,000 terms across the 7 clinical domains. The DMIX PMO intended for subsequent DMIX DF releases to add terminology maps for 21 additional clinical data domains.



- The DOD and VA were unable to deliver additional terminology maps to support the testing and fielding of DF R1 in September 2014. Although no maps were delivered, the DMIX PMO developed DF R1 to allow users to view unmapped patient data for an additional eight clinical domains. DF R1 included updates to both the Joint Legacy Viewer (JLV) and the Bi-directional Health Information Exchange (BHIE) DOD Adapter. The DMIX PMO conducted DF R1 system integration testing, validating the ability to view both mapped and unmapped patient data within 15 clinical domains.
- A DF R0 operational assessment was scheduled for January 2014, but the PEO DHMS did not support operational testing of this release; therefore, none was conducted.
- Using data from live operations, DOT&E determined that DF R0’s operational availability was 53.19 percent, which was unacceptably low. The types of failures and frequency of occurrence suggested systemic problems in the DMIX architecture and supporting network infrastructure.
- Operational testing of DF R1 is planned for 2QFY15.

## Virtual Lifetime Electronic Record (VLER)

- The DMIX PMO conducted system integration testing of VLER v2.0.2.0 in September and October 2014. The Army Test and Evaluation Command (ATEC) and United States Army Medical Department Board (USAMEDDBD) will

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test VLER v2.0.2.0 as part of DMIX R2 operational testing in 3QFY15.

## **Integrated Electronic Health Record (iEHR)**

- In January 2014, USD(AT&L) directed PEO DHMS to: (1) transition all relevant iEHR Increment 2 clinical application requirements to the DHMSM program; (2) complete iEHR Increment 1 Milestone B requirements including Context Management, Single Sign-On (SSO), and Roaming capabilities; and (3) conduct an operational assessment of iEHR Increment 1 in coordination with DOT&E.
- Prior to being realigned under the DHMSM and DMIX programs, iEHR Increment 1 was intended to provide 59,000 users at 16 sites access to DOD and VA patient data. However, the DOD recently decided to limit iEHR Increment 1 fielding to only the Captain James A. Lovell Federal Health Care Center (JALFHCC), where the system is currently deployed.
- An operational assessment of iEHR, conducted by USAMEDDBD at JALFHCC in April 2014, demonstrated that users considered iEHR Increment 1 Context Management, SSO, and Roaming capabilities helpful when they were available. However, iEHR Increment 1 did not provide these capabilities reliably. Four of the 66 users surveyed reported that Context Management sometimes displayed data corresponding to the wrong patient, creating a potential risk to patient safety. JALFHCC and PEO DHMS took immediate action to protect patient safety.
- In July 2014, USD(AT&L) approved a limited fielding for iEHR Increment 1 to JALFHCC and directed that: (1) Context Management, SSO, and Roaming capabilities be part of the DHMSM requirements; (2) full deployment of iEHR Increment 1 to additional sites was no longer required; and (3) a follow-on operational assessment of iEHR Increment 1 would be conducted at JALFHCC to evaluate system effectiveness following DMIX PMO corrective actions.
- ATEC and USAMEDDBD conducted a follow-on operational test in September 2014 after the DMIX PMO made system and network improvements that showed improved system availability.
  - A small subset of users experienced the Context Management toolbar disappearing or turning black preventing use of the capability.
  - No patient safety deficiencies were observed.
  - Cybersecurity testing could not be scheduled during the operational test but is planned for 1-2QFY15.
- In November 2014, PEO DHMS approved iEHR Increment 1 Full Deployment to JALFHCC in coordination with the Assistant Secretary of Defense, Health Affairs.

## **System**

- The DMIX program provides the infrastructure and services to support the integrated sharing of standardized health data among the DOD's DHMSM, DOD legacy systems, VA, other Federal agencies, and private sector healthcare providers.

DHMSM will replace DOD legacy healthcare systems including AHLTA, the Composite Health Care System, and the EHR component of the Theater Medical Information Program – Joint program. Together, DHMSM and DMIX are intended to modernize the Military Health System to enhance sustainability, flexibility, and interoperability, for improved continuity of care.

- DOD is developing DMIX incrementally, delivering upgrades to capabilities that have already been fielded.
  - Data Federation is designed to advance DOD and VA interoperability by providing standardized VA and DOD health data through mapping to standard medical terminology using the JLV browser, which presents aggregated patient data from DOD and VA healthcare systems. The JLV provides an integrated read-only, chronological view of health data from DOD and VA EHR systems, eliminating the need for VA or DOD clinicians to access separate viewers to obtain real-time patient information.
  - The VLER provides views of a patient's medical history and clinical visits in the outpatient environment within DOD medical facilities. The VLER also provides the ability to both retrieve and share medical documentation with external partners, such as the VA and other Federal and commercial institutions.
  - The BHIE enables the VA to access clinical data from multiple DOD and VA systems using the BHIE DOD Adapter, BHIE Share, and Clinical Data Repository/Health Data Repository. The Clinical Data Repository/Health Data Repository enables bi-directional exchange of outpatient pharmacy and medication allergy data for checking drug-to-drug and drug-to-allergy interaction.
  - The Medical Community of Interest system facilitates seamless connectivity between DOD and VA healthcare providers, applications, and data via a shared, secure network capability.
  - The iEHR SSO and Context Management system capabilities are intended to automate user log-on to all published applications via a Common Access Card. Context Management allows users to enter a patient once in a Context Management Toolbar or Context Management-enabled application and the same patient will automatically populate in other Context Management-enabled applications. iEHR provides a Roaming capability to allow users to access their information from multiple devices. It maintains persistent virtual desktops for each user, allowing providers to continue viewing and updating patient records across multiple end-user devices.

## **Mission**

The DOD, VA, other Federal agencies, and private sector providers will use the DMIX infrastructure and services to:

- Support an integrated sharing of standardized health data
- Securely and reliably exchange standardized electronic health data with all partners

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## Major Contractors

- Data Federation/JLV: Hawaii Resource Group – Honolulu, Hawaii
- Data Federation (Enterprise Service Bus/Service Oriented Architecture): Harris – Leesburg, Virginia
- Test Support: Deloitte – Falls Church, Virginia
- JALFHCC SSO and Context Management: General Dynamics Information Technology – Fairfax, Virginia
- Program Manager/VLER support: Technatomy – Fairfax, Virginia

## Activity

- PEO DHMS consolidated all health data sharing and interoperability programs, projects, and initiatives under a automated information system called DMIX. DOT&E placed DMIX on test and evaluation oversight on February 18, 2014. The following sections discuss testing of the DMIX capabilities.

### Data Federation

- The 2014 National Defense Authorization Act required all DOD and VA healthcare data to be computable in real time and in compliance with national standards by October 1, 2014. The DOD and VA delivered terminology maps for seven clinical domains in November 2013 to support DF R0.
- The DMIX PMO conducted DF R0 system integration testing from November through December 2013.
- On December 18, 2013, the PEO DHMS approved fielding of DF R0, including JLV upgrades, to nine VA and DOD sites where JLV had been deployed previously.
- DOT&E worked with ATEC and USAMEDDBD during 2013 to plan a DF R0 operational assessment. The operational assessment was scheduled for January 2014, but the PEO DHMS did not support operational testing of this release; therefore, none was conducted.
- DOT&E received log files from the systems on which DF R0 was operating in January and February 2014 to assess the availability of the network and software infrastructure of DF R0 following its deployment.
- From July through August 2014, the DMIX PMO conducted system integration testing of the next release, DF R1.
- From August through September 2014, the DMIX PMO conducted capacity testing of JLV v2.2.0.2 and BHIE DOD Adapter v1.0.1.7.2 at the Richmond Development and Test Center (DTC).
- On September 12, 2014, PEO DHMS approved fielding of DF R1, supporting an expanded DOD user base of no more than 1,000 users at 68 sites.

### VLER

- In September and October 2014, the DMIX PMO conducted system integration testing of VLER v2.0.2.0 at the Richmond DTC. VLER v2.0.2.0 provides software and hardware upgrades to VLER v2.0.1.3, the currently fielded version.
- ATEC and USAMEDDBD will test VLER v2.0.2.0 as part of DMIX R2 operational testing in 3QFY15

## iEHR

- USAMEDDBD conducted an operational assessment of iEHR Increment 1 at JALFHCC in April 2014.
- USAMEDDBD conducted a follow-on operational test of iEHR Increment 1 at JALFHCC in September 2014.

## Assessment

### Data Federation

- The DMIX PMO originally scheduled the DF R0 system integration test from November 11 – 22, 2013, but extended the schedule to correct defects, overcome environment outages, and test additional requirements. The DMIX PMO created 20 patient records along with medical history to exercise terminology mappings within the 7 clinical domains. A more robust set of patient data was created for testing at the Richmond DTC, but could not be used because the site was not yet fully operational. During testing, four software patches were applied to the JLV and two software patches were applied to the BHIE DOD Adapter. After discovered defects were corrected, all tested clinical data were queried, retrieved, and displayed correctly across all domains, except for the immunization domain, where 4 of 32 trials had duplicate entries due to an open BHIE DOD Adapter software defect.
- DOT&E determined that DF R0's operational availability was 53.19 percent, which was unacceptably low. The types of failures and frequency of occurrences suggest systemic problems in the DMIX architecture and supporting network infrastructure. User confidence in DF R0 is expected to be negatively affected by low system availability and inadequate outage notification procedures. The DMIX PMO intends to replace or improve these systems under the DMIX program as time and resources permit.
- The DF R1 system integration test was expected to include 8 additional terminology maps, for a total of 15 of the required 28 maps. However, the DOD and VA were unable to deliver any additional maps in time to support testing. The DMIX PMO had completed enhancements to JLV and the BHIE DOD Adapter to allow users to view unmapped patient data for these additional eight clinical domains. The DMIX PMO validated the integration and display of patient data (both mapped and unmapped) within the 15 clinical domains. Test metrics included JLV's ability to display a complete and accurate record, by validating that

displayed clinical data matched those in the database. The DMIX PMO used a larger data set of 284 patient records, as compared to 20 patient records used in DF R0 testing, resulting in greater coverage of mapped clinical data. During the test event, two software patches were applied to both the JLV and BHIE DOD Adapter to fix high-severity defects. After the defects were corrected, all tested clinical data were queried, retrieved, and displayed correctly.

- During capacity testing of the JLV and BHIE DOD Adapter, the DMIX PMO encountered schedule delays due to system and DTC environment problems. The majority of tests executed during capacity testing were unsuccessful, so the DMIX PMO performed hardware and software upgrades to JLV and BHIE DOD Adapter to improve system performance. Following system upgrades, JLV v2.2.0.2 and BHIE DOD Adapter v1.0.1.7.2 could support 300 concurrent users, exceeding the 250-user requirement. DOT&E analysis of JLV user activity through July 2014 showed limited use of JLV, resulting in a concurrent user load well below the required capacity.
- Subsequent DMIX DF releases were planned to add terminology maps for 21 additional clinical data domains, but the DOD and VA were unable to deliver any additional maps to support the testing and fielding of DF R1 in September 2014. It is unclear when either the DOD or VA will provide additional maps in support of the DMIX program.
- Operational testing of DF R1 is planned for 2QFY15. ATEC and USAMEDDBD will assess the accuracy and completeness of mapped terminology, as well as the procedures and tools to maintain terminology maps, as part of DMIX R2 operational testing.

## **VLER**

- No operational test data are available to assess VLER.

## **iEHR**

- The operational assessment, conducted in April 2014, showed that most JALFHCC users considered iEHR Increment 1 Context Management, SSO, and Roaming capabilities helpful when they were available. However, iEHR Increment 1 did not provide these capabilities reliably.

Four of the 66 users surveyed reported that Context Management sometimes displayed data corresponding to the wrong patient, creating a potential risk to patient safety. JALFHCC alerted all personal of the potential patient safety problem and provided mitigation instructions. PEO DHMS deployed developer and test teams to support JALFHCC, but the teams were unable to duplicate the problem. Because the problem could not be re-created in a laboratory test environment, it requires operational testing to resolve.

- User inability to connect to the Application Virtualization Hosting Environment was a pervasive problem, resulting in a loss of Context Management, SSO, and Roaming capabilities. As a workaround, users kept trying to connect until the system worked. This cumbersome and time-consuming process discouraged users from using the system.
- The follow-on operational test, which ATEC and USAMEDDBD conducted after system and network improvements, showed improved system availability. However, a small subset of users experienced the Context Management toolbar disappearing or turning black preventing use of the capability. No patient safety issues were observed. Cybersecurity testing could not be scheduled during the test and is planned for 1-2QFY15.

## **Recommendations**

- Status of Previous Recommendations. This is the first annual report for this program.
- FY14 Recommendations.
  1. The DOD and VA should accelerate clinical terminology mapping efforts; or if not feasible, pursue an alternate approach to exchange healthcare data in real time between the departments.
  2. The DMIX PMO should correct the iEHR Increment 1 toolbar defect to ensure the system is available to all users.
  3. The DMIX PMO should conduct cybersecurity testing of iEHR Increment 1.
  4. ATEC and USAMEDDBD should conduct operational testing of DF R1 and DMIX R2 as planned.