



Program Executive Office



## *Enterprise Intelligence and Data Solutions/ Military Health System Information Platform*

# DATA SCIENCE RESOURCES

*Harnessing the power of data to support the Military Health System*



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# ENTERPRISE INTELLIGENCE AND DATA SOLUTIONS PROGRAM MANAGEMENT OFFICE (EIDS PMO)

The EIDS PMO’s mission is to deliver, connect, integrate, and curate health data at the right time, right place, and right format to enable informed decisions, research and innovation across the Military Health System (MHS), services and federal space.

The PMO works to support MHS Strategic Goals and provide seamless data services and decision support for clinicians, patients, beneficiaries, analysts, researchers, and Department of Defense (DOD) leadership to drive organizational insights and better patient outcomes. EIDS manages a vast array of data-related assets, including data warehouses, data virtualization tools and visualization solutions (CarePoint) that in combination makes up a system of systems—the MHS Information Platform (MIP).

## EIDS’ OBJECTIVES

- Deliver first-class data platforms for advanced analytics, business intelligence, registries and data discovery capabilities
- Promote interoperability between legacy systems and the DOD’s electronic health record, MHS GENESIS
- Centralize, standardize and analyze data to support data-driven decisions and promote better patient/population health outcomes
- Manage enterprise data and architecture

## THE MIP

EIDS owns and operates the MIP, the largest secondary repository of health-related data in the Defense Health Agency (DHA). The MIP’s mission is to provide a comprehensive analytics solution with flexible tools and trusted data to accomplish research goals and in-depth data science. It provides self-service access to high trust, governed data and enables traditional reporting and dashboarding capabilities in a secure, cloud-based platform. Users are able access and analyze data within a single, cohesive environment with a collaborative user community. The MIP has a wealth of data at the ready for strategic data use, optimization and innovation.



The EIDS PMO implements a robust data management process to ensure data quality standards are created, data is merged equitably, and data is reliable, timely and trusted. The data management process automates as much as possible and has touch points with dozens of technical and functional points of contact to resolve issues. EIDS includes pro-active monitoring of MIP tools to optimize user performance and to fix issues before affecting end user delivery. In addition, EIDS facilitates a DHA data literacy program which includes training, a search engine-like data catalog, easy business rules identification, and click-of-a-button data lineage investigation.

## KEY BENEFITS

- Provides trusted and aggregated data from 150+ DOD data sources on a scalable platform ranging in periodicity
- Easy-to-use analytic tools for any level of data literacy ranging from simple analytics to ML
- Secure, powerful and flexible Cloud foundation with deep data going back 20+ years with over a petabyte of storage
- Full suite of visualization and analytic tools to meet any need or user expertise
- CarePoint platform enables the creation and sharing of organizational insights



## BULK DATA EXTRACT (BDE) VERSION 3.0

The MHS GENESIS Bulk Data Extract (BDE) version 3.0, known as BDE 3.0, is a daily delivery of change data capture records across 330 tables in the MHS GENESIS schema. EIDS implemented BDE 3.0 to deliver MHS GENESIS data within the AWS GovCloud environment through SQL views.

EIDS developed software to perform the Extract, Transform and Load (ETL) process for the BDE feed. The BDE ETL validates and merges the daily feed into the GovCloud and data is accessible to users through difference views.

### KEY BENEFITS

- Improves DHA's capability to transfer MHS GENESIS data into tables within the MIP
- Automated ETL process optimizes data processing and increases scalability
- Increases data science capabilities by leveraging Python, R, and many other analytical capabilities against MHS GENESIS data

### KEY FEATURES

- 330+ tables
- Roughly 1600 flat files processed daily with multi-step data quality controls during ETL
- Users can easily request additional tables through centralized EIDS website, One Front Door

## HEALTH INFORMATION ARCHIVE (HIA)

HIA combines legacy data needed to support medical information required for business intelligence, continuity of care, longitudinal research, and legal requirements.

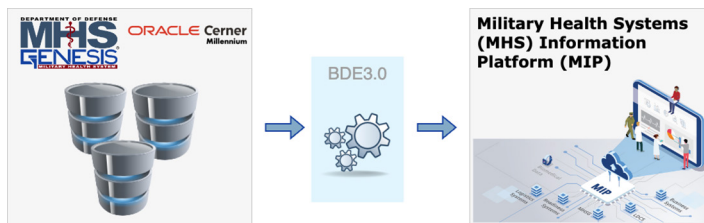
HIA ingests legacy data into the MIP within the DHA Government Cloud environment. Next, ETL functions map the data into a common model maintained in the HIA solution. Records management capability is provided to users via a web-based application. The longitudinal health record is presented via a Fast Healthcare Interoperability Resources application programming interface (API) to be consumed by MHS GENESIS and the Joint Longitudinal Viewer.

### KEY BENEFITS

- Enables the archival and decommission of DHA legacy systems, supporting full deployment to MHS GENESIS
- Provides clinicians with direct access to a single source of a patient's longitudinal historical medical record
- Legacy systems in the initial iterations of HIA:
  - CHCS/Cache
  - Surgical Scheduling System (S3)
  - AHLTA CDR (post-FOC Q4FY2024)
  - CIS-ESSENTRIS (GDR and Audit Data/PDFs/XMLs)
  - Anesthesia Reporting Monitoring Device
- Legacy systems being archived for decommissioning
  - WMSNi
  - COAG Clinic
  - EBMS-T

### KEY FEATURES

- Retains and stores all legacy system data for retrieval from the MIP Enclave within the GovCloud
- Provides internal and external systems and API to retrieve legacy data
- Provides capability to exchange and transfer data externally with Veterans Affairs (VA) and MHS GENESIS
- Provides Normalization and Standardizing of legacy data



## DOD AND VA INFRASTRUCTURE FOR CLINICAL INTELLIGENCE (DAVINCI)

DAVINCI provides a desired level of interface between data warehouses for the DHA and Veterans Health Administration (VHA). It is a historic repository for unprecedented joint analytics and research platform.

DAVINCI provides a comprehensive view into health records to facilitate rapid analysis of longitudinal care, improved coordination of polytrauma patients, and accelerated disability evaluations with a solid foundation for an integrated clinical intelligence platform. DAVINCI serves as the framework for advancing interoperability between DHA and VHA for independent or joint research and analysis by the two Departments to further enhance health services and outcomes for Service Members and Veterans.



### KEY BENEFITS

- Detection and treatment insight into multi-symptom syndromes such as Traumatic Brain Injury (TBI) and Post Traumatic Stress Disorder which are difficult to identify, track and treat with traditional approaches limited to data available within one Department
- Enables joint data analytics efforts in support of predictive analytics, precision medicine, registries and future bi-Departmental collaborations

### KEY FEATURES

- Repository of combined DHA/VHA health data for a full longitudinal health record
- Implements a common data model for a consolidated view of combined data within the appropriate context for semantic interoperability and usable format for syntactic interoperability
- Leverages data virtualization to present views of DHA data with persisted VHA data in one repository

## MHS COMMON DATA MODEL

The MHS Common Data Model transforms health data into a standardized format, allowing multiple data sources to be combined for standardized analytics.

To enhance patient care, addressing questions about treatment effectiveness and adverse drug effects is crucial. However, electronic health data from the MHS originates from disparate sources with differing standards for representing clinical concepts. Traditionally, analysts had to manually extract and standardize data from each source individually or create custom research implementations, which was time-consuming and prone to errors.

Employing the Observational Health Data Sciences and Informatics (OHDSI) Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) resolves these challenges by harmonizing diverse data within the MHS into a common format. This allows analysts to gain a unified view, streamlining evidence-based research processes. Moreover, it facilitates collaboration between agencies such as the DOD and VA, as they both transform their data into a common internationally recognized standard. Thus, it builds upon the success of the DAVINCI project while incorporating recent MHS GENESIS BDE data, ensuring compatibility with current advancements.

### KEY BENEFITS

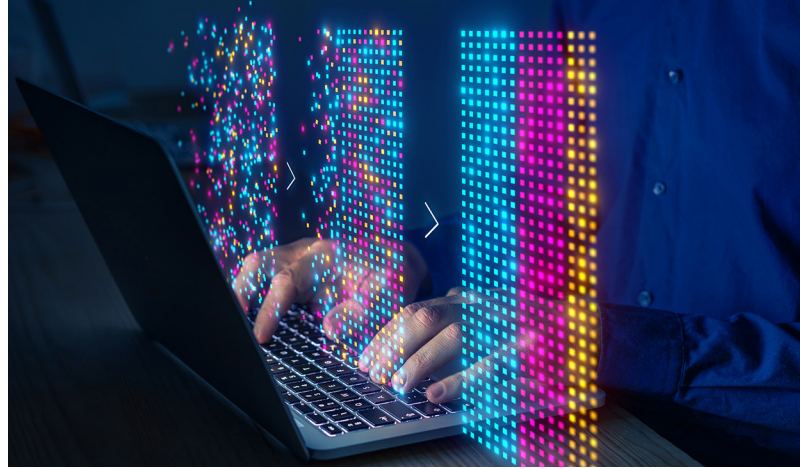
- Allows researchers to conduct evidence-based research across diverse datasets
- Makes complex health data comprehensible and actionable
- Ensures data quality through reliable data definition and validation rules
- Enables reproducible studies that make results more reliable
- Complies with security protocols within the MIP to protect patient data

### KEY FEATURES

- Harmonizes disparate data sources into an internationally recognized standard
- Provides analytics, research and data visualization applications
- Standardizes guidelines for representing medical concepts and vocabularies



# DATA SCIENCE TOOLS



## DATA SCIENCE IN THE MIP – AI/ML

EIDS continues to focus on providing MIP users state of the art data science tools to accomplish analytical tasks. The introduction of AI into the MIP brings capabilities like ML, Natural Language Processing, Predictive Analytics and much more to the platform. The introduction of AI/ML has helped DHA uncover the value of such data. The MIP provides a suite of data science tools and capabilities to enable AI/ML development, testing, validation and deployments leveraging the massive dataset.

Projects developed in the MIP include readiness tools such as Medical Evaluation Readiness Information Toolset and MSK Nest, and predictive analytic tools focusing on opioids, suicide and TBI.

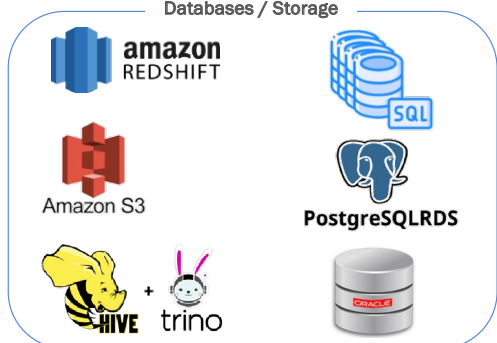
### KEY BENEFITS

- Enhances readiness and predictive analytics capabilities
- Workbench Integrated Development Environment platform allows data scientists to develop in multiple programming languages.
- Speeds up ML development cycles by employing MLOps within a scalable architecture
- Use of Cloud Native functions to enhance data processing of big data and batch processing

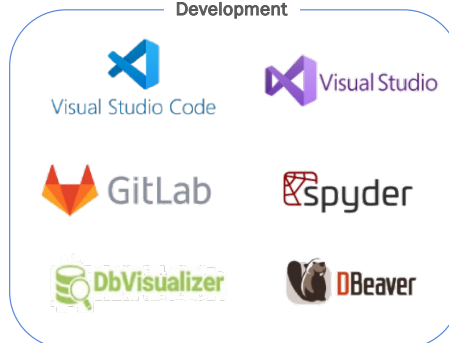
### KEY FEATURES

- Library and package integration capabilities with Anaconda / POSIT / GitLab
- Leverage AWS services for an integrated data access capability
- MIP Capabilities include:
  - Anaconda
  - POSIT Workbench
  - SageMaker
  - RStudio
  - EMR Clusters (Auto-scaling)
  - Python
  - cTakes
  - Spark
  - Jupyter
  - Zeppelin Notebooks

#### Databases / Storage



#### Development



#### Data Processing



#### Programming Languages & Tools



#### Visualization and Reporting



# DATA SCIENCE APPLICATIONS

## MILITARY HEALTH SYSTEM POPULATION HEALTH PORTAL (MHSPHP)

The MHSPHP is a centralized, secure, web-based population health management system used by Army, Navy, and Air Force health care teams, as well as Managed Care Support Contractors (MCSC).

The MHSPHP transforms DOD and purchased care administrative data into actionable information. TRICARE Prime/Plus enrollees in need of potential clinical preventive services, disease management, or case management are identified on health care action lists. Specific data sources are outlined in each methodology. MHSPHP methodologies are based on Healthcare Effectiveness Data Information Set (HEDIS®) methodologies or on DOD/VA Clinical Practice Guidelines. Using the MHSPHP, all Military Medical Treatment Facilities and MCSC health care teams can proactively manage the health status of their patients over the web and TBI.

Admissions Enrollee View	Admissions Facility View	Antidepressant Mod Mgt	Asplenia
Asthma Medications	Back Pain, Acute	Back Pain, Recurrent	Breast Cancer Screening
Cardiovascular Disease Risk	Cervical Cancer Screening	CHF	Children with Pharyngitis
Children with URI	Chlamydia Screening	Cholesterol in CVD	Colon Cancer Screening
COPD	COVID-19 Immunization/Risk	Depression	Diabetes
Diabetes MicroAlbumins	Direct Oral Anticoag Stewardship	Duplicate PCMs	ER/Urgent Care
Health Services	High Risk Admissions	High Risk Obstetrics	High Utilizers
High Utilizers Summary	Hypertension	Immunizations	Inborn Errors of Immunity
Lipid Panel	Low Back Pain Imaging	Mental Health Follow-Up	Opioid Management
Unfilled Labs	Unfilled Radiology	Quality Indicators	Well Child

### KEY BENEFITS

- Feature rich, flexible application that provides functionality required to manage patient populations
- Metadata driven application configuration reduces time to stand up new registries, or modify existing registries

### KEY FEATURES

- Consolidated view of patient data from Direct Care and Network Care health care systems
- Role-based access to enforce proper level of access to Protected Health Information / Personally Identifiable Information based on user function

### Complex Registries

The EIDS CarePoint Information Portal also hosts standalone registries and is in the process of development and integration of several high-priority registries.

DoDTR/Pandemic Registry	JHASIR * §	DVEIVR * †
In support of the Joint Trauma Systems (JTS)	The Joint Hearing and Auditory System Injury Registry (JHASIR) enables longitudinal analysis of Service members and Veterans with service-related hearing and auditory system injury related conditions.	The Defense and Veterans Eye Injury and Vision Registry (DVEIVR) is a DoD/VA initiative that provides quantitative data for longitudinal outcome analyses of eye trauma and vision impairment.
ORION †	OPIOID Registry	TBI Registry
The Organizational Incident Operational Nexus (ORION) allows identification and tracking of service members involved in a non-combat, unit-level traumatic incident, and allows for stratification of members based on trauma exposure to identify those who may need mental health care.	Registry data spans more than 200 variables, is supported by DHA PI 6025.04 and 6025.07, and allows a pharmacist to scan a CAC card to obtain a ML recommendation for Naloxone Rx.	In support of the Defense Intrepid Network for TBI and Brain Health
Case Management Registries	Complex Pediatric Registry	Deployment Limiting Health Conditions
Case Management Screening	Sickle Cell Anemia	Hyperlipidemia
Case Management	Chronic Kidney Disease	Hypertension
	Down Syndrome	Diabetes Mellitus
	Inflammatory Bowel Syndrome	Short Acting Reversible Contraceptives
	Neonates	

## TBI PORTAL

The TBI Portal is a DHA enterprise application within CarePoint. This interface surrounding the patient registry provides a consolidated view of TBI patient data to inform clinical decision making across the MHS.

The TBI Portal drives patient-centered care at the individual, facility, and MHS-wide levels. Integrating disparate data sources from across the MIP, it provides a comprehensive view of a patient's longitudinal data to inform clinical care decisions and support treatment planning. At the facility and enterprise level, the portal's easy-to-use dashboards and interactive reports allow providers to aggregate, summarize, and review TBI patient data.

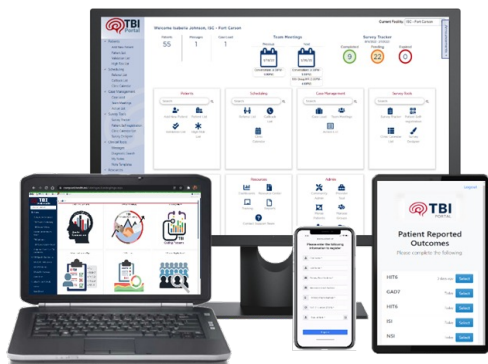
The TBI Portal enables the exploration of clinical data to identify trends, monitor health outcomes, and support research into TBI and its associated health condition. This will lead to greater understanding of TBI, enhanced clinical capabilities and patient treatment, and improved outcomes for patients.

### KEY BENEFITS

- Supports improved TBI care and facilitates patient tracking and case management
- Increases opportunities for research and innovation by providing a central repository of multi-site data
- Enhances the exploration of clinical data through interactive reports

### KEY FEATURES

- Tracks patient-reported outcomes, measures and surveys
- Enables advanced tagging and labeling of patients' conditions and injuries
- Offers data analysis capabilities for performance improvement within a specific TBI clinic or across the MHS
- Incorporates organizational reports, metrics, and information to monitor health outcome measures
- Estimates patient risk factors using built-in analytics, forecasting, and predictive models



## CLINICAL ASSESSMENT MANAGEMENT PORTAL (CAMP)

CAMP is an enterprise service which integrates standardized questionnaires, computer adaptive tests, and other surveys to enable clinical communities and organizations to collect such information from patients. Hosted in CarePoint, CAMP easily interfaces with analytic and dashboard services without data exchange or agreements. The CAMP application provides an enterprise solution for the collection, management, and tracking of patient-reported outcomes and standardized patient questionnaires. Utilized by several DHA clinical communities, the portal enables improved tracking and evaluation of patient-centered care.

CAMP currently consists of 1,000+ surveys from different domains including mental health, pain, musculoskeletal, TBI, women health, and many more. It combines scheduling, clinical, and self-report data from numerous disparate systems by leveraging the MIP.

### KEY BENEFITS

- Incorporates the Patient Reported Outcomes Measurement Information System (PROMIS)
- Optimized for all devices, including smartphones
- Enhances the exploration of clinical data through interactive reports
- Synchronizes to MHS GENESIS to ensure accurate and real time health and clinical data

### KEY FEATURES

- Provides data to effectively measure and improve wellness, injury prevention, and care effectiveness
- Allows user to configure and customize surveys, email templates, and survey schedules without coding changes
- Incorporates organizational reports, metrics, and information to monitor health outcomes measures
- Estimates patient risk factors using built-in analytics, forecasting, and predictive models





## PATIENT REPORTED OUTCOMES CLINICAL RECORD (PROCR)

PROCR is a clinical decision support utility for clinical care that focuses on pain-related psychosocial factors and treatment history and musculoskeletal (MSK) health, such as MSK outcomes, readiness, and screening.

Serving as a decisioning and treatment tool for clinical care and health utilization studies, PROCR uses instruments developed by the National Institutes of Health, collectively known as the PROMIS. PROCR administers questions in a wide range of pain and MSK related areas using the Clinical Assessment Survey Tool, a survey application available through any web-enabled device. PROMIS leverages computer adaptive testing to predict appropriate questions based on a patient's response; therefore, presenting the fewest possible number of questions without sacrificing the precision of a classic short form. PROCR is intended to fulfill two essential clinical needs: (1) providing seamless communication of assessment results in an actionable manner and (2) providing a data repository for clinical research and health utilization studies.

PROCR consists of two primary care communities: Pain Assessment Screening Tool & Outcomes Registry, and Military Orthopedics Tracking Injuries & Outcomes Network.

### KEY BENEFITS

- Provides data to effectively measure pain and MSK health management using patient reported outcomes
- Promotes consistent treatment; greater accuracy to normalize best practices across the care continuum, optimize medical readiness, and increase healthcare value and cost effectiveness

### KEY FEATURES

- Creates, stores, delivers, and maintains patient-reported responses to outcome measurements
- Allows patients to complete questionnaires with computer adaptive testing on self-entered electronic data device (e.g., internet, patient portal, clinic setting)
- Allows staff to view the patient self-entered data

## MHS DIGITAL BIOBANK

The MHS Digital Biobank is a cloud-based platform that supports analytics and storage of genomic data to advance precision medicine and troop readiness across the MHS enterprise. As a central and secure repository for genomic data, the platform offers bioinformatic and clinical workflows as well as automated analytics.

The Digital Biobank enables precision medicine research via scalable and secure storage, processing, and analysis of massive volumes of sequencing data from disparate sources.

MHS Digital Biobank supports the following use cases in support of precision medicine:

- Force Health Protection Medical Readiness
- Precision Operational Medicine
- Human Performance
- Bio-surveillance of microbial species

### KEY BENEFITS

- Novel capability in MIP to store, share, and analyze genomics data in a secure cloud environment
- Features a streamlined, flexible application suitable to support a diverse variety of use cases to improve patient care across MHS
- Increased potential for cross-laboratory collaboration across DHA and MHS
- Dynamic and scalable platform for analytic/research support

### KEY FEATURES

- Upload genomic (vcf, fasta, fastq, fast5) and phenotype (csv) data in original and in compressed (gz, zip) formats
- Analyze genomics data with Zeppelin Coding notebook, genomic wide association study Genome Analysis Toolkit, and share the analysis and its outputs
- Request access to sets of data, for analytics and to download for local analytics
- Manage, create, and perform analysis on cohorts of uploaded data

## GLOSSARY

**AI/ML:** Artificial Intelligence / Machine Learning

**API:** Application Programming Interface

**AWS:** Amazon Web Service

**BDE:** Bulk Data Extract

**CAMP:** Clinical Assessment Management Portal

**CDM:** Common Data Model

**DAVINCI:** DOD and VA Infrastructure For Clinical Intelligence

**DHA:** Defense Health Agency

**DOD:** Department of Defense

**EIDS:** Enterprise Intelligence and Data Solutions

**ETL:** Extract, Transform and Load

**HIA:** Health Information Archive

**MCSC:** Managed Care Support Contractors

**MHS:** Military Health System

**MHSPHP:** Military Health System Population Health Portal

**MIP:** MHS Information Platform

**MSK:** Musculoskeletal

**OHDSI:** Observation Health Data Science and Informatics

**OMOP:** Observational Medical Outcomes Partnership

**PMO:** Program Management Office

**PROCR:** Patient Reported Outcomes Clinical Record

**PROMIS:** Patient Reported Outcomes Measurement Information System

**TBI:** Traumatic Brain Injury

**VA:** Veterans Affairs

**VHA:** Veterans Health Administration