The Armed Forces Health Surveillance Division (AFHSD) continues to be the standard bearer for global health surveillance, and our 2022 accomplishments bear witness to that fact. We are a division aligned with the Defense Centers for Public Health—Falls Church, within the Public Health Directorate in the Defense Health Agency (DHA). AFHSD operates three main branches: Epidemiology and Analysis (E&A), Global Emerging Infections Surveillance (GEIS), and Integrated Biosurveillance (IB). We have 120 highly skilled employees, 21 of whom work at the three Defense Centers for Public Health (12-Aberdeen, 4-Dayton, 5-Portsmouth), which we call “AFHSD Satellite Cells.”

In support of DHA's role as a Combat Support Agency, AFHSD steers functional requirements for an interagency effort to develop and fully integrate the Biosurveillance Hub and Portal with increased capabilities, to expand direct support to the Combatant Commands (CCMDs), establish mechanisms to improve early warning data and communicate everyday situational awareness that informs all levels of operational decision making. We are codifying our relationships built during the COVID-19 response and seeking to leverage new partnerships for a whole-of-government approach and invite global allies. This tactic will position the DHA to work with other agencies and jointly solve challenges facing our DOD population.

Our capabilities deliver value to the Military Health System (MHS). AFHSD provides perspective for the future and direction of timely surveillance and analysis to provide senior leaders and front-line healthcare workers critical information to shape the battlespace and unified military strategy. We support the defense public health transformation and work tirelessly to refine our role as a focal point for federal health surveillance efforts.

As you read AFHSD's annual report, we hope it will remind you of our recent successes and the future path that we will take to ensure our mission in 2023. We look forward to continuing this effort with agility, relevancy, and timeliness to support the Joint Force. Their goal is to help the CCMDs and the military services make the best decisions in protecting the health and readiness of the DOD's military and beneficiaries.

PATRICK W. KENNEDY, Colonel, USAF, BSC
Chief, Armed Forces Health Surveillance Division
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THE ARMED FORCES HEALTH SURVEILLANCE DIVISION is the central epidemiologic health resource for the U.S. military. We conduct medical surveillance to protect those who serve our nation in uniform and allies who are critical to our national security interests. AFHSD is a component of DHA and falls under Public Health.

AFHSD is organized into three branches: Epidemiology and Analysis, Global Emerging Infections Surveillance, and Integrated Biosurveillance. There is also a Special Projects Cell.

We maintain a presence at three service public health hubs— the Defense Center for Public Health-Aberdeen (Army), Defense Center for Public Health-Dayton (Air Force), and Defense Center for Public Health-Portsmouth (Navy and Marine Corps).

Our health information analysis supports worldwide disease surveillance and public health activities to improve the U.S. military’s Force Health Protection mission.
THE ELEMENTS OF MILITARY MEDICAL SURVEILLANCE

TOOLS OF SURVEILLANCE

The Defense Medical Surveillance System (DMSS) and the Department of Defense Serum Repository (DODSR) are long-standing and vital assets to medical surveillance within the U.S. Armed Forces. The DMSS and DODSR have their historic roots in routine human immunodeficiency virus (HIV) screening and surveillance. However, their functions were expanded in the early 1990s to encompass all diseases and injuries relevant to the protection of U.S. forces and deployment health.

The DMSS receives data from multiple sources and integrates it in a continuously expanding longitudinal surveillance database for all individuals who have served in the military since 1990. DMSS records are maintained on person, place, and time of reference. Through traditional epidemiologic practices, users can mine the data for efficient and powerful analyses of morbidity among Service members.

The Defense Medical Epidemiology Database (DMED), derived from the DMSS, provides select data that are de-identified and remotely accessible to online users. The purpose of DMED is to provide standard epidemiologic methodology used to analyze active duty personnel and medical event data. DMED is available to authorized users—including U.S. military medical providers, epidemiologists, medical researchers, safety officers, and medical operations and clinical support staff—who are responsible for surveying health conditions in the U.S. military and conveying this information to commanders for monitoring and enhancing the health of the active duty component. With appropriate documentation, civilian collaborators in military medical research and operations may also access DMED.

The DODSR was established in 1989 to store sera collected during the DOD’s testing program for HIV infections. Later, the DODSR was designated to receive serum specimens collected before and after operational deployments.

The DODSR specimens are housed in modern freezers with advanced cooling equipment and technology. The DMSS database stores demographic, occupational, and medical information in longitudinal surveillance and records links to the repository specimens. It is a unique and powerful resource to support the conduct of military medical surveillance, clinical care, and seroepidemiologic investigations.

During 2022, AFHSD processed and dispensed serum specimens in support of 21 seroepidemiologic studies and analyses for clinical needs, operational studies (including characterizing the sero-prevalence of COVID-19, Lyme Disease, and Crimean-Congo Hemorrhagic Fever among deployed U.S. military personnel) and in support of research studies including a study examining osteoporosis and serum biomarkers of bone turnover, the association of Vitamin D and Multiple Sclerosis, and a serologic investigation on Hymenoptera Venom Hypersensitivity Evaluation.
DMSS STRUCTURE AND FUNCTIONAL RELATIONSHIP

**Personnel Data**
- Active Duty
  - Since 1990
  - 8.4 million persons
  - 115 million records
- Reserve Component
  - Since 1990
  - 3.5 million persons
  - 43.6 million records
- Casualty*
  - Since 1980
  - 61,427 records
- Military Entrance Processing Stations
  - Since 1985
  - 16.0 million persons
  - 40.3 million records

**Medical Data**
- In-patient
  - Since 1990
  - 28.3 million records
- Ambulatory
  - Since 1996
  - 3.58 billion records
- Reportable Events
  - Since 1995
  - 1,590,105 records
- Immunizations*
  - Since 1985
  - 177 million records
- Prescription Data*
  - Since 2014
  - 140 million records
- Periodic Health Assess*
  - Since 2017
  - 7.66 million records

**Laboratory Data**
- Serologic Specimens
  - Since 1985
  - 12.2 million persons
  - 74 million specimens
- Chemistry
  - Since 2010
  - 583 million records
- Microbiology
  - Since 2010
  - 50.6 million records

**Deployment Data**
- Deployment Rosters
  - Since 1990
  - 7.6 million records
- Pre- and Post Deployment Health Assessments
  - Since 1994
  - 176,757,325 surveys
- Theater Medical Data
  - INPT/Ambulatory (TMDS)
    - Since 2008
    - 9,814,876 records
- Theater Medical Data
  - Meds (TMDS-MEDS)
    - Since 2008
    - 13,738,047 records

**Services of the Armed Forces Health Surveillance Division**
- Medical Surveillance Monthly Report (MSMR)
- Ad hoc Requests
- Studies and Analyses
- Routine Reports and Summaries

**DMSS**
- Monthly Synchronization

**DMED**
- Hospitalization Queries
- Ambulatory Queries
- Reportable Events Queries
- Personnel Data Queries

Current as of May 2023
DMSS: Defense Medical Surveillance System
DMED: Defense Medical Epidemiology Database
* Service Member Data Only

Version 5.0
Remote access to DMSS data (non-Privacy Act only)
AFHSD distributed approximately 80% of its funds directly to laboratory partners through the GEIS program following an extensive internal and external proposal review process. Core funding for biosurveillance totaled $50.301M in FY22. In addition to core funding, the GEIS Branch also disbursed $10.22M in supplemental funding for COVID-19 and genomic surveillance efforts.

Primary recipients of GEIS core biosurveillance funding included Army and Navy OCONUS Service laboratories Armed Forces Research Institute of Medical Sciences (AFRIMS); U.S. Army Medical Research Directorate-Africa (USAMRD-A); U.S. Army Medical Research Directorate-Georgia (USAMRD-G); and Naval Medical Research Unit (NAMRU) INDO PACIFIC (NAMRU IP), NAMRU EUROPE, AFRICA, CENTRAL (EURAFCENT), NAMRU EUROPE AFRICA CENTRAL, NAMRU SOUTH.

Multiple CONUS-based military and university partners also received funding, including: the Defense Centers for Public Health-Portsmouth EpiData Center (DCPH-P-EDC); Navy Entomology Center of Excellence (NECE); Naval Medical Research Command (NMRC), Naval Health Research Center (NHRC); Pharmacovigilance Center (PVC); U.S. Air Force School of Aerospace Medicine/Defense Centers for Public Health-Dayton (USAFSAM/DCPH-D); U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID); Walter Reed Army Institute of Research (WRAIR); and Uniformed Services University of the Health Sciences (USUHS), among others.

<table>
<thead>
<tr>
<th>GCC</th>
<th>AMOUNT</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRICOM</td>
<td>$9,663,000</td>
<td>16.0</td>
</tr>
<tr>
<td>CENTCOM</td>
<td>$975,000</td>
<td>1.6</td>
</tr>
<tr>
<td>EUCOM</td>
<td>$1,909,000</td>
<td>3.1</td>
</tr>
<tr>
<td>INDOPACOM</td>
<td>$12,879,000</td>
<td>21.3</td>
</tr>
<tr>
<td>NORTHCOM</td>
<td>$6,763,023</td>
<td>11.2</td>
</tr>
<tr>
<td>SOUTHCOM</td>
<td>$7,677,000</td>
<td>12.7</td>
</tr>
<tr>
<td>Cross-GCC</td>
<td>$20,542,215</td>
<td>33.9</td>
</tr>
<tr>
<td>Not applicable</td>
<td>$113,000</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>$60,521,238</td>
<td>100.0</td>
</tr>
</tbody>
</table>

TABLE 1. GEIS Branch Funding Distribution by Geographic Combatant Command (GCC)

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>AMOUNT</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Force</td>
<td>$5,285,000</td>
<td>8.7</td>
</tr>
<tr>
<td>Army</td>
<td>$25,446,000</td>
<td>42.0</td>
</tr>
<tr>
<td>Navy</td>
<td>$25,719,000</td>
<td>42.5</td>
</tr>
<tr>
<td>DHA</td>
<td>$2,697,000</td>
<td>4.5</td>
</tr>
<tr>
<td>Other</td>
<td>$1,374,238</td>
<td>2.3</td>
</tr>
<tr>
<td>Total</td>
<td>$60,521,238</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The remaining funds supported various AFHSD Branches and headquarters, biosurveillance initiatives, comprehensive health surveillance service, support contract staff, contract personnel working with the Medical Surveillance Monthly Report (MSMR) and the DODSR, and other infrastructure costs.
EPIDEMIOLOGY AND ANALYSIS
The Epidemiology and Analysis (E&A) Branch integrates the expertise of epidemiologists, preventive medicine physicians, and data analysts to provide timely analyses and reports of actionable health information. The branch uses AFHSD health surveillance tools—the DMSS and the DODSR—and provides surveillance products to DOD policymakers, military leaders, healthcare providers, public health officers, and researchers.

In addition, E&A staff analyze and interpret large data sets, publish the MSMR, develop and disseminate standards for case definitions, and train preventive medicine residents. The branch receives and responds to hundreds of health-related inquiries and investigations on the U.S. military with the intent of preserving the health of the U.S. Armed Forces. Many inquiries are initiated by key leaders throughout the DOD and relate to military operations. Each analysis and report distributed by the section entails numerous hours of epidemiologic expertise and programming by analysts to extract relevant data from the billions of health records stored in the DMSS and blood sera in the DODSR.

**IN 2022, E&A STAFF MEMBERS SUPPORTED SEVERAL AD HOC REQUESTS FOR DATA ANALYSES AND DISTRIBUTED HUNDREDS OF PERIODIC REPORTS THROUGHOUT THE DOD.**

These ad hoc requests and periodic reports look for trends over time of diseases and injuries such as communicable diseases, training-related injuries, mental health illnesses, traumatic brain injury (TBI), and deployment health. Ad hoc requests and periodic reports have helped Defense Department policymakers shape their Force Health Protection (FHP) programs and healthcare professionals develop preventive measures against diseases or injuries affecting U.S. service members and their beneficiaries.

**E&A SATELLITES**

AFHSD E&A maintains satellite staff at Defense Centers for Public Health – Aberdeen, Portsmouth, and Dayton. Satellite staff primarily support surveillance at their respective public health centers but also contribute valuable expertise to the enterprise and regularly participate in joint meetings including the bi-weekly Request Assessment Process, monthly E&A staff meetings, and the quarterly Health Surveillance Steering Group.

**THE ABERDEEN SATELLITE** staff, which includes 14 epidemiologists, supports several divisions and branches within the Clinical Public Health and Epidemiology Directorate at DCPH-A including Behavioral and Social Health Outcomes Practice, Injury Prevention, Disease Epidemiology, and Army Hearing Conservation and Readiness. Reports released during 2022 for which staff contributed significantly include the weekly Army COVID-19 Installation report, the annual Army Health of the Force report,

**THE PORTSMOUTH SATELLITE** staff work within the EpiData Center (EDC) which, along with Health Analysis, and Health Promotion and Wellness, is part of the Navy and Marine Corps Force Health Protection Command Population Health Directorate. Portsmouth satellite staff serve as subject matter experts in behavioral and operational health, reportable and emerging infections, and data systems and application development.

**THE DAYTON SATELLITE** staff works closely with the DOD Global Respiratory Pathogen Surveillance Program, which performs global sentinel site based respiratory surveillance analyzing more than 22,000 specimens from sentinel sites around the world annually.

**MEDICAL SURVEILLANCE MONTHLY REPORT**

The *MSMR* is the premiere medical peer-reviewed journal published by AFHSDF and DHA. The monthly journal, launched in 1995, provides evidence-based estimates of the incidence, distribution, impact, and trends of illness and injuries among U.S. military service members and associated populations. The *MSMR* continuously evaluates manuscript submissions for scientific accuracy to publish relevant articles on military public health, epidemiology, surveillance, and disease and injury prevention.

*MSMR* reports present data, public health information, and original research with direct relevance to the operational fitness of military members or MHS beneficiaries’ health, safety, and well-being. *MSMR* devotes one issue each year to describe the morbidity burdens attributable to various illnesses, injuries, and other medical conditions among service members and MHS beneficiaries.

**FOLLOWED BY THE HEALTH CARE BURDEN OF DISEASE AND INJURY, MENTAL HEALTH DISORDERS, AND HEAT INJURIES.**

*MSMR* is indexed in MEDLINE and PubMed and Scopus, which regularly review their indexed journals for adherence to peer-reviewed standards. In 2022, *MSMR*’s LinkOut hit on PubMed increased by 5%, to 4,068 in total, from 3,851 in 2021, which represented a substantial increase of 30% from 2020. *MSMR*’s average number of page hits per month in PubMed in 2022 was 339.

The journal impact factor for the *MSMR* surpassed 1.0 and increased from 0.7 in 2020 to 1.9 in 2022. The team attributes this rise to publishing articles based on geographical combatant command priorities, responses to congressional inquiries, and newly published studies in the general population. Those writing scientific articles also cited *MSMR* reports in their published findings, and that improved its ranking from 431 in 2020 to 387 out of 577 journals in 2022.

*MSMR* readership consists of public health practitioners, clinicians, and leadership from military health domains, with a subscriber list of over 1,300 that includes scientists, researchers, and educators from academia and the private sector.

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IN 2022, *MSMR* PUBLISHED 38 ARTICLES, INCLUDING 15 ORIGINAL FULL REPORTS, SEVEN BRIEF REPORTS, 14 UPDATES OF PREVIOUSLY PUBLISHED DATA ANALYSES, AND EIGHT SURVEILLANCE SNAPSHOTS. THE MOST FREQUENT TOPICS OF ORIGINAL ARTICLES AND UPDATES IN 2022 FOCUSED ON COVID-19,
As a key DOD source for health surveillance and epidemiologic training, AFHSD hosts preventive medicine residents from Uniformed Services University (USUHS) for a five-week practicum rotation under the supervision of senior staff. Residents enhance their understanding of the complexities of health surveillance systems, knowledge and application of epidemiology, and critical analytical skills. They also are exposed to AFHSD daily operations and initiatives. Central to their rotation, residents design and execute a data analysis project using the DMSS. Residents begin with a hypothesis and design an epidemiologic study in which they analyze and interpret data and generate a publishable manuscript and an oral presentation.

Resident and student projects have resulted in published articles such as “Incidence and management of chronic insomnia, active component, U.S. Armed Forces, 2012 to 2021”, “Obesity prevalence among active component service members prior to and during the COVID-19 pandemic, January 2018–July 2021”, and “COVID-19 and depressive symptoms among active component U.S. service members, January 2019–July 2021.” Completed resident projects are published in the MSMR or other peer-reviewed journals or presented at the 2023 American College of Preventive Medicine meeting. Additionally, the E&A Branch offers additional rotation and practicum opportunities for occupational and environmental medicine residents and Master of Public Health and Master of Science in Public Health degrees at USUHS.

SINCE 2008 AFHSD HAS TRAINED 81 RESIDENTS WITH DIVERSE ACADEMIC BACKGROUNDS FROM THE THREE MILITARY SERVICES AS WELL AS TWO DOCTOR OF PUBLIC HEALTH STUDENTS. IN 2022, THERE WERE THREE AIR FORCE RESIDENTS AND THREE NAVY RESIDENTS.
GLOBAL EMERGING INFECTIONS SURVEILLANCE

The Global Emerging Infections Surveillance (GEIS) Branch oversees and manages a portfolio of infectious disease surveillance projects executed through a strategically positioned global network of Army, Navy, Air Force, and DHA laboratory partners and critical public health and Military Treatment Facility (MTF) laboratories.

GEIS accomplishes its vision and mission through three strategic objectives (i.e., Strategic Ends): Surveillance, Products, and Program Management. The GEIS Program Office (GEIS-PO) implements these objectives by:

- Funding GEIS Partner Laboratories (GEIS-PLs) to conduct surveillance for emerging infections that threaten the health of the Force and/or military operations;
- Developing and disseminating surveillance information products to stakeholders that provide early warning of emerging threats and battlespace awareness of infectious diseases across geographical locations;
- Providing program management for the GEIS Network (GEIS-N) of laboratory partners through a robust annual business cycle that incorporates strategic guidance, program evaluation, and sound fiscal stewardship.

In 2022, GEIS Celebrated 25 Years of Funding of Infectious Disease Surveillance Activities Worldwide.

Partners in the GEIS-N conduct surveillance designed to provide near-real time data on infectious disease threats to inform DOD decision-makers. Providing timely communication about operational public health threats is critical to enabling GCC FHP decision-making and mission success. The Branch coordinates directly with the GCC Command Surgeons and Service component FHP Officers to capture operational infectious disease priorities. These priorities are communicated to the GEIS-N through strategic guidance documents in the annual Request for Proposals. The GEIS-PLs utilize these guidance documents to develop and execute surveillance activities within four Focus Areas: Antimicrobial Resistant and Sexually-Transmitted Infections (AMR/STI), Enteric Infections (EI), Febrile and Vector-Borne Infections (FVBI), and Respiratory Infections (RI).
Each GEIS Focus Area defines its priorities and direction through Focus Area Roadmaps, review of annual proposals, data collection from funded projects, and translation of findings into products packaged and disseminated to GEIS audience members. The GEIS-PLs incorporate the GEIS Strategy, Focus Area Roadmaps, and GEIS-GCC alignment documents to design and conduct surveillance activities in annual proposals. In 2022, the core metrics and key performance indicators (KPIs) were established and codified in the GEIS Strategy to develop a foundation for evaluating programmatic success and progress for GEIS. These metrics and KPIs are often adjusted to align with strategic goals and objectives.

Starting in FY24, the GEIS Strategic Plan will encompass new objectives, new surveillance lines of effort, and newly rescoped Focus Areas. The GEIS Branch will replace the mission and vision within this plan with a Purpose Statement aligned with the DHA mission and vision. The GEIS Branch will also replace its strategic ends, ways, and means with objectives that align to three main pillars (programmatic, surveillance, and products), used to evaluate surveillance activities and focus efforts on generating meaningful data with a high return on investment. The team will incorporate four new lines of effort to reflect DHA priorities; each GEIS-funded project will map to the following: 1) pandemic preparedness, 2) operational support, 3) countermeasure assessment, and 4) MTF support/Direct Care delivery.

The Antimicrobial Resistant and Sexually-Transmitted Infections (AMR/STI) Focus Area will merge with the Enteric Infections (EI) Focus Area. While the pathogens in these Focus Areas are unique, the underlying theme and priority across this group of pathogens is antimicrobial resistance. The new focus area will be Antimicrobial Resistant Infections.

Finally, three cross-cutting initiatives in the Strategic Plan will highlight how next-generation sequencing (NGS) and bioinformatics (BI), One Health, and data modernization play a central, strategic role in nearly all GEIS-funded activities.

IN 2022, GEIS DISTRIBUTED $50.301 MILLION IN FUNDING TO 23 DOD LABORATORIES AND MTFS TO CONDUCT INFECTIOUS DISEASE SURVEILLANCE TO INFORM FHP. THE GEIS ALSO ALLOCATED $8.475 MILLION IN FUNDING TO SUPPORT THE DOD’S SARS-COV-2 GENETIC SEQUENCING EXPANSION EFFORTS AND $1.745 MILLION TO SUPPORT GENERAL PANDEMIC PREPAREDNESS ACTIVITIES. ONCE FUNDED, GEIS-PLS WORK WITH HOST NATIONS AND REGIONAL PARTNERS TO CONDUCT DISEASE SURVEILLANCE ACROSS THE GLOBE.
GEIS PARTNERS

FIGURE 1. Map of GEIS Partner Locations

GEIS-PLS: NMRC, including NAMRU INDO PACIFIC, NAMRU EURAFCENT, NAMRU SOUTH, and NHRC, WRAIR, including U.S. Army Medical Directorate-Armed Forces Research Institute of Medical Sciences (US-AMD-AFRIMS), USAMRD-Georgia (USAMRD-G), and USAMRD-Africa (USAMRD-A); DCPH-Dayton (formerly USAFSAM); and USUHS

ADDITIONAL DOD PARTNERS: 18th Operational Medical Readiness Squadron (18 OMRS), 65th Medical Brigade (65th MED BDE), Navy Entomology Center of Excellence (NECE), Pharmacovigilance Center (PVC), United States Army Medical Research Institute of Infectious Diseases (USAMRIID), and Walter Reed Biosystems Unit (WRBU)

MILITARY TREATMENT FACILITY (MTF) PARTNERS:
Joint-Base Lewis-McChord (JBLM)/Madigan Army Medical Center (MAMC), Landstuhl Regional Medical Center (LRMC), and Tripler Army Medical Center (TAMC)

PUBLIC HEALTH COMMAND/CENTER PARTNERS:
DCPH-Portsmouth-EpiData Center, Navy Environmental Preventive Medicine Unit (NEPMU) 2, NEPMU 5, NEPMU 7, Public Health Command (PHC) Europe, and PHC Pacific.

INITIATIVES

The GEIS-PO is responsible for several initiatives that enrich the support for its surveillance activities. The primary initiatives include Data-to-Decision, data modernization, and next-generation sequencing and bioinformatics (NGS-BI).

GEIS DATA-TO-DECISION INITIATIVE

The GEIS Branch continued to implement, evaluate, and refine the Data-to-Decision Initiative launched in late 2017. This
initiative aims to rapidly communicate infectious disease surveillance findings from GEIS-funded projects to the GEIS audience (e.g., GCCs) to inform HHS decision-making. For 2022, GEIS-PLs continued to provide surveillance findings to the GEIS Branch every month. The GEIS Branch developed and disseminated **11 Monthly Surveillance Reports** that communicated notable surveillance findings to GEIS audience members. Additionally, GEIS published over **40 SPOT reports** that urgently communicated high and moderate threat surveillance findings to GEIS audience members. Most SPOT reports shared surveillance findings resulting from SARS-CoV-2 whole genome sequencing efforts. These reports highlighted the identification of novel variants and monitored the emergence and distribution of the Omicron variant.

Over the past year, the Data-to-Decision Initiative has accomplished several goals. First, GEIS continued to curate its CarePoint site, making several significant modifications to improve navigation and functionality to the GEIS-PLs and other audiences. ‘Newsworthy’ reports and announcements were featured using contemporary graphical buttons, and Data-to-Decision reporting was moved to the GEIS CarePoint page via a fillable submission form. Second, the AMR/STI Focus Area began a pilot program to collect structured data on antimicrobial resistance testing among three GEIS-PLs. This data was collected, summarized, and reported over six months with the intent to expand this data initiative to all laboratories conducting antimicrobial resistance surveillance in the GEIS-N within one to two years. From lessons learned in this initial pilot, the AMR/STI Focus Area will develop and share a standardized data collection tool with participating laboratories. This will reduce the time and effort in receiving and transforming data. This is just one example of how GEIS continues implementing process improvements to yield more effective data products and reduce the reporting burden on the GEIS-PLs.

**DATA MODERNIZATION INITIATIVE**

The GEIS Program Office continues to collaborate with Program Executive Office, Defense Healthcare Management Systems (PEO DHMS) to implement a cloud-based data lake environment for the GEIS-N that will be fully operational in one to two years. This will enable seamless data sharing between GEIS-PLs and the GEIS-PO and allows the GEIS team to keep pace with the changing disease and technology landscapes in a scalable manner. Once operational, the GEIS Data Lake will also replace time-consuming data collection and management processes that currently exist. With the implementation of direct and standardized data submission into the data lake, the GEIS Branch will be able to generate more timely and relevant analyses and products to the GCCs and other GEIS audience members.

The GEIS-PO implemented a more streamlined approach to tracking and receiving programmatic and surveillance data using the Microsoft 365 suite of products. This has allowed the GEIS-PO to automate historically manually intensive processes and decrease the text-heavy, email-based burden of data reporting for partners. By continuing to modernize our approaches to funding, tracking, and evaluating surveillance projects worldwide, the GEIS-PO can dedicate more time to data-driven insight generation and ensure the GEIS portfolio remains efficient and effective in resource sharing, DOD priorities, and funding.

In addition to modernizing the GEIS-PO, GEIS extends knowledge and resources to empower the GEIS-PLs to enhance local data management practices. This will ensure improved accuracy, reliability, and timeliness of data and enable partners to more effectively distribute findings to pertinent stakeholders, reach-back support, and other subject matter experts. These accomplishments demonstrate GEIS’s commitment to improving the efficiency, effectiveness, and accessibility of biosurveillance data. Epidemiologists and subject-matter experts from the GEIS-PO advise on the building of the Biosurveillance Hub & Portal. Once fully operational, these advisors will remain critical data producers and consumers within this platform.

**NEXT GENERATION SEQUENCING AND BIOINFORMATICS CONSORTIUM**

The increasing availability and affordability of NGS technologies have dramatically increased the capability of DOD medical and public health laboratories to detect and characterize infectious disease threats. As a result, NGS has become a critical component of comprehensive biosurveillance programs within DOD. In 2017, GEIS established the Next-Generation Sequencing and Bioinformatics Consortium (NGSBC) to promote collaboration, development, and harmonization of NGS and BI capabilities among the
GEIS-PLs. The end goal is to increase the availability and quality of genomic data and information products to inform FHP decision-making. Because of these investments in sequencing capabilities across the GEIS-N, the NGSBC - including several partners with existing sequencing capabilities outside of the continental U.S. (OCONUS) - was able to rapidly establish SARS-CoV-2 genomic surveillance in early in the COVID-19 pandemic. Similarly, GEIS-PLs rapidly pivoted to sequence mpox samples upon request when it emerged as an epidemic in 2022.

The NGSBC partners routinely collected, sequenced, and reported SARS-CoV-2 data throughout the pandemic, monitoring trends and changes to inform FHP decision-making. In 2022, the Consortium partners were able to 1) detect and report on the emergence of vaccine breakthrough infections (VBTs) and fast-spreading Variants of Concern (VOCs) within DOD populations 2) track the surge in Delta and Omicron cases 3) and in some cases, identify the first known cases of select VOCs within the Military Health System (MHS). The GEIS-PO disseminated SARS-CoV-2 genomic sequencing data using a weekly report summarizing lineage information at the military installation level, emphasizing VBTs and VOCs. The GEIS-PO continued to update and maintain a SARS-CoV-2 variant dashboard on the Health Surveillance Explorer (HSE) that displayed the geographic distribution of variants over time.

The GEIS Branch continues to support the maintenance and expansion of SARS-CoV-2 sequencing efforts at two OCONUS MTFs: LRMC in Germany and TAMD in Hawaii. Five core laboratories of the NGSBC (e.g., NHRC, NMRC, USAFSAM, USAMRIID, and WRAIR), the OCONUS MTFs, MAMC, and four additional OCONUS partners (AFRIMS, NAMRU-SOUTH, PHC-P and USAMR-D-A) continue to actively sequence SARS-CoV-2 samples, monitor for emerging variants, and report their findings to the GEIS Branch on a weekly or monthly basis. These partners produced 33 SPOT reports in 2022 related to SARS-CoV-2 sequencing, which included descriptions of key emerging mutations among SARS-CoV-2 viruses, detection of novel and emergent variants in MHS beneficiaries, severe clinical outcomes related to infection, and outbreak investigations on Naval vessels, recruit training centers, military academies, and overseas installations.

The GEIS Branch utilized the health.mil platform to feature a series of six laboratory vignettes that highlighted the expansive sequencing capabilities of the GEIS-N, particularly as it related to CONUS-based laboratory sequencing of SARS-CoV-2 samples. GEIS is optimistic that the network capabilities will continue to flourish and function as a sustainable solution for the advanced characterization of novel and emerging pathogens that might threaten the Force.

The GEIS Branch is planning for the second iteration of its Pathogen Detection Project (PDP) to stay on the leading edge of NGS technologies and activities. The PDP is a blinded panel exercise that assesses proficiency in sequencing and bioinformatic analysis among participating GEIS-PLs and supports the establishment of a stronger foundation for future pathogen discovery activities. These sequencing capability and proficiency testing expansions underscore the need for a secure, accessible global platform for data transfer and analysis. Accordingly, the GEIS-PO continues to pursue a more coordinated approach for data sharing and reporting with the Digital Biobank, which will enhance network-wide support and capabilities in bioinformatics. The GEIS-PO is also broadening its scope with respect to NGS-BI to include water surveillance activities such as wastewater testing for SARS-CoV-2 and other FHP-relevant pathogens.

**STAYING ON THE LEADING EDGE**

The GEIS Branch is responsible for several initiatives to stay ‘on the leading edge’ in the ever-evolving landscape of laboratory capabilities and technologies. For example, as genetic sequencing capabilities have evolved and grown, so has the desire to have mobile platforms that could shorten the time from sample collection to reporting results. To support the deployment and utilization of this technology, the GEIS Branch established a user group for partners leveraging the MinION, a portable genetic sequencing platform. Since 2019, the MinION User Group has served as a forum for government-funded users of the Oxford Nanopore MinION to share information and best practices, discuss troubleshooting and challenges, and encourage collaboration. Currently, the group has 155 participants from 30 U.S. Government (USG) and other organizations. In 2022, GEIS partners gave four presentations about applications of MinION technology there were shared widely within the GEIS-N. GEIS will continue to offer the opportunity for partners to present their findings and learn from others through this forum.

GEIS Chief U.S. Navy Cdr. Matthew Kasper (middle) stands with U.S. Army Maj. Hunter Smith, U.S. Army Maj. Ashley Hydrick, Stephanie Cinkovich, PhD, and Kathleen Creppage, DrPH, at the American Society of Tropical Medicine & Hygiene annual meeting in Seattle, Wash. (ASTMH)
To promote harmonization and synchronization among GEIS-PLs, the GEIS Branch established the GEIS Laboratory Capability Database in 2019 with collated, detailed information on the various capabilities of each of the GEIS-PLs. This database is a resource for laboratories looking to collaborate across the network, particularly if there is a need to identify a partner with specific instrumentation or capability. The database also contains an assay matrix, allowing partners to view, compare, or select assays currently in use at GEIS-PLs. This ensures the availability of more consistent and comparable testing within the network. The GEIS Branch plans to move the database to its GEIS CarePoint Site in 2023 to improve accessibility for the network.

The GEIS Branch continues to populate a GEIS Partner Publication Database to track publications as a component of evaluating project progress and outcomes GEIS-funded efforts. From 2016 to 2022, GEIS logged 353 publications in 110 unique journals. In 2022 alone, the GEIS-N published 47 manuscripts. These initiatives have provided tremendous value to the Branch, and it will continue seeking further innovation opportunities to stay on the leading edge.

BRANCH FOCUS AREA OVERVIEWS

ANTIMICROBIAL RESISTANCE & SEXUALLY TRANSMITTED INFECTIONS (AMR/STI) FOCUS AREA:

The AMR/STI Focus Area portfolio addresses the surveillance of antibiotic resistant organisms. The Focus Area conducts surveillance of Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter spp., & Escherichia coli (ESKAPE-E) pathogens and multidrug-resistant STIs, specifically Neisseria gonorrhoeae and Mycoplasma genitalium, among U.S. Service members and other FHP-relevant populations around the world. The projects in the AMI/STI portfolio are divided into “surveillance categories,” a collection of similar surveillance activities centered on common themes such as pathogen/disease targets, populations, surveillance techniques, etc. These surveillance categories are:

1. Trauma-related infections.
3. Sexually transmitted infections surveillance.
4. Combating Antibiotic Resistant Bacteria (CARB) initiative supported activities.

The desired outcome of coordinated surveillance for AMR/STI pathogens is to provide data to inform FHP decision-making, DOD policy, and public health authorities for preventing, detecting, and responding to AMR threats.

CURRENT PORTFOLIO:

In 2022, the AMR/STI Focus Area supported 18 sustainment and seven competed projects at 12 DOD partner laboratories, totaling approximately $8.5 million. This amount included $4.1 million to promote CARB activity, a national-level initiative, by conducting AMR surveillance in the MHS. GEIS-directed CARB funding also maintains two critical multi-drug-resistant organism (MDRO) pathogen repositories - the WRAIR Multidrug-Resistant Organism Repository and Surveillance Network (MRSN) and the USU GC Reference Laboratory & Repository. Overall, the AMR/STI portfolio conducted prospective surveillance in 21 operationally important countries worldwide.

WHERE WE ARE GOING:

The AMR/STI Focus Area will concentrate on additional FHP-relevant targets, such as community-acquired infections and MDRO infections in traumatic injuries. Increasing collaboration and harmonization of surveillance methodologies across the GEIS-N will improve the integrity and cohesiveness of data and outputs, which will ultimately better inform FHP. The AMR/STI Focus Area works with partners to establish a more integrated, standardized, and harmonized approach to AMR/STI surveillance activities across the network. One Health domains (e.g., human, animal, and environmental) will also become a priority of the Focus Area, incorporating surveillance that uses animal and environmental sentinels to improve data collected for FHP decision-making.

RECENT ACCOMPLISHMENTS:

The AMR/STI Focus Area received a total of eight SPOT reports in 2022. Seven were reported by WRAIR-MRSN and one from NHRC. The WRAIR-MRSN SPOT reports are a collaborative effort with GEIS-N partners to link bacteria collected from CONUS and OCONUS facilities to facilitate enhanced detection of MDROs.

NAMRU SOUTH lab technicians conduct AMR/STI surveillance through their laboratory in Iquitos, Peru. (GEIS/June Early)
**ENTERIC INFECTIONS (EI) FOCUS AREA:**

The GEIS Branch continued to collaboratively fund projects across nine DOD partner laboratories totaling approximately $4.5 million. The multisite Global Travelers’ Diarrhea (GTD) Study continued prospective surveillance efforts in Djibouti, Egypt, Honduras, Kenya, Nepal, Peru, and the Republic of Georgia. The GEIS-PLs (AFRIMS and USAMRD-G) conducted enteric surveillance activities during military exercises in the INDOPACOM and EUCOM AORs. Additionally, advanced characterization of enteric pathogens expanded to focus on antibiotic resistance. In 2022, the EI Focus Area supported 11 sustainment projects and one competed project across nine DOD partner laboratories. The EI Focus Area continued to build an integrated, multi-lab network of enteric surveillance activities among U.S. military personnel, western travelers, and in forward deployed settings. The Focus Area provides DOD communities and GCCs with information about the disease burden and assists in identifying high-risk populations to help inform decisions regarding patient care, preventive medicine measures, public health reporting, and infection control. The EI Focus Area portfolio addresses military-relevant enteric pathogens through:

1. Surveillance for acute gastroenteritis in the U.S. military (including recruit and forward-deployed populations), foreign military, and foreign civilian populations.
2. Characterization of enteric disease with a focus on the category of travelers’ diarrhea among immune-naïve travelers.
3. Advanced characterization of enteric pathogens that includes antimicrobial susceptibility testing (AST) and molecular testing of antimicrobial resistance genes.

**CURRENT PORTFOLIO:**

In 2022, the EI Focus Area supported 11 sustainment projects and one competed project across nine DOD partner laboratories totaling approximately $4.5 million. The multisite Global Travelers’ Diarrhea (GTD) Study continued prospective surveillance efforts in Djibouti, Egypt, Honduras, Kenya, Nepal, Peru, and the Republic of Georgia. The GEIS-PLs (AFRIMS and USAMRD-G) conducted enteric surveillance activities during military exercises in the INDOPACOM and EUCOM AORs. Additionally, advanced characterization of enteric pathogens expanded to focus on antibiotic resistance used for empiric treatment for diarrheal illness. The Focus Area created a testing priority list for molecular markers that will enhance the understanding of resistance genes, antibiotic resistance patterns, and dispersion of enteric pathogens geographically.

**WHERE WE ARE GOING:**

The EI Focus Area continues to fund projects across the GCCs that will increase knowledge of the epidemiology, etiology, and antimicrobial resistance patterns of enteric infections. Testing for resistance among diarrheagenic pathogens poses numerous challenges, including the need to standardize the methodology for testing and interpretation. Therefore, the GEIS Branch continues to collaborate with NHRC to...
harmonize and standardize reporting for the GTD study. The efforts consist of updating the data extraction, patient questionnaire, Standard Operating Procedures, and case definitions across sites in five continents. The EI Focus Area continues to develop a centralized model of sequencing with NHRC (the GTD Study coordinating site) as the core laboratory for enteric pathogen sequencing.

**RECENT ACCOMPLISHMENTS:**

- The NHRC sustainment study of population-based surveillance for pathogens associated with Acute Gastroenteritis (AGE) among U.S. military trainees identified an elevated rate of AGE among recruits at Marine Corps Recruit Depot - Parris Island (MCRD-PI). Forty-one cases of AGE were identified from 4 April to 6 April 2022. The BioFire FilmArray Gastrointestinal (GI) Panel was used to test available specimens, 100% (7/7) of which were positive for norovirus GI/GII and one specimen was also positive for rotavirus A. The response by MCRD-PI leadership was quick to contain the spread of the cluster.

- The GTD Study encompasses a collaborative effort between NHRC and OCONUS partner labs, including NAMRU EURAFCENT, NAMRU SOUTH, USAMRD-A, USAMRD-G, and AFRIMS. The GTD Study aims to characterize the causative pathogens of diarrheal disease among travelers and investigate their antibiotic resistance profiles to inform FHP practices to reduce the impacts of diarrheal disease’s transmission. In 2020 and 2021, the Enteric Infections Focus Area noted marked decreases in specimens and enrollments in the GTD Study due to the travel limitations imposed during the COVID-19 pandemic. However, in FY22 the study saw a significant increase in the amount of GTD enrollments from 104 (FY21) to 255 (FY22). The sites also identified over 173 enteric pathogens in FY22, compared to just 75 in FY21. Of note, most enrolled subjects were co-infected with two or more enteric pathogens. The Focus Area is positioned to support collecting and testing increased samples as more global travel occurs.

**FEBRILE AND VECTOR-BORNE INFECTIONS (FVBI) FOCUS AREA:**

The FVBI Focus Area portfolio focuses on actionable surveillance of vector-borne and zoonotic febrile infections that threaten the health of U.S. Service Members. The FVBI Focus Area seeks to better characterize the composite risk of febrile and vector-borne diseases to U.S. personnel, inform FHP decision-making with timely and relevant surveillance data, and contribute to countermeasure development. To accomplish these objectives, the FVBI Focus Area surveillance projects fall into three general areas: 1) characterizing acute febrile illnesses (AFI) by linking syndromes to causative pathogens; 2) documenting the geographic and temporal distributions of vectors, reservoirs, and associated pathogens; and 3) assessing the effectiveness of FHP countermeasures to vector-borne infections.

**CURRENT PORTFOLIO:**

In 2022, the FVBI Focus Area supported 16 competed projects and 37 sustainment projects at 17 partner laboratories (incl. two interagency collaborators), funded at over $18 million. The FVBI Focus Area maintained vector surveillance across OCONUS partner labs, including an expansion of insecticide resistance efforts to countries such as Panama (NAMRU SOUTH) and South Korea (65th MED BDE). The WRBU also initiated one of the first projects to assess insecticide resistance in ticks. AFI surveillance continued in important partner nations, such as Jordan and Ghana (NAMRU EURAFCENT). FVBI also focused on factors responsible for rapid diagnostic test (RDT) failure in malaria screening, such as the distribution of pfhrp2 gene deleted *Plasmodium falciparum* parasites. Data from Cameroon (NAMRU EURAFCENT) indicated that reduced RDT sensitivity in the region may have contributed to the increased malaria incidence in 2021. In contrast, data from Vietnam (NAMRU INDO PACIFIC) indicated that RDTs remained a viable option for screening in the Central Highland regions. Finally, the WRBU team integrated new features to the VectorMap portal, such as insecticide resistance and bloodmeal collections. These updates aided longstanding efforts to develop ecological niche models and determine vector surveillance location gaps, which in turn aid future surveillance site selection.

**WHERE WE ARE GOING:**

The FVBI Focus Area will increase value for DOD customers by further refining its surveillance niche and harnessing efficiencies made possible by new tools or techniques. First, the FVBI Focus Area will direct efforts and resources toward unique DOD FHP needs, constraints, and gaps, which may not be addressed in the surveillance conducted by interagency and coalition partners. For the FVBI Focus Area, familiarity with DOD personnel, tools, and operations enables tailored and actionable surveillance. Second, the FVBI Focus Area will enter the next phases in its initiative to harmonize surveillance procedures and data integration across GEIS-N. These phases will focus on capabilities that enable faster shifts to priority operational needs and unexpected outbreaks and allow regional partners closer coordination and common surveillance pictures. Third, the FVBI Focus Area will shift how it conducts AFI surveillance to increase the value and timeliness of results. AFI is a global operational FHP concern, but seeking answers to narrower, regional questions may be the most efficient means to providing actionable AFI surveillance information. The FVBI Focus Area seeks to maximize surveillance output by exploiting mature data and lab processing technologies, seamless coordination across the GEIS-N, and procedures adapted to DOD-specific needs.

**RECENT ACCOMPLISHMENTS:**

- PHC-P began serving as a regional reach back laboratory to provide higher capability molecular processing of samples from other INDOPACOM partners. Over 4,800 pools of
approximately 85,000 specimens were analyzed by the lab as of November 2022, with a turnaround time of 1.4 days for pathogen detection requests. Positive detections included 21 pools of Japanese encephalitis virus, three pools of severe fever with thrombocytopenia syndrome virus, one pool of West Nile virus, 65 pools of Rickettsia spp. and two pools of Plasmodium vivax.

► NAMRU EURAFCENT expanded surveillance coverage into Yemen. As of December 2022, over 4,000 Anopheles mosquitoes were collected from eight governorates on the south coast of Yemen. Eight hundred mosquitoes were Anopheles stephensi, an invasive vector that can transmit endemic malaria parasites. Surveillance on Sokatra Island of Yemen also began in December 2022 and preliminary findings indicated the presence of the invasive vector, An. stephensi. The island was originally malaria-free, but that status might change due to ongoing pathogen testing on this invasive species.

► The WRBU developed 108 ecological niche models and eight vector hazard reports in collaboration with USAMRD-A, USAMRD-G, NAMRU EURAFCENT, NAMRU SOUTH, NECE, NEPMU 5, AFRIMS, WRAIR, 18th OMRS and 65th MED BDE. Integrating IRMapping (insecticide resistance) and Bloodmeal Analysis tools increases VectorMap’s position as the most expansive dataset combining public literature and the United States National Museum specimen records.

RESPIRATORY INFECTIONS (RI) FOCUS AREA:
The RI Focus Area portfolio supports surveillance activities for many respiratory pathogens but specializes in the detection of and response to pathogens with pandemic potential, including those that emerge at the human-animal interface. This occurs through routine surveillance among U.S. military members (including recruit, ship-board, and deployed populations), MHS beneficiaries, foreign military, and civilian populations, as well as animal and environmental sampling. Advanced characterization evaluates vaccine effectiveness and monitors potential antigenic shift/drift and emerging SARS-CoV-2 and influenza variants.

CURRENT PORTFOLIO:
In FY22, the RI Focus Area supported 31 sustainment and five competed projects at 15 DOD partner laboratories across all GCCs, totaling approximately $18.9 million. Like FY21, SARS-CoV-2 continued to represent the highest portion of respiratory disease surveillance. Influenza and other respiratory illnesses continued detection at low levels. RI Focus Area continued surveillance at the human-animal interface while monitoring swine and birds in South America, Africa, and Asia. Respiratory projects leveraged the Next Generation Sequencing and Bioinformatics Consortium to provide high-quality sequencing data for surveillance, vaccine formulation, and FHP efforts.

WHERE WE ARE GOING:
The RI Focus Area continues to support the DOD Global Respiratory Pathogen Surveillance Program (DODGRPSP) to provide broad surveillance of respiratory infections. The annual review of sentinel sites optimizes surveillance across the MHS by ensuring sites with greater potential for participation continue to be included as part of the network while inactive sites are removed or further evaluated to understand barriers to participation. Surveillance at the human-animal interface will continue, emphasizing the One Health approach. Future project funding will consider pandemic preparedness, surge capability, and pathogen identification processes. The RI Focus Area will focus on improving awareness of partner findings and resources to enhance network collaboration, particularly regarding next-generation sequencing and bioinformatics. Finally, the RI Focus Area aims to coordinate with external organizations to improve synchronization and decrease duplication of effort.

RECENT ACCOMPLISHMENTS:
► NHRC established surveillance and testing capabilities in Guam to support FHP by reducing the time it takes to analyze a sample. This allows NHRC to support shipboard surveillance by adding a supply pick-up and sample drop-off location for the U.S. Pacific Fleet.

► In collaboration with GEIS-PO, DCPH-Dayton (formerly USAFSAM) continued to manage the DODGRPSP in FY22, providing 52 weekly summary reports. DCPH-Dayton identified 104 sentinel sites for participation for the 2022-2023 season.

► Data from AFHSD, DCPH-Dayton, and NMRC presented at the Food and Drug Administration’s Vaccine and Related Biological Products Advisory Committee annual influenza vaccine meeting to inform the composition of the 2022-2023 Northern Hemisphere influenza vaccine.

For more information about GEIS, please visit our CarePoint site: https://carepoint.health.mil/sites/AFHSB/geis/
INTEGRATED BIOSURVEILLANCE
The Integrated Biosurveillance (IB) Branch provides near real-time situational awareness of infectious diseases and health threats to military populations within the DOD. The branch aids in making informed decisions for timely public health interventions and assists Combatant Commands (CCMD) in formulating Force Health Protection (FHP) guidelines or adjusting priority levels in specific regions and countries.

This branch is part of a global network that maintains key partnerships with DOD partners and Inter-agency counterparts including the National Center for Medical Intelligence (NCMI), Department of Homeland Security/National Biosurveillance Integration Center (NBIC), CDC, Department of State, and Defense Threat Reduction Agency (DTRA). Given the complex nature of the nature of epidemics and outbreaks, there is a critical need for timely data collection and processing that involves a multi-step process with numerous stakeholders, and IB serves as a “One-Stop Shop” that collects, analyzes, and distributes data and biosurveillance information from reliable resources and partner organizations, such as the National Center for Medical Intelligence (NCMI), the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO).

This branch comprises three sections, Alert and Response Operations (ARO), Innovation and Evaluation (I&E), and Geographic Information System (GIS). In addition to IB’s flagship product, the weekly AFHSD Health Surveillance Update (AHSU), IB generates a variety of recurring and ad hoc health surveillance reports including Executive Summaries, SPOT Reports, disease-specific surveillance summaries, forecast reports, and Reportable Medical Event summaries. Furthermore, IB identifies potential public health threats via all-hazards horizon scanning of open-source surveillance data, shares this information with DOD, Interagency partners, and other DHA components, and communicates on these events through various formal channels. Concurrently, IB conducts syndromic and event-based surveillance of MHS beneficiaries through systems such as DRSi and DOD ESSENCE, integrating this data with open-source information where appropriate (Figure 1). These products and more are also accessible in the Health Surveillance Explorer (HSE) mapping application (Figure 2).

The HSE is an interactive web-based application developed by the GIS Section to provide CCMD decision-makers with timely, relevant, actionable, and comprehensive health surveillance information to promote, maintain, and enhance the health of Active Duty SMs and Military Health System (MHS) beneficiaries. It also provides a near real-time picture of health threats, disease outbreaks, and other events of military interest and/or relevance to the DOD. Information about the HSE including how to register for an account is available at www.health.mil/hse.

IB is always forward-looking and responsive, using forecasting techniques to anticipate future threats and inform planning and decision-making to enhance military readiness.

**Figure 1.**

**INTEGRATED BIOSURVEILLANCE**

ALERT AND RESPONSE OPERATIONS FY22 SIGNIFICANT ACCOMPLISHMENTS

During the past fiscal year, the ARO Section has continued to improve the quality of content and expand the reach of its numerous biosurveillance products. The ARO Section has been actively involved in providing the most relevant information on health threats of military interest. In addition to this primary role, the ARO Section has participated in presentations, table-top exercises, and working-group meetings with other federal agencies and groups, such as the National Security Council, to discuss emerging threats including Ebola and mpox. These biosurveillance products have helped inform policy at the Office of the Secretary of Defense. The ARO Section continues to

“[W]e find your product (AHSU) to be helpful for [our] understanding of health events that have the potential to impact the health-care and public health sector.”

— U.S. Department of Health and Human Services (April 2022)

“Thank you for your continued excellence in health surveillance”

— Commander, Naval Medical Forces Pacific (May 2022)
be recognized for its high quality, outstanding, and value-added contributions to the DOD’s biosurveillance efforts.

The following highlights some of the more significant accomplishments of the ARO Section:

► Enhanced FHP strategy through proactive disease surveillance, timely responses to requests for information, and delivering crucial information to inform commander FHP posture decisions. As an example, a comprehensive report was generated, detailing the epidemiology of tick-borne encephalitis (TBE) in several Eastern European countries, including Germany, the Czech Republic, Poland, Bulgaria, and Ukraine. This in-depth biosurveillance analysis provided the crucial epidemiological data needed to inform TBE vaccine recommendations for the Health Readiness Policy & Oversight, Office of the Assistant Secretary of Defense (Health Affairs).

► Participated in the U.S. Interagency Global Monkeypox Response Team, which provided a high-level overview of the global mpox epidemiological situation and U.S. response efforts. The team, composed of subject-matter experts from numerous USG departments and agencies, including United States Agency for International Development (USAID), Centers for Disease Control and Prevention (CDC), United States Department of Homeland Security (DHS), and United States Department of Agriculture (USDA), developed the Weekly Mpox Situational Report. This report provided a curated, focused summary of the global outbreak trajectory and an update on key activities and developments related to the global response.

► Regularly produced and distributed health updates, including 52 AFHSD Health Surveillance Updates (AHSUs), 47 COVID-19 Executive Summaries (EXSUMS), 45 COVID-19 Surveillance Summaries, and nine EXSUMs on events of special interest, including mpox, Ebola virus disease in the Democratic Republic of the Congo and Uganda, and the first human detection of novel influenza A(H5N1) in the U.S. These reports provided vital information on medical countermeasures, diagnostics, and transmission.

► Responded to numerous Requests for Information from the CCMDs on various topics, including infectious disease risks in several geographical locations and specific diseases, such as COVID-19 and tick-borne encephalitis.

► Established and maintained regular engagement with CCMDs, participating in key events such as the Pandemics and Infectious Diseases Coordination Conference hosted by USNORTHCOM, and Viral Supremacy Tabletop Exercise 2022, providing critical insights to enhance and improve biosurveillance practices.

► Gained access to the Theater Medical Data Store (TMDS) and participated in weekly meetings with DCPH-Portsmouth and DOD ESSENCE subject matter experts to explore data functionalities and ways to leverage near real-time shipboard and in-theater surveillance data.

► Utilized DOD systems and including DOD ESSENCE, the Armed Forces Health Longitudinal Technology Application (AHLTA), the Disease Reporting System internet (DRSI), and DCIRs/CCIRs to establish a comprehensive master list of MHS mpox cases, enabling the creation of an interactive dashboard in the HSE that provided real-time case data and demographic information. This surveillance data aided senior DHA leaders in tracking the outbreak in the MHS population.

► Supported the biweekly DOD Epidemiology Chiefs meeting, providing global health surveillance briefings at the beginning of each meeting and contributing to finalizing, and disseminating official highlights from approximately 21 meetings. AFHSD hosts this Tri-Service call and provides a forum for the informal exchange of professional information, consultation, and discussion across the Services.

► Continued expanding the subscriber base for the AHSU and other surveillance products to more than 2,500, demonstrating a substantial growth in annual subscriptions.

Figure 2. Key features contained in the Health Surveillance Explorer mapping application.
INNOVATION AND EVALUATION FY22 SIGNIFICANT ACCOMPLISHMENTS:

The Innovation and Evaluation (I&E) Section is a crucial component of the IB Branch that provides vital forecasting analytics about respiratory disease threats, including COVID-19, respiratory syncytial virus (RSV), and seasonal influenza. In response to the COVID-19 pandemic, I&E developed a “Markets to Watch” product, and an associated interactive dashboard, that combines civilian and military data sources to highlight trends in COVID-19 activity and allow near real-time monitoring of DOD health status across MHS Markets. This data provides senior leaders with a crucial planning tool and allows them to anticipate potential threats to military health and readiness.

The following accomplishments are significant to I&E Section:

► Produced and distributed over 150 COVID-19 Markets to Watch reports, spotlighting disease and hospital activity trends within and surrounding CONUS MTFs and installations, facilitating real-time monitoring and providing a comprehensive overview of the health status of MHS Markets. These reports also provided information on CDC COVID-19 Community Transmission Levels in the counties where MTFs are located to show a) new civilian and DOD MHS case rates; b) current COVID-19 hospitalizations; c) two-week percent change in new civilian cases, and d) two-week percent in new civilian hospitalizations.

► In collaboration with various academic, government, and private industry partners, including National Institutes of Health (NIH) and Centers for Disease Control (CDC), the I&E Section successfully completed projects on COVID-like illness and influenza-like illness, and COVID-19 forecasting. Using advanced forecasting techniques and analysis of medical encounter and laboratory data among MHS beneficiaries, these products generated accurate short-term forecasts for the CONUS MHS Markets. These products provided leadership with invaluable insight for proactive decision-making and timely interventions to prevent and control the spread of respiratory pathogens.

► Created two new interactive dashboards for AFHSB-IB’s COVID-19 Markets to Watch and Respiratory Forecasting efforts. The Respiratory Forecasting Dashboard (Figure4) utilized time-series (autoregressive integrated moving average, error-trend-seasonality, exponentially weighted moving average, and vector autoregression) and machine learning (the random forest algorithm, which focuses on forecasting rather than explanation) models to forecast disease trajectory for short-term forecasts (spanning one to four weeks ahead) for 120 CONUS MHS Markets during the 2021-2022 influenza season.

► The Markets to Watch Dashboard (Figure 4) provided routine surveillance of COVID-19 among active-duty, MHS, and civilian populations across 120 CONUS MHS Markets. This resource allows for Market-specific breakdowns of seven-day case averages, hospitalizations, vaccinations, inpatient and ICU occupancy trends, and CDC community levels. This information enables the anticipation of increasing respiratory disease activity that could potentially impact military health and readiness, thereby guiding planning and resource allocation within the MHS population.

To access the IB forecasting dashboards, visit: https://care-point.health.mil/sites/AFHSB/IB (CAC required).

► Developed data access partnerships with three new states (Florida, Georgia, New York), enabling DOD ESSENCE users working at MTFs to view and review civilian ESSENCE data for their local communities. Data exchange between DOD and the Veterans Health Administration (VHA) allowed AFHSB to view aggregate data for VHA facilities. These partnerships leverage the CDC and Prevention’s National Syndromic Surveillance Program ESSENCE platform.
GEOGRAPHIC INFORMATION SYSTEM FY22 SIGNIFICANT ACCOMPLISHMENTS:

The HSE is a continuously evolving and well-maintained application for health surveillance within the Defense Health Agency. Given the current landscape, leveraging geographical tools to visualize biosurveillance data has become increasingly crucial for decision-making across the DOD at all levels. Within the realm of infectious disease monitoring, digital and interactive web-based dashboards offer users the ability to access up-to-date information. This information is gathered and synthesized from a variety of surveillance platforms, making it a centralized hub for stakeholders.

Key milestones for the GIS Section in FY22 include:

► Over 12,000 views on the HSE, indicating high engagement and utilization of the mapping application and its features including dashboards and web maps.

► Enhanced the range of COVID-19 products and resources, including improvements to AFHSD’s COVID-19 Dashboard, updated three days a week. These upgrades included the creation of Delta and Omicron SARS-CoV-2 sublineage maps, the development of country-specific time series graphs, and the integration of MHS data on the prevalence of SARS-CoV-2 variants and vaccine breakthrough infections by major MTFs and MHS Markets.

► Integrated new country features into the HSE, including links to the U.S. Department of State for travel information, advisories, and alerts, as well as the National Center for Medical Intelligence’s Infectious Disease Risk Assessments (IDRA), and the DOD Foreign Clearance Guide, which provides information necessary for aircraft international mission planning and execution, personnel travel to foreign countries, as well as general information on foreign locations.

► In partnership with the Evaluation and Analysis (E&A) Branch, the GIS Section has comprehensively revamped the Heat/Cold Illness Dashboard. This updated tool now offers easily accessible, location-specific information, featuring highlights of the top five MTFs with the highest reported heat and cold injury cases. Additionally, it presents annual case counts for heat/cold injuries dating back to 2018 for historical insights. Moreover, the dashboard details the incidence of specific conditions such as heat exhaustion, heat stroke, frostbite, and hypothermia, as well as other heat/cold related illnesses, over both the past two and twelve months. These statistics are provided for CONUS and OCONUS MTFs (Figure 5).

► Developed new HSE layers featuring medical events occurring at CONUS and OCONUS locations from the Disease Reporting System internet outbreak module, with an outbreak-specific query function enabling users to search by outbreak type, etiologic agent, Geographic Combatant Command, country, date of event, and setting (land or shipboard).

► In 2022, mpox outbreaks were reported in several countries where the disease is not endemic. Most U.S. cases were reported in major metropolitan areas. To closely monitor the escalating global mpox outbreak, which was declared a public health emergency of international concern by the WHO on July 23, 2022, the GIS Section created the Mpx Dashboard. The dashboard uses a comprehensive and relational database of MHS mpox cases, enabling users to track, display, and analyze daily the incidence of mpox by CONUS and OCONUS MTF and key demographic and epidemiologic indicators, including beneficiary status (ADSMs vs. other beneficiaries), Service, sex, age group, and symptom onset date. This dashboard allowed DHA leaders to more closely examine the spread of the disease in the MHS population (Figure 6).

► The HSE has garnered over 12,000 views, indicating high engagement and utilization of the mapping application and its features, such as dashboards and web maps.
Figure 5. AFHSD’s Heat/Cold Illness Dashboard.

Figure 6. AFHSD’s Mpox Dashboard.

ALL DASHBOARDS SHOW SIMULATED DATA
The Special Projects Cell (SPC) is a new organizational line of effort for AFHSD that combines current and future tools used to perform health surveillance, analyses, and monitor all hazard events that may impact the health and readiness of the warfighter. This cell focuses on two key initiatives: the Interagency Collaboratory (current) and the Biosurveillance Hub and Portal project (future). The initiatives within the SPC portfolio are considered tools as they can or will provide vital resources to AFHSD and other DOD surveillance entities to perform surveillance, collaborate with internal and external partners, and communicate emerging threats to decision-makers and other key stakeholders.

**BIOSURVEILLANCE HUB AND PORTAL**

Biosurveillance Hub and Portal (BSHP) was initially developed to meet the urgent operational need for real-time health surveillance information with communication channels across the health community. The project grew into an all hazards biosurveillance system, following mandates in the National Biodefense Strategy and DoD Directive (DoDD) 6420.02 “DoD Biosurveillance”, which directs the DoD to establish a biosurveillance program that “integrates, synchronizes, and standardizes biosurveillance-related activities, to support countering weapons of mass destruction, biodefense and comprehensive health surveillance and forecasting.” Comprehensive biosurveillance includes naturally occurring, accidental, and intentional health threats to people, animals, and the environment. To build an integrated and comprehensive biosurveillance system for the DOD, engagement from health; chemical, biological, radiological, and nuclear (CBRN); and medical intelligence entities is required. In response to a September 2020 INDOPACOM Joint Urgency Operational Need, the Joint Requirements Oversight Council (JROC) validated the capabilities gaps across all Combatant Commands. JROC issued three Memorandums (JROCM 098-20, 049-21, and 066-22) requesting that the DHA “accelerate the development of a centralized DoD biosurveillance hub and standard portal to integrate collected internal and external data and information across the Services and CCMDs.”

The BSHP, as conceived, will provide a workbench where subject matter experts can collaborate to quickly integrate curated products from existing systems across DOD health, CBRN, and medical intelligence surveillance entities while providing the capability to review underlying data and synthesize publicly available information. This will lead to products with specific

![Figure 1. Biosurveillance Integration through BSHP](image-url)
actionable information and operational relevance. The BSHP will also provide the communication tools needed to rapidly communicate these findings.

BSHP products will ensure leadership, key stakeholders, and other partners have trusted biosurveillance information available to make informed decisions. An all hazards biosurveillance system, like the BSHP, requires a seamless integration of biosurveillance assets: people, processes, tools, and technology (Figure 1). To accomplish the BSHP project, AFHSD works in coordination with the Program Executive Office Defense Healthcare Managements Systems.

**BSHP FY22 ACCOMPLISHMENTS INCLUDE:**

- Developed charter for the BSHP project and four cross-organizational working groups (WGs): Functional Requirements; Architecture, Integration and Cyber; Advanced Analytics and Data Science; and Data and Data Sources.
- Conducted bi-weekly Biosurveillance Sub-working group meetings with stakeholders to identify requirements and capabilities prior to Biosurveillance Capabilities Based Assessment kick-off.
- Collaborated with DHA J5 to initiated BSHP Requirements Traceability Matrix.
- Collected and catalogued guiding documents from different stakeholder communities to create capabilities list and identify near, mid- and long-term objectives.
- Drafted JROCM 066-22 in collaboration with JS J8, and the different stakeholders.
- Briefed Joint Staff Functional and Joint Capability Boards on DHA progress with BSHP.
- Collaborated with DHMS to create Biosurveillance WG structure and establish BSHP WGs.

**THE INTERAGENCY COLLABORATORY**

In March 2020, the COVID-19 pandemic surged across the country. The pandemic revealed that no common framework existed in government to capture, analyze, and predict outbreaks of communicable diseases like COVID-19. An inter-agency platform is needed to better manage and integrate data from across the federal government to assist the government’s response to COVID-19 and future pandemics. This will allow for better coordination amongst stakeholders in addressing needs in healthcare and our supply chain during a pandemic. In January 2021 the president issued an Executive Order 13994 to ensure coordinated, data-driven responses to COVID–19 and future high-consequence public health threats across all government entities.

The interagency collaborative laboratory, “Collaboratory”, is a working group that brings together health surveillance agencies and infectious disease experts to enhance data sharing and standardization of surveillance methodologies to facilitate a more consistent and unified response to the COVID-19 pandemic and future emerging threats. Membership in the Collaboratory includes public health experts from the DOD, the Department of Veterans Affairs (VA), the Centers for Disease Control and Prevention (CDC), and other interagency organizations. VA and DoD’s global presence can fill the gaps caused by waning state and local COVID-19 data tracking. The Collaboratory holds weekly meetings with work group members to discuss progress on seven major topical areas related to COVID-19: data definitions, data aggregation agreements, testing strategies, environmental & animal health (One Health), disparities and equity, vaccination effectiveness, & future care. The Collaboratory held two virtual symposia in 2022, bringing experts together to discuss these topical areas in detail.

**COLLABORATORY 1.0**

The initial virtual event of the Interagency Collaboratory, “Collaboratory 1.0”, occurred in May 2022 and brought over 60 subject matter experts together for five days to discuss the current state of COVID-19 knowledge and surveillance practices. The main priority of this event was to identify and address gaps in pandemic data and related needs for real-time public health surveillance.

Collaboratory 1.0’s goal was to discern and prioritize areas where shared definitions and data standards were needed across agencies, identify data gaps and potential solutions, and draft a flexible but discrete approach to priority areas. The Max.gov federal platform was utilized for collaboration between SMEs and storing of artifacts for future operational reference across agencies. The outputs from the Collaboratory consisted of data products and approaches that support VHA and DHA pandemic preparedness and contribute to CDC’s Center for Forecasting and Outbreak Analytics (CFA).

**COLLABORATORY 2.0**

The second virtual event of the Interagency Collaboratory, “Collaboratory 2.0”, occurred in August 2022 and brought over 80 subject matter experts together for three days to discuss progress made on gaps identified during Collaboratory 1.0 and reassess the current needs related to COVID-19 public health response and how the Collaboratory could support. Collaboratory 2.0 continued our shared Federal commitment toward data sharing and the application of these data to better predict and manage COVID-19 and emerging health threats. Multiple interagency data sharing artifacts were developed, including showcasing new data pipelines’ ability to plot syndromic surveillance data from Department of Defense and Veterans Affairs on the same graph.


55. Mancuso JD, Teneza-Mora NC. Letter to the Editor: Clarification of Hepatitis C Virus Screening with Case Definitions and Members in the Millennium Cohort Study. *MSMR*. 2022 Sep 1;29(9):16-17. PubMed PMID: 36602947
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DHA MISSION:
The Defense Health Agency supports our Nation by improving health and building readiness—making extraordinary experiences ordinary and exceptional outcomes routine.

DHA VISION:
Unrelenting pursuit of excellence as we care for our joint force and those we are privileged to serve. Anytime, Anywhere—Always.

AFHSD PURPOSE:
To protect the Total Force from “all hazard” threats via actionable health surveillance information and support.

AFHSD GOALS:
- Flexible, Responsive, and Predictive to Our Customers
- Early warning Capability of Global “all hazard” Threat Assessment Specific to Our Customers
- Inform Risk Management Decisions Across the Health Surveillance Enterprise.