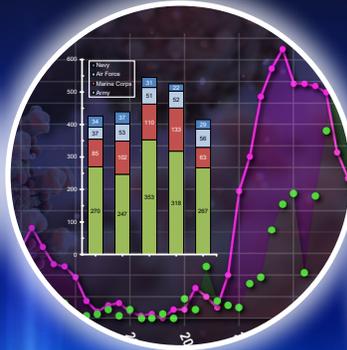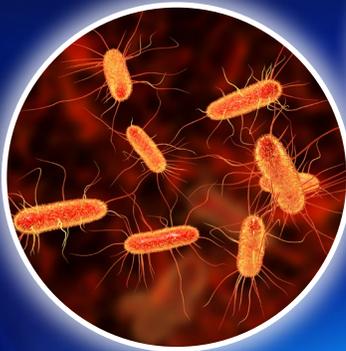# ARMED FORCES HEALTH SURVEILLANCE DIVISION

Annual Report 2022

FRIENDS AND COLLEAGUES

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

CONTENTS

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.
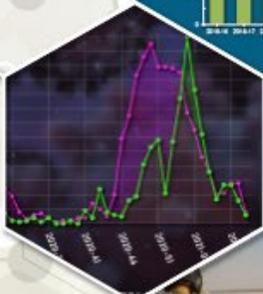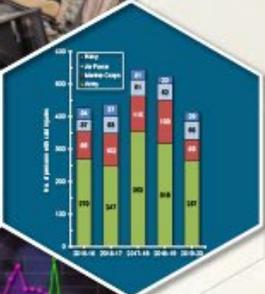
THE ELEMENTS OF MILITARY MEDICAL SURVEILLANCE

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.

WITH MORE THAN 4.7 BILLION DATA RECORDS, INCLUDING MORE THAN 1.4 BILLION RECORDS ON U.S. SERVICE MEMBERS ALONE, THE DMSS REMAINS THE DEPARTMENT OF DEFENSE (DOD'S) PREMIER EPIDEMIOLOGIC HEALTH SURVEILLANCE RESOURCE.

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.

WITH MORE THAN 74 MILLION SERIAL SERUM SPECIMENS FROM OVER 12.2 MILLION INDIVIDUALS, THE DODSR IS THE WORLD'S LARGEST SERUM REPOSITORY OF ITS KIND.

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 Crime-an-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
43.8 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 1980
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

DMSS

Monthly Synchronization

Medical Surveillance Monthly Report (MSMR)

Ad hoc Requests

Studies and Analyses

Routine Reports and Summaries

Services of the Armed Forces Health Surveillance Division

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)

FINANCES

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 1. GEIS Branch Funding Distribution by Geographic Combatant Command (GCC)		
GCC	**AMOUNT**	**%**
AFRICOM	$9,663,000	16.0
CENTCOM	$975,000	1.6
EUCOM	$1,909,000	3.1
INDOPACOM	$12,879,000	21.3
NORTHCOM	$6,763,023	11.2
SOUTHCOM	$7,677,000	12.7
Cross-GCC	$20,542,215	33.9
Not applicable	$113,000	0.2
Total	$60,521,238	100.0

TABLE 2. FY22 GEIS Branch Funding Distribution by Service		
SERVICE	**AMOUNT**	**%**
Air Force	$5,285,000	8.7
Army	$25,446,000	42.0
Navy	$25,719,000	42.5
DHA	$2,697,000	4.5
Other	$1,374,238	2.3
Total	$60,521,238	100.0

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
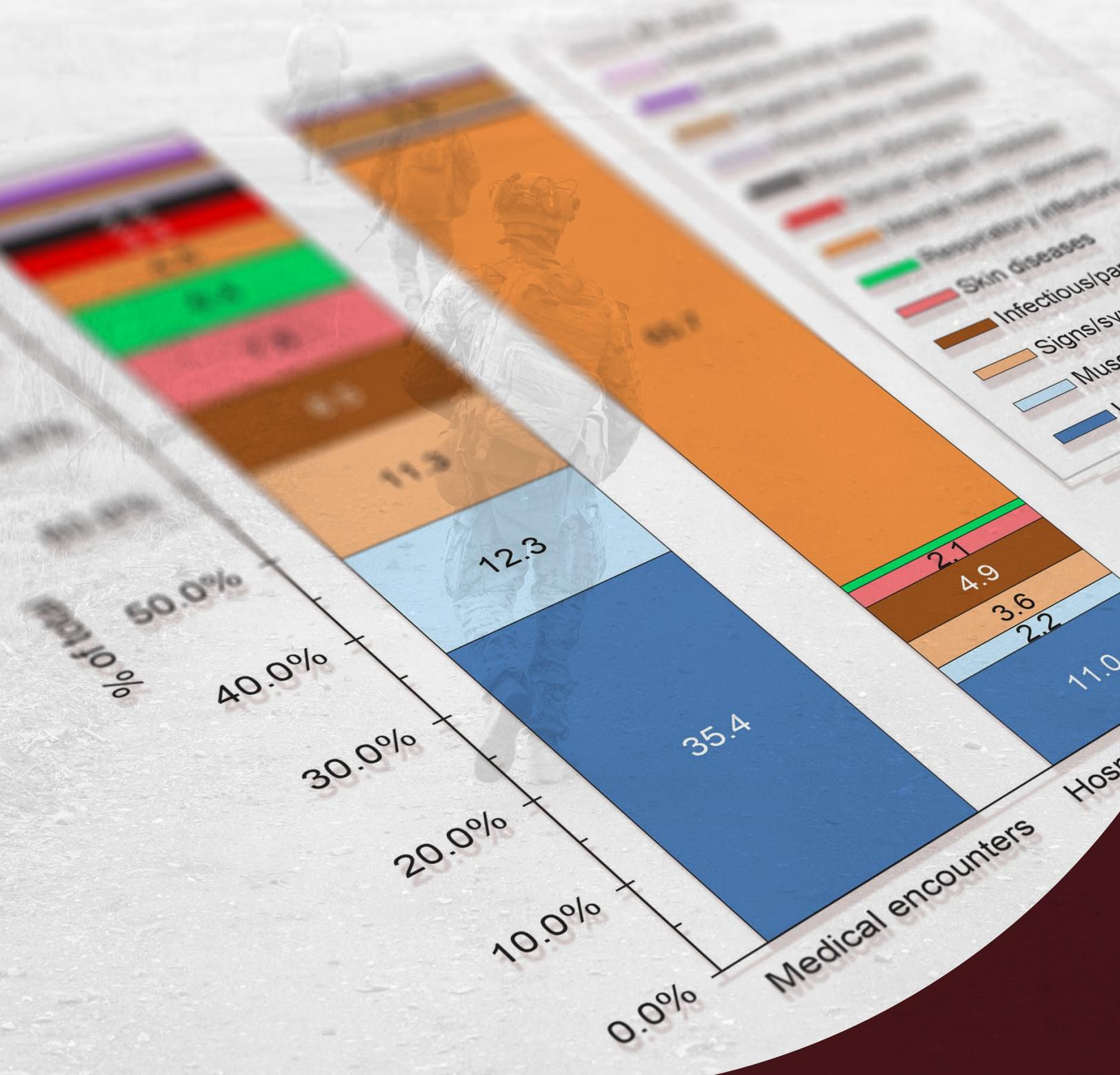
EPIDEMIOLOGY AND ANALYSIS

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.

Examples of Select AFHSD Periodic Reports in 2022

1. Army Heat and Cold Weather Injury Report
2. Deployment Health Compliance Report
3. DOD Consolidated Influenza Surveillance Report
4. DOD Eye Injury Report
5. Health Affairs (HA) Mental Health Report
6. HA Post-Traumatic Stress Disorder Report
7. HA TBI Report
8. Malaria Case-Finding Report
9. Public Health Assessment (PHA) Suicidal and Homicidal Ideation Report
10. PHA Tobacco Use Report
11. U.S. Army Special Operations Command Reportable Events
12. U.S. Army Training and Doctrine Command Training-related Injuries

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.

IN 2022, E&A COMPLETED THREE ANALYSES IN RESPONSE TO CONGRESSIONAL INQUIRIES RELATED TO MILITARY EXPOSURES. THEY INCLUDED CANCER INCIDENCE AND MORTALITY FOR FIXED WING AVIATORS AND SUPPORT PERSONNEL, ALL-CAUSE MORTALITY IN PERSONNEL WHO SPENT ANY TIME AT AN UZBEKISTAN BASE FROM 2001 TO 2005, AND ADVERSE EVENTS IN SERVICE MEMBERS FOLLOWING ADMINISTRATION OF THE COVID-19 VACCINE.

E&A also continued to support important DOD research studies including former Vice President Joe Biden's Cancer Moonshot initiative, which aims to accelerate cancer research and make additional therapies available to patients while also improving cancer prevention and detection at an early stage.

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 Mortality Surveillance in the U.S. Army report, and the annual Injury Surveillance for Gender Integration in the Army report archived in the Defense Technical Information Center. Other notable publications include the public health information paper, "Estimating the Cost of Injuries among U.S. Army Soldiers," as well as the following manuscripts: "Estimates of Direct Medical and Indirect Costs Associated with COVID-19 Among U.S. Active Duty Army Soldiers," published in *Military Medicine*, "Prevalence of Self-Reported Bothersome Tinnitus in U.S. Army Soldiers," published in the *American Journal of Audiology*, and "Suicide Behavior among Heterosexual, Lesbian/Gay, and Bisexual Active Component Service Members in the U.S. Armed Forces," published in the *MSMR*. Health Surveillance and COVID-19 Surveillance were also presented at the 2022 Army Public Health Course.

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 AFHSD 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.

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,

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.

GRADUATE MEDICAL EDUCATION

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.

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.

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.

AFHSD hosted preventive medicine residents from the Uniformed Services University of the Health Sciences for a five-week practicum rotation under the supervision of senior staff. During orientation, the group toured the facilities, including the DOD Serum Repository and lab. (AFSHD/Tanisha Blaise)

GLOBAL EMERGING INFECTIONS SURVEILLANCE

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.

VISION

To ensure operational success through mitigating infectious diseases threats, enabling the health and readiness of U.S. Service members.

MISSION

To increase battlespace awareness and improve Total Force Readiness in support of the unified Combatant Commands via a global laboratory network focused on mitigating the threat of emerging infectious diseases to U.S. Service members.

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).

1997
The year GEIS was established to improve infectious disease surveillance, prevention, and response across the DOD.

4
Focus areas of targeted infectious disease surveillance:
• Antimicrobial Resistant and Sexually Transmitted Infections
• Enteric Infections
• Febrile and Vector-borne Infections
• Respiratory Infections

100+
Surveillance sites where where GEIS activities are conducted.

24
Number of partner laboratories operated by the services, DOD and public health commands.

11
Number of partners performing SARS-CoV-2 whole genome sequencing at their laboratories.

2017
The year that the Next Generation Sequencing and Bio-Informatics Consortium was established to promote collaboration, training and development, and harmonization of capabilities.

150+
The average number of proposals received each year from military and government-funded laboratories.

CELEBRATING 25 YEARS OF SURVEILLANCE

THE GLOBAL EMERGING INFECTIONS SURVEILLANCE (GEIS) BRANCH CELEBRATES 25 YEARS OF SURVEILLANCE.

As one of four Armed Forces Health Surveillance Division branches, GEIS partners with military service laboratories to support force health protection throughout the DOD.

Monitoring infectious disease threats is a full-time mission.
https://www.health.mil/GEIS

DHA Defense Health Agency

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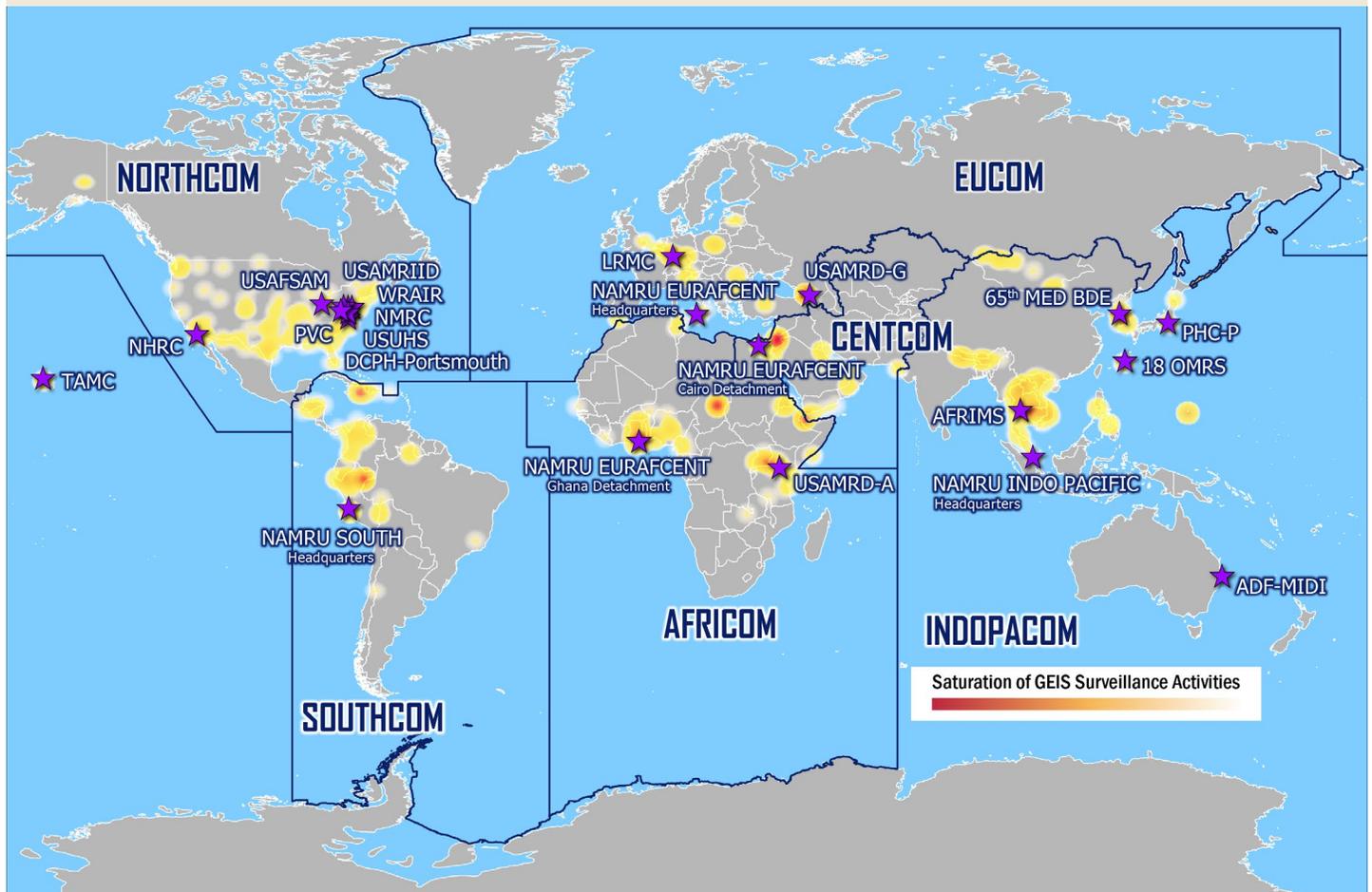
GEIS-PLS: NMRC, including NAMRU INDO PACIFIC, NAMRU EURAFCENT, NAMRU SOUTH, and NHRC, WRAIR, including U.S. Army Medical Directorate-Armed Forces Research Institute of Medical Sciences (US-AMD-AFRIMS), USAMRD-Georgia (USAMRD-G), and USAMRD-Africa (USAMRD-A); DCPH-Dayton (formerly USAFSAM); and USUHS

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 Biosystematics 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 FHP 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

GEIS staff members Lindsay Morton and U.S. Air Force Capt. Manuel Moncada (front middle) met laboratory network partners from Landstuhl Regional Medical Center, Tripler Army Medical Center, and Air Force Research Laboratory at the American Society for Microbiology conference on Rapid Applied Microbial Next-Generation Sequencing. (GEIS)

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 TAMC 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 USAMRD-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.
2. Healthcare-associated & community-acquired infections (HAI/CAI) laboratory-based surveillance.
3. Sexually transmitted infections surveillance.
4. Combating Antibiotic Resistant Bacteria (CARB) initiative supported activities.

NAMRU SOUTH lab technicians conduct AMR/STI surveillance through their laboratory in Iquitos, Peru. (GEIS/June Early)

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.

- WRAIR-MRSN reported HAIs and CAIs among U.S. Service members caused by pathogens such as pan-drug resistant (PDR) *Pseudomonas aeruginosa*, extensively-drug resistant (XDR) *Klebsiella pneumoniae*, carbapenemase-producing *Acinetobacter baumannii*, and colistin-resistant *Escherichia coli*. WRAIR MRSN received these isolates from LRMC, which conducted culture screenings upon admission to detect and prevent the spread of MDROs. The results led to the recommendation of appropriate actions to prevent further spread within the Military Health System and other healthcare systems.

- LRMC identified the *mobilized colistin resistance (mcr)* gene in an *E. coli* isolate. The *mcr* gene is a mobile plasmid-mediated resistance factor that confers resistance to the antibiotic colistin. LRMC also identified a PDR *P. aeruginosa* harboring the *imipenemase metallo-β-lactamase* (IMP) gene, which confers resistance to all carbapenems and ceftazidime-avibactam. Antibiotics such as colistin and carbapenems are critical last-line treatment options recommended in the Joint Trauma Systems Clinical Practice Guidelines for patients with infections caused by MDR bacteria. These mobile resistance genes can easily transfer between bacteria and spread rapidly. Both isolates were identified while conducting culture screenings of patients upon admission. Admission screening highlights the importance of implementing appropriate mitigation efforts to prevent and control MDROs in hospital settings.

- USAMRD-G confirmed the presence of carbapenem-resistant bacteria in the Republic of Georgia. These bacteria are highly resistant to carbapenems, a class of antibiotics used as a last line of treatment for Gram-negative bacteria. In this instance, antimicrobial susceptibility testing showed that 100% of *A. baumannii* and 95% of the *K. pneumoniae* collected in recent samples were resistant to carbapenems. Furthermore, transferable carbapenem resistance genes like *New Delhi metallo-β-lactamase* (NDM*)*, *oxacillinase-48* (OLA-48), and *K. pneumoniae carbapenemase* (KPC) were identified in the isolated bacteria. Genomic surveillance conducted in coordination with the WRAIR-MRSN, revealed that the *A. baumannii* and *K. pneumoniae* isolates collected in the Republic of Georgia were closely related to wound infection isolates from Ukrainian Service members between 2014-2020. This illustrates the importance of ongoing collaborative surveillance across the GEIS-N to improve understanding of the global landscape of AMR threats to further safeguard U.S. Service members residing and working in areas across the globe.

- NMRC confirmed the presence of *Burkholderia pseudomallei* in environmental samples obtained by NAMRU EURAFCENT collaborative partners in Ghana. These findings provide the first confirmatory identification of *B. pseudomallei* from the environment in Ghana. In May 2022, the NMRC tested 100 environmental samples collected from a surveillance site in Central Ghana and found 55 (55%) to be positive for *B. pseudomallei*, the causative agent for melioidosis. Infections by these bacteria can be difficult to diagnose and may be an under-recognized cause of treatment failures for presumed typical infections. No specific resistance to recommended treatment options was noted in the tested isolates. *B. pseudomallei* has been a recurring source of infections during military operations in areas it is endemic zone in the INDOPACOM AOR.

ENTERIC INFECTIONS (EI) FOCUS AREA:

The GEIS-PLs 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 estimated enteric 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 militarily-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 antibiotics 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 continued 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 *Anopheline* 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.
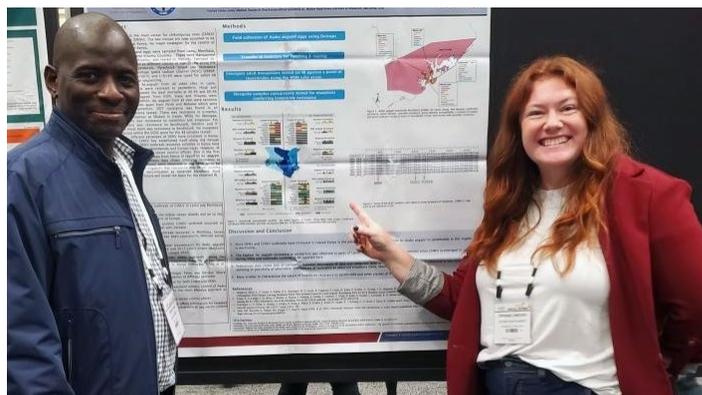
Stephanie Cincovich, PhD and GEIS laboratory partner Fredrick Eyase (USAMRD-A) present a poster at the American Society of Tropical Medicine & Hygiene annual meeting in Seattle, Wash. (GEIS/Kathleen Creppage)

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 DODGRP-SP 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.

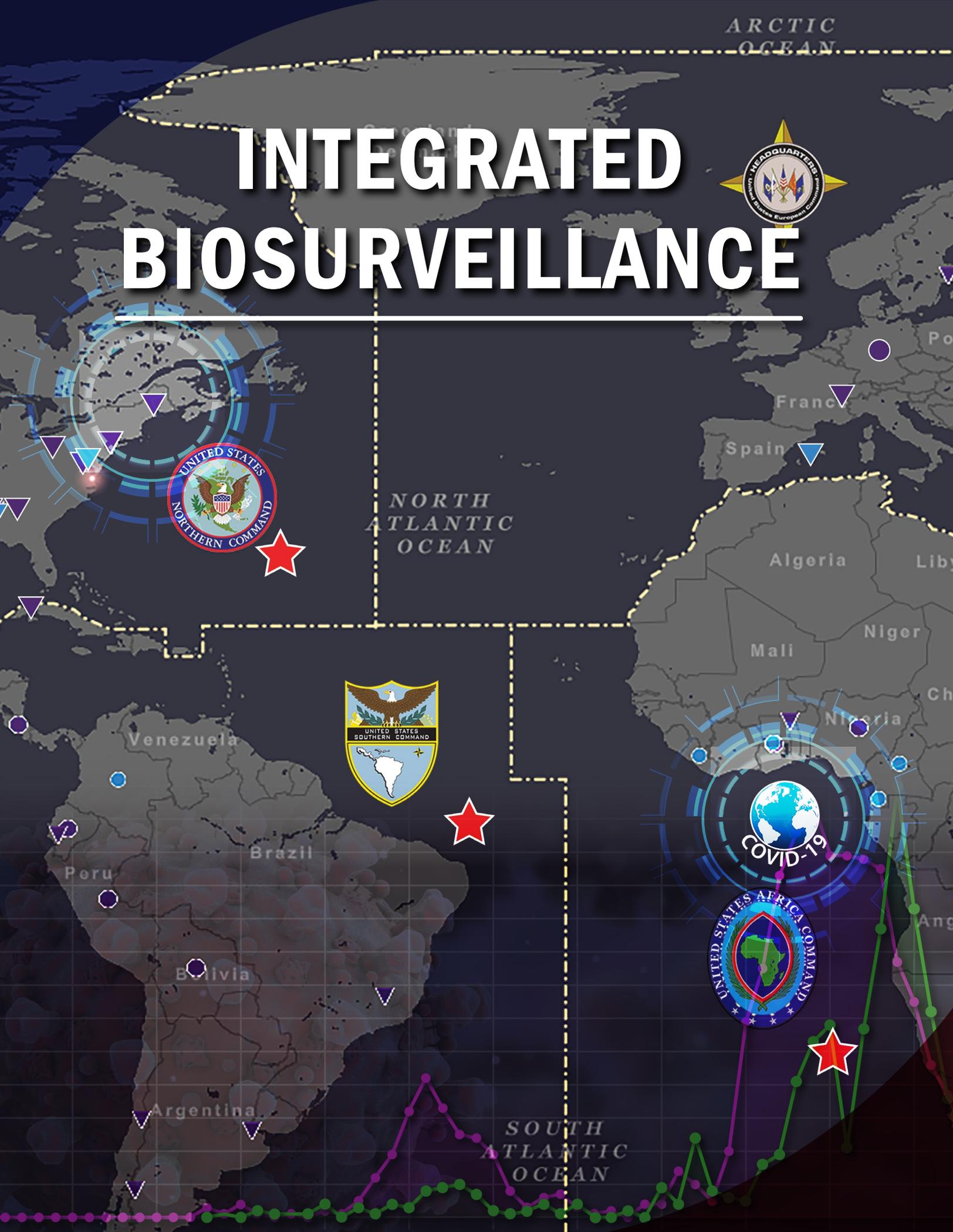For more information about GEIS, please visit our CarePoint site: https://carepoint.health.mil/sites/AFHSB/geis/

INTEGRATED BIOSURVEILLANCE

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 to 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

Figure 1.
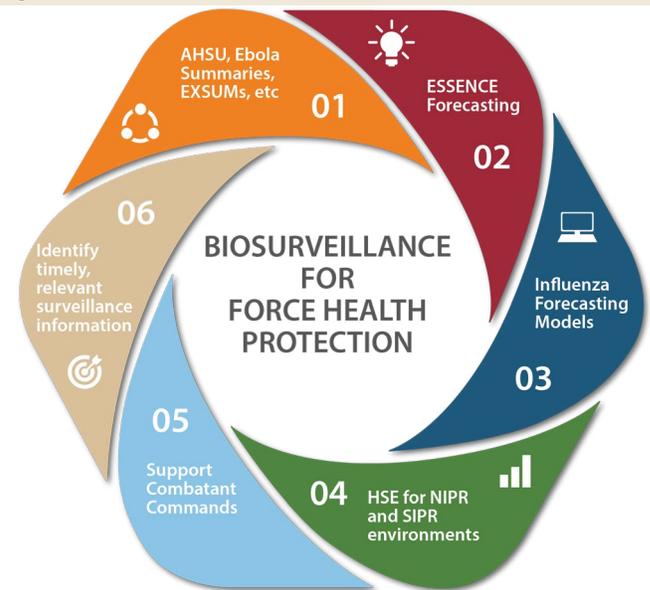
open-source information where appropriate (Figure 1). These products and more are also accessible in the Health Surveillance Explorer (HSE) mapping application (Figure 2).

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.

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

"[We] 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 (AHSU), 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.

EMPOWER YOUR DECISION MAKERS WITH NEAR REAL-TIME INTEGRATED GLOBAL HEALTH SURVEILLANCE INFORMATION USING THE HSE, THE ULTIMATE TOOL FOR FORCE HEALTH PROTECTION

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 AFHSD-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://carepoint.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 AFHSD to view aggregate data for VHA facilities. These partnerships leverage the CDC and Prevention's National Syndromic Surveillance Program ESSENCE platform.

Respiratory Forecasting (Figure 3) and MHS Markets to Watch Dashboard (Figure 4).
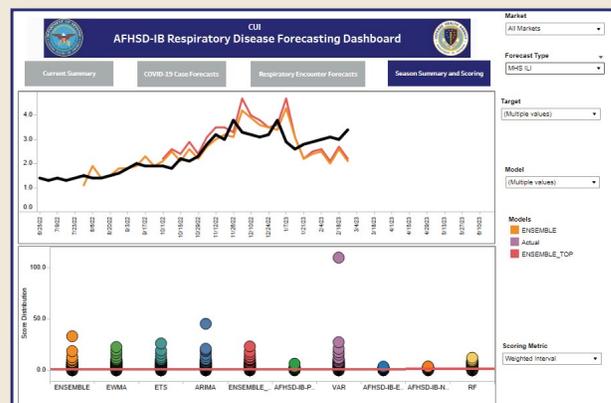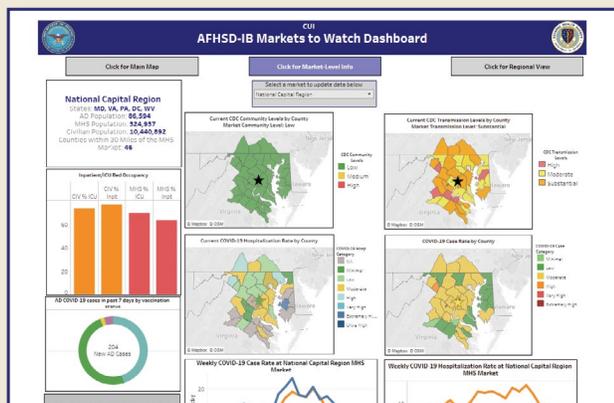
GEOGRAPHIC INFORMATION SYSTEM FY22 SIGNIFICANT ACCOMPLISHMENTS:

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 Mpox 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 (AD SMs 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.
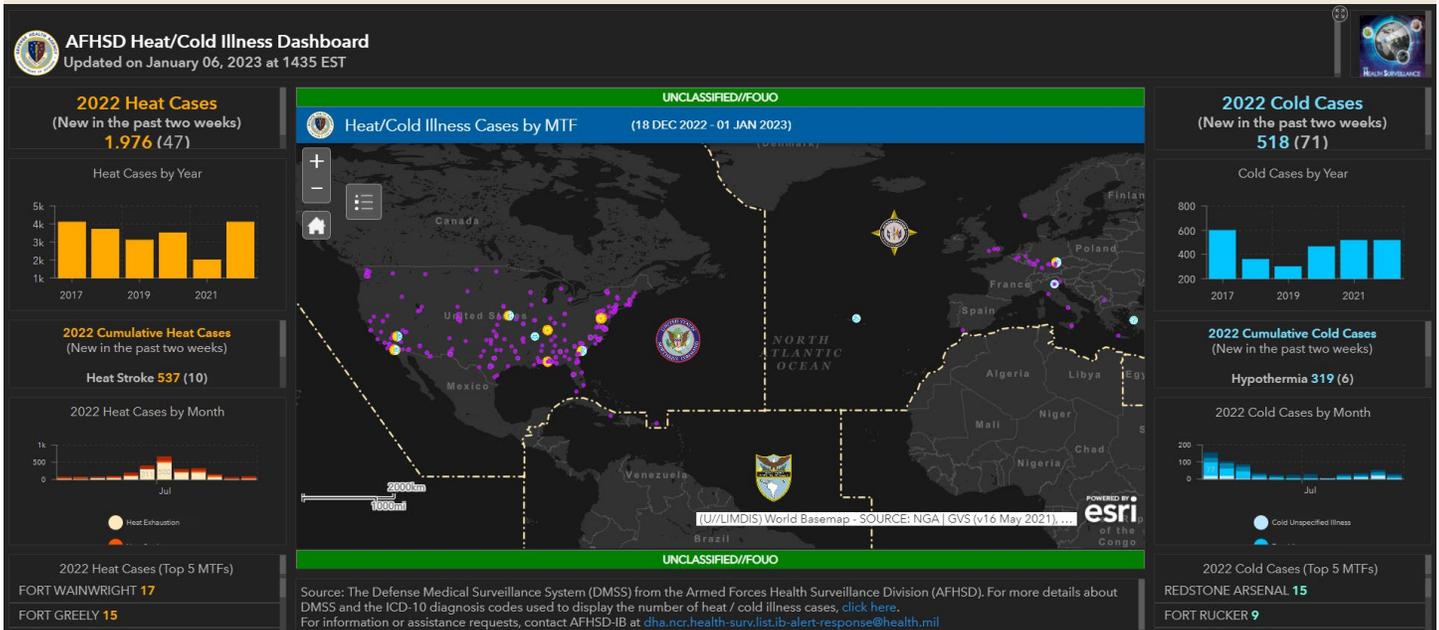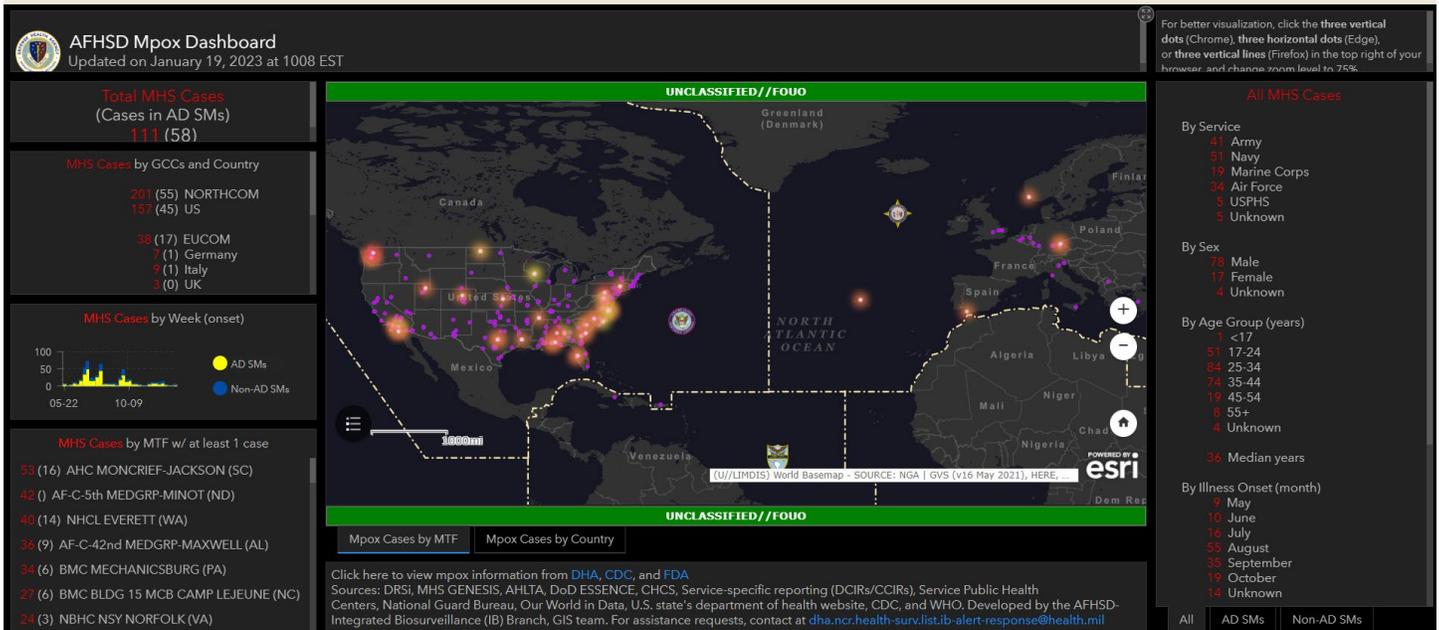
Figure 5. AFHSD's Heat/Cold Illness Dashboard.

Figure 6. AFHSD's Mpox Dashboard.

ALL DASHBOARDS SHOW SIMULATED DATA

SPECIAL PROJECTS CELL

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
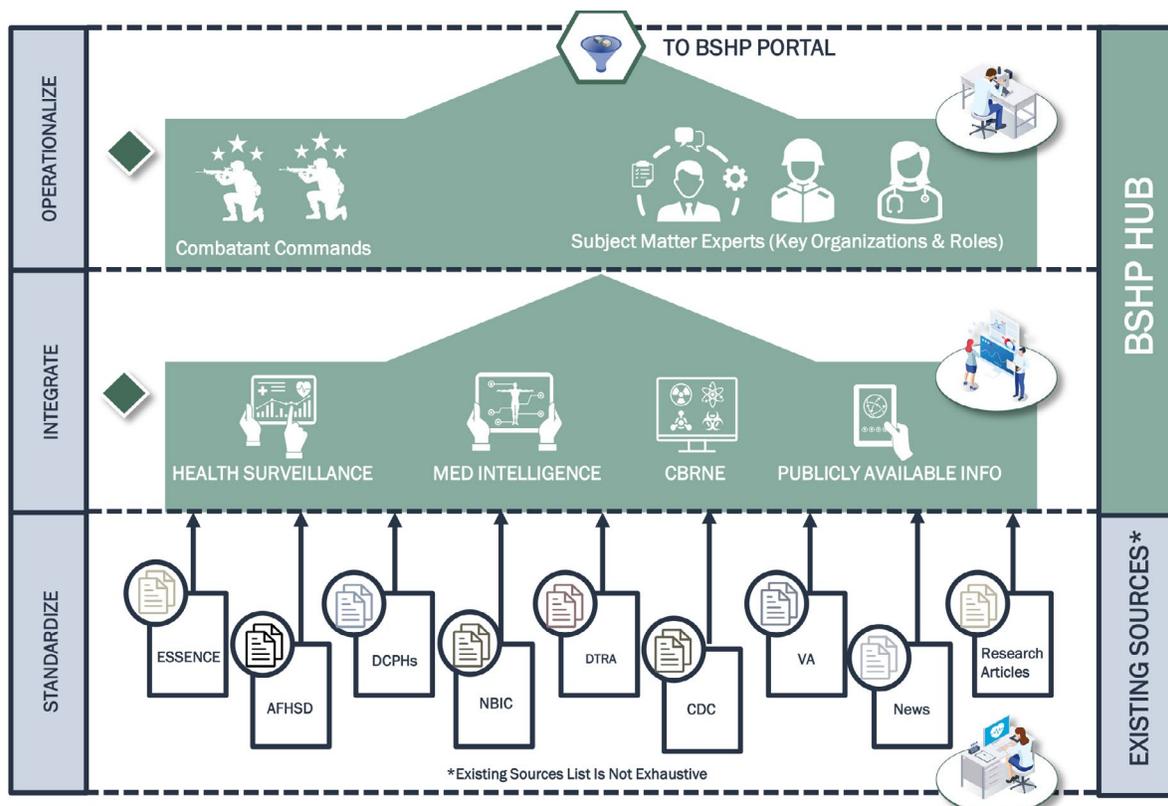

Figure 1. Biosurveillance Integration through BSHP

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 interagency 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.

AFHSD AND GEIS-FUNDED PUBLICATIONS LIST 2021-2022

1. Chaorattanakawee S, Wofford RN, Takhampunya R, et al. Tracking tick-borne diseases in Mongolian livestock using next generation sequencing (NGS). *Ticks Tick Borne Dis*. 2022;13(1):101845. doi:10.1016/j.ttbdis.2021.101845

2. Lee SH, Chong ST, Kim HC, et al. Surveillance and Molecular Identification of Borrelia Species in Ticks Collected at U.S. Army Garrison Humphreys, Republic of Korea, 2018-2019. *J Med Entomol*. 2022;59(1):363-371. doi:10.1093/jme/tjab170

3. Blyth DM, Liang Z, Williams M, Murray CK. Immune interference revisited: Impact of live-attenuated influenza vaccine prior to yellow fever vaccination. *Vaccine*. 2022;40(6):961-966. doi:10.1016/j.vaccine.2021.12.031

4. Hu W, Sjoberg PA, DeMarcus LS, Robbins AS. Influenza Vaccine Effectiveness Estimates among US Department of Defense Adult Beneficiaries over Four Consecutive Influenza Seasons: A Test-Negative Design Study with Different Control Groups. *Vaccines (Basel)*. 2021;10(1):58. Published 2021 Dec 31. doi:10.3390/vaccines10010058

5. Smith DR, Singh C, Green J, et al. Genomic and Virological Characterization of SARS-CoV-2 Variants in a Subset of Unvaccinated and Vaccinated U.S. Military Personnel. *Front Med (Lausanne)*. 2022;8:836658. Published 2022 Jan 27. doi:10.3389/fmed.2021.836658

6. Thabet HS, TagEldin RA, Fahmy NT, et al. Spatial Distribution of PCR-Identified Species of Anopheles gambiae senu lato (Diptera: Culicidae) Across Three Eco-Vegetational Zones in Cross River State, Nigeria. *J Med Entomol*. 2022;59(2):576-584. doi:10.1093/jme/tjab221

7. Pollett S, Kuklis CH, Barvir DA, et al. The seroepidemiology of dengue in a US military population based in Puerto Rico during the early phase of the Zika pandemic. *PLoS Negl Trop Dis*. 2022;16(1):e0009986. Published 2022 Jan 21. doi:10.1371/journal.pntd.0009986

8. Loyola S, Torre A, Flores-Mendoza C, et al. Molecular Characterization by Multilocus Sequence Typing and Diversity Analysis of *Rickettsia asembonensis* in Peru. *Vector Borne Zoonotic Dis*. 2022;22(3):170-177. doi:10.1089/vbz.2021.0077

9. Kiyaga S, Kyany'a C, Muraya AW, et al. Genetic Diversity, Distribution, and Genomic Characterization of Antibiotic Resistance and Virulence of Clinical *Pseudomonas aeruginosa* Strains in Kenya. *Front Microbiol*. 2022;13:835403. Published 2022 Mar 14. doi:10.3389/fmicb.2022.835403

10. Matulis GA, Altantogtokh D, Lantos PM, et al. Hotspots in a cold land-reported cases of rabies in wildlife and livestock in Mongolia from 2012-2018. *Zoonoses Public Health*. 2022;69(6):655-662. doi:10.1111/zph.12954

11. De Los Santos MB, Ramírez IM, Rodríguez JE, Beerli P, Valdivia HO. Genetic diversity and population structure of Leishmania (Viannia) braziliensis in the Peruvian jungle. *PLoS Negl Trop Dis*. 2022;16(5):e0010374. Published 2022 May 23. doi:10.1371/journal.pntd.0010374

12. Letizia AG, Pratt CB, Wiley MR, et al. Retrospective Genomic Characterization of a 2017 Dengue Virus Outbreak, Burkina Faso. *Emerg Infect Dis*. 2022;28(6):1198-1210. doi:10.3201/eid2806.212491

13. Nimo-Paintsil SC, Mosore M, Addo SO, et al. Ticks and prevalence of tick-borne pathogens from domestic animals in Ghana. *Parasit Vectors*. 2022;15(1):86. Published 2022 Mar 12. doi:10.1186/s13071-022-05208-8

14. Ergunay K, Mutinda M, Bourke B, et al. Metagenomic Investigation of Ticks From Kenyan Wildlife Reveals Diverse Microbial Pathogens and New Country Pathogen Records. *Front Microbiol*. 2022;13:932224. Published 2022 Jul 1. doi:10.3389/fmicb.2022.932224

15. Cer RZ, Voegtly LJ, Adhikari BN, et al. Genomic and virologic characterization of samples from a shipboard outbreak of COVID-19 reveals distinct variants within limited temporospatial parameters. *Front Microbiol*. 2022;13:960932. Published 2022 Aug 10. doi:10.3389/fmicb.2022.960932

16. Ellis GC, Lanteri CA, Hsieh HC, et al. Coccidioidomycosis Seroincidence and Risk among Military Personnel, Naval Air Station Lemoore, San Joaquin Valley, California, USA[1]. *Emerg Infect Dis*. 2022;28(9):1842-1846. doi:10.3201/eid2809.220652

17. Ruekit S, Srijan A, Serichantalergs O, et al. Molecular characterization of multidrug-resistant ESKAPEE pathogens from clinical samples in Chonburi, Thailand (2017-2018). *BMC Infect Dis*. 2022;22(1):695. Published 2022 Aug 17. doi:10.1186/s12879-022-07678-8

18. Gibson S, Linthicum KJ, Turrel MJ, Anyamba A. Rift Valley fever virus: Movement of infected humans threatens global public health and agriculture. *CABI Reviews* (2022) 17(029). doi: 10.1079/cabireviews202217029

19. Fontecha G, Escobar D, Ortiz B, Pinto A, Serrano D, Valdivia HO. Field Evaluation of a Hemozoin-Based Malaria Diagnostic Device in Puerto Lempira, Honduras. *Diagnostics (Basel)*. 2022;12(5):1206. Published 2022 May 11. doi:10.3390/diagnostics12051206

20. Villena FE, Sanchez JF, Nolasco O, et al. Drug resistance and population structure of Plasmodium falciparum and Plasmodium vivax in the Peruvian Amazon. *Sci Rep*. 2022;12(1):16474. Published 2022 Oct 1. doi:10.1038/s41598-022-21028-3

21. Pollio AR, Jiang J, Lee SS, et al. Discovery of *Rickettsia* spp. in mosquitoes collected in Georgia by metagenomics analysis and molecular characterization. *Front Microbiol*. 2022;13:961090. Published 2022 Sep 8. doi:10.3389/fmicb.2022.961090

22. Hustedt J, Prasetyo DB, Fiorenzano JM, von Fricken ME, Hertz JC. Phlebotomine sand flies (Diptera: Psychodidae) and sand fly-borne pathogens in the Greater Mekong Subregion: a systematic review [published correction appears in *Parasit Vectors*. 2022 Nov 17;15(1):432]. *Parasit Vectors*. 2022;15(1):355. Published 2022 Oct 5. doi:10.1186/s13071-022-05464-8

23. Corrigan J, Marion B, English J, et al. Minimal Rickettsial Infection Rates and Distribution of Ticks in Uganda: An Assessment of the Seasonal Effects and Relevance to Tick-Borne Disease Risk in East Africa. *J Med Entomol*. 2023;60(1):185-192. doi:10.1093/jme/tjac166

24. Arnold CE, Voegtly LJ, Stefanov EK, et al. SARS-CoV-2 Infections in Vaccinated and Unvaccinated Populations in Camp Lemonnier, Djibouti, from April 2020 to January 2022. *Viruses*. 2022;14(9):1918. Published 2022 Aug 30. doi:10.3390/v14091918

25. Tang CY, Boftsi M, Staudt L, et al. SARS-CoV-2 and influenza co-infection: A cross-sectional study in central Missouri during the 2021-2022 influenza season. Virology. 2022;576:105-110. doi:10.1016/j.virol.2022.09.009

26. Maljkovic Berry I, Hang J, Fung C, et al. Genomic surveillance of SARS-CoV-2 in US military compounds in Afghanistan reveals multiple introductions and outbreaks of Alpha and Delta variants. *BMC Genomics*. 2022;23(1):513. Published 2022 Jul 15. doi:10.1186/s12864-022-08757-5

27. Adenaiye OO, Lai J, Bueno de Mesquita PJ, et al. Infectious Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in Exhaled Aerosols and Efficacy of Masks During Early Mild Infection. *Clin Infect Dis*. 2022;75(1):e241-e248. doi:10.1093/cid/ciab797

28. Hakre S, Lam EY, Maljkovic-Berry I, et al. Investigation of an outbreak of COVID-19 among U.S. military personnel and beneficiaries stationed in the Republic of Korea, June-July 2021. *PLOS Glob Public Health*. 2022;2(5):e0000236. Published 2022 May 27. doi:10.1371/journal.pgph.0000236

29. Thommana A, Shakya M, Gandhi J, et al. Intrahost SARS-CoV-2 k-mer Identification Method (iSKIM) for Rapid Detection of Mutations of Concern Reveals Emergence of Global Mutation Patterns. *Viruses*. 2022;14(10):2128. Published 2022 Sep 27. doi:10.3390/v14102128

30. Valdivia HO, Anderson K, Smith D, et al. Spatiotemporal dynamics of Plasmodium falciparum histidine-rich protein 2 and 3 deletions in Peru. *Sci Rep*. 2022;12(1):19845. Published 2022 Nov 18. doi:10.1038/s41598-022-23881-8

31. Crispell G, Williams K, Zielinski E, Iwami A, Homas Z, Thomas K. Method comparison for Japanese encephalitis virus detection in samples collected from the Indo-Pacific region. *Front Public Health*. 2022;10:1051754. Published 2022 Nov 24. doi:10.3389/fpubh.2022.1051754

32. Loyola S, Popuche D, Rios Z, Huaman A, Ampuero JS, Guevara C. Detection of Zika Virus in Oropharyngeal Swabs from Patients with Acute Febrile Illness. *Am J Trop Med Hyg*. 2022;107(6):1242-1244. Published 2022 Nov 7. doi:10.4269/ajtmh.22-0292

33. Kamau J, Ergunay K, Webala PW, et al. A Novel Coronavirus and a Broad Range of Viruses in Kenyan Cave Bats. *Viruses*. 2022;14(12):2820. Published 2022 Dec 17. doi:10.3390/v14122820

34. Celone M, Pecor DB, Potter A, Richardson A, Dunford J, Pollett S. An ecological niche model to predict the geographic distribution of Haemagogus janthinomys, Dyar, 1921 a yellow fever and Mayaro virus vector, in South America. *PLoS Negl Trop Dis*. 2022;16(7):e0010564. Published 2022 Jul 8. doi:10.1371/journal.pntd.0010564

35. Polsomboon Nelson S, Bourke BP, Badr R, et al. Ticks (Acari: Ixodidae) and Associated Pathoge Collected From Domestic Animals and Vegetation in Stann Creek District, Southeastern Belize, Central America [published correction appears in *J Med Entomol*. 2022 Nov 16;59(6):2190]. *J Med Entomol*. 2022;59(5):1749-1755. doi:10.1093/jme/tjac112

36. Yaro AS, Linton YM, Dao A, et al. Diversity, composition, altitude, and seasonality of high-altitude windborne migrating mosquitoes in the Sahel: Implications for disease transmission. Frontiers in Epidemiology. 2022;2. doi:10.3389/fepid.2022.1001782

37. Georges M, Odoyo E, Matano D, et al. Determination of *Enterococcus faecalis* and *Enterococcus faecium* Antimicrobial Resistance and Virulence Factors and Their Association with Clinical and Demographic Factors in Kenya. *J Pathog*. 2022;2022:3129439. Published 2022 Nov 9. doi:10.1155/2022/3129439

38. Mills EG, Martin MJ, Luo TL, et al. A one-year genomic investigation of Escherichia coli epidemiology and nosocomial spread at a large US healthcare network. *Genome Med*. 2022;14(1):147. Published 2022 Dec 30. doi:10.1186/s13073-022-01150-7

39. Kamau J, Ergunay K, Webala PW, et al. A Novel Coronavirus and a Broad Range of Viruses in Kenyan Cave Bats. *Viruses*. 2022;14(12):2820. Published 2022 Dec 17. doi:10.3390/v14122820

40. Bopp NE, Jencks KJ, Siles C, et al. Serological Responses in Patients Infected with Mayaro Virus and Evaluation of Cross-Protective Responses against Chikungunya Virus. *Am J Trop Med Hyg*. 2021;106(2):607-609. Published 2021 Nov 29. doi:10.4269/ajtmh.21-0579

41. Loyola S, Huaman A, Popuche D, et al. Evaluation of Two Serological Assays for Diagnosing Zika Virus Infection. *Diagnostics (Basel)*. 2021;11(9):1696. Published 2021 Sep 17. doi:10.3390/diagnostics11091696

42. Andrade Justi S, Soghigian J, Pecor DB, et al. From e-voucher to genomic data: Preserving archive specimens as demonstrated with medically important mosquitoes (Diptera: Culicidae) and kissing bugs (Hemiptera: Reduviidae). *PLoS One*. 2021;16(2):e0247068. Published 2021 Feb 25. doi:10.1371/journal.pone.0247068

43. Dale C, Justi SA, Galvão C. *Belminus santosmalletae* (Hemiptera: Heteroptera: Reduviidae): New Species from Panama, with an Updated Key for *Belminus* Stål, 1859 Species. *Insects*. 2021;12(8):686. Published 2021 Jul 30. doi:10.3390/insects12080686

44. Goodwin A, Padmanabhan S, Hira S, et al. Mosquito species identification using convolutional neural networks with a multitiered ensemble model for novel species detection. *Sci Rep*. 2021;11(1):13656. Published 2021 Jul 1. doi:10.1038/s41598-021-92891-9

45. Lima-Cordón RA, Cahan SH, McCann C, et al. Insights from a comprehensive study of Trypanosoma cruzi: A new mitochondrial clade restricted to North and Central America and genetic structure of TcI in the region. *PLoS Negl Trop Dis*. 2021;15(12):e0010043. Published 2021 Dec 17. doi:10.1371/journal.pntd.0010043

46. Nadolny RM, Kennedy AC, Rodgers JM, et al. Carios kelleyi (Acari: Ixodida: Argasidae) Infected With Rickettsial Agents Documented Infesting Housing in Kansas, United States. *J Med Entomol*. 2021;58(6):2398-2405. doi:10.1093/jme/tjab069

47. Takhampunya R, Sakolvaree J, Chanarat N, et al. The Bacterial Community in Questing Ticks From Khao Yai National Park in Thailand. *Front Vet Sci*. 2021;8:764763. Published 2021 Nov 22. doi:10.3389/fvets.2021.764763

48. Legendre BW, Boltz J, Riegodedios AJ, Brown AM, Kaplan MR, Feinberg JH, Sullivan AJ, Dawn M W, Luse TM, Glasheen CE, Poitras BT, Hollis E, Myers C. Seroepidemiologic Investigation of a COVID-19 Outbreak Aboard a U.S. Navy Ship. *MSMR*. 2022 Dec 31;29(12):2-10. PubMed PMID: 36821705

49. Dinkeloo E, Luse T. Emergency Mental Health Care Utilization and the COVID-19 Pandemic Among U.S. Armed Forces and Dependents, 1 January 2017 to 31 March 2021. *MSMR*. 2022 Dec 31;29(12):11-16. PubMed PMID: 36821713

50. Hsu NM, Sayers DR. Brief Review: Clinical and Epidemiologic Characteristics of Genital Skin Lesions Due to Infectious Causes. *MSMR*. 2022 Dec 31;29(12):17-19. Review. PubMed PMID: 36821714

51. Paxton Willing MM, Tate LL, O'Gallagher KG, Evatt DP, Riggs DS. In-Theater Mental Health Disorders Among U.S. Soldiers Deployed Between 2008 and 2013. *MSMR*. 2022 Nov 1;29(11):11-17. PubMed PMID: 36790903

52. Armed Forces Health Surveillance Division. Update: Cold Injuries, Active and Reserve Components, U.S. Armed Forces, July 2017–June 2022 *MSMR*. 2022 Nov 1;29(11):2-10. PubMed PMID: 36790877

53. Romano CJ, Bukowinski AT, Hall C, Burrell M, Gumbs GR, Conlin AMS, Ramchandar N. Brief Report: Pediatric Vaccine Completion and Compliance Among Infants Born to Female Active Duty Service Members, 2006-2016. *MSMR*. 2022 Nov 1;29(11):18-22. PubMed PMID: 36790926

54. Zhu Y, Kolaja CA, Stamas N, Matsuno RK, Rull RP. Brief Report: Menstrual Suppression Among U.S. Female Service Members in the Millennium Cohort Study. *MSMR*. 2022 Sep 1;29(9):19-22. PubMed PMID: 36602879

55. Mancuso JD, Teneza-Mora NC. Letter to the Editor: Clarification of Hepatitis C Virus Screening with Case Definitions and Prevalence Among Trainees. *MSMR*. 2022 Sep 1;29(9):16-17. PubMed PMID: 36602947

56. Mancuso JD, Seliga N, Legg M, Stahlman SL. Evaluation of the *MSMR* Surveillance Case Definition for Incident Cases of Hepatitis C. *MSMR*. 2022 Sep 1;29(9):10-14. PubMed PMID: 36602971

57. Armed Forces Health Surveillance Division. Update: Routine Screening for Antibodies to Human Immunodeficiency Virus, U.S. Armed Forces, Active and Reserve Components, January 2017-June 2022. *MSMR*. 2022 Sep 1;29(9):2-9. PubMed PMID: 36603023

58. Stahlman SL, Hsu NM, Mancuso JD. Viral hepatitis C, active component, U.S. Armed Forces, 2011-2020. *MSMR*. 2022 Oct 1;29(10):2-7. PubMed PMID: 36603055

59. Armed Forces Health Surveillance Division. Update: Contraception Among Active Component Service Women, U.S. Armed Forces, 2017-2021. *MSMR*. 2022 Oct 1;29(10):8-13. PubMed PMID: 36603113

60. Butler C, Haydu L, Bryant J, Mata J, Tchandja J, Hogan K, Hando B. Musculoskeletal Injuries During U.S. Air Force Special Warfare Training Assessment and Selection, Fiscal Years 2019-2021. *MSMR*. 2022 Aug 1;29(8):2-6. PubMed PMID: 36327377

61. Gao H, Truong J, Taylor B, Robles-Morales G, Aitken T. Prevalence and Distribution of Refractive Errors Among Members of the U.S. Armed Forces and the U.S. Coast Guard, 2019. *MSMR*. 2022 Aug 1;29(8):7-12. PubMed PMID: 36327381

62. MacGregor A, Jurick S, McCabe C, Harbertson J, Dougherty A, Galarneau M. Brief Report: Pain and Post-Traumatic Stress Disorder Screening Outcomes Among Military Personnel Injured During Combat Deployment. *MSMR*. 2022 Aug 1;29(8):13-15. PubMed PMID: 36327387

63. Stahlman S, Clerkin C, Kohler B, Howe W Jr, Cronin K, Wells N. Brief report: Phase I results using the virtual pooled registry cancer linkage system (VPR-CLS) for military cancer surveillance. *MSMR*. 2022 Jul 1;29(7):26-27. PubMed PMID: 36250490

64. Beymer M, Nichols N, Watkins Y, Jarvis P, Ambrose F, Shafir C, Jeffery D. Suicide behavior among heterosexual, lesbian/gay, and bisexual active component service members in the U.S. Armed Forces. *MSMR*. 2022 Jul 1;29(7):19-24. PubMed PMID: 36250491

65. Kwaah B, Gruner W, DeMarcus L, Thervil J, Castillo F, Muehleman D, Fries A, Sjoberg P, Robbins A. Surveillance trends for SARS-CoV-2 and other respiratory pathogens among U.S. military health system beneficiaries, 27 September 2020–2 October 2021 *MSMR*. 2022 Jul 1;29(7):2-10. PubMed PMID: 36250533

66. Morton L, Forshey B, Bishop-Lilly K, Cer R, Fries A, Bogue A, Undewood R, Bazaco S, Starr C, Gruner W, Malagon F, Myers C, Maljkovic Berry I, Kugelman J, Creppage K, Scheckelhoff M, Taylor K, Pimentel G. Establishment of SARS-CoV-2 genomic surveillance within the Military Health System during 1 March-31 December 2020. *MSMR*. 2022 Jul 1;29(7):11-18. PubMed PMID: 36250580

67. Armed Forces Health Surveillance Division. Absolute and relative morbidity burdens attributable to various illnesses and injuries, active component, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):2-9. PubMed PMID: 36250737

68. Armed Forces Health Surveillance Division. Hospitalizations, active component, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):10-16. PubMed PMID: 36250756

69. Armed Forces Health Surveillance Division. Ambulatory visits, active component, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):17-24. PubMed PMID: 36250757

70. Armed Forces Health Surveillance Division. Medical evacuations out of the U.S. Central and U.S. Africa Commands, active and reserve components, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):27-33. PubMed PMID: 36250782

71. Armed Forces Health Surveillance Division. Morbidity burdens attributable to various illnesses and injuries, deployed active and reserve component service members, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):34-39. PubMed PMID: 36250783

72. Armed Forces Health Surveillance Division. Absolute and relative morbidity burdens attributable to various illnesses and injuries, non-service member beneficiaries of the Military Health System, 2021. *MSMR*. 2022 Jun 1;29(6):40-50. PubMed PMID: 36250815

73. Armed Forces Health Surveillance Division. Surveillance snapshot: Illness and injury burdens, reserve component, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):25. PubMed PMID: 36250816

74. Armed Forces Health Surveillance Division. Surveillance snapshot: Illness and injury burdens, recruit trainees, U.S. Armed Forces, 2021. *MSMR*. 2022 Jun 1;29(6):26. PubMed PMID: 36250817

75. Armed Forces Health Surveillance Division. Update: Sexually transmitted infections, active component, U.S. Armed Forces, 2013-2021. *MSMR*. 2022 May 1;29(5):2-11. PubMed PMID: 36250848

76. Eick-Cost A, Fedgo A. Evaluation of ICD-10-CM-based case definitions of ambulatory encounters for COVID-19 among Department of Defense health care beneficiaries. *MSMR*. 2022 May 1;29(5):12-16. PubMed PMID: 36250849

77. Smith J, Beymer M, Schaughency K. The association between two bogus items, demographics, and military characteristics in a 2019 cross-sectional survey of U.S. Army soldiers. *MSMR*. 2022 May 1;29(5):18-22. PubMed PMID: 36250850

78. Stahlman S. Surveillance snapshot: Tick-borne encephalitis in Military Health System beneficiaries, 2012-2021. *MSMR*. 2022 May 1;29(5):23. No abstract available. PubMed PMID: 36250851

79. Winkler EL, Stahlman SL, Wells NY, Chauhan AV, Hiban KM, Costello AA, Mancuso JD. COVID-19 Booster Vaccination in the U.S. Military, August 2021-January 2022. *Am J Prev Med*. 2023 Feb;64(2):270-274. doi: 10.1016/j.amepre.2022.07.017. Epub 2022 Aug 29. PubMed PMID: 36123230, PMCID: PMC9420709

80. Hu W, Sjoberg PA, Fries AC, DeMarcus LS, Robbins AS. Waning Vaccine Protection against Influenza among Department of Defense Adult Beneficiaries in the United States, 2016-2017 through 2019-2020 Influenza Seasons. *Vaccines* (Basel). 2022 Jun 1;10(6). pii: 888. doi: 10.3390/vaccines10060888. PubMed PMID: 35746496, PMCID: PMC9229659

81. Hu W, Fries AC, DeMarcus LS, Thervil JW, Kwaah B, Brown KN, Sjoberg PA, Robbins AS. Circulating Trends of Influenza and Other Seasonal Respiratory Viruses among the US Department of Defense Personnel in the United States: Impact of the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2022 May 13;19(10). pii: 5942. doi: 10.3390/ijerph19105942. PubMed PMID: 35627483, PMCID: PMC9141702

82. DeGroot D, Henderson K, O'Connor F. Exertional heat illness at Fort Benning, GA: Unique insights from the Army Heat Center. *MSMR*. 2022 Apr 1;29(4):2-7. PubMed PMID: 35608507

83. Williams VF, Oh GT. Update: Heat illness, active component, U.S. Armed Forces, 2021. *MSMR*. 2022 Apr 1;29(4):8-14. PubMed PMID: 35608520

84. Daniele DO, Murray J. Update: Exertional rhabdomyolysis, active component, U.S. Armed Forces, 2017-2021. *MSMR*. 2022 Apr 1;29(4):15-20. PubMed PMID: 35608521

85. Daniele DO, Wilkerson T. Update: Exertional hyponatremia, active component, U.S. Armed Forces, 2006-2021. *MSMR*. 2022 Apr 1;29(4):21-26. PubMed PMID: 35608522

86. Sellers B, Townley JR, Ropp C, Legault G. Brief report: Refractive surgery trends at tri-service refractive surgery centers and the impact of the COVID-19 pandemic, fiscal years 2000-2020. *MSMR*. 2022 Mar 1;29(3):17-19. PubMed PMID: 35485768

87. Legg M, Stahlman S, Chauhan A, Patel D, Hu Z, Wells N. Obesity prevalence among active component service members prior to and during the COVID-19 pandemic, January 2018-July 2021. *MSMR*. 2022 Mar 1;29(3):8-16. PubMed PMID: 35485798

88. Russell J, Vick S. Brief report: Using syndromic surveillance to monitor MIS-C associated with COVID-19 in Military Health System beneficiaries. *MSMR*. 2022 Mar 1;29(3):20-21. PubMed PMID: 35485829

89. Williams V, Ying S, Stahlman S. Surveillance snapshot: Medical separation from service among incident cases of osteoarthritis and spondylosis, active component, U.S. Armed Forces, 2016-2020. *MSMR*. 2022 Mar 1;29(3):22. PubMed PMID: 35485830

90. [No authors listed] Update: Malaria, U.S. Armed Forces, 2021. *MSMR*. 2022 Mar;29(3):2-7. PubMed PMID: 35486624

91. Legg M, Seliga N, Mahaney H, Gleeson T, Mancuso JD. Diagnosis of hepatitis C infection and cascade of care in the active component, U.S. Armed Forces, 2020. *MSMR*. 2022 Feb 1;29(2):2-7. PubMed PMID: 35442607

92. Reynolds ME, Gu W. A new approach to categorization of ocular injury among U.S. Armed Forces. *MSMR*. 2022 Feb 1;29(2):8-14. PubMed PMID: 35442608

93. Williams VF, Ying S, Stahlman S. Surveillance snapshot: Health care burden attributable to osteoarthritis and spondylosis, active component, U.S. Armed Forces, 2016-2020. *MSMR*. 2022 Feb 1;29(2):15. PubMed PMID: 35442612

94. Mease LE, Yun DH, Egbert J, Yassin A, Faestel P, Bateman S, Moyer CS, Terrio J. Description of a COVID-19 Beta variant outbreak, Joint Base Lewis-McChord, WA, February-March 2021. *MSMR*. 2022 Jan 1;29(1):2-6. PubMed PMID: 35404558

95. Smetana CA, Patel DM, Stahlman S, Chauhan A, Wells NY, Ying S. COVID-19 and depressive symptoms among active component U.S. service members, January 2019-July 2021. *MSMR*. 2022 Jan 1;29(1):7-13. PubMed PMID: 35404559

96. Clark LL, Snitchler CL. Surveillance snapshot: Lengths of hospital stays for service members diagnosed with sepsis, active component, U.S. Armed Forces, 2011-2020. *MSMR*. 2022 Jan 1;29(1):14. PubMed PMID: 35404560

ACRONYMS

AFHSD	Armed Forces Health Surveillance Division		IE	Innovation and Evaluation
AFRICOM	U.S. Africa Command		IHR	International Health Regulations
AFRIMS	U.S. Armed Forces Research Institute of Medical Sciences		ILI	influenza-like illness
AGE	acute gastroenteritis		IPL	Institut Pasteur du Laos
AHSU	AFHSD Health Surveillance Update		JPEO-CBRND	Joint Program Executive Office for Chemical, Biological, Radiological, Nuclear Defense
AMR	antimicrobial resistance		JROC	Joint Requirements Oversight Council
APHC	U.S. Army Public Health Center		JROCM	Joint Requirements Oversight Council Memorandums
AOR	Area of Responsibility		KPI	Key performance indicators
ARO	Alert and Response Operations		LOE	line of effort
BAACH	Brian Allgood Army Community Hospital		LRMC	Landstuhl Regional Medical Center
BI	Bioinformatics		MDRO	multidrug-resistant organisms
BSHP	Biosurveillance Hub and Portal		MERS-CoV	Middle East Respiratory Syndrome Coronavirus
CAC	Common Access Card		MHS	Military Health System
CARB	Combating Antibiotic Resistant Bacteria		MRSN	Multidrug-Resistant Organism Repository and Surveillance Network
CCMD	Combatant Command			
CDC	Centers for Disease Control and Prevention		*MSMR*	*Medical Surveillance Monthly Report*
CENTCOM	U.S. Central Command		NAMRU EAC	Naval Medical Research Unit EURAFCENT
CONUS	Contiguous United States		NAMRU IP	Naval Medical Research Unit INDO PACIFIC
CSA	Combat Support Agency		NAMRU S	Naval Medical Research Unit SOUTH
DCPH-A	Defense Centers for Public Health – Aberdeen		NATO	North Atlantic Treaty Organization
DCPH-D	Defense Centers for Public Health – Dayton		NCMI	National Center for Medical Intelligence
DCPH-P	Defense Centers for Public Health – Portsmouth		NECE	Navy Entomology Center of Excellence
DCPH-P-EDC	Defense Centers for Public Health-Portsmouth EpiData Center		NEPMU	Navy Environmental Preventive Medicine Unit
DHA	Defense Health Agency		NEPMU-2	Navy Environmental Preventive Medicine Unit 2
DHS	United States Department of Homeland Security		NGS	Next-generation sequencing
DMED	Defense Medical Epidemiology Database		NHRC	Naval Health Research Command
DMSS	Defense Medical Surveillance System		NIH	National Institutes of Health
DMTS	Data Management and Technical Support		NMRC	Naval Medical Research Command
DOD	Department of Defense		OCONUS	outside the contiguous United States
DoDGRPSP	DOD Global Respiratory Pathogen Surveillance Program		PVC	Pharmacovigilance Center
DODSR	Department of Defense Serum Repository		PHC	Public Health Command
DRSi	Disease Reporting System internet		PHC-E	Public Health Command Europe
DTRA	Defense Threat Reduction Agency		PTSD	Post-traumatic stress disorder
E&A	Epidemiology and Analysis		PVC	Pharmacovigilance Center
EDC	EpiData Center		RI	Respiratory Infections
EI	Enteric Infections		RME	reportable medical event
EID	emerging infectious disease		SMS	Surveillance Methods and Standards
ESSENCE	Electronic Surveillance System for the Early Notification of Community-based Epidemics		SOUTHCOM	U.S. Southern Command
			SPC	Special Projects Cell
EUCOM	U.S. European Command		SSBP	Surveillance of Suicidal Behavior Publication
NAMRU EURAFCENT	Navy Region Europe, Africa, Central		STI	sexually transmitted infections
			TAMC	Tripler Army Medical Center
FHP	force health protection		TBI	traumatic brain injury
FY	fiscal year		USDA	United States Department of Agriculture
FVBI	Febrile and Vector-Borne Infections		USG	United States Government
GAO	Government Accountability Office		USAFSAM	U.S. Air Force School of Aerospace Medicine
GCC	Geographic Combatant Command		USACE	U.S. Army Corps of Engineers
GEIS	Global Emerging Infections Surveillance		USAID	United States Agency for International Development
GEIS-PO	GEIS Program Office		USAMC	U.S. Army Medical Command
GIS	Geographic Information Systems		USAMRD-A	U.S. Army Medical Research Directorate–Africa
GTD	Global Travelers' Diarrhea		USAMRD-G	U.S. Army Medical Research Directorate–Georgia
H7N9	avian influenza A (subtype H7N9)		USAMRIID	U.S. Army Medical Research Institute for Infectious Diseases
HAI	healthcare-associated infection		USFK	United States Forces Korea
HAdV-B55	human adenovirus type 55		USINDOPACOM	U. S. Indo-Pacific Command
HAdV-11a	human adenovirus 11a			
HIV	human immunodeficiency virus		USUHS	Uniformed Services University of the Health Sciences
HPV	human papilloma virus		VE	vaccine effectiveness
IB	Integrated Biosurveillance		WG	working group
ICD-9	International Classification of Diseases, Ninth Revision		WHO	World Health Organization
ICD-10	International Classification of Diseases, 10th Revision		WRAIR	Walter Reed Army Institute of Research
ID	identification			

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.