



AFHSB

ARMED FORCES HEALTH SURVEILLANCE BRANCH



HEALTH SURVEILLANCE, ANALYSIS, AND INSIGHT FOR ACTION

ANNUAL REPORT 2018

CONTENTS

●	THE HISTORY OF AFHSB.....	4
	The Origins of AFHSB	5
	AFHSB Organizational Structure	6
	Customers and Stakeholders	6
	AFHSB Finances	7
●	THE ELEMENTS OF MILITARY MEDICAL SURVEILLANCE	8
	Tools of Surveillance.....	9
	DMSS Structure and Functional Relationship	10
	Epidemiology Analyses and Reports	11
	AFHSB E&A Satellites.....	14
	Surveillance Methods and Standards	17
	Medical Surveillance Monthly Report	18
	Residency Training.....	19
●	GLOBAL EMERGING INFECTIONS SURVEILLANCE (GEIS)	20
	Global Emerging Infections Surveillance	21
●	BIOSURVEILLANCE IN THE DoD	28
	Integrated Biosurveillance.....	29
●	AFHSB PUBLICATIONS.....	32
	AFHSB Publications	33
●	2018 PARTNER PUBLICATIONS.....	34
●	ACRONYMS	39

FRIENDS AND COLLEAGUES

The Armed Forces Health Surveillance Branch (AFHSB) is in its fourth year of existence as part of the Defense Health Agency (DHA), and I continue to take pride in our team's accomplishments in solidifying DHA's role as a Combat Support Agency (CSA) and providing the military services and the Military Health System (MHS) with sound epidemiologic data to improve the health and readiness of all service members.

Our success is a testament to the hard work of the over 100 staff members at our four sections and three Military Service-aligned satellites. We continue to build upon the successes of the past as we support the military public health transition for the DHA and its Public Health Directorate, refine our role as a CSA, and establish our ability to provide value to the MHS.

HIGHLIGHTS FROM 2018 INCLUDE THE FOLLOWING:

The AFHSB's Integrated Biosurveillance (IB) section continued to expand on its critical support of the Combatant Commands (CCMDs) with the establishment of a unique Health Surveillance Explorer (HSE) mapping capability, which is able to provide the CCMDs, the Joint Staff, the Military Services, and other MHS public health leadership with near real-time global health surveillance and awareness of outbreaks of operational significance worldwide. This web-based mapping capability has been expanded to provide IB's customers, particularly the CCMDs, the ability to visualize important details on military-relevant diseases and other medical events/outbreaks. This capability provides CCMD's and medical planners with medical threat information "at the tips of their fingers" in a reliable fashion, making possible DHA's fourth goal to "Deliver Globally Integrated Health Solutions to Combat Forces." The establishment of the HSE mapping platform addresses an important gap that the CSA Review Team (CSART) 2018 report identified—the clear need for a "one-stop shop" for biosurveillance information that is curated, timely, military-relevant, and presented in a quick and easily understandable format for force health protection (FHP) decision makers.

The IB section has also begun to engage on an "Influenza Forecasting Challenge" initiative in coordination with the Defense Threat Reduction Agency (DTRA), U.S. Centers for Disease Control (CDC), the National Institutes of Health (NIH), and academic centers across the United States (such as Columbia, Carnegie Mellon, University of Virginia, University of Georgia, University of Massachusetts, University of Arizona and Predictive Science, Inc.). In this important collaboration, each group will be provided with seasonal Department of Defense (DoD) location-specific influenza data from 28 military treatment facility (MTFs) in order to generate models and influenza spread for the 2019–2020 influenza season. These models will forecast the onset, peak week, and influenza burden at these CONUS MTFs, and these forecasts will be scored and ranked according to how accurately they predict the targets. As these forecasts continue to improve, they will be used to inform senior leaders during the influenza season as well as during a pandemic.

The AFHSB's Epidemiology and Analysis (E&A) section continued to provide top-notch, high-quality support to the DoD leadership with production of a broad range of epidemiologic surveillance reports and public health consultation support to MHS officials, completing over 1,400 epidemiologic analytical ad hoc and routine reports in support of the Military Services and the CCMDs. These 2018 reports were

highlighted by the publication of the annual burden of disease analyses in the *Medical Surveillance Monthly Report (MSMR)*, a publication with over 1,200 subscribers and the DoD's only MEDLINE-searchable journal, as well as by the analysis of acute respiratory infections as part of the "Warfighter Respiratory Health Report" to Congress detailing the scope and impact of respiratory illnesses on military personnel — particularly on deployed troops — dating from the first Gulf War (1990) through the end of 2018. Of note also, the E&A staff continued to provide analyses and subject matter expertise for AFHSB's "DoD Seasonal Influenza Surveillance Summary" which contains CCMD-specific weekly analyses of the influenza activity among MHS beneficiaries.

Our Global Emerging Infections Surveillance (GEIS) section continued to expand DoD's worldwide infectious disease surveillance footprint by providing timely, actionable infectious disease threat information to force readiness in CCMD areas of responsibilities (AORs) by synchronizing projects with other United States Government (USG) interagency partners in coordination meetings in order to reduce duplication of efforts and address gaps in its surveillance efforts. Additionally, GEIS' continued full engagement with CCMDs in the "Data-to-Decision" initiative to rapidly get infectious disease surveillance data from the field into the hands of decision makers such as CCMDs has resulted in further protection of the health of the force and improvements to its readiness. This large effort consisted of the provision of spot reports and routine monthly updates containing new findings for approximately 170 completed surveillance projects. In addition, it is noteworthy to mention that GEIS continued to expand global infectious disease surveillance by including the North Atlantic Treaty Organization (NATO) partner nations in order to more fully integrate disease surveillance initiatives with partner militaries in support of Joint/Combined Force deployments in the U.S. European Command (EUCOM) and U.S. Africa Command (AFRICOM) AORs.

One notable accomplishment this past year was GEIS program support to the World Health Organization (WHO), CDC, and the U.S. Food and Drug Administration (FDA)'s 2019–20 influenza strain selection. In this role, GEIS provided worldwide geographic and region-specific influenza surveillance and genetic sequencing information on over 700 influenza strains. This massive effort was critical in ensuring that the Northern Hemisphere's seasonal influenza vaccine composition was as close as possible to the expected prevailing circulating strains for the upcoming influenza season.

As you read AFHSB's annual report, we hope it will continue to remind you of our recent successes and the future path that we will take to ensure our mission in 2020. We look forward to continuing this tireless effort in support of the Joint Force in order to fulfill the ultimate goal of helping the CCMDs and the Military Services make the best decisions in protecting the health and readiness of DoD's military and beneficiaries. ■



DOUGLAS A. BADZIK, MD, MPH, COL, MC, USA
Chief, Armed Forces Health Surveillance Branch

THE HISTORY OF AFHSB

VISION

To be the *central, integrated, customer-focused* epidemiologic and global health surveillance resource for the Department of Defense.

MISSION

To provide *timely, relevant, actionable, and comprehensive* health surveillance support to the Joint Staff, Combatant Commands (CCMDs) and Military Services in order to promote health and enhance Force Health Protection, Readiness and Lethality.

CRITICAL FUNCTIONS:

- Acquire, analyze/interpret, and disseminate health surveillance information and recommend evidence-based policy
- Develop, refine, and improve standardized surveillance methods.
- Serve as a focal point for sharing health surveillance products, expertise, and information.
- Coordinate a global program of militarily relevant infectious disease surveillance.



THE ORIGINS OF AFHSB

The AFHSB is the central epidemiologic health surveillance resource for the U.S. military. The branch operates within DHA's Public Health Directorate under the Assistant Director for Combat Support.

AFHSB was created in February 2008 as the Armed Forces Health Surveillance Center following the merger of the Army Medical Surveillance Activity's Defense Medical Surveillance System (DMSS) with DoD Serum Repository (DoDSR), the DoD Global Emerging Infections Surveillance and Response System (DoD-GEIS), and the Global Health Surveillance Activity from the Office of the Deputy Assistant Secretary of Defense for Force Health Protection and Readiness.

As the central repository of medical surveillance data for the U.S. Armed Forces, AFHSB manages the DMSS and the DoDSR. The DMSS contains current and historical data on diseases and medical events such as hospitalizations, ambulatory visits, reportable medical events (RMEs), laboratory tests, immunizations, periodic and deployment-related health assessments, and casualty data

affecting service members throughout their military careers. The DMSS contains billions of data records on service members and other MHS beneficiaries.

The DoDSR was established in 1989 to store sera collected during the DoD's testing program for human immunodeficiency virus (HIV) infections. Later, the DoDSR was designated to receive serum specimens collected before and after operational deployments. With more than 66 million serial serum specimens from over 11 million individuals, the DoDSR is the world's largest serum repository of its kind.

In 1997, the DoD established DoD-GEIS in response to a Presidential Decision Directive to expand its mission to include support of global surveillance, training, research, and response to emerging infectious disease (EID) threats. GEIS coordinates AFHSB's global EID surveillance and response initiatives among a network of partner organizations and executes a militarily relevant surveillance program involving respiratory infections, enteric infections, febrile and vector-borne infections (FVBI), and antimicrobial-resistant organisms. The

AFHSB also plays a key role in integrating biosurveillance by collecting data and information in near real-time of the threats from endemic diseases and EIDs relevant to the military worldwide.

AFHSB publishes summaries of notifiable diseases, trends of illnesses of special interest, and field reports describing outbreaks and case occurrences in its peer-reviewed journal, *MSSMR*. AFHSB also provides up-to-date information on diseases that could affect force health readiness and protection.

AFHSB also assumed responsibility of the health surveillance capabilities of the Service Public Health Hubs, which include personnel from the U.S. Army Public Health Center (APHC), U.S. Air Force School of Aerospace Medicine (USAFSAM), and the Navy and Marine Corps Public Health Center (NMCPHC). The Service Public Health Hubs' select surveillance personnel and assets are satellites of AFHSB.

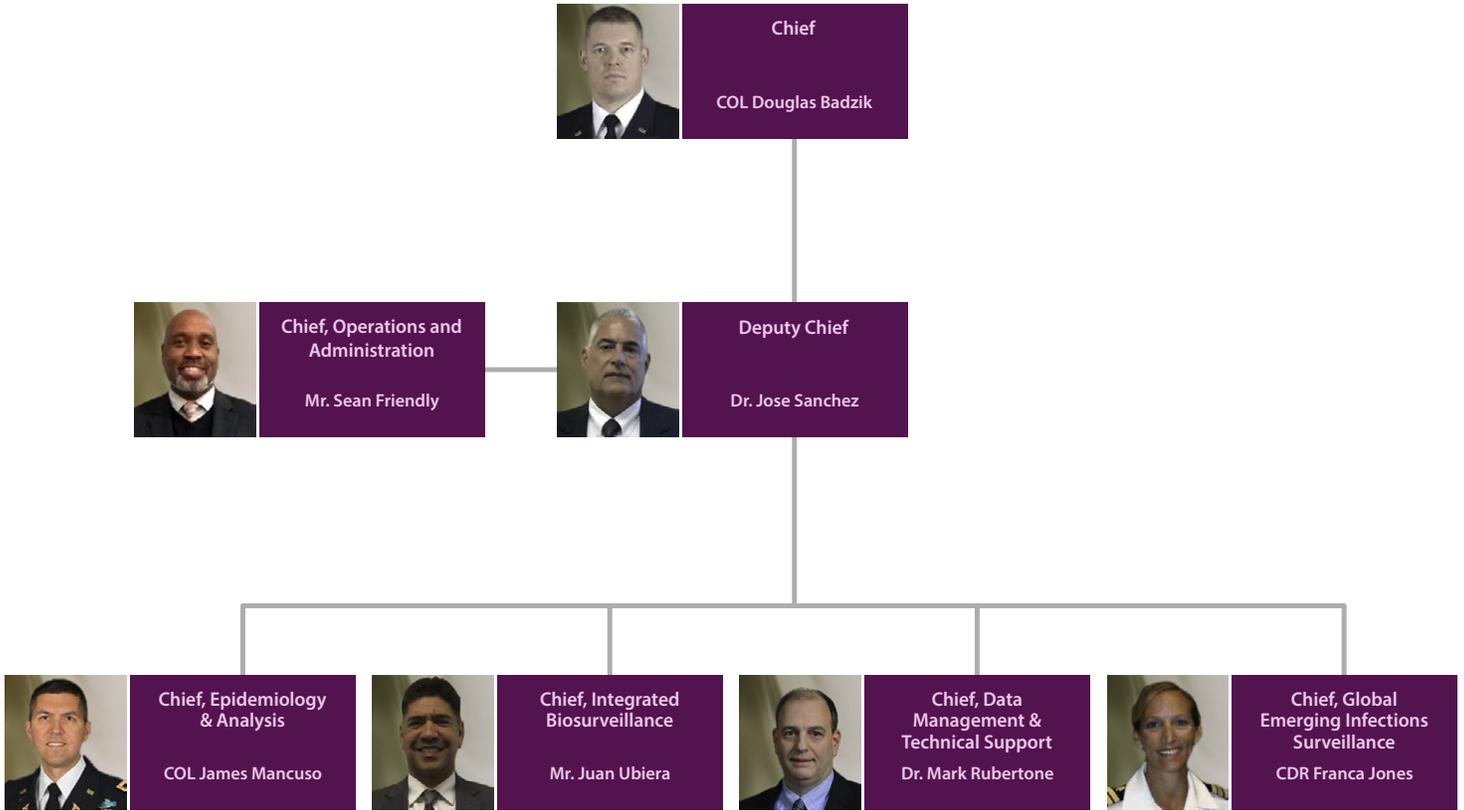
AFHSB is currently organized into four sections: Data Management and Technical Support (DMTS), E&A, GEIS, and IB. ■

DEFENSE HEALTH AGENCY

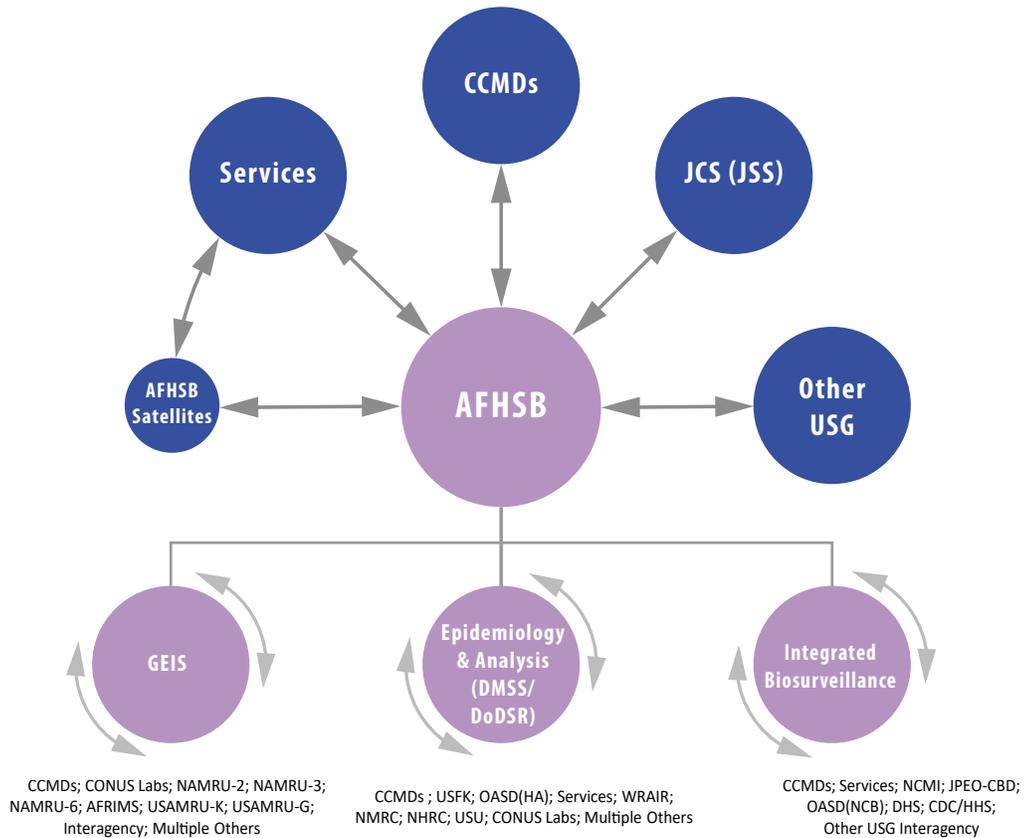
The DHA is a joint, integrated CSA that enables the Army, Navy, and Air Force medical services to provide a medically ready force and ready medical force to CCMDs in both peacetime and wartime. The DHA supports the delivery of integrated, affordable, and high-quality health services to MHS beneficiaries and is responsible for driving greater integration of clinical and business processes across the MHS.



AFHSB ORGANIZATIONAL STRUCTURE



CUSTOMERS AND STAKEHOLDERS



AFHSB FINANCES

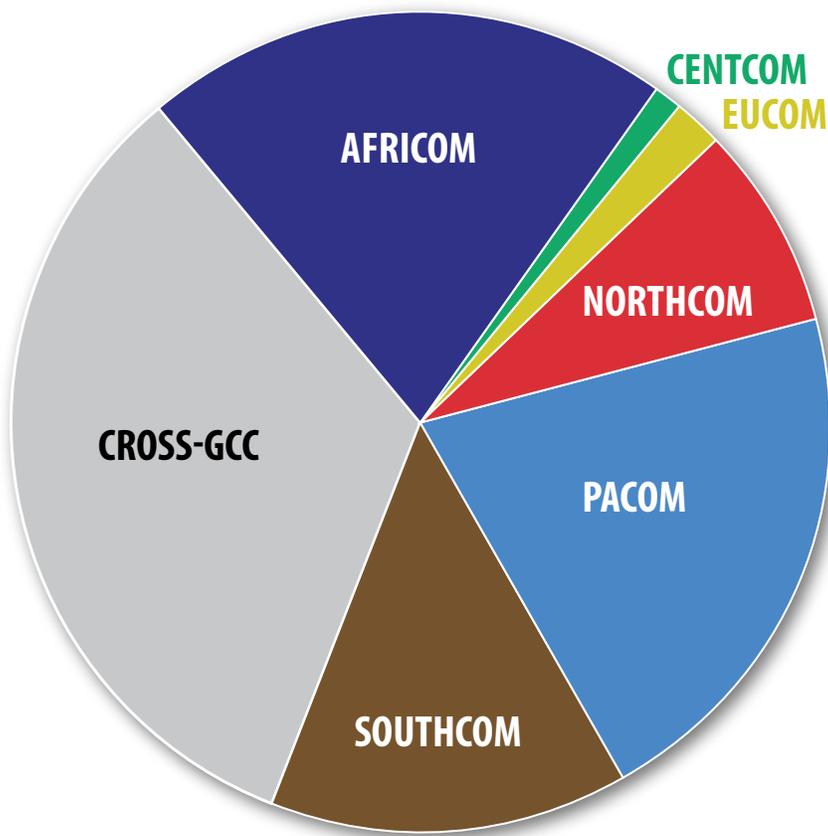
AFHSB distributed 77.2% of its funds directly to laboratory partners through the GEIS program following an extensive internal and external proposal review process.

Funding recipients included the Army and Navy overseas laboratories such as the US Army Medical Directorate of the Armed Forces Research Institute of Medical Sciences (USAMD-AFRIMS) U.S. Army Medical Research

Directorate-Georgia (USAMRD-G); U.S. Army Medical Research Directorate-Kenya (USAMRD-K), and Naval Medical Research Center Unit No. 2, 3, and 6 (NAMRU-2, NAMRU-3, and NAMRU-6, respectively). Several CONUS-based military and university partners including the Naval Medical Research Center (NMRC), Naval Health Research Center (NHRC); USAFSAM; NMCPHC; Walter Reed Army Institute of Research (WRAIR);

and Uniformed Services University of the Health Sciences (USU) among others also received funding in support of their robust programs that benefit the DoD and partners. The remaining funds supported various AFHSB sections and headquarters as well as biosurveillance initiatives, comprehensive health surveillance service and support contract staff, contract personnel working with the MSMR and the DoDSR, and other infrastructure costs. ■

FY18 DISTRIBUTION OF GEIS FUNDING FOR SURVEILLANCE



CCMD	Amount	%
AFRICOM	\$ 12,261,697	20.8
CENTCOM	\$ 506,594	0.9
EUCOM	\$ 1,585,483	2.7
NORTHCOM	\$ 4,606,934	7.8
PACOM	\$ 12,562,042	21.3
SOUTHCOM	\$ 8,142,000	13.8
Cross-GCC	\$ 19,297,250	32.7
	\$ 58,962,000	100.0

THE ELEMENTS OF MILITARY MEDICAL SURVEILLANCE

TOOLS OF SURVEILLANCE

The DMSS and DoDSR are longstanding and vital assets to medical surveillance within the U.S. Armed Forces. The DMSS and DoDSR have their historic roots in routine 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 3 billion data records, including more than 1 billion records on U.S. service members alone, the DMSS remains the DoD's premier epidemiologic health surveillance resource.

The Defense Medical Epidemiology Database (DMED) is derived from the DMSS, providing 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.

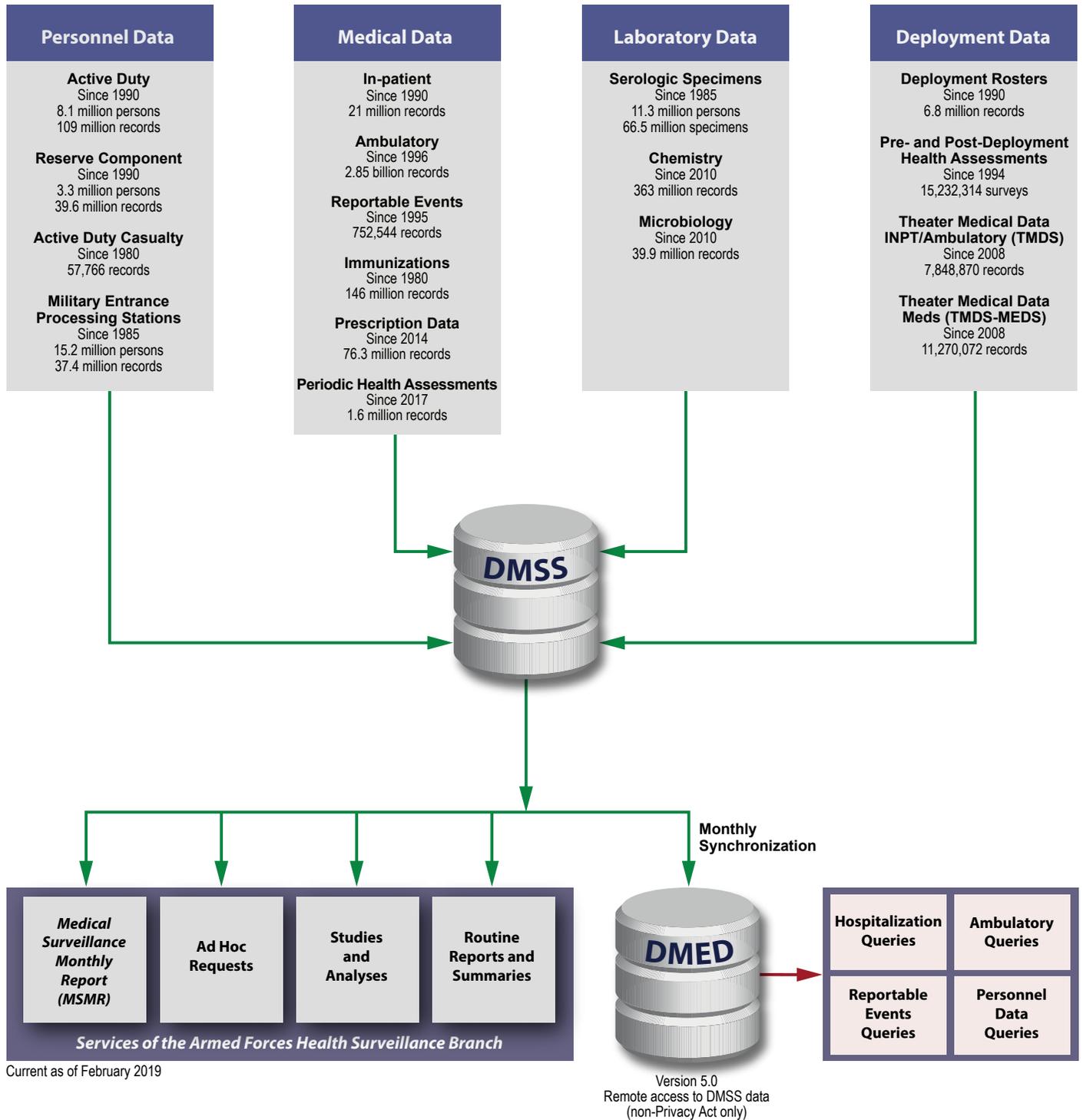
The DoDSR specimens are housed in modern freezers with advanced cooling equipment and technology. The DMSS database stores demographic,

occupational, and medical information in longitudinal surveillance and records links to the DoDSR specimens. It is a unique and powerful resource to support the conduct of military medical surveillance, clinical care, and seroepidemiologic investigations. During 2018, AFHSB processed and dispensed more than 20,500 aliquots of serum specimens in support of 30 seroepidemiologic studies and analyses.

Of these studies, seven were for clinical needs, eight were operational, and the remaining 15 were in support of research studies, including a study examining alpha-1 acid glycoprotein and its role in the neuropsychiatric side effects of mefloquine, an analysis regarding biomarkers, and biomechanics associated with injury-mediated osteoarthritis, a spectrometric serum analysis of biomarkers in oropharyngeal squamous cell carcinoma, and an analysis of tick-borne febrile illness in a cohort of U.S. Military Academy cadets. ■



DMSS STRUCTURE AND FUNCTIONAL RELATIONSHIP



EPIDEMIOLOGY ANALYSES AND REPORTS

The E&A section integrates the expertise of epidemiologists, preventive medicine physicians, and data analysts to provide timely analyses and reports of actionable health information. The section uses AFHSB health surveillance tools—the DMSS and DoDSR—and provides surveillance products to DoD policymakers, military commanders, 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 section 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.

E&A staff members prepare analyses under two general categories: periodic reports and ad hoc requests. In 2018, the section 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 FHP programs and healthcare professionals develop preventive measures against diseases or injuries

affecting U.S. service members and their beneficiaries.

For example, E&A staff provided analyses and subject matter expertise for AFHSB’s Seasonal Influenza Surveillance Summary report during the influenza season. This report contains weekly summaries of influenza activity among MHS beneficiaries by CCMD. The influenza report highlights data about outpatient medical encounters for influenza-like illness (ILI), mandatory reports about cases of influenza hospitalizations, and ancillary services data on laboratory test results provided by the NMCPHC to assess weekly influenza activity in the Defense Department.

Another report, the U.S. Central Command (CENTCOM) Deployment Health Report, is produced quarterly for its Surgeon’s Office. “This report provides data on medical encounters that occurred in CENTCOM starting in 2008 through the 15 months before the report is run. These data are grouped by disease and injury categories. Additionally, the report provides extensive data on medical air transports (MATs) out of CENTCOM reported by month starting in October 2001. The MAT data are provided by disease, battle, and non-battle injury categories and by specific areas of interest, such as musculoskeletal issues and mental health disorders and other most common diseases. MAT data are provided on both service members and civilian/contractors who are deployed to CENTCOM. The report was updated in 2018 to incorporate newly mapped disease and injury categories and International Classification of Disease, 10th revision (ICD-10) codes.

During 2018, E&A supported requests for analyses on trends of diseases and injuries that are considered to be of special interest by military leaders at the CCMDs. E&A, for example, produced

responses for two ad hoc requests by CENTCOM on influenza-like illness in specific countries in the Command’s area of responsibility, updated and improved the disease non-battle injury mappings that are used for a quarterly CENTCOM report, and supported a request from the U.S. Army Forces Command (FORSCOM) for an investigation of suicidal behaviors among Army Service members.

In 2018, E&A completed four analyses in response to congressional inquiries. The staff provided the data and analysis for a study on the health of tilt-rotor pilots in response to a requirement in the fiscal year (FY) 2017 National Defense Authorization Act (NDAA) (more details below). Additionally, the staff conducted an analysis of eating disorders among active component service members at the request of the Congressional Research Service. E&A supported the Senate Armed Services Committee request for data on heat illnesses between 2013–2017 and provided data on contraceptive use among service members for a Congressional briefing to Senator Jeanne Shaheen.

As part of the inquiry regarding the health of helicopter and tilt-rotor pilots mentioned above, a working group between the military services and E&A was convened to develop the study, interpret the results, and conduct a comprehensive literature review on the topic. The epidemiologic retrospective cohort study evaluated 31 acute and chronic medical conditions including injuries and mental health, metabolic, neurologic, orthopedic, and respiratory conditions among.

E&A also continued to support the DoD’s efforts to address former Vice President Joe Biden’s Cancer Moonshot initiative. This initiative aims to accelerate cancer research and make additional therapies available to patients while also

THE ELEMENTS OF MILITARY MEDICAL SURVEILLANCE

improving the ability to prevent cancer and detect it at an early stage. E&A provided epidemiologic guidance, DoDSR specimens, and accompanying data from the DMSS to assist the Walter Reed National Military Medical Center's John P. Murtha Cancer Center in the design and implementation of two additional studies in support of this effort. One study will try to identify genomic and spectrometric serum biomarkers among diffuse

large B-cell lymphoma cases. The other study will be a molecular study of the DoDSR specimens for melanoma cases.

The E&A section also continued to collaborate with other federal partners such as CDC and the FDA in 2018. E&A's work with CDC included reporting potential malaria cases among service members to be included in CDC's National Malaria Surveillance System. E&A, in

collaboration with the GEIS section, the AFHSB's Air Force satellite, and the NHRC provided the FDA with evaluation of influenza vaccine effectiveness (VE) analyses. Additionally, in conjunction with GEIS, E&A assisted with the study design and provided data and specimens for two FDA studies evaluating influenza correlates of protection and the effects of multiple annual influenza vaccinations on immune responses. ■



FY18 AFHSB Periodic Reports in One Year

REPORT NAME

DD2900 Referral Management Report
MHA Count Report
PDHRA Dashboard
Deployment Health Compliance Report
Deployment Health Report
Post-deployment Health Assessment - MH Reserve Guard referrals
Deploy Form Summary Report
FHPQA TBI
MSMR Deployment Health Assessment Summary
Army ILI Trend Report
IB Flu Forecasting Challenge Report
Influenza Surveillance Report
Malaria Case-Finding Report
Malaria YTD Korea
VA Influenza Surveillance Report
Army Heat and Cold Weather Injury Report
TRADOC Injuries by Training Cycle
Army Satellite Injury Report
Gender Integrated Units Person Time
Army Injury&Overuse Report
DoD Eye Injury Annual Report
DoD Eye Injury Quarterly Report
DoD Hearing Injury Annual Report
DoD Hearing Injury Quarterly Report
Injury Installation Reports
TRADOC Cold Injury Report
TRADOC Heat Injury Report
TRADOC Training-related Injuries Report
USASOC Special Reportable Events (Semi-Annual)
Separatee Screening Compliance
DVBIC TBI Screen
Health Affairs (HA) Mental Health Report
Health Affairs (HA) TBI Report
Health Affairs (HA) PTSD Report
ANAM Report
PHA Tobacco Use Report
IB RME Weekly Report
EUCOM RMES Monthly Summary
Smallpox Cardiac AE Report

Total Reports 415

AFHSB E&A SATELLITES

AFHSB E&A maintains satellite staff at APHC, NMCPHC, and USAFSAM. Satellite staff primarily support Service-specific 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 Approval Process (RAP), quarterly E&A staff meetings, and the quarterly Health Surveillance Steering Group (HSSG).

The HSSG, established in 2017, represents a coordinated effort by AFHSB and the Services to collaborate on common surveillance issues in order to develop reports that advance the mission of DOD public health. Important HSSG accomplishments in 2018 included development of the consolidated influenza report, and development of the DoD Health of the Force report. This report aims to provide summary measures to provide an overall picture of Service member health to leadership.

THE NAVY SATELLITE staff work within the EpiData Center (EDC) which, along with Health Analysis, and Health Promotion and Wellness, is part of the NMCPHC Population Health Directorate. Staff include three epidemiologists and a statistician who serve as subject matter experts in behavioral and operational health, reportable and emerging infections, and data systems and application development. Significant contributions by satellite staff include a report outlining 5-year suicide trends for the Surgeon General Navy Medicine Force Health Report, a 10-year comparative analysis of pneumonia and respiratory encounter rates among Marines at various training sites that had important implications for future training exercises, and ongoing evaluation of data from MHS GENESIS to help ensure that surveillance data continues to be available to the surveillance community as the DoD transitions from

legacy systems to the new electronic medical record.

THE ARMY SATELLITE staff, which includes five epidemiologists, support several division within APHC including the Behavioral and Social Health Outcomes Practice (BSHOP), Injury Prevention, Disease Epidemiology, Army Hearing, and Vision Conservation and Readiness.

BSHOP completed 44 ad hoc and routine requests on suicidal behavior, alcohol use, and behavioral health outcomes during 2018. Annual reports released during 2018 include the 2017 Surveillance of Suicidal Behavior Publication, the 2016 Behavioral Health Risk Assessment Data Report, and Surveillance of Suicide Cases (National Guard and Reserve) January through December 2016. The cell also contributed significantly to the 2018 Army Health of the Force report.

As part of the Injury Prevention Division, satellite staff contributed to ongoing improvements and expansion of the Weather Related Injury Repository during 2018 which allowed the team to respond to 44 requests for information related to heat and cold-weather illnesses. The team was also instrumental in adding location-specific information related to heat illness to the HSE. Adding the 'heat layer' to the HSE improves accessibility of timely surveillance data with the potential to both improve awareness and reduce the incidence of heat illness among Service members worldwide.

The Disease Reporting System, Internet (DRSi) is the official repository for RMEs for the DoD. The Disease Epidemiology Division manages DRSi for the Army. Disease Epidemiology also oversees the Reportable Medical Events Working Group (RMEWG) and publication of the tri-Service Armed Forces Reportable Medical Events Guidelines and Case Definitions. Important accomplishments

in 2018 include coordination of ongoing discussions related to adding elevated lead levels to the DoD list of RMEs, development of a communicable disease toolkit to assist and standardize collection of information related to RMEs.

In collaboration with the Vision Center for Excellence, Injury Prevention, and the National Military Audiology and Speech Pathology Center, Army satellite staff instituted several practices to incorporate rigorous epidemiological and statistical analysis in the Army's tracking and evaluation of vision and hearing among Service members in 2018. Satellite staff are currently working on a project to improve visualization of surveillance data using an online interface. This will allow the vision and hearing community to readily utilize data to improve vision and hearing conservation efforts.

THE AIR FORCE SATELLITE staff, which includes two active duty public health officers and a civilian epidemiologist, work closely with the DoD Global Respiratory Surveillance (DoDGRS) program. This program performs global sentinel site based respiratory surveillance analyzing more than 22,000 specimens from sentinel sites around the world annually. Collection and analysis of specimens allows sequencing and global tracking of influenza strains and data related to vaccine effectiveness; it also assists the Centers for Disease Control and Prevention and World Health Organization with annual vaccine strain selection. The DoDGRS program is active in publication of their surveillance findings including three MSMR articles in 2018. Additional accomplishments include expansion of the number and scope of sentinel sites covered by the DoDGRS program in order to provide an expanded source of data for vaccine strain selection, and improved capabilities related to recognizing the emergence of novel flu strains. ■

Air Force Satellite Reports

REPORT NAME	COUNT
DRSi Weekly Report	52
DRSi Monthly Report	12
DRSi Annual Report	1
Influenza Weekly Report	38
Influenza Final Report	1
Midseason Vaccine Effectiveness Estimates	1
Air Force Public Health Report	2
Total Reports	107

Army Satellite Reports

REPORT NAME	COUNT
DRSi Daily Report	250
DRSi Weekly Report	52
DRSi Monthly Report	12
DRSi Re-development Report	1
Influenza Weekly Report	23
Vectorborne Disease Monthly Report	6
Tri-Service Epidemiology Technician Monthly Training	10
Medical Event Reporting Survey	1
Heat Illness Monthly Report	6
Cold Weather Injury Monthly Report	6
TRADOC Heat Illness Monthly Report	5
Reportable Medical Event Annual Report	1
Weekly Vaccine Preventable Disease Case Summary	10
Reportable Medical Event Requests for Information	20
Heat Illness Requests for Information	44
Injury Annual Report	1
Army Installation Civilian Injury Data Reports	29
Army Installation Active Duty Medical Reports	40
Army Installation Safety RMIS Reports	25
Soldier 2020 IET Gender Integration Analysis	1
IET Injury Surveillance Report	1
Behavioral Health Risk Assessment Report	1
Surveillance of Suicidal Behavior Publication	1
Fort Gordon Suicidal Activity Report	4
XVIII Airborne Suicidal Activity Monthly Report	12
Regional Health Command Quarterly Suicidal Activity Report	4
DoDSER Completeness Monthly Report	12
DoDSER Compliance Monthly Report	12
Total Reports	590

Navy Satellite Reports

REPORT NAME	COUNT
DRSi Malaria Linelist	1
DRSi AF Quarterly Report	1
Force/Fleet Health Surveillance Report	10
Navy Suicide Case Review	9
Case Finding Daily Reports	188
AFHSB Linelist Reports	188
Meningitis Laboratory Results	188
HL7 Users Guide	7
ARO Report	10
Tuberculosis Annual Report	1
Traumatic Brain Injury Surveillance Annual Report	1
Traumatic Brain Injury Surveillance Quarterly Report	5
Hearing Conservation Program Civilian Summary	1
Comprehensive Industrial Hygiene Laboratory Cadmium Testing	1
Influenza Seasonal Summary	1
Influenza Weekly Report	13
Serious Influenza Report	66
Hepatitis B Linelist	1
Intrauterine Infection	1
Comorbid TBI-PTSD Report	0
Coccidioidomycosis Linelist	1
Air Force HL7 Data Gap Analysis	1
Zika Weekly Report	12
Zika Monthly Report	3
Anemia Among Naval Aviators	2
Strep A Among SOIW Trainees	6
Clinical Practice Guidelines Compliance	1
DoD Chikungunya Ten-Year Linelist	1
Total Reports	720

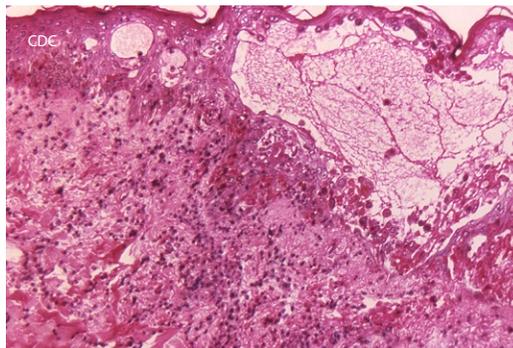
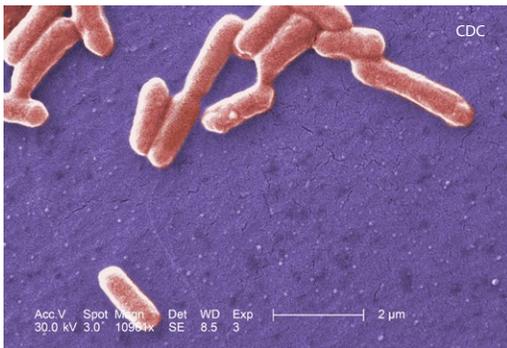
SURVEILLANCE METHODS AND STANDARDS

AFHSB's Surveillance Methods and Standards (SMS) working group develops, documents, and publishes standard surveillance case definitions and methodologies for studies that utilize DMSS data. The working group includes representatives from all services and consults, when needed, with experts from the Defense Department during the case definition development process. These case definitions allow Defense Department public health practitioners to measure disease trends and related biological phenomena in different environments and situations over time.

The ongoing documentation of AFHSB's case definitions and methodologies promotes internal consistency and credibility of its surveillance efforts as well as consistency and comparability of public health information and data across multiple agencies. The AFHSB case definitions also serve as guidelines for other DoD health surveillance and research organizations. The AFHSB case definitions are designed for use with administrative healthcare data derived from the U.S. military electronic health record and contained in the DMSS and other available datasets. The definitions primarily use ICD-9 and ICD-10 codes to identify conditions of interest diagnosed in the MHS.

In 2018, the SMS working group developed and documented 15 new case definitions, updated several others, and continued its efforts to develop ICD-10 code sets for its existing case definitions. The AFHSB prioritizes its case definition documentation process on militarily relevant conditions and on those conditions frequently used in AFHSB reports. To date, there are more than 120 condition-specific case definitions in 18 categories available on AFHSB's website. The SMS working group developed and documented, among others, new case definitions for male and female infertility, intestinal *Escherichia coli* (*E. coli*), rubella (German measles), varicella (chicken pox), and shigellosis (*Shigella*).

AFHSB also maintains and publishes the "Armed Forces Reportable Medical Events Guidelines and Case Definitions" with the July 17, 2017, version available on AFHSB's website. The DoD uses these guidelines to help military public health officers, healthcare providers, and laboratories identify and report specific diseases and conditions of public health importance to both military and civilian authorities. ■



MEDICAL SURVEILLANCE MONTHLY REPORT

Launched in 1995, the *MSMR* is the flagship publication for AFHSB. The monthly journal's articles provide 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's* readership includes professionals throughout the MHS, such as public health officials, clinicians, researchers, academicians, healthcare planners, policy-makers, and analysts.

The *MSMR* is indexed on MEDLINE and has more than 1,200 online subscribers. During 2018, the *MSMR* received 9,028 total page hits on AFHSB's website. The average number of page hits per month was 752. Articles published in the *MSMR* have generated media coverage in diverse publications, including *the New York Times*, *Nature (a British multidisciplinary scientific journal)*, *USA Today*, *The Standard*, *The Daily Record*, *Infection*

Control Today, *Medical Express*, *the Examiner*, *The Fayetteville Observer*, *International Business Times*, *The Los Angeles Times*, *The Washington Post*, *The Times News*, *Stars and Stripes*, and *Military Times*.

In 2018, the *MSMR* published a total of 52 articles, including 31 original full reports, 9 updates of previously published data analyses, 5 brief reports, 5 surveillance snapshots, 1 letter to the editor, and 1 editorial. Twenty-one of the articles were submitted by authors not affiliated with the *MSMR* editorial staff. The most frequent topics of original articles and updates in 2018 were healthcare burden of disease and injury, influenza, vector-borne diseases, heat injuries, and sexually transmitted infections (STIs). The *MSMR* continues to welcome manuscript submissions for relevant articles on topics in military public health, epidemiology, surveillance, and disease and injury prevention. ■

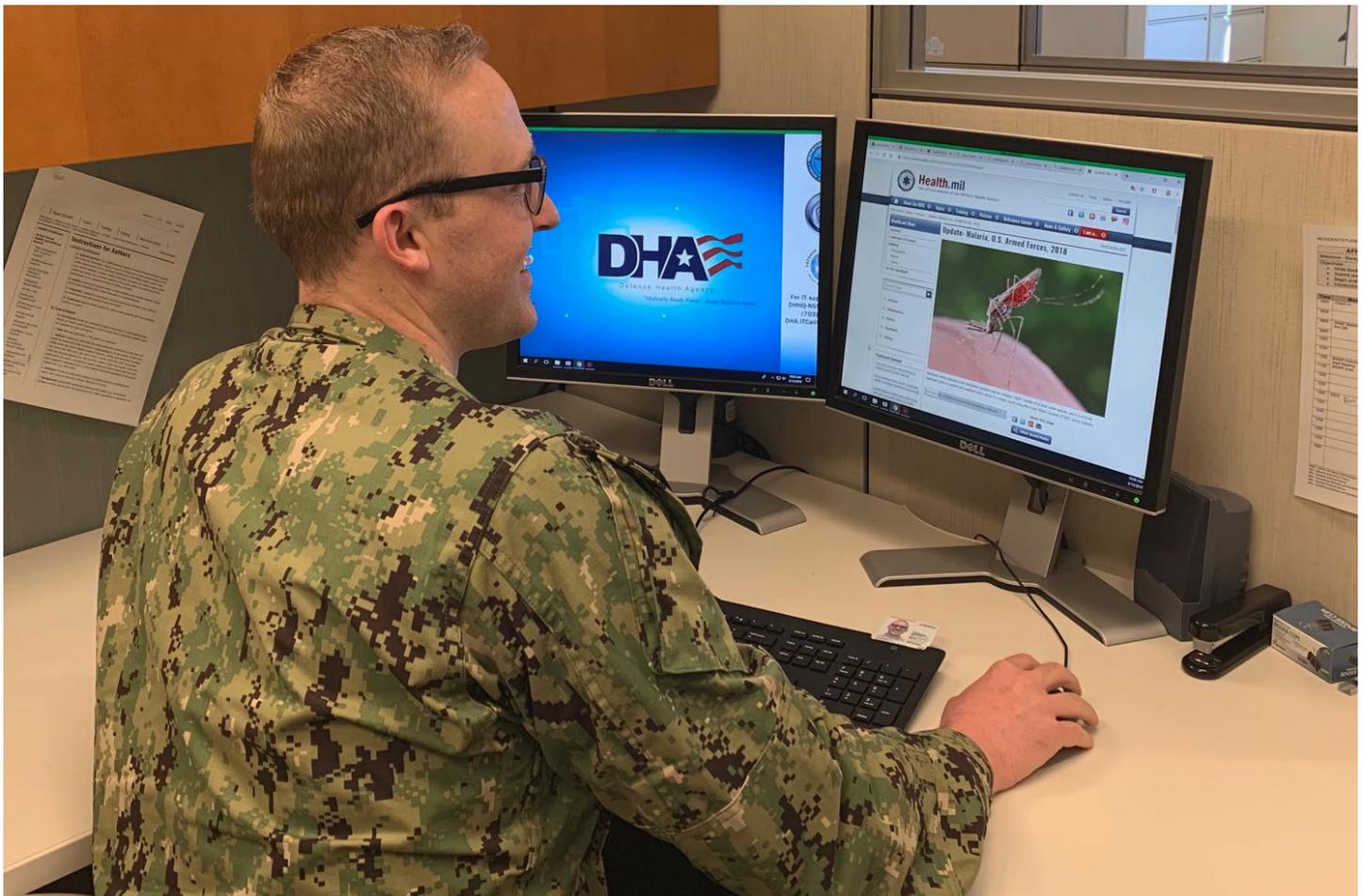


RESIDENCY TRAINING

As a key DoD source for health surveillance and epidemiologic training, AFHSB hosts preventive medicine residents from USU 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 AFHSB 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 AFHSB has trained 58 residents with diverse academic backgrounds from the three Military Services as well as two Doctor of Public Health students. In 2018, there were two Army residents, three Navy residents, and three Air Force residents. Resident and student projects have re-

sulted in published articles such as “Polypharmacy involving opioid, psychotropic, and central nervous system depressant medications, period prevalence and association with suicidal ideation, active component, U.S. Armed Forces, 2016,” “Psychiatric medical evacuations in individuals with diagnosed pre-deployment family problems, active component, U.S. Armed Forces, 2002–2014,” and “Variations in the incidence and burden of illnesses and injuries among non-retiree service members in the earliest, middle, and last 6 months of their careers, active component, U.S. Armed Forces, 2000–2015.” More than one-third of the completed resident projects are published in the *MSMR* or other peer-reviewed journals or presented at the American College of Preventive Medicine or the American Public Health Association meetings. Additionally, the E&A section 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 USU. ■





GLOBAL EMERGING INFECTIONS SURVEILLANCE (GEIS)

GEIS VISION

To mitigate the threat of emerging infectious diseases to the U.S. military through a global laboratory network.

GEIS MISSION

Inform force health protection decision making and enhance global health security through a global laboratory network that analyzes and provides timely, actionable infectious disease surveillance information to the Geographic Combatant Commands and partner agencies

GEIS CORE LABORATORY PARTNERS:

The following are the core GEIS partners who conducted ongoing surveillance projects on behalf of GEIS: NMRC in Silver Spring, Maryland, including NAMRU-2 in Singapore/Cambodia; NAMRU-3 in Cairo, Egypt; NAMRU-3 Ghana Detachment in Accra, Ghana; NAMRU-6 in Lima, Peru, and NHRC in San Diego, California; WRAIR in Silver Spring, Maryland, including AFRIMS in Bangkok, Thailand; USAMRD-G in Tbilisi, Republic of Georgia; and USAMRD-K in Nairobi, Kenya; USAFSAM in Dayton, Ohio; USU in Bethesda, Maryland

MILITARY TREATMENT FACILITY LABORATORIES: Brian Allgood Army Community Hospital (BAACH), Landstuhl Regional Medical Center (LRMC), and Tripler Army Medical Center(s)

PUBLIC HEALTH COMMANDS: Navy and Marine Corps Public Health Center-EpiData Center (NMCPHC-EDC), Navy Environmental Preventive Medicine Unit 2 and 5 (NEPMU-2 and NEPMU-5 respectively), and Public Health Command Europe (PHC-E)

ADDITIONAL PARTNERS: 18th Aerospace Medicine Squadron (18 AMDS), Theater Preventive Medicine Flight, 65th Medical Brigade, National Aeronautics and Space Administration (NASA), Navy Entomology Center of Excellence (NECE), Office of the Surgeon General-Pharmacovigilance Center (OTSG-PVC), U.S. Army Corps of Engineers (USACE), U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID), and U.S. Military Academy (USMA) at West Point.

GLOBAL EMERGING INFECTIONS SURVEILLANCE

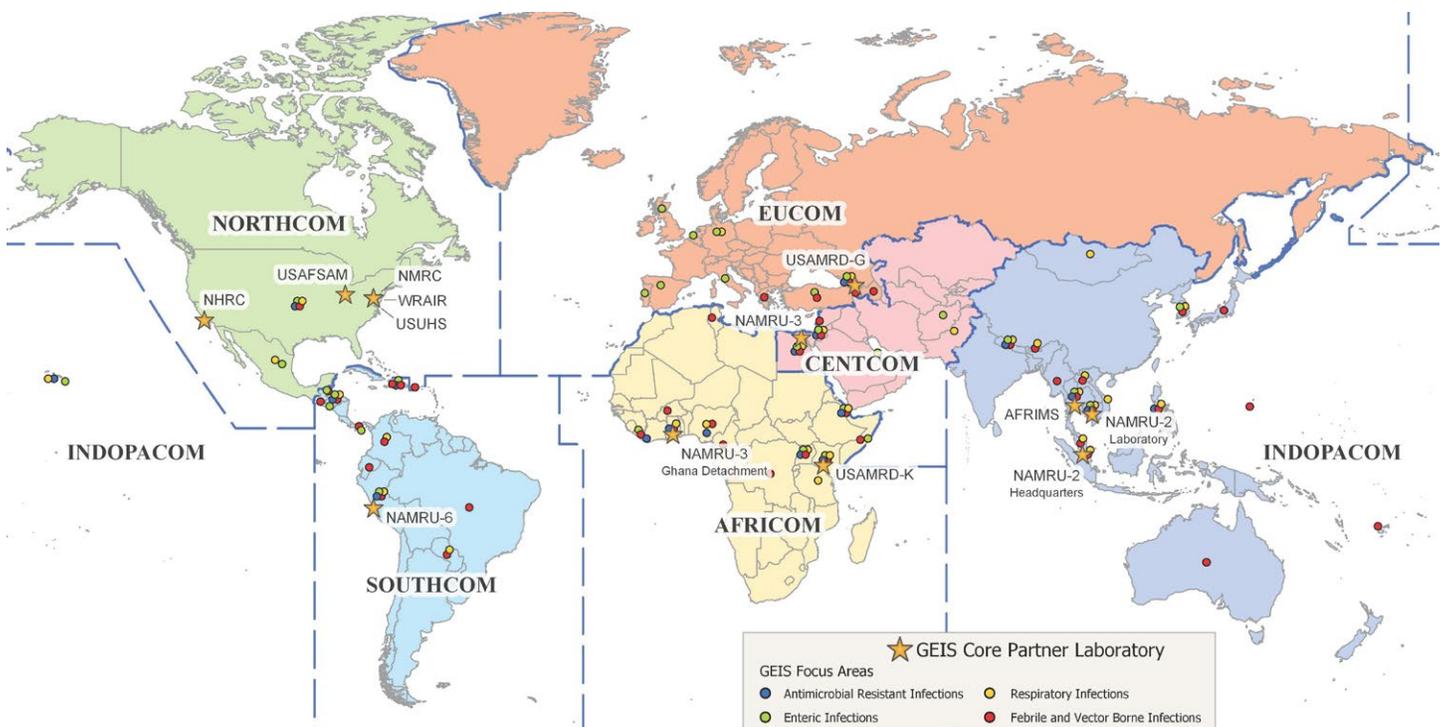
The GEIS section oversees and manages a globally integrated infectious disease surveillance portfolio that operates through a strategically positioned global network of U.S. Army, Navy, and Air Force laboratory partners to provide early, accurate detection of emerging infections to inform FHP decision making and enhance national and global health security. Providing timely communication about operational public health threats is critical to enabling Geographic Combatant Command FHP decision making and mission success. As such, GEIS coordinates directly with the GCC surgeons to capture their infectious disease and theater campaign priorities and uses these priorities to fund the laboratory network's surveillance efforts in four primary areas of focus: antimicrobial resistant infections, enteric infections, febrile and vector-borne infections, and respiratory infections.

In 2018, GEIS provided \$59 million in funding to 27 DoD laboratories and USG agencies to conduct infectious disease surveillance to inform FHP. The service laboratories work with host nations and regional partners to conduct disease surveillance and outbreak response; this collaboration indirectly improves partner nation surveillance and outbreak response capabilities, thereby supporting efforts toward global health security.

Over the course of the past year, GEIS responded to a request from the GCC Surgeons to coordinate infectious disease surveillance activities across multiple DoD and USG agencies in their AOR. The goal of this initiative is to establish a globally integrated infectious disease surveillance enterprise that supports GCC FHP decision making, security cooperation, and operations planning. In order to meet this goal, GEIS funded the Center for Global Health Engagement

to develop a regionally focused infectious disease surveillance coordination report for each GCC AOR by holding regional meetings with each GCC and integrating the DoD and other agencies to form the USG infectious disease surveillance enterprise. Outcomes of each meeting included a summary of GCC priority countries by region, infectious disease threats to FHP by region, and the identification of surveillance gaps. These outcomes ultimately informed the solicitation, submission, and selection of projects for GEIS funding in FY19 and will continue to drive GEIS funding in future years.

GEIS continued to implement and refine the Data-to-Decision initiative it launched in late 2017. The goal of this initiative is to provide timely, actionable information from GEIS-funded projects to the GCCs to inform FHP decision making. Over the course of 2018, GEIS



laboratory partners provided surveillance findings to the GEIS Program Office on a monthly basis, and GEIS subsequently provided reports summarizing the findings and their potential FHP implications to the GCCs. Through this initiative, GEIS also responded to requests from the GCCs for infectious disease surveillance data to inform FHP decision making during specific missions, such as troop deployment to the Southwest border region in late 2018 and into early 2019. The Data-to-Decision initiative will continue into its second full year of implementation in 2019. GEIS is working to improve the collection and analysis of standardized, structured data to enhance information gathering.

In 2017, GEIS established the Next-Generation Sequencing and Bioinformatics Consortium in order to develop a capability for the DoD that uses data from NGS and BI to inform FHP decision making. The Consortium brought DoD partners together to share information on NGS/BI implementation, capabilities, and standard operating procedures to achieve a harmonized approach to sequencing and BI within the network. In 2018, the Consortium completed

the Pathogen Discovery Pilot Project to evaluate the ability of DoD laboratories to identify and characterize unknown pathogens and to guide coordinated training efforts. The project was led by three core CONUS sequencing laboratories (WRAIR, NMRC, USAMRIID), with 12 OCONUS and CONUS participating laboratories. A blinded panel of spiked samples, containing human pathogens and negative controls, was constructed to simulate samples that would come from clinical cases and be sent to participating laboratories for testing. Participating laboratories were evaluated on their ability to use NGS to identify and characterize pathogens in the blinded panel. In return, they were provided feedback and detailed recommendations for improving wet lab and BI techniques in their laboratories. Based on the gaps identified with this exercise, the core sequencing laboratories developed a series of NGS and BI training modules and initiated coordinated training activities at strategic sequencing locations. These efforts will lead to confidence in high-quality sequence data to inform FHP decision making and improve diagnostic and vaccine development.

ANTIMICROBIAL RESISTANCE (AMR)

FOCUS: AMR surveillance projects primarily target the identification of multidrug-resistant organisms (MDRO) in populations of interest around the world. The AMR portfolio includes projects that monitor the following six bacterial pathogens: *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* which are also known as ESKAPE; and observes healthcare-associated infections (HAIs), wound infections, drug-resistant STIs, and emerging resistance patterns in nearly 20 countries. Data provide actionable information to enhance knowledge of resistance patterns among circulating pathogens, inform effective treatment options for Service members in deployed locations, and directly support the DoD Combating Antibiotic-Resistant Bacteria National Action Plan.

WHAT'S NEW IN FY18: The AMR Focus Area supported 21 competed projects and 10 work plan projects at 12 DoD partner laboratories, totaling approximately \$10 million. The AMR portfolio expanded to include prospective surveillance efforts



Site visit in Uganda – MAJ Ashbaugh with GEIS laboratory partners

for HAIs and/or STIs in Nepal, Ghana, Djibouti, and the Dominican Republic while continuing surveillance with partner nations Cambodia, Egypt, Honduras, Jordan, Kenya, Peru, the Philippines, Republic of Georgia, Thailand, and Uganda. The AMR portfolio continued to support enhanced surveillance of wound infections associated with blast injuries and added surveillance of AMR patterns in *Mycoplasma genitalium*.

WHERE WE'RE GOING: The AMR Focus Area will work to improve coordination and development of standard operating procedures for OCONUS laboratories submitting isolates to the Multidrug-Resistant Organism Repository and Surveillance Network (MRSN) and the DoD Gonococcal Repository & Reference Laboratory. This goal will be met by de-conflicting NGS technologies, optimizing whole genome sequencing and BI capabilities, implementing quality assurance/quality control and proficiency testing, and improving communication within the surveillance network. Additionally, the AMR Focus Area will work across the laboratory network to harmonize collection and testing of AMR isolates from HAIs and wound infections and further explore the use of geospatial visualization tools to identify endemic threats and “hot spots” for emerging resistance.

DOD SERVICE LABORATORIES AND OTHER ORGANIZATIONS SUPPORTED IN FY18: AFRIMS, NAMRU-2, NAMRU-3, NAMRU-6, NMCPHC-EDC, NMRC, OTSG-PVC, Tripler Army Medical Center (TAMC), USAMRD-G, USAMRD-K, USU, and WRAIR

FY18 ACCOMPLISHMENTS:

▶ AFRIMS identified the first dual mobilized colistin resistance (MCR) genes in a human clinical isolate. Further characterization of MDRO isolates collected from hospital patients resulted in the identification of two *E. coli* isolates, each positive for

both MCR-1 and MCR-3 genes, which is unusual because bacteria with this dual MCR genotype has previously been confirmed only in agricultural samples. There are multiple indicators that growing resistance to many antibiotics — including colistin, which is widely used in human and veterinary medicine— is more prevalent in countries in the U.S. Indo-Pacific Command (USINDOPACOM) area of responsibility. Monitoring of MCR determinants in colistin-resistant gram-negative bacteria is needed to ensure optimal treatment efficacy for military members and civilians deployed to an endemic area who may become injured and require treatment for bacterial infection.

- ▶ The MRSN detected the introduction of pan-drug-resistant (PDR) organisms into the MHS from a deployed tertiary care facility. Over 75% of these isolates were carbapenemase-producers and were resistant to every antibiotic that MRSN tested. PDR and carbapenemase-producing bacteria are extremely rare (<0.01%) in CONUS and OCONUS medical MTFs. It is imperative to inform MHS stakeholders of such organisms to ensure stringent infection control measures are utilized to prevent their proliferation.
- ▶ NAMRU-6 identified the first healthcare-associated infections *K. pneumoniae* Carbapenemase (KPC) that produces *P. aeruginosa* as a part of the GEIS AMR surveillance program of HAI multidrug resistant (MDR) ESKAPE pathogens. NAMRU-6 confirmed three *P. aeruginosa* isolates as extensively drug-resistant. Continuing surveillance for MDR pathogens worldwide is critical to determining the risk to DoD personnel in acquiring MDR pathogens and guiding treatment options.



CAPT Franca Jones (left) and LTC Michael Boivin (right) conduct a site visit at Joint Task Force-Bravo, Honduras. Courtesy: AFHSB

ENTERIC INFECTIONS (EI)

FOCUS: EI surveillance projects address militarily relevant enteric pathogens that degrade readiness through 1) surveillance for acute gastroenteritis (AGE) in the U.S. military (including recruit, shipboard, and forward-deployed populations) and in foreign military and civilian populations; 2) characterization of travelers’ diarrhea in immune-naïve travelers; 3) advanced characterization and antimicrobial susceptibility testing of enteric pathogens; and 4) detecting emerging pathogens in previously tested “pathogen negative” stool samples.

WHAT’S NEW IN FY18: The EI Focus Area supported 9 competed projects and 13 work plan projects at 11 DoD partner laboratories totaling approximately \$5.5 million. The multisite Global Travelers’ Diarrhea (GTD) study continued prospective surveillance efforts in Cambodia, Djibouti, Honduras, Kenya, Nepal, Peru, the Republic of Georgia, and Thailand. EI surveillance expanded to two MTFs, TAMC and Brian Allgood Army Community Hospital (South Korea). GEIS supported NAMRU-6’s expansion of enteric surveillance activities during

military exercises in the SOUTHCOM AOR and USAMRD-K's initiation of AGE surveillance in Somalia. Additionally, advanced characterization of enteric pathogens was expanded and will enhance the understanding of resistance genes, virulence factors, and dispersion of enteric pathogens geographically.

WHERE WE'RE GOING: The EI Focus Area will continue to expand AMR testing of enteric pathogens to better understand resistance trends and support treatment recommendations. Furthermore, standardization of the GTD study and optimization of its protocol will continue to be addressed to increase data utility as infection rates, case severity, and treatment associations are examined in a harmonized way across sites in five continents. The EI Focus Area will also incorporate the idea that the health of people is connected to the health of animals and the environment through its One Health approach. This will produce more funded projects, with five competed projects for FY19 that include surveillance of animal or environmental food-borne pathogens. Finally, the EI Focus Area will seek to expand utilization of the TaqMan® array platform across multiple sites to improve standardization of diagnostic results and allow rapid testing of AMR bacteria. These efforts will lead to improved actionable information for FHP in the most cost-effective manner across militarily relevant geographic locations within each GCC.

DOD SERVICE LABORATORIES AND OTHER ORGANIZATIONS SUPPORTED IN FY18: 65TH MED BDE/BAACH, AFRIMS, LRMC, NAMRU-2, NAMRU-3, NAMRU-6, NEPMU-5, NHRC, USAMRD-G, USAMRD-K, USU

FY18 ACCOMPLISHMENTS:

▶ USAMRD-K detected extended-spectrum beta-lactamase targets in 52% of *Shigella* spp. (TEM and OXA-1) and 57% of *Salmonella* spp. (TEM, OXA 1, and CTX group 1).

This analysis is unique, particularly since there are no data on MDR determinants from *Shigella* isolates from fecal specimens of patients hospitalized in Kenya. This work can inform FHP antibiotic policies and empirical treatment of bacterial diarrhea.

- ▶ FilmArray-based surveillance among U.S. Service members deployed to Beyond the Horizon 18 - El Salvador revealed that a majority of pathogens tested positive for multiple types of pathogenic *E. coli* as well as *Salmonella* and *Campylobacter*. These findings informed GCC medical planners' logistic and treatment decisions, enhancing FHP. NHRC provided laboratory support to a large outbreak at the Marine Recruit Training Depot, San Diego. NHRC's work helped direct preventive medicine efforts to remediate the outbreak. NHRC also supported AGE surveillance among recruits and trainees, collecting and testing 185 specimens over the course of the year. Routine surveillance characterizes the epidemiology of AGE in U.S. military recruits and trainees, and these data can be used to inform preventive measures, update prophylaxis or empiric treatment regimens, and guide future vaccine research.
- ▶ LRMC collected and tested 865 samples from 15 clinics in the EU-COM AOR, with enteropathogenic *E. coli* and *Campylobacter* spp. being the most commonly identified. These data have assisted GCC and public health officials by providing knowledge of pathogens most commonly detected at operationally important sites in the EUCOM AOR.
- ▶ The 65th MED BDE collected stool samples from patients with diarrhea and/or gastrointestinal symptoms, providing the first data on circulating enteric pathogens for U.S. military and dependents in the op-

erationally important Republic of Korea. Pathogenic *E. coli* was isolated most frequently, and this baseline of data can aid in monitoring trends of important enteric pathogens, including potential spikes in pathogen circulation that warrant additional preventive or response measures.

FEBRILE AND VECTOR-BORNE INFECTIONS (FVBIs)

FOCUS: FVBI surveillance projects address vector-borne and zoonotic pathogens that threaten the health of U.S. Service members, with the goal of better characterizing risk to U.S. personnel, guiding FHP decision making, and informing countermeasure development. To accomplish these objectives, FVBI surveillance projects fall into three general areas: identifying causes of acute febrile illness, including drug-resistant malaria; documenting the presence of vectors, reservoirs, and associated pathogens; and understanding environmental drivers of exposure and infection.

WHAT'S NEW IN FY18: The FVBI Focus Area supported 24 competed projects and 38 work plan projects at 18 DoD partner laboratories, totaling approximately \$20.8 million. FY18 efforts enhanced the GEIS network's surveillance capabilities for vector-borne and zoonotic pathogens, including increased vector surveillance activities on and around Soto Cano Air Base, Honduras, through a partnership with NAMRU-6; establishment of the framework for a malaria parasite repository at WRAIR; focused insecticide resistance testing in Southeast Asia; and increased utilization of NGS to examine dengue viruses in U.S. Africa Command (AFRICOM). The GEIS network began projects that extended FVBI surveillance activities into Azerbaijan, Cameroon, and Somalia.

WHERE WE'RE GOING: The FVBI Focus Area will continue to increase coordination and collaboration on vector-borne diseases across the GEIS network,



CAPT Franca Jones (3rd from the right) and LTC Michael Boivin (far right) meet with NAMRU-6 scientists during a site visit to Honduras. Courtesy: AFHSB

particularly as related to improving acute febrile illness surveillance, coordinating antimalarial drug resistance testing, and detecting malaria rapid test failure. FVBI activities will capitalize on the NGS/BI Consortium for validating pathogen detection, identification, and characterization activities. These activities will enhance the capability to identify known and/or emerging FVBI vectors and pathogens for expanded FHP decision-making capabilities globally.

DOD SERVICE LABORATORIES AND OTHER ORGANIZATIONS SUPPORTED IN FY18: 18 AMDS, 65th MED BDE, AFRIMS, NAMRU-2, NAMRU-3, NAMRU-6, NASA, NECE, NEPMU-2, NHRC, NMRC, USACE, USAMRD-G, USAMRD-K, USAMRIID, USMA, USU, and WRAIR

FY18 ACCOMPLISHMENTS:

- ▶ AFRIMS and NAMRU-6 expanded understanding of Zika virus (ZIKV)

geographic distribution and documented its ongoing circulation in Thailand, Bolivia, and northeastern Peru. Even though circulation (and media attention) have decreased, Zika Virus (ZIKV) still presents a threat to U.S. Forces and other DoD beneficiaries.

- ▶ Partners at the Australian Defense Forces documented *Plasmodium falciparum* strains associated with malaria rapid diagnostic test failure (*pfhrp2*- and *pfhrp3*-deletion mutants) in countries in AFRICOM, INDOPACOM, and SOUTHCOM. The malaria RDT approved for use in the U.S. military relies on the detection of the *pfhrp2* gene product for diagnosis of malaria caused by *P. falciparum*. Continued surveillance for the prevalence of these mutants is important to determine the future sensitivity of RDTs

and treatment options for malaria among U.S. Service members.

- ▶ AFRIMS detected *Leptospira* in water, rodent, and domestic animal samples and also documented the active circulation of rickettsial pathogens in vectors and rodent hosts at Cobra Gold training sites. Findings alerted Commanders to the risk of these endemic pathogens and supported exercise planning and implementation of FHP measures.
- ▶ AFRIMS also documented novel viruses and bacteria that expanded the geographic range of known pathogens. Examples include Spondweni virus in Haiti, the first identification of this flavivirus in the Western Hemisphere (NEPMU-2); expanded range of West Nile virus in northeastern Turkey (WRAIR); outbreaks of chikungunya and dengue viruses in Kenya (USAMRD-K);



Site visit to Uganda – LTC Boivin, MAJ Ashbaugh, and LeeAnne Lynch at the Zika Forest. Courtesy: AFHSB

characterization of Lassa virus in Liberia (NAMRU-3); and evidence for endemic Japanese encephalitis virus circulation in Guam (18 AMDS). This up-to-date information is critical to examining the risks to U.S. Service members deployed to outbreak regions and can guide investments into medical countermeasures.

RESPIRATORY INFECTIONS (RI)

FOCUS: RI surveillance projects address rapid pathogen detection and response, especially for those respiratory infections with pandemic potential, through surveillance of U.S. military members (including recruit, shipboard, and deployed populations), other MHS beneficiaries, and foreign military and civilian populations as well as at the human–animal interface. Advanced characterization is also conducted to monitor concerns such as influenza antigenic drift and shift and to evaluate VE and response.

WHAT'S NEW IN FY18: The RI Focus Area supported 10 competed and 18 work plan projects at 14 DoD partner laboratories, totaling approximately \$18.4 million. Because of the potential for a spill-over event to initiate the next pandemic,

the RI Focus Area increased surveillance at the human–animal interface with the start of RI surveillance among swine in Peru and expansion among poultry in Southeast Asia. The first shipboard FilmArray® polymerase chain reaction system for respiratory and gastrointestinal disease detection was deployed, enabling faster response to disease clusters. Partners in the Republic of Korea (ROK) initiated a comparison of the burden of RIs between U.S. and ROK Forces. A comparison of VE between the three influenza vaccine production technologies also commenced.

WHERE WE'RE GOING: The RI Focus Area will support the DoD Global Respiratory Pathogen Surveillance Program (DoDGRS) to provide broad surveillance of RIs; a sentinel site evaluation will optimize surveillance across the MHS. Surveillance at the human–animal interface will continue, especially where spill-over is possible. The Focus Area aims to standardize laboratory workflows across the network while better characterizing samples and reducing the number of samples that fail to detect a pathogen. Another area of emphasis will include improving awareness of partner findings

and resources to enhance network collaboration.

DOD SERVICE LABORATORIES AND OTHER ORGANIZATIONS SUPPORTED IN FY18:

65th MED BDE/BAACH, AFRIMS, LRMC/PHC-E, NAMRU-2, NAMRU-3, NAMRU-6, NEPMU-5, NHRC, NMRC, USAFSAM, USAMRD-G, USAMRD-K, USU, and WRAIR

FY18 ACCOMPLISHMENTS:

- ▶ NHRC and FDA analysis of data from an influenza A (H3N2) outbreak at Marine Corps Recruit Depot – Parris Island showed that unvaccinated recruits with preexisting antibodies had lower odds of having an infection, which could improve future risk assessments and outbreak response. A pseudovirus neutralization assay was found to be a better marker of influenza immunity than classical hemagglutination inhibition assays, which could lead to a more accurate method for evaluating vaccination response.
- ▶ NMRC found nine cases of previously unidentified Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection, suggesting a potential false negative rate of 17% (9/52) for the assay in use by the Kingdom of Saudi Arabia. Therefore, MERS-CoV risk predictions for U.S. Forces in Saudi Arabia and the region are likely underestimates.
- ▶ WRAIR found that overall adenovirus serotype distribution in the MHS was similar to the U.S. general population and was caused primarily by serotypes not covered by the vaccine. However, in persons 16–25 years old, serotypes covered by the vaccine were most common, indicating a benefit of vaccination in this age range. Statistically significant differences in age and associated serotype could offer insight into

duration and cross-protection of adenovirus immunity.

- ▶ NHRC serotyped samples from an adenovirus outbreak in U.S. personnel in the ROK and found 47% (31/66) were typed as human adenovirus type 55 (HAdV-B55) and human adenovirus 11a (HAdV-11a) — the first detection of this serotype in

the MHS. HAdV B55 is an emerging pathogen in the region and is not covered by the vaccine. Detection is not surprising, but further surveillance is needed to describe HAdV B55 epidemiology and effective preventive measures.

- ▶ USAFSAM continued to manage the DoDGRS in FY18, finalizing

results on 11,977 specimens from 98 locations and conducting phylogenetic analysis on a portion of influenza samples to determine geographic distribution and predominance of clades. Data were provided to CDC and FDA to inform selection of the seasonal influenza vaccine strains. ■



LTC Michael Boivin (5th from the right), MAJ Hayley Ashbaugh (6th from the right) and LeeAnne Lynch (3rd from the right) meet with local scientists during a site visit to Tanzania. Courtesy: AFHSB

BIOSURVEILLANCE IN THE DoD



INTEGRATED BIOSURVEILLANCE (IB)

The National Strategy for Biosurveillance offers a complex definition for biosurveillance. It is defined as “the process of gathering, integrating, interpreting, and communicating essential information related to all-hazards threats or disease activity affecting human, animal, or plant health to achieve early detection and warning, contribute to overall situational awareness of the health aspects of an incident, and to enable better decisionmaking at all levels.” The DoD uses global biosurveillance networks to identify and track these public health threats to national security that are unbounded by state, regional, and international borders. DoD partners are from multidisciplinary agencies, including the Office of the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, DHA, and military service research agencies.

The DoD's biosurveillance enterprise has two primary strategic goals:

- ▶ **SITUATIONAL AWARENESS** of biological warfare programs, threat agents and technologies, and intent and use.
- ▶ **ENHANCED DoD PUBLIC HEALTH** by providing situational awareness of naturally occurring microbial pathogens and infectious disease incidence, prevalence, and emerging countermeasures.

Effective biosurveillance requires an interdisciplinary and integrated approach that coordinates efforts across federal and non-federal agencies. Accurate capture of threat information, thorough risk assessment, and rapid risk communication are critical for countermeasure development and other planning and response activities.

With the recent designation as a CSA, the DHA must design and deliver solutions

to CCMDs that meet the demands of the 21st century battlespace. This battlespace will feature a Joint Force aligned to execute globally integrated operations characterized by global agility, flexibility, and small, low-signature capabilities, increased partnership, and cross-domain synergy to maintain the initiative in every domain. This creates a challenge for the MHS in providing comprehensive health surveillance to deployed forces in a highly distributed operating environment and minimal, if any, pre-established health service infrastructure to detect, respond to, and/or prevent disease threats from reducing health security and threatening the health of the force.

The AFHSB established the IB section to execute global horizon scanning of public health threats to forces operating in all six GCCs. The vision of IB is to provide enhanced FHP and national security through comprehensive public health surveillance support to the GCCs and military services. To achieve this vision, IB's mission is to inform FHP decision making and enhance global health security by detecting and rapidly communicating public health threats in support of GCCs and USG national security priorities.

IB staff members have a wide variety of skills and experiences in the fields of infectious disease epidemiology, preventive medicine, family medicine, veterinary epidemiology, statistical analysis, and occupational and environmental health. The staff lends its expertise by collaborating with other offices in the Defense Department as well as external USG agencies. Those agencies include the National Security Council and Office of Science and Technology Policy, the U.S. Department of Homeland Security's Science and Technology Directorate and DHA's Office of Health Affairs, along with DoD's Office of Undersecretary of

Defense for Policy and the Office of the Joint Staff.

IB continues to engage with its DoD and interagency partners to be the focal point for biosurveillance information. This comprehensive health surveillance strategy will:

- ▶ Scan the horizon for global event-based, open-source raw or aggregated data to gather, analyze, and rapidly disseminate information on current and emerging health events of military interest
- ▶ Provide indicator-based surveillance and analysis of raw unstructured data and relevant information technology platforms to identify potential healthcare and non-healthcare information that can provide early detection of disease outbreaks
- ▶ Synchronize biosurveillance efforts across the DoD programs
- ▶ Provide near real-time surveillance, DoD public health threat assessment, and situational awareness for its customers

IB is primarily organized into two offices: the Office of Alert and Response Operations (ARO) and the Office of Innovation and Evaluation (IE).

ARO monitors biosurveillance data sources and communicates routinely with the DoD as well as USG interagency, non-USG, and international partners to detect and report all-hazard events (e.g., emerging and re-emerging infectious diseases and environmental incidents) relevant to the health of all military personnel, including beneficiaries and veterans. ARO develops timely and relevant products based on these data and information, provides expertise on issues relevant to the health of DoD populations, and coordinates information

gathering and resource leveraging, as available. ARO also disseminates information through various communication channels depending on the level of urgency.

ARO FY18 ACCOMPLISHMENTS INCLUDE:

- ▶ Creating and releasing the HSE capability as a Geographic Information Systems (GIS) map interface providing CCMD and Military Service decision makers timely, actionable, and integrated biosurveillance alert and response capabilities in a DoD Common Access Card (CAC) enabled platform. The HSE is designed to be the central “one-stop shop” for DoD health surveillance responsive to CCMD needs by providing 1) timely, relevant, FHP threat-prioritized, health surveillance events customized by CCMD needs; 2) easily accessed CCMD-specific FHP information; and 3) country-specific FHP-relevant information available at one site.
- ▶ Increasing customer interest in ARO products by increasing the number of individuals receiving our products by 24% during FY18. Reached over 960 visits to the HSE in FY18 during the first three months of its existence.
- ▶ Integrating surveillance across domains by adding the capability to monitor classified networks to improve comprehensive health surveillance and allow GCC desk officers within the section to better communicate with the global CCMDs.
- ▶ Producing and distributing 50 AFHSB Health Surveillance Updates (AHSU) reporting on more than 125 public health events of interest to the Global CCMDs.
- ▶ Producing and distributing 11 disease-specific surveillance summaries on topics including MERS-CoV and the Ebola outbreaks in the northeastern and northwestern Democratic Republic of the Congo.
- ▶ Developing fully unclassified 508-compliant versions of surveillance summaries on the AFHSB website and sharing with non-governmental organizations and foreign nations.
- ▶ Producing and distributing six executive summaries and four spot reports for relaying quick information on topics, including norovirus in U.S. troops in Kuwait, WHO Emergency Committee meetings, novel and variant influenza viruses, Ebola outbreaks in northeastern and northwestern Democratic Republic of Congo, and other events.
- ▶ Writing and presenting weekly reports on current health events being tracked, RMEs, and global health items of interest.
- ▶ Improving DoD comprehensive health surveillance information products to focus closely on events currently or potentially affecting FHP by better integrating DoD reportable medical event reporting, laboratory and medical encounter data, and syndromic surveillance monitoring.
- ▶ Participating in the steering committee of the Biosurveillance Indications and Warnings Analytic Community (BIWAC) with interagency partners. BIWAC manages the Wildfire web-based discussion portal for relaying and requesting information from USG sources.
- ▶ Maintaining up-to-date guidance for detecting and reporting MERS-CoV and Influenza A (H7N9) and distributing this guidance to our partners.
- ▶ Continuing to serve as the gold standard for tracking and recording ZIKV cases in the MHS beneficiary population, coordinating data flow from each of the services and collating all data, including laboratory and RME data and ad hoc reporting.
- ▶ Answering numerous requests for information on specific diseases as well as laboratory testing information and biosurveillance in the Defense Department processes for detecting and reporting specific diseases.
- ▶ Participating in EUCOM's Pandemic Influenza and Infectious Disease exercise to enhance regional and global health surveillance through multilateral military participation in the event of a biological event within the AOR.
- ▶ Developing health scenarios for the Office of the Secretary of Defense (Policy) Insidious Outbreak Table Top Exercises, which assessed DoD policies, authorities, and governance framework that could facilitate a unified, effective national response to an overseas and CONUS infectious disease outbreak.
- ▶ Participating in interagency policy committees, including the Biosurveillance Sub-Interagency Policy Committee, the Biological Defense Research and Development Subcommittee, and the Foreign Animal Disease Threats Working Group.
- ▶ Collaborating daily with the Department of Homeland Security's National Biosurveillance Integration Center on health events. Those interactions included participating in their daily and weekly working calls and quarterly meetings.
- ▶ Presenting on ARO activities, including “The Avian Influenza Epidemic,” which was a featured presentation at the 2018 Esri Federal GIS Conference, and the HSE, which was showcased to the White House Medical Unit Staff, all CCMD Surgeon Sections, various DoD public health students through courses, and multiple senior leaders across the DoD. The

HSE featured on the National Geospatial Agency portal as an innovative use of GIS for health surveillance.

The Office of IE assesses biosurveillance needs through evaluation and consultation on the use of existing and potential development of new biosurveillance systems, data, and data sources. Within IE, the Epidemiology Investigations team provides expertise of AFHSB's other divisions. The Epidemiology Investigations team also collaborates with interagency partners such as the CDC, WHO, U.S. Department of Homeland Security, U.S. Department of Agriculture, other DoD and non-government U.S. organizations.

IE'S FY18 ACCOMPLISHMENTS INCLUDE:

- ▶ Conducting an analysis of influenza laboratory data and their correlation with ILI medical encounter data for incorporation into a fused syndromic detector algorithm in Electronic Surveillance System for the Early Notification of Community-based

Epidemics (ESSENCE), presented at the International Society for Disease Surveillance Conference.

- ▶ Producing a weekly influenza map for the HSE, incorporating DMSS medical encounter, laboratory, vaccination, and civilian ILINet data to provide an interactive web-based map of the DoD influenza burden.
- ▶ Establishing predictive modeling knowledge and capacity through internal analysis of medical encounter data and external collaboration with leading forecasting modelers through participation in the Pandemic Prediction and Forecasting Science and Technology Working Group meetings, establishing data sharing agreements to develop operational influenza forecasts, and contributing to the "Wisdom of Crowds" forecast in CDC's influenza forecasting challenge.
- ▶ Providing end-user public health recommendations to the developers of the Biosurveillance Ecosystem

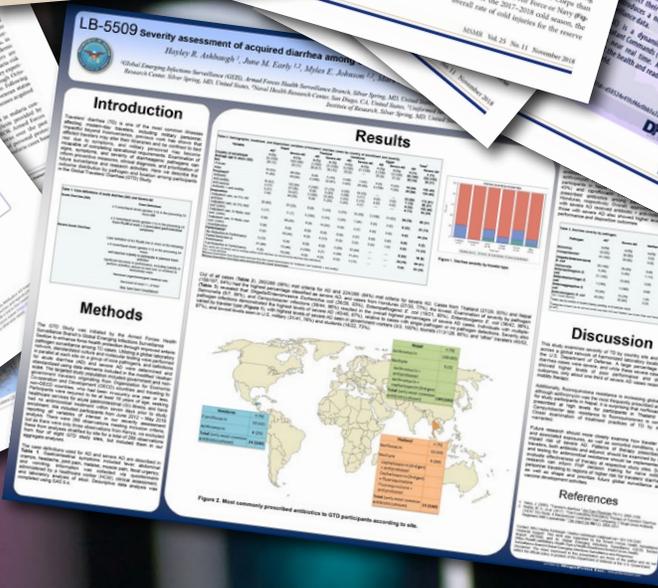
through monthly meetings and an evaluation report.

- ▶ Collaborating with the services to improve the functionality of ESSENCE, which brings advanced visualization capability on par with the civilian sector. Upgrading to same code as civilian ESSENCE provides an opportunity to share future system enhancements and allow for easier data sharing across agencies.
- ▶ Organizing the National Syndromic Surveillance Program data sharing pilot project between DoD, CDC, and Virginia Department of Health. This project piloted viewing DoD data from Virginia installations in the same syndromic surveillance system as civilian public health data from Virginia.
- ▶ Assisting in the development of new data streams allowing for laboratory results data to be visualized for inclusion as a new function of ESSENCE v5. ■



Dr. Duvel (Bill) Wright demonstrates the functions of the Health Surveillance Explorer tool. Courtesy: AFHSB

AFHSB PUBLICATIONS



AFHSB PUBLICATIONS

Publications and presentations are used to communicate important findings and occurrences to peers and policymakers, to archive data and information for future reference, and to teach resident physicians and developing scientists. AFHSB staff and partners are strongly encouraged to submit the results of their work to professional meetings and journals, particularly those that are peer reviewed, and to use the development of abstracts, oral presentations, posters, and manuscripts as teaching vehicles. Each year, AFHSB partners submit proposals

for collaboration and these usually provide the background and the basis for the development of internal reports, abstracts, and manuscripts.

In 2018, AFHSB staff and GEIS partners prepared and published manuscripts in peer-reviewed journals and posters for international and national conferences. These papers and presentations helped further our understanding of disease transmission, severity, prevention. AFHSB reports and publications are located on its website. A large number of AFHSB projects and protocol studies are

initiated in response to specific questions or needs for data. Many of these projects are done by junior staff members with supervision by senior managers.

Because some of the work done by the AFHSB staff is of great interest to the DoD and other government agencies, AFHSB staff is encouraged to consider submission of selected reports to the Defense Technical Information Center, which serves the DoD community as a central resource for scientific and technical information. ■



2018 PARTNER PUBLICATIONS

1. Anderson KB, Simasathien S, Watanaveeradej V, et al. Clinical and laboratory predictors of influenza infection among individuals with influenza-like illness presenting to an urban Thai hospital over a five-year period. *PLoS One*. 2018;13(3):e0193050.
2. AFHSB. Absolute and relative morbidity burdens attributable to various illnesses and injuries, active component, U.S. Armed Forces, 2017. *MSMR*. 2018;May;25(5):2–9.
3. AFHSB. Absolute and relative morbidity burdens attributable to various illnesses and injuries, non-service member beneficiaries of the Military Health System, 2017. *MSMR*. 2018;May;25(5):32–41.
4. AFHSB. Ambulatory visits, active component, U.S. Armed Forces, 2017. *MSMR*. 2018;May;25(5):17–23.
5. AFHSB. Hospitalizations, active component, U.S. Armed Forces, 2017. *MSMR*. 2018;May;25(5):10–16.
6. AFHSB. Morbidity burdens attributable to various illnesses and injuries, deployed active and reserve component service members, U.S. Armed Forces, 2017. *MSMR*. 2018;May;25(5):26–31.
7. AFHSB. Surveillance Snapshot: Illness and injury burdens, recruit trainees, active component, U.S. Armed Forces, 2017. *MSMR*. 2018;May;25(5):25.
8. AFHSB. Surveillance snapshot: Illness and injury burdens, reserve component, U.S. Armed Forces, 2017. *MSMR*. 2018;May;25(5):24.
9. AFHSB. Surveillance snapshot: Influenza immunization among U.S. Armed Forces healthcare workers, August 2013–April 2018. *MSMR*. 2018;Oct;25(10):21.
10. AFHSB. Update: Cold weather injuries, active and reserve components, U.S. Armed Forces, July 2013–June 2018. *MSMR*. 2018;Nov;25(11):10–17.
11. AFHSB. Update: Heat illness, active component, U.S. Armed Forces, 2017. *MSMR*. 2018;Apr;25(4):6–12.
12. AFHSB. Update: Malaria, U.S. Armed Forces, 2017. *MSMR*. 2018;Feb;25(2):2–7.
13. AFHSB. Update: Medical evacuations, active and reserve components, U.S. Armed Forces, 2017. *MSMR*. 2018;Jul;25(7):17–22.
14. AFHSB. Update: Routine screening for antibodies to human immunodeficiency virus, civilian applicants for U.S. military service and U.S. Armed Forces, active and reserve components, January 2013–June 2018. *MSMR*. 2018;Sep;25(9):2–8.
15. Bautista CT, Hollingsworth BP, Sanchez JL. Repeat chlamydia diagnoses increase the hazard of pelvic inflammatory disease among US Army women: a retrospective cohort analysis. *Sex Transm Dis*. 2018;45(11):770–773;doi: 10.1097/OLQ.0000000000000878.
16. Bautista CT, Wurapa EK, Sateren WB, Hollingsworth BP, Sanchez JL. Longitudinal association of gonorrhea and bacterial vaginosis with repeat chlamydia diagnoses among U.S. Army women: a retrospective cohort analysis. *Mil Med Res*. 2018;5(1):37;doi: 10.1186/s40779-018-0184-3.
17. Brooks KM, Zeighami R, Hansen CJ, McCaffrey RL, Graf PCF, Myers CA. Surveillance for norovirus and enteric bacterial pathogens as etiologies of acute gastroenteritis at U.S. military recruit training centers, 2011–2016. *MSMR*. 2018;Aug;25(8):8–12.
18. Brooks RD, Grier T, Dada EO, Jones BH. The combined effect of cigarette smoking and fitness on injury risk in men and women. *Nicotine Tob Res*. 2018 Jul 24;doi: 10.1093/ntr/nty155.
19. Castillo Ore RM, Caceda RE, Huaman AA, et al. Molecular and antigenic characterization of group C orthobunyaviruses isolated in Peru. *PLoS One*. 2018;13(7):e0200576.
20. Chakhunashvili G, Wagner AL, Power LE, et al. Severe acute respiratory infection (SARI) sentinel surveillance in the country of Georgia, 2015–2017. *PLoS One*. 2018;13(7):e0201497.
21. Chang KS, Kim GH, Ha YR, et al. Monitoring and control of *Aedes albopictus*, a vector of Zika virus, near residences of imported Zika virus patients during 2016 in South Korea. *Am J Trop Med Hyg*. 2018;98(1):166–172.
22. Chen HW, Lukas H, Becker K, et al. An improved enzyme-linked immunoassay for the detection of *Leptospira*-specific antibodies. *Am J Trop Med Hyg*. 2018;99(2):266–274.
23. Chen HW, Zhang Z, Belinskaya T, Ching WM. Brief report: Leptospirosis seroconversion surveillance among U.S. Army infantry forces assigned to South Korea, 2011–2014. *MSMR*. 2018;25(8):13–15.
24. Chen HW, Zhang Z, Belinskaya T, et al. The trend of prevalence for *Leptospira* specific antibodies among the acute febrile patients in Peru. *J Med Microbiol Diagn*. 2018;7(3):280.

25. Clark LL. Surveillance snapshot: Cardiovascular-related deaths during deployment, U.S. Armed Forces, October 2001–December 2012. *MSMR*. 2018;Jul;25(7):30.
26. Clark LL, Stahlman S, Taubman SB. Human papillomavirus vaccine initiation, coverage, and completion rates among U.S. active component service members, 2007–2017. *MSMR*. 2018;Sep;25(9):9–14.
27. Clausen SS, Stahlman SL. Food-allergy anaphylaxis and epinephrine autoinjector prescription fills, active component service members, U.S. Armed Forces, 2007–2016. *MSMR*. 2018;Jul;25(7):23–29.
28. Coleman R, Eick-Cost A, Hawksworth AW, et al. Department of Defense end-of-season influenza vaccine effectiveness estimates for the 2017–2018 season. *MSMR*. 2018;Oct;25(10):16–20.
29. Cowell AN, Valdivia HO, Bishop DK, Winzeler EA. Exploration of *Plasmodium vivax* transmission dynamics and recurrent infections in the Peruvian Amazon using whole genome sequencing. *Genome Med*. 2018;10(1):52.
30. de Laurent ZR, Chebon LJ, Ingasia LA, et al. Polymorphisms in the K13 gene in *Plasmodium falciparum* from different malaria transmission areas of Kenya. *Am J Trop Med Hyg*. 2018;98(5):1360–1366.
31. DeMarcus LS, Soderlund LV, Voss JD. Assessment of 12 influenza-like illness case definitions using Department of Defense Global, Laboratory-based Influenza Surveillance Program Data, 2011–2014. *MSMR*. 2018;25(1):10–15.
32. Eide RP 3rd, Stahlman S. Polypharmacy involving opioid, psychotropic, and central nervous system depressant medications, period prevalence and association with suicidal ideation, active component, U.S. Armed Forces, 2016. *MSMR*. 2018;Jun;25(6):2–9.
33. Ewers EC, Anisowicz SK, Ferguson TM, et al. Antibiotic resistance, molecular characterizations, and clinical manifestations of Campylobacteriosis at a military medical center in Hawaii from 2012–2016: a retrospective analysis. *Sci Rep*. 2018;8(1):11736.
34. Foley DH, Pecor DB. An Excel spreadsheet tool for exploring the seasonality of *Aedes* vector hazard for user-specified administrative regions of Brazil. *US Army Med Dep J*. 2018;Jan–Jun(1–18):22–28.
35. Fries AC, Gruner W, Hanson J. Sampling considerations for detecting genetic diversity of influenza viruses in the DoD Global Respiratory Pathogen Surveillance Program. *MSMR*. 2018;Aug;25(8):16–21.
36. Gathii K, Nyataya JN, Mutai BK, Awinda G, Waitumbi JN. Complete coding sequences of dengue virus type 2 strains from febrile patients seen in Malindi District Hospital, Kenya, during the 2017 dengue fever outbreak. *Genome Announc*. 2018;6(15):e00076-18.
37. GeurtsvanKessel CH, Islam Z, Islam MB, et al. Zika virus and Guillain-Barre syndrome in Bangladesh. *Ann Clin Transl Neurol*. 2018;5(5):606–615.
38. Hauschild VD, Lee T, Barnes S, Forrest L, Hauret K, Jones BH. The etiology of injuries in the US Army initial entry training. *US Army Med Dep J* 2018 Jul–Dec; (2-18):22–29.
39. Im JH, Huh K, Yoon CG, et al. Malaria control and chemoprophylaxis policy in the Republic of Korea Armed Forces for the previous 20 years (1997–2016). *Malar J*. 2018;17(1):295.
40. Jiang J, An H, Lee JS, et al. Molecular characterization of *Haemaphysalis longicornis*-borne rickettsiae, Republic of Korea and China. *Ticks Tick Borne Dis*. 2018;9(6):1606–1613.
41. Jiang J, Richards AL. Scrub typhus: no longer restricted to the tsutsugamushi triangle. *Trop Med Infect Dis*. 2018;3(1):11.
42. Juarez D, Guevara C, Wiley M, et al. Isolation of complete equine encephalitis virus genome from human swab specimen, Peru. *Emerg Infect Dis*. 2018;24(8):1578–1580.
43. Kim HC, Chong ST, Suh JH, et al. *Ixodes nipponensis* Kitaoka and Saito and *Amblyomma testudinarium* Koch (Acari: Ixodida: Ixodidae) collected from reptiles (lizards, skinks, and snakes) in the Republic of Korea, 2016. *Syst Appl Acarol*. 2018;23(4):757–767.
44. Kim HC, Kim WK, No JS, et al. Urban rodent surveillance, climatic association, and genomic characterization of Seoul virus collected at U.S. Army Garrison, Seoul, Republic of Korea, 2006–2010. *Am J Trop Med Hyg*. 2018;99(2):470–476.
45. Kim HC, Park JG, Kwon YS, et al. Ticks collected from soil/nest litter and live and dead nestlings of migratory seabirds during their breeding season at six uninhabited islands, Republic of Korea during 2009 and 2014–2017. *Syst Appl Acarol*. 2018;23(8):1519–1530.
46. Kim WK, No JS, Lee SH, et al. Multiplex PCR-based next-generation sequencing and global diversity of Seoul virus in humans and rats. *Emerg Infect Dis*. 2018;24(2):249–257.
47. Klein TA, Seyoum B, Forshey BM, et al. Cluster of vivax malaria in U.S. soldiers training near the demilitarized zone, Republic of Korea during 2015. *MSMR*. 2018;Nov;25(11):4–9.

48. Koka H, Sang R, Kutima HL, Musila L. *Coxiella burnetii* detected in tick samples from pastoral communities in Kenya. *BioMed Res Int*. 2018;2018:8158102.
49. Konongoi SL, Nyunja A, Ofula V, et al. Human and entomologic investigations of chikungunya outbreak in Mandera, Northeastern Kenya, 2016. *PLoS One*. 2018 Oct 11;13(10):e0205058.
50. Lertsethtakarn P, Silapong S, Sakpaisal P, et al. Travelers' diarrhea in Thailand: a quantitative analysis using TaqMan® array card. *Clin Infect Dis*. 2018;67(1):120–127.
51. Linsuwano P, Krairojananan P, Rodkvamtook W, Leepitakrat S, Davidson S, Wanja E. Surveillance for scrub typhus, rickettsial diseases, and leptospirosis in US and multinational military training exercise Cobra Gold sites in Thailand. *US Army Med Dep J*. 2018(1–18):29–39.
52. Loyola S, Flores-Mendoza C, Torre A, et al. *Rickettsia asembonensis* characterization by multilocus sequence typing of complete genes, Peru. *Emerg Infect Dis*. 2018;24(5):931–933.
53. Maina AN, Jiang J, Luce-Fedrow A, St John HK, Farris CM, Richards AL. Worldwide presence and features of flea-borne *Rickettsia asembonensis*. *Front Vet Sci*. 2018;5:334.
54. Margulieux KR, Srijan A, Ruekit S, et al. Extended-spectrum β -lactamase prevalence and virulence factor characterization of enterotoxigenic *Escherichia coli* responsible for acute diarrhea in Nepal from 2001 to 2016. *Antimicrob Resist Infect Control*. 2018;7:87.
55. Masakhwe C, Linsuwano P, Kimita G, et al. Identification and characterization of *Orientia chuto* in trombiculid chigger mites collected from wild rodents in Kenya. *J Clin Microbiol*. 2018;56(12).
56. McKee DL, Hu Z, Stahlman S. Incidence and sequelae of acute pelvic inflammatory disease among active component females, U.S. Armed Forces, 1996–2016. *MSMR*. 2018;Oct;25(10):2–8.
57. Millar EV, St. Clair KJ, Schlett CD, et al. Brief report: Pre- and post-deployment prevalence of *Staphylococcus aureus* colonization among U.S. Navy submariners. *MSMR*. 2018; Aug;25(8):2–7.
58. Mitgang EA, Hartley DM, Malchione MD, Koch M, Goodman JL. Review and mapping of carbapenem-resistant Enterobacteriaceae in Africa: using diverse data to inform surveillance gaps. *Int J Antimicrob Agents*. 2018;52(3):372–384.
59. Morrison BJ, Martin NJ, Rehman T, et al. Influence of sample collection tube method, anticoagulant-containing plasma versus serum, on influenza virus hemagglutination inhibition titer and microneutralization titer serological assays. *BMC Health Serv Res*. 2018;18(1):651.
60. Mullins KE, Maina AN, Krueger L, et al. Rickettsial infections among cats and cat fleas in Riverside County, California. *Am J Trop Med Hyg*. 2018;99(2):291–296.
61. Nelson K, Maina AN, Brisco A, et al. A 2015 outbreak of flea-borne rickettsiosis in San Gabriel Valley, Los Angeles County, California. *PLoS Negl Trop Dis*. 2018;12(4):e0006385.
62. O'Donnell FL, Stahlman S, Fan M. Surveillance for vector-borne diseases among active and reserve component service members, U.S. Armed Forces, 2010–2016. *MSMR*. 2018;Feb;25(2):8–15.
63. O'Donnell FL, Stahlman S, Oetting AA. Incidence rates of diagnoses of cardiovascular diseases and associated risk factors, active component, U.S. Armed Forces, 2007–2016. *MSMR*. 2018;Mar;25(3):12–18.
64. Pecor DB, Foley DH, Potter A. Mosquito surveillance conducted by US military personnel in the aftermath of the nuclear explosion at Nagasaki, Japan, 1945. *US Army Med Dep J*. 2018(1–18):8–13.
65. Phasomkusolsil S, Tawong J, Khaosanorh S, et al. Colonization and maintenance of *Anopheles belenrae* and *Anopheles pullus* from the Republic of Korea. *J Am Mosq Control Assoc*. 2018;34(4):260–264.
66. Plant EP, Eick-Cost AA, Ezzeldin H, Sanchez JL, Ye Z, Cooper MJ. The effects of birth year, age and sex on hemagglutination inhibition antibody responses to influenza vaccination. *Vaccines (Basel)*. 2018;6(3):pii: E39;doi: 10.3390/vaccines6030039.
67. Poland GA, Kennedy RB, Ovsyannikova IG, Palacios R, Ho PL, Kalil J. Development of vaccines against Zika virus. *Lancet Infect Dis*. 2018;18(7):e211–e219.
68. Pollett S, Melendrez MC, Maljkovic Berry I, et al. Understanding dengue virus evolution to support epidemic surveillance and counter-measure development. *Infect Genet Evol*. 2018;62:279–295.
69. Ponnusamy L, Willcox AC, Roe RM, et al. Bacterial microbiome of the chigger mite *Leptotrombidium imphalum* varies by life stage and infection with the scrub typhus pathogen *Orientia tsutsugamushi*. *PLoS One*. 2018;13(12):e0208327.
70. Rodkvamtook W, Kuttasingkee N, Linsuwano P, et al. Scrub typhus outbreak in Chonburi Province, Central Thailand, 2013. *Emerg Infect Dis*. 2018;24(2):361–365.

71. Ruksasiri S, Lurchachaiwong W, Wassanarungroj P, et al. Antimicrobial resistant *Helicobacter fennelliae* isolated from non-diarrheal child stool sample in Battambang, Cambodia. *Gut Pathog*. 2018;10:18.
72. Rupp BL, Ying S, Stahlman S. Psychiatric medical evacuations in individuals with diagnosed pre-deployment family problems, active component, U.S. Armed Forces, 2002–2014. *MSMR*. 2018;Oct;25(10):9–15.
73. Shoubaki L, Eick-Cost AA, Hawksworth A, Hu Z, Lynch L, Myers CA, Federinko S. Brief report: Department of Defense midseason vaccine effectiveness estimates for the 2017–2018 influenza season. *MSMR*. 2018;25(6):26–28.
74. Shoubaki LA. Brief report: Department of Defense Global, Laboratory-based Influenza Surveillance Program's influenza vaccine effectiveness estimates and surveillance trends for 2016–2017 influenza season. *MSMR*. 2018;25(1):8–9.
75. Shoubaki LA. Surveillance snapshot: Summary of the Department of Defense Global respiratory Pathogen Surveillance Program, 2017–2018 influenza season. *MSMR*. 2018;25(10):22.
76. Smith JL, Pugh CL, Cisney ED, et al. Human antibody responses to emerging Mayaro virus and cocirculating alphavirus infections examined by using structural proteins from nine new and old world lineages. *mSphere*. 2018;3(2).
77. Snesrud E, McGann P, Chandler M. The birth and demise of the IS*Ap11-mcr-1*-IS*Ap11* composite transposon: the vehicle for transferable colistin resistance. *MBio*. 2018;9(1).
78. Srijan A, Margulieux KR, Ruekit S, et al. Genomic characterization of nonclonal *mcr-1*-positive multidrug-resistant *Klebsiella pneumoniae* from clinical samples in Thailand. *Microb Drug Resist*. 2018;24(4):403–410.
79. Stahlman S, Oetting AA. Mental health disorders and mental health problems, active component, U.S. Armed Forces, 2007–2016. *MSMR*. 2018;Mar;25(3):2–11.
80. Stahlman S, Oh GT. Thyroid disorders, active component, U.S. Armed Forces, 2008–2017. *MSMR*. 2018;Dec;25(12):2–9.
81. Stahlman S, Taubman SB. Fireworks injuries, active component, U.S. Armed Forces, 2008–2017. *MSMR*. 2018;Sep;25(9):25–27.
82. Stahlman S, Taubman SB. Incidence of acute injuries, active component, U.S. Armed Forces, 2008–2017. *MSMR*. 2018;Jul;25(7):2–9.
83. Swanson KC, Darling N, Kremer P, et al. Outbreak of influenza and rhinovirus co-circulation among unvaccinated recruits, U.S. Coast Guard Training Center Cape May, NJ, 24 July–21 August 2016. *MSMR*. 2018;25(1):2–7.
84. Takhampunya R, Korkusol A, Promsathaporn S, et al. Heterogeneity of *Orientia tsutsugamushi* genotypes in field-collected trombiculid mites from wild-caught small mammals in Thailand. *PLoS Negl Trop Dis*. 2018;12(7):e0006632.
85. Tam CC, Anderson KB, Offeddu V, et al. Epidemiology and transmission of respiratory infections in Thai Army recruits: a prospective cohort study. *Am J Trop Med Hyg*. 2018;99(4):1089–1095.
86. Tam CC, Offeddu V, Anderson KB, et al. Association between semi-quantitative microbial load and respiratory symptoms among Thai military recruits: a prospective cohort study. *BMC Infect Dis*. 2018;18(1):462.
87. Uptegraft CC, Stahlman S. Variations in the incidence and burden of illnesses and injuries among non-retiree service members in the earliest, middle, and last 6 months of their careers, active component, U.S. Armed Forces, 2000–2015. *MSMR*. 2018;Jun;25(6):10–17.
88. Ventocilla JA, Nunez J, Tapia LL, et al. Genetic variability of *Plasmodium vivax* in the north coast of Peru and the Ecuadorian Amazon basin. *Am J Trop Med Hyg*. 2018;99(1):27–32.
89. Vongphayloth K, Hertz JC, Lakeomany K, et al. The genus *Dermacenter* (Acari: Ixodidae) in Laos: a review and update of species records. *J Med Entomol*. 2018;55(4):1047–1050.
90. Voorhees MA, Padilla SL, Jamsransuren D, et al. Crimean-Congo hemorrhagic fever virus, Mongolia, 2013–2014. *Emerg Infect Dis*. 2018;24(12):2202–2209.
91. Waitumbi JN, Buddhdev N, Awinda G, et al. Zika virus screening in the Kenyan Olympic team attending the 2016 Olympic Games in Brazil. *Open J Prev Med*. 2018;8:183–187.
92. Washington MA, Jerse AE, Rahman N, et al. First description of a cefixime- and ciprofloxacin-resistant *Neisseria gonorrhoeae* isolate with mutations in key antimicrobial susceptibility-determining genes from the country of Georgia. *New Microbes New Infect*. 2018;24:47–51.
93. Weitzel T, Aylwin M, Martinez-Valdebenito C, et al. Imported scrub typhus: first case in South America and review of the literature. *Trop Dis Travel Med Vaccines*. 2018;4:10.
94. Weitzel T, Jiang J, Acosta-Jamett G, et al. Canine seroprevalence to *Orientia* species in southern Chile: a cross-sectional survey on the Chiloe Island. *PLoS One*. 2018;13(7):e0200362.

95. White SK, Lednicky JA, Okech BA, Morris JG Jr., Dunford JC. Spondweni virus in field-caught *Culex quinquefasciatus* mosquitoes, Haiti, 2016. *Emerg Infect Dis*. 2018;24(9):1765–1767.
96. White SK, Mavian C, Salemi M, et al. A new “American” subgroup of African-lineage chikungunya virus detected in and isolated from mosquitoes collected in Haiti, 2016. *PLoS One*. 2018;13(5):e0196857.
97. Williams VF, Oetting AA, Stahlman S. Update: Lightning strike injuries, active component, U.S. Armed Forces, 2008–2017. *MSMR*. 2018;Sep;25(9):20–24.
98. Williams VF, Oh GT, Stahlman S. Incidence and prevalence of the metabolic syndrome using ICD-9 and ICD-10 diagnostic codes, active component, U.S. Armed Forces, 2002–2017. *MSMR*. 2018;Dec;25(12):20–25.
99. Williams VF, Oh GT, Stahlman S. Update: Accidental drownings and near drownings, active component, U.S. Armed Forces, 2013–2017. *MSMR*. 2018;Sep;25(9):15–19.
100. Williams VF, Oh GT, Stahlman S. Adrenal gland disorders, active component, U.S. Armed Forces, 2002–2017. *MSMR*. 2018;Dec;25(12):10–19.
101. Williams VF, Stahlman S, Oh GT. Coccidioidomycosis, active component, U.S. Armed Forces, 2007–2017. *MSMR*. 2018;Apr;25(4):2–5.
102. Williams VF, Stahlman S, Taubman SB. Diagnoses of eating disorders, active component service members, U.S. Armed Forces, 2013–2017. *MSMR*. 2018;Jun;25(6):18–25.
103. Williams VF, Stahlman S, Ying S. Herpes zoster, active component, U.S. Armed Forces, 2000–2016. *MSMR*. 2018;Mar;25(3):19–27.
104. Yang Y, Walls SD, Gross SM, Schroth GP, Jarman RG, Hang J. Targeted sequencing of respiratory viruses in clinical specimens for pathogen identification and genome-wide analysis. *Methods Mol Biol*. 2018;1838:125–140.

ACRONYMS

AD-CS	Assistant Director for Combat Support
AFHSB	Armed Forces Health Surveillance Branch
AFMR	Air Force Mortality Registry
AFRICOM	U.S. Africa Command
AFRIMS	U.S. Armed Forces Research Institute of Medical Sciences
AGE	acute gastroenteritis
AMD	Aerospace Medicine Squadron
AMR	antimicrobial resistance
APHC	U.S. Army Public Health Center
AOR	Areas of Responsibility
ARO	Office of Alert and Response Operations
BAACH	Brian Allgood Army Community Hospital
BIWAC	Biosurveillance Indications and Warnings Analytic Community
BSHOP	Behavioral and Social Health Outcomes Practice
CAC	Common Access Card
CARB	Combating Antibiotic Resistant Bacteria
CSART	CSA Review Team
CCMD	Combatant Command
CDC	Centers for Disease Control and Prevention
CENTCOM	U.S. Central Command
CONUS	contiguous United States
CSA	Combat Support Agency
DHA	Defense Health Agency
DMED	Defense Medical Epidemiology Database
DMSS	Defense Medical Surveillance System
DMTS	Data Management and Technical Support
DoD	Department of Defense
DoD-GEIS	DoD Global Emerging Infections Surveillance and Response System
DoDGRS	DoD Global Respiratory Pathogen Surveillance Program
DoDSR	Department of Defense Serum Repository
DRSi	Disease Reporting System internet
E&A	Epidemiology and Analysis
EDC	EpiData Center
EI	enteric infection
EID	emerging infectious disease
EPEC	enteropathogenic E. coli
ESSENCE	Electronic Surveillance System for the Early Notification of Community-based Epidemics
EUCOM	U.S. European Command
FDA	U.S. Food and Drug Administration
FHP	force health protection
FY	fiscal year
FORSCOM	United States Army Forces Command
FVBI	febrile and vector-borne infection
GAO	Government Accountability Office
GCC	Geographic Combatant Command
GEIS	Global Emerging Infections Surveillance
GHE	Global Health Engagement
GHSA	Global Health Security Agenda
GIS	Geographic Information Systems
GTD	Global Travelers' Diarrhea
H7N9	avian influenza A (subtype H7N9)
HAI	healthcare-associated infection
HAdV-B55	human adenovirus type 55
HAdV-11a	human adenovirus 11a
HIV	human immunodeficiency virus
HPV	human papilloma virus
HSSG	Health Surveillance Steering Group
IB	Integrated Biosurveillance

ICD-10-CM	International Classification of Diseases, 10th Revision, Clinical Modification
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
ID	identification
IE	Office of Innovation and Evaluation
IHR	International Health Regulations
ILI	influenza-like illness
IPL	Institut Pasteur du Laos
LOE	line of effort
LRMC	Landstuhl Regional Medical Center
MAT	medical air transports
MDR-TB	multidrug-resistant tuberculosis
MDO	Multidrug resistant
MDRO	multidrug-resistant organisms
MERS-CoV	Middle East Respiratory Syndrome Coronavirus
MHS	Military Health System
MRSN	Multidrug-Resistant Organism Repository and Surveillance Network
<i>MSMR</i>	<i>Medical Surveillance Monthly Report</i>
MTF	military treatment facility
NAMRU-2	Naval Medical Research Unit No. 2
NAMRU-3	Naval Medical Research Unit No. 3
NAMRU-6	Naval Medical Research Unit No. 6
NATO	North Atlantic Treaty Organization
NDM-1	New Delhi metallo-beta-lactamase-1
NECE	Navy Entomology Center of Excellence
NEPMU-2	Navy Environmental Preventive Medicine Unit 2
NHRC	Naval Health Research Center
NIH	National Institutes of Health
NMCPHC	Navy and Marine Corps Public Health Center
NMCPHC-EDC	Navy and Marine Corps Public Health Center-EpiData Center
NMRC	Naval Medical Research Center
OCONUS	outside the contiguous United States
OTSG-PVC	Office of the Surgeon General Pharmacovigilance Center
PCR	polymerase chain reaction
PHC-E	Public Health Command Europe
RAP	Request Approval Process
RI	Respiratory infections
RME	reportable medical event
RMEWG	Reportable Medical Events Working Group
SMS	Surveillance Methods and Standards
SOUTHCOM	U.S. Southern Command
SSBP	Surveillance of Suicidal Behavior Publication
STI	sexually transmitted infections
TAMC	Tripler Army Medical Center
TBI	traumatic brain injury
USG	United States Government
USAFSAM	U.S. Air Force School of Aerospace Medicine
USACE	U.S. Army Corps of Engineers
USAMC	U.S. Army Medical Command
USAMRD-G	U.S. Army Medical Research Directorate-Georgia
USAMRD-K	U.S. Army Medical Research Directorate-Kenya
USAMRIID	U.S. Army Medical Research Institute for Infectious Diseases
USINDOPACOM	U. S. Indo-Pacific Command
USU	Uniformed Services University of the Health Sciences
VE	vaccine effectiveness
WHO	World Health Organization
WRAIR	Walter Reed Army Institute of Research
WRIR	Weather-Related Injury Repository



Armed Forces Health Surveillance Branch

11800 Tech Road, Suite 220, Silver Spring, MD 20904

www.health.mil/AFHSB | www.facebook.com/afhsbpage/ | www.twitter.com/afhsbpage