Infectious Diseases

Harris County Public Health, Office of Science, Surveillance, and Technology/Surveillance and Epidemiology Unit

Houston, Texas

Assignment Description

The Surveillance and Epidemiology Unit (SEU), which is housed in the Office of Science, Surveillance and Technology (OSST), is responsible for routine disease surveillance, outbreak control and prevention, and response to public health emergencies. The CSTE Fellow will fully participate in SEU activities. He/she will gain hands-on experience in infectious disease surveillance, data analysis, emergency response, community outreach, and other surveillance/public health activities. The Fellow will participate in, and likely have the opportunity to lead disease and outbreak investigations involving medical record review, patient interviews, questionnaire design, control measure implementation, data collection and analysis, report writing, and presentations. As an important part of the SEU team, the Fellow will also participate in preparedness and response activities as time permits, and dependent upon the level of public health response required. Since Harris County Public Health (HCPH) is a large, urban health department, public health response may be organized under Incident Command Structure (ICS) and require interdivisional involvement.

HCPH is a Public Health Accreditation Board-accredited health department since 2018. It was recognized in 2016 by National Association of County and City Health Officials (NACCHO) as Local Health Department (LHD) of the Year for its cornerstone values of Innovation, Engagement, and Equity. HCPH has also adopted One Health and Health Equity approaches in public health practice. The Fellow will have the opportunity to interact with other divisions and offices across the agency according to his/her interests and availability. These include: Tuberculosis Elimination, Refugee Health Screening, and HIV Prevention Programs in Disease Control and Clinical Prevention Division; Environmental Public Health Division (EPH); Veterinary Public Health Division; Mosquito and Vector Control Division (MVCD); Nutrition and Chronic Disease Prevention Division; Office of Policy and Planning; Office of Communications, Education and Engagement; and the Office of Public Health Preparedness and Response (OPHPR). As a part of One Health efforts, an innovative Data Warehouse is also housed within OSST, which provides the Fellow a favorable environment to explore and utilize various data from departments across HCPH, such as data from MVCD, EPH, and OPHPR. In addition, the Fellow will have opportunities to participate in various agency wide meetings, trainings and education, including Public Health Matters, One Health Tag Up, the Chronic Disease Tag Up, the HCPH Journal Club, and the Epidemiology Forum. Furthermore, the Fellow may engage in conferences and outreach activities organized by HCPH such as the One Health conference, Food Safety Summit, Mobile Heath Village events in the community. With the extensive experience of hosting previous CSTE AEF fellows, SEU has created a comprehensive curriculum to integrate the Fellow to a full spectrum of public health activities.

HCPH’s setting as the 3rd most populous county in the nation, provides important context for the depth and breadth of experience an incoming Fellow will gain, by being part of a team that provides epidemiology services to such a large, complex, and diverse urban population. Harris County has the 8th busiest international airport in the United States, which is ranked 3rd for non-stop domestic and international service (http://www.flightstats.com/go/Airport/airportDetails.do?airportCode=iah). The
Houston area has numerous international travelers, one of the world’s busiest ports, and the world’s largest medical center. The SEU provides epidemiology services, including surveillance of notifiable conditions, to this population.

In the past, HCPH SEU has been involved in investigations of human rabies, Japanese Encephalitis, a large outbreak of hepatitis B associated with long-term care facilities, H1N1 influenza pandemic, and the largest national outbreak of West Nile virus (WNV) reported to date. In recent years, SEU has also accumulated extensive experience in response to Ebola, Zika outbreak, severe flu season of 2017-2018, Hurricane Harvey, the resurgence of measles in 2019, the ITC chemical fires and many interesting foodborne illness clusters identified by PulseNet. The SEU’s public health surveillance and response in the mega-shelter at NRG Center post-Hurricane Harvey was awarded the NACCHO Model Practice of 2017. This year, the unit successfully responded to the resurgence of measles and Intercontinental Terminal Company (ITC) chemical fires, with identification of four measles and contact investigations of hundreds of individuals and conducting active surveillance and syndromic surveillance post ITC chemical fires. Because of the diverse population and large area we serve, Epidemiologists in our unit gain rich experiences by investigating various types of rare and exotic diseases and respond to public health emergencies.

**Day-to-Day Activities**

The Fellow will apply principles of Epidemiology to day-to-day disease surveillance and control activities and respond to public health emergencies within the jurisdiction of HCPH. The areas of particular importance are the surveillance, control, and prevention of notifiable infectious conditions, including diseases related to potential bioterrorism agents, outbreak situations, and other public health emergencies or natural disasters. In the context of learning general disease surveillance, the Fellow will focus on Multidrug Resistant Organisms (MDROs), Hospital Acquired Infections (HAIs), and vaccine preventable diseases (VPDs), which have been identified as priorities in HCPH’s SEU.

With guidance from mentors and the Surveillance Supervisor, the Fellow’s day-to-day activities may include:

- Investigating reports of notifiable conditions in Harris County residents as assigned. This process involves review of medical records, interpretation of laboratory reports, patient interviews, implementation of control measures, facility visits, and completion of surveillance forms (with other steps as necessary based on the situation or condition).
- Providing information and Epidemiology consultations related to public health issues via telephone, mailings, and presentations to individuals, schools, child care centers, nursing homes, hospitals, health care providers, and other agencies in order to identify notifiable conditions, outbreaks, and public health emergencies and prevent the spread of disease.
- Analysis of epidemiological data to describe disease burden and characteristics in the county and produce reports.
- Exploration of opportunities to improve disease surveillance.
- Conduct disease investigations and provide interventions for epidemic or unusual community health related events or outbreaks, including those related to potential bioterrorism agents and
other public health issues, thus contributing to the development of the public health preparedness capacity of the unit.

**Potential Projects**

**Surveillance Activity** General Infectious Disease Surveillance Rotation and Specific Surveillance Focuses

**General Disease Surveillance Rotation**

In the first months of the fellowship (length to be determined in consultation with the Fellow and considering the program’s priorities), the Fellow will conduct Epidemiology investigations for various notifiable infectious diseases in order to gain broad experience in Epidemiology surveillance and be prepared for the future profession. A full spectrum of both common and rare notifiable conditions has been seen in HCPH’s jurisdiction, including: salmonellosis, shigella, campylobacteriosis, enterohemorrhagic E. coli, cryptosporiosis, cyclosporiasis, Listeriosis, Vibrio, invasive streptococcal infection, multi-drug resistant infections, hepatitis, meningitis, chickenpox, mumps, measles, pertussis, invasive Haemophilus influenzae, Lyme disease, typhus fever, Chagas disease, Leishmaniasis, legionellosis, influenza-associated pediatric mortality, Chikungunya virus, WNV, malaria, ZIKV, dengue, and brucellosis, among others.

The aforementioned surveillance activities involve: 1) Review of medical records, interpretation of laboratory reports, testing recommendations, patient interviews, implementation of control measures, and completion of surveillance forms, with other steps as necessary based on the situation or condition. 2) Provision of information and epidemiology consultations related to public health issues via telephone consultation, mailings, and presentations to individuals, schools, child care centers, nursing homes, hospitals, health care providers, and other agencies in order to identify notifiable conditions, outbreaks, and public health emergencies and prevent the spread of disease.

After this rotation, the Fellow will have a comprehensive understanding of infectious disease surveillance and its workflow in the field and have proficiency in our new electronic disease surveillance database, MAVEN.

This rotation will be followed by surveillance activities in specific areas to allow the fellow to obtain in-depth understanding of certain conditions of public health significance.

**Multidrug Resistant Organisms (MDROs) and Hospital Acquired Infections (HAIs)**

Antimicrobial resistance and hospital acquired infections are emerging public health threats. Antibiotic resistance causes infections in at least 2 million people and at least 23,000 deaths a year in the United States (https://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf). About 10% of hospitalizations are complicated by HAIs and as many as 75% of HAIs are caused by organisms that are first-line antimicrobial therapy resistant (Haque, M. et al. Health care-associated infections - an overview. Infection and Drug Resistance, 11, 2321â€“2333. doi:10.2147/IDR.S177247). Reporting for MDROs (Carbapenem-resistant Enterobacteriaceae (CRE) and multidrug-resistant Acinetobacter (MDR-
A)) began in 2014, with 2015 being the first full year of reporting within Harris County. The Fellow will conduct surveillance investigations of MDROs and certain HAIs, including those reported from Antibiotic Resistant Laboratory Network (ARLN), classified cases, and implement infection control measures utilizing Epi Case Criteria, Emerging and Acute Infectious Disease Guidelines, and CDC Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms. The ARLN is a nationwide surveillance system that works to rapidly detect antibiotic resistance patterns and inform local agencies to intervene quickly to mitigate further spread.

The Fellow will conduct investigations of reported cases by medical records review and laboratory result interpretation, and interviewing patients, providers and facilities. The Fellow will also conduct facility outreach and education such as Infection Control Assessment and Response (ICAR) in collaboration with the HAI Epidemiologist of Texas Department of State Health Services (DSHS).

Vaccine Preventable Diseases and Vaccination Profile, Harris County, TX

The measles outbreak in 2019 in the US highlights the impact of resurgence of vaccine preventable diseases (VPD) and the importance of vaccination. HCPH identified four cases at the beginning of 2019. We have also seen mumps outbreaks in congregate settings as other jurisdictions in the nation. Despite the advancement of vaccination, approximately 42,000 adults and 300 children still die every year from vaccine-preventable diseases in the United States (https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases#star). To prevent and ultimately eradicate VPD, it is important to understand the trends of VPD and vaccination in communities for impactful interventions. The Fellow will receive trainings on VPDs and conduct epidemiological investigations of reported VPDs such as Measles, Mumps, Pertussis, etc. The Fellow will also analyze VPD data that SEU has collected over decades for rates and trends of various diseases. With the assistance from SEU and OSST Data Warehouse GIS staff, the Fellow may analyze the diseases spatially and temporally, if applicable. The Fellow will collect the data of vaccinations in Harris County, particularly for schools and independent school districts. With the guidance of mentors, the Fellow will design an epidemiologic study and analyze the potential association between immunization rates and VPD rates as appropriate. In addition, the Fellow may analyze outbreak data of pertussis, mumps, and chickenpox to identify patterns and make recommendations for surveillance and interventions. Ultimately, the Fellow will develop a profile of VPD and vaccinations in HC to provide an overview of these analyses. The Fellow will also review literature and build experience on VPD and vaccination, and explore further opportunities for epidemiological studies in this area. The Fellow may participate in immunization outreach activities of HCPH Mobile Health Events and gain first-hand experience in the field of public health services and explore potential partnerships with other programs.

Surveillance Evaluation  Evaluation of MDRO and HAI Surveillance in Harris County

As aforementioned, MDROs became reportable in Texas just years ago, and reporting through ARLN is recent and voluntary. However, MDRO cases and ARLN alerts in Harris County account for a substantial proportion of overall reports in our region. Evaluation of MDRO surveillance in the past years will be helpful to identify strengths and weaknesses in surveillance and improve the system. The Fellow will conduct a comprehensive evaluation of MDRO and HAI surveillance in HCPH’s jurisdiction utilizing Updated Guidelines for Evaluating Public Health Surveillance Systems from the Centers for Disease
Control and Prevention (CDC). The evaluation will help the Fellow understand the current state of specific components of surveillance systems and their mechanisms. Selected surveillance system attributes to be evaluated include data quality, flexibility, simplicity, and representativeness. Post evaluation recommendations and possible implementation will contribute to the overall improvement of the surveillance of MDROs and HAIs at HCPH in the future.

**Major Project  Understanding the Burden and Pattern of MDROs and HAIs in Harris County, TX, and Improving the Surveillance**

MDROs and HAIs have significant public health impacts. According to the recently published CDC Antibiotic Resistance Threats in the United States, 2019, more than 2.8 million antibiotic-resistant infections occur in the U.S. each year, and more than 35,000 people die as a result. CRE causes 13,100 hospitalizations and 1,100 deaths in 2017; Carbapenem-resistant Acinetobacter causes 8,500 hospitalizations and 700 deaths in the same year. The Multidrug-resistant Acinetobacter (MDR-A) infection rate in 2016 in Harris County is 4.5 per 100,000 persons, compared to the rate of 3.6 in Texas (https://www.dshs.texas.gov/IDCU/health/antibiotic_resistance/MDR-A-Data.aspx). Understanding the burden and pattern of MDROs and HAIs is the primary step in combating multidrug resistant organisms and infections. The Fellow will explore and analyze SEU MDRO surveillance data and the data from National Healthcare Safety Network (NHSN) to describe the burden (case counts and infection rates) and patterns (organisms, resistance mechanisms, and distributions) of MDROs and HAIs in Harris County. NHSN is the nation’s most widely used HAI tracking system developed by the CDC. It is a secure, internet-based surveillance system that allows healthcare facilities to report HAI data, patient safety surveillance information, and antibiotic use and antibiotic resistance data. The Fellow will summarize the findings and present as appropriate.

The surveillance for MDROs and HAIs in HCPH is conducted by epidemiologists based on the patient’s address or/and the location of the facility involved, in collaboration with hospital infection control practitioners (ICPs), as for other notifiable conditions. However, patients with MDRO infections often are individuals that have been transferred among different healthcare facilities during prolonged time period for care. This poses a challenge in surveillance investigations, patient tracking, control measure implementation, and facility outreach due to the cross-jurisdictional surveillance and complex healthcare history. In addition, reporting and submitting isolates to ARLN is relatively new and voluntary, the efficiency of the surveillance needs to be further understood. Also, each healthcare facility has different levels of capacity in terms of monitoring and reporting MDROs and HAIs and implementing control measures. All these dimensions make MDRO and HAI surveillance an area for further evaluation and improvement. The Fellow will identify gaps in the surveillance based on the experience in conducting investigations and implementing control measures, and the findings in evaluation of the surveillance system. The Fellow will also review literature and other sources to research innovative methods of surveillance for MDROs and HAIs. Further, the Fellow will make recommendations to improve the surveillance systems at local level.

In the efforts to identify surveillance gaps and improvement strategies, the Fellow will engage in the regional MDRO Taskforce to discuss the MDRO containment plan in collaboration with other LHDs, healthcare facilities, DSHS regional office, as well as build partnership with ICPs in local facilities, HAI epidemiologists in other LHDs, DSHS regional and central office. The Fellow will also participate in
MDRO/HAI meetings and conferences to gain broad and in-depth knowledge of MDRO/HAI surveillance and control.

**Additional Project**  
**Introduction to Chronic Disease Data Sources for Public Health and Creating a Cardiovascular Disease (CVD) Profile for Harris County**

The fellow will gain exposure to and understanding of data sources for use in applied chronic disease epidemiology and research with guidance from the primary supervisor and through communication with the Texas Department of State Health Services (DSHS). The fellow will choose appropriate datasets for completion of projects examining various facets of chronic disease outcomes and risk factors. A continuous learning process will occur from initial exposure to data sources until the fellow can serve as a subject matter expert by providing insights to HCPH colleagues on appropriate data sources for use in their work. They will also explore data sources available online through other public health entities including CDC. The fellow will have the opportunity to analyze data from both internal and external data sources such as DSRIP data, BRFSS, etc.

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**Additional Project**  
**Understanding the Burden of the Opioid Epidemic (OE) in Harris County, TX**

The burden of the U.S.’s OE within Harris County and the HCPH jurisdiction is not well understood. The Fellow will work with HCPH’s chronic disease epidemiologist and Nutrition and Chronic Disease Prevention (NDCP) Division to participate in activities designed to increase understanding of this burden in the local community. The Fellow will analyze available overdose-related data such as syndromic surveillance data collected by jurisdictional hospitals and mortality data collected by Texas DSHS Vital Statistics Unit, to describe the geographic burden and distribution, demographic characteristics of affected individuals (if possible), selected clinical characteristics, trends over time, and risk factors for dependence or overdose, and overdose-related fatalities, as well as any reports received related to overdoses. The fellow will also conduct research related to the availability of preventive and treatment-related resources within Harris County and HCPH jurisdiction for individuals affected by opioid dependency, including but not limited to needle and syringe exchange programs, methadone and other prescription opioid replacement treatments, and other substance abuse related programs.

Additionally, the fellow will attempt to gain access to and utilize information available through Texas’s prescription monitoring program to characterize and identify trends over time in controlled substance prescribing by Harris County (or HCPH jurisdiction) providers, including information related to reason for prescription, specialty of prescriber, expected duration of use for prescribed opioids, and other potentially useful information. The fellow will also develop an OE monitoring report template that will enable the Epidemiology Program to continue future monitoring, ultimately leading to development and
evaluation of targeted prevention strategies and decreases in negative outcomes and healthcare costs related to the OE. This would complement the fellow’s surveillance work in identifying local resources available for individuals affected by opioid dependence.

**Preparedness Role**

Harris County is no stranger to emergencies and HCPH has long experienced responding to these situations. The Surveillance and Epidemiology Unit plays an integral part in the HCPH response to public health emergencies and natural disasters. In September 2005, as ICS was set up to respond to the large numbers of evacuees arriving in Harris County following Hurricane Katrina, HCPH led the Medical Branch Operation at the Astrodome/Reliant Complex. The Epidemiology Program had primary responsibility to implement a comprehensive epidemiological surveillance in all shelter areas. HCPH applied a health assessment in the clinic triage areas for all evacuees seeking care in shelter clinics. Further investigations were conducted for all evacuees suspected of having infectious diseases. Routine, preexisting surveillance systems were maintained and allowed for follow up of hospitalized evacuees. Additionally, epidemiologists rounded in all shelter areas every 12 hours to identify any infection control related issues that arose.

One example of an infection control issue was the identification of large ice chests with drinks accessible to all evacuees placed at various places in the shelters. Immediately, risk of fecal-oral transmission of infectious pathogens was identified and the practice was corrected. Volunteers were placed at all ice chests to distribute drinks as needed. In collaboration with the University of Texas School of Public Health, a daily cot-to-cot survey was implemented to assess the general health status of evacuees in the shelter areas. This effort was instrumental in quick identification of a Norovirus outbreak in the main shelter area at the Astrodome. HCPH also tracked immunizations given in the shelters, laboratory tests ordered, medical complaints, and pharmaceutical usage. In addition to these disease control efforts, environmental shelter assessments were conducted and appropriate health education messages for evacuees and response personnel were provided.

The Epidemiology Program staff stayed at shelters of last resort (for residents with significant medical conditions who were unable to evacuate) during Hurricane Ike and participated in the post-hurricane response. Epidemiology-related activities implemented as part of the post-hurricane response included shelter assessments and other active surveillance activities.

The HCPH Epidemiology Program responded to the 2014-15 Ebola Outbreak by conducting passenger monitoring to more than 100 individuals arriving from West African countries including some passengers categorized under some risk that required direct active monitoring. The CDC/CSTE Applied Epidemiology Fellow assigned to our agency at that time took an active role during that response. Since 2015, our program began actively responding to the ongoing ZIKV emergency. From 2015 to 2017, more than 1,660 reports of suspected ZIKV in residents of Harris County were investigated.

After Hurricane Harvey in the Fall of 2017, the SEU played a critical role in public health surveillance and response. Active surveillance was conducted in the NRG mega-shelter to rapidly detect communicable and high-consequence illness and to prevent disease transmission. An online survey tool and novel epidemiology consulting method were developed to aid in this surveillance.
Surveillance included daily review of onsite medical, mental health, pharmacy, and vaccination activities, as well as nightly cot-to-cot resident health surveys. Symptoms of infectious disease, exacerbation of chronic disease, and mental health issues among evacuees were closely monitored. Rapid epidemiology consultations were performed for shelter residents displaying symptoms consistent with communicable illness or other signs of distress during nightly cot surveys. Onsite rapid assay tests and public health laboratory testing were used to confirm disease etiologies. When indicated, disease control measures were implemented, and residents referred for further evaluation. Analyses were performed to describe the surveillance results.

This year, SEU participated in the emergency response to ITC chemical fires. On March 17, 2019, chemical storage tanks at Deer Park ITC facility burned sending a black smoke plume in the air. The fire had continued until March 20, 2019. Chemicals released from the fire were naphthalene, gasoline, xylene, and pygas (benzene mixture). The incident caused concerns in communities around the vicinity of the incident and across the county. Benzene exposure, school closures, and shelters-in-place were some of the concerns within communities. Harris County Public Health worked with various partners to monitor the incident and ensure the public health and safety of the community. In this response, SEU initiated active surveillance with partners including area hospitals, schools ISDs, and free-standing emergency centers within Harris County to monitor the health impact of the community and provide daily situational awareness to executive leadership to assist with decision making. The surveillance activities utilized data from active area hospital and free-standing emergency center surveillance; ESSENCE syndromic surveillance; Southeast Texas Regional Advisory Council (SETRAC) EMTrack surveillance; HCPH Mobile Health Events health assessment; and Texas Poison Control Center calls. SEU responded to a large volume of calls from the public, providers, and laboratories inquiring about specific testing guidelines and health concerns. These calls were later routed to Harris Health System’s “Ask My Nurse” Helpline. Subsequently, commercial laboratories were contacted for volume of benzene testing. In addition, SEU had sent out 7 HAN alerts on behalf of HCPH to regional public health partners to raise situational awareness and provide guidance.

SEU staff also participates in emergency response drills for suspected biological terrorist attacks and prophylaxis distribution, known as SNS (Strategic National Stockpile) and Point of Dispensing (POD) exercises, as well as an exercise for nuclear incidents, known as Community Reception Center (CRC).

The Fellow may be assigned to participate in any of the above activities should a public health emergency occur. In addition, the Fellow may participate in Community Assessment for Public Health Emergency Response (CASPER) activities conducted regularly by HCPH to assess community emergency preparedness or in response to public health emergencies. To date, HCPH has conducted numerous CASPERs since 2015 and accumulated valuable information and experience from it.

In times of emergency response, the Fellow will have responsibilities including shelter disease surveillance and/or additional disease surveillance specific to the nature of the emergency. After Hurricane Harvey, for instance, the entire Epidemiology Program participated in both shelter and community disease surveillance activities related to the hurricane and subsequent flooding. This provided unique experience to staff in disaster preparedness and response.
**Additional Activities**

Depending on the interests of the Fellow and as time permits, the Fellow may also analyze other surveillance data related to tick-borne diseases to understand the patterns and trends of the emerging public health threat.

In addition, the Fellow will attend various meetings, including agency-wide meetings, as well as the regional bimonthly meeting of epidemiologists in Texas Health Region 6/5 South and weekly DSHS Epidemiology conference calls.

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**Mentors**

**Primary**

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**Secondary**

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