ID: 58990354
Infectious Diseases - HAI, Infectious Diseases - Host Site Description
California Department of Public Health

Assignment Location: Richmond, US-CA
California Department of Public Health
Healthcare Associated Infections Program

Primary Mentor: Tisha Mitsunaga, Dr.PH
Antimicrobial Resistance Prevention and Epidemiology Supervisor
California Department of Public Health

Secondary Mentor: Sam Horwich-Scholefield, MPH
Antimicrobial Resistance Epidemiologist
California Department of Public Health

Work Environment
Hybrid

Assignment Description

During their time with the HAI Program, the fellow will have the opportunity to directly observe and interact with Program members from a variety of clinical, communication, and epidemiological backgrounds. Specifically, the position sits with the Surveillance and Analytics-CalREDIE team, which includes the secondary mentor, two additional epidemiologists, and a data specialist, and is headed by the primary mentor. The primary mentor is also the acting team lead for the Epidemiologic Response and Prevention team which includes four additional epidemiologists. The AEF fellow's primary assignment will be to assist with surveillance and response activities for AR pathogens, primarily CPOs and Candida auris.

With the support of the mentors, Surveillance and Analytics-CalREDIE and Epidemiologic Response and Prevention teams, and other HAI Program staff (including interaction most routinely with 15 infection preventionists, 3 medical epidemiologists, and the Program Chief and Assistant Chief), the fellow's day-to-day activities will be as an epidemiologist focusing During their time with the HAI Program, the fellow will have the opportunity to directly observe and interact with Program members from a variety of clinical, communication, and epidemiological backgrounds. Specifically, the position sits with the Surveillance and Analytics-CalREDIE team, which includes the secondary mentor, two additional epidemiologists, and a data specialist, and is headed by the primary mentor. The primary mentor is also the acting team lead for the Epidemiologic Response and Prevention team which includes four additional epidemiologists. The AEF fellow's primary assignment will be to assist with surveillance and response activities for AR pathogens, primarily CPOs and Candida auris.

With the support of the mentors, Surveillance and Analytics-CalREDIE and Epidemiologic Response and Prevention teams, and other HAI Program staff (including interaction most routinely with 15 infection preventionists, 3 medical epidemiologists, and the Program Chief and Assistant Chief), the fellow's day-to-day activities will be as an epidemiologist focusing on AR-related activities. These include managing AR data and maintaining a database, interacting with local public health jurisdiction staff and healthcare facilities to investigate HAI and AR cases or outbreaks, coordinating with regional, state, and local public health and clinical laboratories, and attending weekly laboratory, investigations, and HAI Program staff meetings as relevant. In addition, the fellow will be given ample dedicated time to complete projects that are requirements of the fellowship, and opportunities to explore their own interests. The throughline of these activities, however, will be a focus on building skills related to surveillance. This includes routine review of new cases, analysis of incoming electronic laboratory reporting (ELR), and follow-up with local health departments to obtain epidemiologic data. Working with and understanding surveillance data through collecting, abstracting, standardizing, and managing it, will be an essential part of the AEF fellow's daily activities, and serves as the

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foundation for many of the fellow's projects, including the surveillance system evaluation, cluster/outbreak investigation, and proposed major project.

Describe Statistical and Data Analysis Support, Such as Databases, Software, and Surveillance Systems Available to the Fellow

The AEF participant will have substantial statistical and data analysis support, provided by a team of epidemiologists, data analysts, and information technology specialists. The CDPH HAI Program can provide access to SAS, R, and Python statistical programming languages; the Data and Research team houses several advanced SAS users and the secondary mentor is highly proficient in R. These staff can provide programming support and advice on statistical methodology, study design, and data presentation. In addition, several team members are available to support an AEF fellow as they develop skills in data visualization platforms like Tableau or Power BI. The fellow will also have the opportunity to work extensively with databases in Microsoft Access and on the PowerApps platform, as well as with CalREDIE and the National Healthcare Safety Network, the state's electronic reportable disease surveillance system and HAI reporting system respectively. The fellow may have access to other software and applications such as REDCap to support additional data collection and analysis needs and interests as relevant and available.

For most of these software programs and databases, CDPH offers mostly virtual trainings for employees, and the HAI Program allots considerable time for professional development and self-guided training. CDPH has a partnership with nearby UC Berkeley offering additional, free, epidemiology-focused web-based trainings for staff, such as causal inference or data modelling. These courses are offered on a rolling basis, and the 2025 schedule has not yet been posted. Finally, CDPH has recently launched a partnership with LinkedIn Learning Trainings, which offers virtual trainings in different programming languages, including R, Python, and SQL, as well as more general courses in epidemiology and biostatistics.

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Projects

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Surveillance Activity Title: Antimicrobial-Resistant (AR) Pathogen Electronic Surveillance

Surveillance Activity Description:
The fellow will work closely with members of the Surveillance and Analytics-CalREDIE team to carry out several routine surveillance activities, receiving incoming data from CalREDIE. CalREDIE serves as the primary repository of electronic laboratory reporting (ELR) and other disease investigation information (e.g., patient demographics, discharge summaries). This process requires familiarity with HL7 messaging and other components of ELR, and combining that knowledge with data wrangling techniques and data management principles. Augmenting CalREDIE data are other reports and line lists submitted by local health departments; these include public health laboratory testing results, healthcare facility tracking, and reports from jurisdictions not participating in CalREDIE. The fellow may also participate in annual data reconciliation for preparing data to be submitted to CDC as nationally notifiable conditions.

Surveillance Activity Objectives:
The objective of the surveillance activity will be to collect surveillance data, standardize fields and data elements, and integrate reports into the HAI Program's internal tracking systems. To meet this objective, the fellow will, on a routine basis, (1) abstract data from CalREDIE for CPOs and Candida auris, (2) standardize and integrate these data with internal databases, and (3) communicate these results directly to the Surveillance and Analytics-CalREDIE and Epidemiologic Response and Prevention teams. The fellow will be expected to produce regular surveillance reports for mentors, and will work with the surveillance team to address missingness and potential misclassification.

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Surveillance Activity Impact:
The State of California mandates laboratories report Candida auris and CPOs to enable public health to monitor the overall burden and distribution of diseases throughout the state. These pathogens are also nationally notifiable to CDC, contributing to national estimates and informing policy recommendations. However, these pathogens are especially challenging to surveille for, and a robust surveillance system must seamlessly process and manage large volumes of data that come in multiple formats. This surveillance activity has immediate public health impact and is an excellent opportunity for the fellow to understand the challenges and intricacies of public health surveillance. And if surveillance is the cornerstone of applied epidemiology, then this surveillance activity will serve as the basis from which the fellow begins the surveillance system evaluation and major project.

Surveillance System Evaluation Title: CalREDIE Electronic Lab Reporting (ELR) Validation

Surveillance System Evaluation Description:
Since September 2022, laboratories have been mandated to report all identifications of CPO and Candida auris. For C. auris, laboratories also submit isolates when a specimen is obtained from a normally sterile site (e.g., blood). The AEF fellow will work closely with the Surveillance team to conduct one of the first formal evaluations of CalREDIE as a platform for receiving reports for these two pathogen types. The surveillance system evaluation will compare CPO or C. auris results derived from the standard data extraction system described under the Surveillance Activities project to line lists independently obtained from a subset of laboratories from around California. These line lists would be curated directly from the clinical laboratory's laboratory information management system (LIMS), representing "raw" results created before these results are packaged and transmitted to CalREDIE as ELR. While Candida auris results are relatively straightforward, interpreting CPO results from LIMS and matching with ELR could be particularly challenging, as several tests may be needed to fully characterize CPOs (e.g., organism identification, carbapenemase phenotypic tests, carbapenemase molecular tests).

Surveillance System Objectives:
The primary objective of the project would be to determine whether CPO or C. auris results are being reported accurately and completely. The final report will require the fellow to provide background, describe the methods and the representativeness of the LIMS data, calculate sensitivity, specificity, positive predictive value, and negative predictive value. After presenting summary statistics, the report should also address surveillance system attributes like consistency, reliability, and adaptability. Finally, the report will make recommendations on how to improve the overall accuracy and reliability of ELR in the future, such as better methods of outreach, or improving the development of parent-child relationships in HL7 messaging.

Surveillance System Impact:
Electronic laboratory reporting is a fundamental part of public health surveillance, allowing for the transmission of timely, representative, and highly sensitive laboratory results directly to public health departments. When working properly, ELR has a high degree of data quality, and is relatively stable compared to other forms of provider reporting. However, without consistent and comprehensive evaluation, underreporting may become a pervasive issue, skewing surveillance results and potentially missing an outbreak or other concerning increase in the overall burden of cases. Evaluation and validation are critical to the integrity and reliability of public health surveillance systems, and are most needed when a reportable disease is relatively new and laboratory testing is complex, such as with CPOs.

Major Project Title: Social Determinants of Health of Patients with Healthcare-associated Infections

Major Project Description:
The CDPH HAI Program collects, manages and analyzes data on a wide range of diseases and pathogens, from C. difficile infections to central-line associated bloodstream infections to colonization with multidrug-resistant fungi. Some of these

are routinely reported events or diseases from hospitals, while others might be identified during outbreak investigations. We also have access to healthcare utilization, vital records (i.e., death certificates) and patient transfer network data. The fellow's major project would be to integrate these data sources to address the question: What are the racial, ethnic and other sociodemographic characteristics associated with testing positive for an antimicrobial-resistant (AR) pathogen? Firstly, the fellow would conduct a literature review to determine the current state of knowledge regarding US patients testing positive for AR pathogens. Secondly, they would use healthcare utilization data, death certificate data, and the CalREDIE master patient index to match race, ethnicity, gender, and census tract of residence data with case data, providing a more complete picture of these social and demographic characteristics. Next, with the support of methodological experts within the program, the fellow would conduct a risk analysis to determine whether patients with Candida auris or a CPO were more or less likely than other patients to have certain demographic and socioeconomic characteristics.

Major Project Objectives:
The major project will have several objectives and the fellow will be expected to adhere to a timeline, meeting several milestones laid out in the formal data management and analysis plan developed at the inception of the fellowship. The first objective would be to identify data sources (e.g., Department of Health Care Access and Information) and methodologies (e.g., probabilistic matching) to augment existing HAI patient data with demographic data. Once this step is completed, the second objective would be to match select variables to a specific subset of patients (e.g., patients with C. auris infection or colonization). The third objective would be to develop a multivariable regression model to determine the relative risk between groups for becoming a case and conduct sub-analyses focusing in on specific patient populations (e.g., outpatients) or case types (e.g., bloodstream infections). Finally, the fellow would draft a manuscript to describe findings and develop a series of visual graphics to include in presentations, publications, and possible inclusion on the CDPH HAI Program website.

Major Project Impact:
Researchers have described in depth the healthcare-related risk factors (e.g., receipt of antibiotics) associated with developing an infection or being colonized with an AR pathogen. However, there are few studies documenting the risk of becoming a case more broadly at the population-level; by describing the demographic and socioeconomic characteristics of a large number of patients across California, the AEF fellow can make a substantial contribution to the understanding of health equity in a large state with a diverse patient population. The results will be useful and are in alignment with broader HAI Program and CDPH goals to develop strategies to address health disparities among different racial, ethnic, and socioeconomic groups.

Additional Project #1 Title: Antifungal Susceptibility Testing (AFST) and Candida auris Surveillance
Project #1 Type: Surveillance Activity

Project #1 Description:
Candida auris is a drug-resistant yeast that can be resistant to all three classes of antifungals. While still relatively rare, CDC has noted increasing echinocandin resistance identified among C. auris cases since 2019 (Lyman et al. 2023), which is concerning as this class of drugs is the first-line treatment for C. auris infections. The West Region Antimicrobial Resistance Laboratory Network (AR Lab Network) laboratory in Washington State has been conducting antifungal susceptibility testing (AFST) on select Candida auris isolates from California facilities since 2018. Since September 2022, C. auris isolated from normally sterile sites (e.g., blood) is required to be submitted to public health; these isolates are forwarded to the WA lab for AFST to help monitor resistance in the state over time. In addition, we receive AFST results associated with positive C. auris reports in CalREDIE, either via electronic laboratory reporting (ELR) or attached to case reports as a PDF. Relevant information we receive includes but is not limited to the fungal agent and minimum inhibitory concentrations (MICs).

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The CSTE fellow would work with the AR surveillance team and members of the Antimicrobial Stewardship team to develop a semi-automated system to routinely extract, compile, and analyze these results on a monthly or quarterly basis to form a cumulative antibiogram for C. auris. These results could be stratified by geography (e.g., regions of California), specimen source (e.g., blood vs. skin swab), genetic clade, or year of collection.

Project #1 Objectives and Expected Deliverables:
The objectives of this surveillance activity are: 1) to create an automated system for CDPH to routinely extract and compile AFST results from multiple data sources as a resource for public health practitioners and healthcare providers; 2) to develop a dashboard or data visualizations to display results of a cumulative antibiogram for CDPH staff and local health departments to better understand how multidrug resistance has changed over time and space as C. auris continues to spread across California; and 3) to produce a public-facing dashboard to allow healthcare providers and other stakeholders to view results. Upon completion of the project, the CSTE fellow will also present the results in a series of webinars or in-person presentations, along with other updates on C. auris surveillance and epidemiology.

Project #1 Impact:
By compiling and analyzing AFST data from hundreds of isolates collected over an extended period, a cumulative antibiogram has the potential to assist clinicians as they make critical treatment decisions (i.e., guide empiric treatment of suspected C. auris infections), as well as enable public health staff to track concerning trends in resistance profiles over time, such as echinocandin-resistance. Coupling AFST data with genetic information such as Clade type has the potential to inform strategies and allow for prioritization of prevention and response activities in specific regions or healthcare facilities.

Please Describe the Fellow's Anticipated Role in Preparedness and Response Efforts – Include Activities and Time Allocation (Required Competency of Fellowship)

The AEF fellow will have the opportunity to participate in the HAI Program's emergency preparedness activities. In the recent past, HAI Program staff have responded to local health department requests for infection control and disease surveillance support at evacuation shelters during the recent wildfires, and migrant shelters at the US-Mexico border. Besides active participation in outbreak investigations, depending on the fellow's interests, they may participate in healthcare facility-related preparedness activities that occur during the fellowship, such as pandemic influenza planning and development of guidelines for facilities. Besides gaining experience responding to the inevitable emergent situations a public health department faces (e.g., Clade I mpox virus or Ebola), the fellow will also take part in trainings on the Incident Command System and how it has been used in California when responding to different emergencies. We expect emergency response and preparedness to account for less than 5% of the fellow's time.

Please Describe the Fellow's Anticipated Role in Cluster and Outbreak Investigations – Include Activities and Time Allocation (Required Competency of Fellowship)

The HAI Program has a team of seven epidemiologists and medical epidemiologists who routinely investigate HAI (e.g., Legionella) and AR (C. auris, CPO) clusters and outbreaks in California healthcare facilities. The fellow may begin by shadowing an epidemiologist during an investigation. Once the fellow is familiar with the outbreak investigation and response procedures, they may progress to conducting investigations and response for small outbreaks, tracking multiple outbreaks, updating the outbreak database, creating data visualizations, or assisting with large, multifacility outbreaks. Outbreak response can include: making notifications to healthcare facilities about positive test results; gathering and interpreting epidemiologic data on cases; making recommendations for surveillance and infection prevention and control; coordinating testing with facilities and our laboratory partners including for whole genome sequencing; coordinating and participating in onsite infection prevention and control (IPC) assessments with HAI infection preventionists; hosting calls with local health departments, healthcare facilities and other partners for

situational awareness and planning follow-up; keeping track of patient medical records, line lists and notes; and presenting findings on internal outbreak investigation calls and possibly writing up outbreaks for presentation at conferences. HAI Program staff and fellows have also supported CDC Epi-Aids (e.g., containing C. auris in Southern California) and consulted on a wide array of healthcare-associated investigations that can be broad-reaching and multi-jurisdictional (e.g., tuberculosis cases associated with contaminated bone matrix material). Due to the state's size and diversity, the fellow would likely have opportunities to work on similarly interesting investigations as their predecessors did. We anticipate that this will account for approximately 15% of the fellow's time.