ID: 87568497
Infectious Diseases, Environmental Health - Host Site Description
California Department of Public Health

Assignment Location: Richmond, US-CA
California Department of Public Health
Center for Laboratory Sciences, California Department of Public Health

Primary Mentor: Anthony Tran, DrPH, MPH, BSc
State Public Health Laboratory Director and Deputy Directory Center for Laboratory Sciences
California Department of Public Health, Center for Laboratory Sciences

Secondary Mentor: Shua Chai, MD, MPH
Science and Policy Advisor in the CDPH Division of Communicable Disease Control
California Department of Public Health, Center for Infectious Diseases

Work Environment
Hybrid

Assignment Description

The CSTE fellow will gain hands-on experience in applied epidemiology, laboratory sciences, and environmental health through a variety of activities.
Individual, cluster or Outbreak Investigations:

1. Participate in investigations requiring specialized laboratory testing. Recent examples of these investigations include legionellosis (involving Infectious Disease and Environmental laboratories), multiple foodborne outbreaks (e.g., Salmonella, E. coli O157), avian influenza, Mpox (clades 1 and 2), hepatitis outbreaks, infant botulism, Burkholderia infections, locally acquired dengue cases, and imported Zika cases. Fellows may assist with data intake, review of epidemiologic and clinical information, coordination with local health jurisdictions, ensuring appropriate specimen collection, and interpretation of laboratory results in collaboration with Center for Infectious Disease partners.
2. Statistical and Epidemiologic Review of Laboratory Data:
   Within the Center for Laboratory Sciences, there is a broad array of datasets available for in-depth analysis. Depending on the fellow's interests and the Center's priorities, these analyses may include :
   Infectious Diseases Laboratory Data:
   - Respiratory pathogen surveillance data (PCR and sequencing results for influenza, RSV, SARS-CoV-2)
   - Molecular sequencing data for outbreak strain typing
   - Whole-genome sequencing datasets for foodborne pathogens and TB
   - Foodborne pathogen data (Salmonella, E. coli O157, Listeria, norovirus)
   - Vector-borne disease testing (dengue, West Nile virus, Zika)
   - Antimicrobial resistance profiles (MDR/XDR TB, carbapenem-resistant Enterobacteriaceae)

   Environmental Laboratory Data:
   - Heavy metals testing of food and water (lead, arsenic, mercury)
   - Drug and toxin screening (aflatoxins, mycotoxins, pesticide residues)
   - Wildfire-related environmental contamination (air and soil samples for particulates and toxins
3. Active participation in these meetings
   - Bi-weekly Clinic Club meeting: case-based discussions that integrate epidemiologic, clinical, and diagnostic perspectives. Topics often include rare and complex cases such as unexplained pediatric deaths, suspected human rabies, free-living amoeba infections, unusual clusters of pediatric rash illness, and difficult-to-diagnose neurologic conditions. The fellow will be expected to prepare reports and present at these meetings.

- Bi-weekly Lab-Epi Meetings; Engage in discussions of current "hot topics" in infectious disease epidemiology and laboratory science. Recent topics have included measles outbreaks, foodborne illness investigations, legionellosis, emerging infections (e.g., highly pathogenic avian influenza, Mpox), vector-borne diseases (dengue, West Nile virus, Zika), MDR/XDR tuberculosis outbreaks, influenza and pertussis surveillance, hepatitis A outbreaks, and congenital syphilis in California. The fellow will also have opportunities to present at this meeting based on their involvement in ongoing activities.
- Environmental Health Focus Group Meetings: Participate in ad hoc meetings addressing emerging environmental health issues. Recent topics have included aflatoxin detection in food products following a severe outbreak of wild mushroom poisoning from toxic Death Cap mushrooms (>35 reported cases, including multiple deaths and liver transplants), testing for influenza A/H5 in raw milk, environmental assessments in wildfire-affected areas, and heavy metal testing in certain food products.

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

The fellow will have access to a range of statistical, graphics, and bioinformatics tools including R, ArcGIS, Epi Info, python, Terra.bio, and Linux (an operating system for genomic analysis). For statistical support, the fellow will be able to consult with staff epidemiologists and data analysts who are proficient in these tools. Additionally, the fellow will collaborate closely with CLS genomic data scientists who specialize in NGS analysis, bioinformatics tools and pipelines, and phylogenetic analysis.

The fellow will also have access to the Laboratory Information Management System (LIMS), the primary platform for managing laboratory results and operations. Furthermore, they will use the California Reportable Disease Information Exchange (CalREDIE), CDPH's secure, web-based system for electronic disease reporting and surveillance. CalREDIE collects data on reportable diseases from healthcare providers, laboratories, and local health jurisdictions, and integrates with electronic laboratory reporting (ELR). It serves as the primary system for case investigation and outbreak management in California. In addition, the fellow will have access to high-performance computing resources in Snowflake, which enables CDPH to run SQL queries analyzing vaccine coverage, laboratory results, and case surveillance within CalREDIE.

Projects

Surveillance Activity Title: Evaluation of Typhoidal Salmonella Cases in California Using Genomic and Epidemiologic Data

Surveillance Activity Description:
Between 2014 and 2022, California reported 49-97 cases of typhoid fever annually. As part of national foodborne pathogen surveillance, California public health laboratories perform Whole Genome Sequencing (WGS) on most Salmonella isolates. While WGS data are routinely generated, analyses beyond relatedness assessments have been limited.

Given concerns about persistent typhoidal Salmonella infections and emerging antimicrobial resistance (AMR), this project aims to integrate genomic data with phenotypic antimicrobial susceptibility testing (AST) results and case-level metadata. This approach will strengthen understanding of strain characteristics, resistance patterns, and epidemiologic trends.

Surveillance Activity Objectives:
Compile and analyze typhoidal Salmonella case data, including hospital and public health laboratory AST results.

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Collaborate with CLS laboratorians to evaluate Salmonella Typhi and Paratyphi isolates for:

- Genetic relatedness and clustering
- Temporal trends and evidence of persistent infections
- Predicted antimicrobial resistance profiles

Surveillance Activity Impact:
This project will enhance California's typhoidal Salmonella surveillance by linking genomic, laboratory, and epidemiologic data. Findings will inform future genomic epidemiology studies and improve detection of AMR trends, pathogen virulence factors, and demographic shifts in case distribution. Ultimately, this work will strengthen public health response strategies and contribute to national efforts to monitor and control typhoidal Salmonella.

Surveillance System Evaluation Title: Improving Hantavirus Pulmonary Syndrome Surveillance: Reporting Patterns, Diagnostic Accuracy, and System Gaps

Surveillance System Evaluation Description:
Hantavirus Pulmonary Syndrome (HPS) is a rare but severe respiratory illness caused by New World hantaviruses, primarily Sin Nombre virus, transmitted via aerosolized rodent excreta. In California, HPS cases are reported through CalREDIE by laboratories and healthcare providers. From 2010-2025, ~45-50 cases were recorded but reporting sources and trends remain unclear.

Early symptoms (fever, myalgia, headache, GI issues) can rapidly progress to ARDS, requiring advanced interventions such as ECMO. Unfortunately, clinical manifestations of HPS overlap several other illnesses. Yet, accurate diagnosis is critical for optimal patient management and public health response, including vector control. A 5-Point Peripheral Blood Screen (thrombocytopenia, left-shifted neutrophils, hemoconcentration, immunoblasts/plasma cells >10%, absence of toxic granulation) as a presumptive tool have shown high accuracy (sensitivity 96%, specificity 99%) for HPS but unknown how often clinicians use this scoring system.

The CSTE case definition for confirmed HPS cases include the detection of hantavirus-specific IgM or a fourfold rise in IgG, detection of hantavirus RNA by RT-PCR, or detection of hantavirus antigen by immunohistochemistry in tissue. There is a high rate of Hantavirus-specific IgM, however, when testing is done at commercial labs. Anecdotally we know that some of the "false positive" IgM cases have triggered clinicians to initiate higher level of care and transfer. Historically, commercial labs were required to submit IgM-positive specimens to the state VRDL for confirmation; this requirement was recently removed, despite VRDL data showing >70% false-positive rate for commercial IgM tests.

The fellow will collaborate with CDPH Vector-Borne Disease Section and CLS's VRDL to evaluate reporting patterns, diagnostic accuracy, and the impact of policy changes on surveillance quality. For cases deemed to be false positive, the fellow will examine whether health care providers initiated different care based on the IgM and will evaluate costs associated with these false positive test results. Important stakeholders include commercial labs, health care providers, vector control agencies and CSTE.

Surveillance System Objectives:

1. Assess reporting sources for HPS cases in CalREDIE over the past 15 years (laboratory vs. clinician vs. both).A summary report identifying gaps in reporting and actionable recommendations to improve completeness and timeliness of case reporting.
2. Evaluate the use and diagnostic performance of the Five-Point Peripheral Blood Screen by comparing results in confirmed HPS cases versus false-positive IgM cases.
3. An analysis of Five-Point Screen utilization and accuracy, with recommendations for its integration into clinical practice and surveillance protocols.

4. Determine the unintended consequences of false-positive HPS IgM results, including associated costs and medical interventions. A report quantifying healthcare costs, resource utilization, and clinical actions triggered by false-positive results.
5. Analyze the impact of removing confirmatory testing requirements on surveillance data quality and case classification. An evaluation of changes in case definitions, data integrity, and diagnostic accuracy, with policy recommendations to strengthen surveillance.

Surveillance System Impact:
This evaluation will strengthen California's Hantavirus Pulmonary Syndrome (HPS) surveillance system by identifying gaps in case reporting, diagnostic practices, and laboratory confirmation processes. Findings will inform strategies to improve data quality, reduce false-positive results, and optimize clinical decision-making. By assessing the use of the Five-Point Peripheral Blood Screen and analyzing the effects of policy changes, the project will provide actionable recommendations to enhance surveillance accuracy and support timely public health interventions.

Major Project Title: Strengthening Public Health Response to West Nile Virus: Advancing Diagnostics and Clinician Education

Major Project Description:
West Nile neuroinvasive disease includes encephalitis, meningitis, meningoencephalitis and acute flaccid paralysis. Accurate and timely diagnosis is critical for patient management and public health surveillance, yet current methods have significant limitations in terms of timeliness and potential for false positive and false negatives.

Serologic testing remains the primary diagnostic tool, but antibody cross-reactivity with other flaviviruses and prolonged IgM persistence can lead to false positives. Although more specific antibody testing (i.e., plaque reduction neutralization test) can be used to help assess flavivirus cross-reactivity, the tests are only available in public health laboratory and take up to a week to perform. Use of IVIG in suspected autoimmune encephalitis cases further complicates interpretation of serologic tests, and immunocompromised patients may fail to mount detectable antibody responses. While rRT-PCR testing usually can be completed in less than a day and offers higher specificity, commonly tested sample types (serum, plasma, CSF) have poor sensitivity because viral titers decline rapidly and often not present after neurological symptom onset.

Over the past two years, our laboratory (CLS's VRDL) has demonstrated that rRT-PCR on whole blood provides significantly improved sensitivity for detecting West Nile virus (WNV) over an extended period post-onset compared to CSF, plasma, and serum (manuscript in progress). Specifically, our study shows that WNV can be detected in whole blood for at least 28 days post symptom onset, with 94% sample positivity within the first week post symptom onset, 96% in week 2, 95% in week 3, and 100% in week 4. In contrast, only 5% of CSF, 7% of serum, and 9% of plasma samples were positive within the first week of symptom onset for the same individuals. Similar results have been reported in other states. Some European countries are also starting to include whole blood PCR in their diagnostic algorithms. In contrast, only a few small U.S. laboratories currently offer this testing. Expanding access will require collaboration with major commercial laboratories and extensive clinician education to shift diagnostic practices.

This initiative is ideally suited for a CSTE fellow based at CLS, as it bridges laboratory science and epidemiology. The fellow will spearhead coordination with the CLS team, engage the Center for Infectious Disease's arbovirus epidemiologists, and partner with the Centers for Disease Control & Prevention, Division of Vector-Borne Diseases (DVBD) (who are aware and supportive of this initiative) to drive implementation and promote nationwide adoption of whole blood PCR for WNV diagnostics.

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Major Project Objectives:

- Develop recommendations for integrating whole blood PCR results into CSTE case definitions and surveillance protocols.
- Develop educational materials and outreach strategies for healthcare providers and epidemiologists to increase awareness and utilization of this method.
- Quantify the impact of improved diagnostic sensitivity on WNV case detection and surveillance data quality.
- Analyze epidemiologic trends in neuroinvasive WNV cases using enhanced diagnostic methods and compare with historical data.

Major Project Impact:
Improved diagnostic accuracy and surveillance for West Nile disease through adoption of highly sensitive whole blood RT-PCR, leading to better patient management and enhanced public health response.

Additional Project #1 Title: Assessing the Public Health Impact of Emerging Respiratory Variants through Genomic Surveillance
Project #1 Type: Major Project

Project #1 Description:
Respiratory viruses and bacteria cause significant illness and death. Many clinical laboratories use multiplex respiratory pathogen panels (RPPs) to detect multiple pathogens, and CDPH aggregates this data from major hospital and clinical labs for public reporting (Respiratory Virus Report). While this information is valuable for public health and healthcare providers, it lacks detailed characterization-such as RSV subtypes, adenovirus genotypes, and differentiation between enterovirus and rhinovirus.

To address this gap, the CLS launched the Enhanced Respiratory Laboratory Surveillance (ERLS) program three years ago. ERLS collects positive samples from clinical labs and applies advanced molecular methods, including next-generation sequencing (NGS), to characterize circulating respiratory pathogens.

RPP-positive samples include influenza, RSV, adenovirus, parainfluenza, enterovirus/rhinovirus, and Mycoplasma pneumoniae. The program's goal is to achieve genomic resolution for some of these pathogens similar to what was occurred during the COVID-19 pandemic. For example, RSV genomic tracking is now critical with the introduction of monoclonal antibodies and vaccines. Additionally, in collaboration with CDC, antimicrobial resistance testing has been performed on several hundred Mycoplasma pneumoniae samples.

Of the 15,000 samples received by ERLS, testing has been completed on approximately 6,000, but most of the resulting data has not yet been shared with stakeholders because it requires proper formatting and integration. This presents a major opportunity for a CSTE fellow to take the lead in organizing and preparing these large, complex datasets for public health use. The fellow will actively collaborate with CLS genomic data scientists to package and prepare data for sharing by integrating multiple result types (pathogen-specific PCR, Sanger sequencing, subtyping PCR, and metagenomics) into public health surveillance systems. In addition, the fellow will develop visualization tools to track trends and analyze sequencing data to identify mutations and emerging variants.

Project #1 Objectives and Expected Deliverables:

- Integrate molecular (including WGS) from ERLS into other state-wide surveillance systems.
- Develop dashboards and data visualization tools for key respiratory pathogens.
- Monitor and report emerging pathogens' mutations, emerging variants, and recombination events for key respiratory pathogens.
- Develop Communication tools for Stakeholders.

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Project #1 Impact:
The Enhanced Respiratory Laboratory Surveillance (ERLS) project strengthens public health preparedness by delivering detailed molecular and genomic characterization of respiratory pathogens beyond traditional diagnostics. By integrating genomic data into existing surveillance systems and effectively communicating findings to key stakeholders, the CSTE fellow will help realize this potential. Enhanced surveillance enables timely assessment of vaccine effectiveness for diseases such as RSV, informs clinical decision-making for infections such as Mycoplasma and supports evidence-based policy to prevent and control respiratory disease outbreaks.

Additional Project #2 Title: Drug Overdose Epidemiology: Integrating Clinical Toxicology and Street Drug Surveillance
Project #2 Type: Surveillance Activity

Project #2 Description:
Drug overdose remains a leading cause of preventable death, driven by an increasingly unpredictable illicit drug supply involving synthetic opioids, novel psychoactive substances, and polysubstance use. Clinical toxicology data reveal substances contributing to overdoses, while illicit drug testing provides early warnings of market changes. These data are rarely analyzed together, limiting situational awareness.

CLS's Environmental Labs conducts state-of-the art testing on samples from individuals with suspected overdoses and on illicit drug samples to determine their chemical composition. Since 2022, CLS labs have analyzed over 600 patient samples (from overdose patients). And starting in 2025, launched a related program which tests street drugs -these methods are able to detect dozens of different illicit drugs not picked up by other laboratory methods.

This project integrates clinical overdose toxicology results with illicit drug testing data to identify exposure patterns, emerging threats, and populations at greatest risk. Using epidemiologic methods, the fellow will analyze de-identified data from two sources: (1) blood and urine samples from overdose patients and (2) street drug samples collected through public health and law enforcement surveillance. Analyses will include descriptive statistics, trend and time-series evaluations, and stratification by geography and demographics. Findings will inform surveillance, prevention strategies, and public health response.

Project #2 Objectives and Expected Deliverables:
- Describe temporal trends in drugs and drug combinations detected in overdose samples especially as it pertains to emerging substances and adulterants.
- Compare substances in street drug samples with those in overdose patients to assess concordance and timing.
- Examine demographic and geographic patterns of drug exposures and polysubstance use.
- Surveillance summaries highlighting key trends and emerging threats including data visualizations for public health and health care providers.

Project #2 Impact:
Linking clinical overdose outcomes with illicit drug market data will strengthen surveillance, enhance early warning systems, and support more effective prevention and response efforts in California. Linking clinical overdose outcomes with illicit drug market data will strengthen surveillance, enhance early warning systems, and support more effective prevention and response efforts in California.

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

CLS laboratories are integral to California's public health preparedness and response, primarily through rapid identification and confirmation of infectious disease pathogens. Beyond testing, CLS provides leadership in surveillance

for high-impact pathogens such as Sin Nombre virus, West Nile virus, respiratory viruses, and Salmonella. Several proposed projects in this application aim to strengthen these capabilities by improving surveillance systems and diagnostic strategies.

CLS also works closely with California's extensive network of local public health laboratories, providing technical support and readiness for anticipated or ongoing threats such as avian influenza, measles, and West Nile virus. The fellow will help CLS enhance preparedness by evaluating lab-based surveillance systems and strengthening collaboration with the Center for Infectious Diseases.

Mentorship and Field Opportunities:
Dr. Shua Chai, the fellow's secondary mentor from the Center for Infectious Diseases, Division of Communicable Disease Control, will actively involve the fellow in outbreak investigations, including foodborne disease clusters and other field epidemiology opportunities. These experiences may include participation in larger emergency responses such as hepatitis A, Zika, COVID-19, mpox, and H5 influenza. The Center houses epidemiologic and clinical subject matter experts for most communicable diseases in California, ensuring robust mentorship and hands-on experience.
We anticipate these activities will comprise approximately 30% of the fellow's time, providing a unique opportunity to integrate laboratory-based surveillance with applied epidemiology and emergency response.

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

Similar to CLS's role in preparedness and response outlined above, CLS almost always play a pivotal role in infectious disease cluster and outbreak investigation and works closely with Center for Infectious Diseases.

While we cannot predict which pathogens will lead to cluster and outbreak, we know one will occur. The CSTE fellow can play a critical role in this process.

We anticipate that these activities will comprise approximately 20% of the fellow's time.