Infectious Diseases, Injury-Drug Overdose

**Multnomah County Health Department, Public Health Division, Community Epidemiology Services**

Portland, Oregon

**Assignment Description**

This Fellow is assigned to the Multnomah County Health Department’s (MCHD) Community Epidemiology Services (CES) and Communicable Disease Services (CDS) Investigations Team within the Public Health Division. Epidemiologists in CES and the division work across and within the core public health programs in the Department. Through this assignment, our CSTE Fellow can pursue diverse opportunities over the course of their fellowship. We ground the position in Communicable Disease work to assure the chance to participate in the fast-paced setting of disease and outbreak investigations. By positioning the fellow with both CES, the centralized epidemiology unit, and the CDS Investigations Team, the Fellow will have the opportunity to integrate their CDS portfolio through activities that have touchpoints in other content or subspecialty methodology (e.g., ESSENCE surveillance). Our professional development philosophy is to train fellows as an integral member of the team of epidemiologists and public health professionals who work on the frontlines of public health. Opportunities to collect, analyze, and interpret public health data in ways that directly affect disease control and prevention programs, and are used to advise public health policy abound. We have access to a broad range of data sources, ranging from communicable disease surveillance (for the entire Portland metropolitan area) and vital statistics to electronic health records and medical examiner data. We also work with partners to assess information from programs as diverse as refugee health, ambulance transports, and syringe exchanges. Options also exist to design and implement epidemiologic studies of one’s own design.

This fellowship assignment emphasizes a population-level public health perspective for health promotion and harm reduction in our community. Specific benefits to the Fellow include development in the following competency areas: advanced applied epidemiologic research methods and techniques; strong biostatistical skills; evaluation and research design; quantitative and qualitative survey methodology; communication skills; scientific writing; expert knowledge of public administration principles, best practices, and procedures appropriate to departmental scientific and technical research/evaluation practices; principles and practices of effective leadership; knowledge of scientific and technical management principles and practices for project management, strategic planning, facilitative leadership, data visualization, and other functions; and knowledge of federal, state, and local laws, and regulations related to public health practice. The Fellow in this assignment may lead public health surveillance assessments, investigations, and applied public health research; and support the planning and implementation of public health services and response. We encourage the sharing and learning and information through professional networks for example, through attending meetings and conferences, and submitting to peer-reviewed journals.
**Day-to-Day Activities**

MCHD will involve the Fellow in day-to-day activities and research projects that provide hands on applied epidemiology experience. Functional responsibilities include:

- Performing epidemiologic studies and developing public health surveillance systems;
- Participating in or leading the response to public health and communicable disease events such as foodborne outbreaks or occurrences of novel disease conditions;
- Providing consultation to county leaders and staff on scientific, analytic, and technical aspects of epidemiologic investigations and public health surveillance;
- Working with program managers and community partners to develop or modify health interventions, policies or programs based on epidemiologic findings;
- Working with partners across the Health Department to explore the intersections between communicable disease and other aspects of public health (i.e., environmental health, chronic disease, etc.);
- Writing and preparing materials for internal reports, public information, peer-reviewed journals and presentations;
- Participating in internal and external meetings as needed to involve project stakeholders and to learn how public health systems operate.

In addition, we support our fellows in responding to national opportunities that arise through CSTE and CDC requests.

**Potential Projects**

**Surveillance Activity**
**HIV-Syphilis-HCV-Shigella Syndemic: The Intersection of Illicit Drug Use, Housing Insecurity, and Sexual Behaviors**

Since 2018, the Portland metro area experienced sustained increases in new diagnoses for HIV, Syphilis, Hepatitis C, and Shigella. Intersecting behavioral and demographic factors including poly substance use (methamphetamine, heroin), housing instability, and sexual behaviors have been identified as potentially contributing to this syndemic (synergizing epidemic). However, existing routine case interviews for Syphilis and HIV lack sufficient granularity and specificity to provide appropriate resolution of the factors and populations (or sub-populations) driving the disease related increases. As a result, Multnomah County in conjunction with state and local partners have developed and are implementing enhanced questionnaires that will be used to better capture the behaviors and demographic factors among individuals affected by this syndemic.

The CSTE fellow will have the opportunity to analyze these data to determine relative or overlapping behavioral and demographic risk factors between syphilis, shigella, and HIV cases (cross sectional cohort/nested case-case analyses). In parallel, the Multnomah County Harm Reduction Clinic are implementing complementary behavioral surveys with individuals visiting the clinic or their syringe exchanges (N=400). As a result, the Fellow will have the opportunity to merge data sources and implement an IVDU sub-analysis to perform a matched case-control study to identify behavioral risk factors for new HIV or Syphilis acquisition among people using injection drugs. Findings from these
related analyses will help inform prevention strategies, highlight separate transmission chains/overlap among cases, and help to better identify behavioral factors associated with HIV or Syphilis acquisition.

**Surveillance Evaluation**

**Evaluating Giardiasis Disease Reporting and Local Epidemiology: Is Giarda a Sexually Transmissible Enteric Infection (STEI)?**

Giardiasis is a diarrheal illness caused by the parasite Giardia lambia. Infections are acquired through the fecal-oral route where individuals inadvertently consume fecal contaminated water or direct contact with infected animals or persons. Giardiasis is a reportable condition in Oregon with >150 cases reported each year in the Portland metropolitan area. Person-to-person transmission of Giardia among adults is thought to be uncommon and international travel and untreated water consumption are low prevalence exposures with limited opportunity for public health intervention. Therefore, no formal investigation is routinely performed for Giardia.

In recent years, Multnomah County has employed novel methods to estimate sexual transmission of enteric infections among men who have sex with men (MSM) by utilizing person-centric age and gender distributions in conjunction with historical sexually transmitted infection (STI) disease reporting data. Using this methodology, we estimate that propagated sexual transmission commonly occurs for Shigella and possibly Giardia. Specifically, about 20% of adult giardiasis cases have historical STIs compared to the expected baseline of 6-9%. Given the myriad ways Giardia can be acquired, this historical STI prevalence is quite high. Thus, sexual or intimate transmission of Giardia may have an unappreciated public health impact resulting in considerable morbidity. Therefore, there is a need to understand common sources of giardiasis and to estimate the population attributable fractions (PAF) for relevant exposures and sexual transmission among adults.

The primary laboratory test for Giardiasis is a combined Cryptosporidium and Giardia antigen test (ImmunoCard STAT!). Previous cryptosporidiosis investigations in Portland have revealed that over 50% of reported cases tested with ImmunoCard STAT! are false positive (poor predictive value positive [PVP] for reported cases). Poor PVP for cryptosporidiosis case investigations has resulted in low quality surveillance/baseline data, waste of resources, and ethical dilemmas regarding case investigations reinforcing false diagnoses for individuals with other diarrheal etiologies. Predictors of false positivity for cryptosporidiosis are a lack of high-risk exposures, advanced age, and chronic diarrhea (undefined illness onset). It is unclear how well the ImmunoCard STAT! test performs for the Giardia component, but limited studies have suggested higher specificity.

For this project, the CSTE fellow will have the opportunity to evaluate Giardia lab reporting and capture relevant clinical, behavioral, and demographic features of the population with positive Giardia test results. This project will involve performing a power and sample size analysis, developing an enhanced Giardia case interview, reviewing and abstracting case medical charts, performing primary case interviews, and employing a matched nested case-case analysis methodology to:

1. Evaluate the relative PVP for Giardiasis case reports by comparing clinical features, illness timelines, and exposure prevalence between giardiasis cases and cryptosporidiosis cases and test type.
2. Estimate the Giardia PAF for high risk exposures including sexual activity and compare demographic and behavioral risk factor prevalence for Giardiasis relative to Shigellosis and/or Syphilis cases.
At completion of this project, the Fellow will have evaluated PVP of Giardia disease reporting, identified clinical features of adult cases, estimated PAF for different high-risk exposures, provided foundational evidence around the frequency of sexual transmission, and identified behavioral and demographic factors that overlap or differentiate Giardia relative to Shigella or Syphilis.

Major Project Integrating Reportable Communicable Disease and Syndromic Disease Data for Outbreak Detection, Message Evaluation, or Enhanced Prevention

Oregon ESSENCE is a syndromic surveillance system that captures most emergency department and urgent care center visits in the State of Oregon. This system has been utilized for situational awareness by health departments to monitor acute healthcare utilization for specific public health concerns based on reported patient symptoms (chief complaints), nursing assessment (triage notes), and provider interpretation (discharge diagnosis) during outbreaks or other public health events. Ideally, syndromic surveillance queries sensitively and specifically detect syndrome or disease specific healthcare utilization that is not captured by disease reporting OR detects known conditions before laboratory reporting (early identification).

Traditionally, syndromic queries have been developed based on published symptoms or best guesses about the disease syndrome of interest. Queries have then been validated by attempting to fit query data to previous disease specific events. However, developing queries with this approach is subject to biases (healthcare system, patient, disease timeline, etc.) and may miss related diagnoses or common misdiagnoses resulting in uninterpretable data or, worse, false situational awareness (type II or type I error respectively). Indeed, considerable uncertainty exists around interpreting syndromic surveillance data for diseases that are not pandemic (i.e. influenza) OR without a) low incidence, b) high proportions of acute care utilization, and c) distinct pathognomonic disease features present at time of healthcare utilization. In contrast, reportable disease data provide accurate and more interpretable data due to the increased specificity of laboratory confirmed diagnoses. Unfortunately, increased specificity comes at the expense of sensitivity since many reportable diseases have high proportions of illnesses that go undiagnosed.

Previously, we hypothesized that by connecting retrospective laboratory reportable disease data with syndromic data for reported cases, we could identify disease specific features including frequency of healthcare utilization and disease specific chief complaints, triage notes, and discharge (mis)diagnoses. These data could then be used to provide more accurate situational awareness by understanding the frequency of acute care utilization and by developing queries with maximized discriminative ability for the disease of interest (specificity and sensitivity). To test this hypothesis, we successfully developed a methodology to link these complementary data systems together. Subsequently, we have been able to rule out the use of ESSENCE for Cryptosporidiosis (inadequate acute care utilization), while successfully using this methodology to identify a mumps outbreak and perform extensive healthcare system mediated active case finding for vaccinated individuals with mumps who were misdiagnosed at their acute care visit.
Based on the success of this approach, we have identified multiple CSTE fellow projects that can build upon this methodology:

1. **ESSENCE based machine learning query development**: This project will successfully merge reportable disease data with ESSENCE healthcare visit data to identify populations of true cases. The ESSENCE patient characteristics (chief complaint, triage, discharge diagnoses) for these true case visits will then be used to train supervised machine learning algorithms to identify disease-like illness. These algorithms will be prospectively trained as new case reports are received (continuous learning). Thus, machine learning will be employed to search through ESSENCE visits to find individuals that presented to an ED or UC with symptoms that the algorithms statistically estimate are disease-like (e.g., Shigella, Pertussis, etc.). Once developed, these algorithms will be used to identify true cases, potential outbreaks, or provide situational awareness for ongoing outbreaks. Success of this approach will be prospectively evaluated during outbreak investigations by performing algorithm based active case finding with acute care systems.

2. **ESSENCE based evaluation of public health messaging during health events**: Since 2015 Multnomah County Health Department has had multiple public health events that necessitated provider and public based messaging (Shigella, Cryptosporidiosis, Measles, Mumps, HIV, Syphilis, etc.). However, the impact of provider-based messaging on public health responses has not been evaluated. For this project the CSTE fellow will utilize ESSENCE and reportable disease merges to identify queries and terms to develop general disease specific ESSENCE queries. Populations of disease-like ESSENCE visits will then be retrospectively reviewed and scored to determine whether acute care provider diagnoses, clinical suspicion, testing, or patient chief complaints were significantly impacted after messaging (i.e., comparing pre and post messaging intervention ESSENCE terms for changes). This project will evaluate whether messaging influenced diagnoses (reached target population) as well as whether provider and public based messaging during a public health response biases the specificity of ESSENCE queries. Overarching question: is there evidence that public health messaging was received by acute care providers? If so, did this messaging positively or negatively impact the predictive ability of the ESSENCE query?

3. **Estimating acute care utilization and systematically identifying disease-specific queries or missed diagnoses**: This project will involve merging reportable disease data from 2015-2019 with ESSENCE data from the same timeframe (e.g., Hepatitis A, B, C). True case visits will be used to identify populations of key terms that can be used for parameterizing ESSENCE queries. Importantly, the Fellow will identify acute care visits that preceded diagnosis for true cases to determine clinical criteria for visits where true case diagnoses were missed. The goal would be to develop guidance for providers to aid in more timely diagnosis and potentially reduced illness severity or secondary spread (secondary and primary prevention respectively). Successful completion of this project will involve:
   - Estimation of the disease specific rate of acute care utilization
   - Determination of the representativeness of case demographics relative to the disease base population (are ESSENCE population demographics biased compared to laboratory reported cases?)
Defining populations of ESSENCE key terms that are statistically overrepresented among true cases relative to general or existing queries

Identifying ESSENCE visits that precede diagnosis and associating clinical, behavioral, or demographic features with delayed disease diagnoses.

**Major Project Community Engagement: Developing Community Relationships with Populations Disproportionately Impacted by Communicable Diseases**

Communicable disease case investigations and outbreaks in Multnomah County often impact diverse populations. For example, Multnomah County has worked on outbreaks of Measles and Pertussis among vaccine hesitant Slavic populations, Tuberculosis and Mumps among the Micronesian community, Shigella among men who have sex with men (MSM), as well as Hepatitis A prevention, HIV, Syphilis, Shigella, and Hepatitis C among persons experiencing housing instability and poly substance users. Language, social, and cultural barriers as well as government mis-trust can limit effective prevention, disease control, and outreach. Therefore, there is a need for public health to engage directly with communities to:

1. Effectively work with communities during public health events even if their beliefs are at odds with core public health recommendations (e.g. vaccine hesitant populations)
2. Understand cultural beliefs and ideals related to health and prevention
3. Develop trusting relationships of mutual respect
4. Provide culturally sensitive and relevant health messaging
5. Understand appropriate avenues and language for communication during a public health event

For this project the CSTE fellow will identify population specific health disparities and develop a community engagement project employing semi-quantitative and qualitative methods via surveys, focus groups, and/or systematic key informant interviews to directly engage with these populations to achieve the above objectives. Successful completion of this project will result in community relationships and workflows for public health to successfully engage with and communicate to diverse populations. Examples include:

A. Working with Slavic communities to improve cooperation and disease control during public health events. Instead of focusing on increasing vaccine trust (ongoing work elsewhere) this project would involve building trust with public health to ensure cooperation with contact elicitation, home isolation, etc. during vaccine preventable disease events
B. Communicating risk and prevention of sexually transmissible Giardiasis among MSM if found to be an important contributor to disease morbidity (as elucidated from the Giardiasis surveillance evaluation activity listed above).
C. Engagement with the Micronesian community for effective communicable disease outreach.
D. Others as identified by CSTE fellow or community partners.
Surveillance Activity  Opiate Surveillance

Oregon has some of the highest national rates of heroin and nonmedical prescription opioid usage. Given the national opioid epidemic and the high rates of local usage in Multnomah County, there is a need to develop a surveillance system to provide better resolution of opiate usage and opioid related health outcomes (e.g., Self-Injury outcomes) in the Portland area.

This project gives the CSTE Fellow an opportunity to think creatively and analytically by using multiple data sources (e.g. Medical Examiner, Ambulance, Prescription Drug Monitoring, Emergency Visit, Treatment, Syringe Exchange, Poison Center, and Vital Statistics data) to create Multnomah County’s Opiate Surveillance System. Utilizing multiple data streams, the fellow will develop tools to monitor opioid related events across Multnomah County and work to define the relationships between usage and health related outcomes among the different data systems. Ideally these findings can help inform prevention or harm reduction strategies.

The Fellow will have an opportunity to work with multiple partners including Multnomah county epidemiologists and the Oregon Public Health Division to develop and validate queries in our syndromic surveillance system, ESSENCE (see description above under the major project), to capture and assess opiate related acute care visits.

To improve situational awareness, disseminate data, and enhance the opioid surveillance system, the fellow may work to develop data visualizations (Tableau or other), maps (ArcGIS, Tableau), and/or statistical algorithms to help identify changes in opioid related events.

The Fellow will also be given the opportunity to work with leadership, other Portland metro counties, and our Health Officer to make recommendations on how these data can be used in our programs, policies and education efforts.

Preparedness Role

The Fellow will have the opportunity to participate in emergency preparedness and response activities, both within Communicable Disease Services and in the wider Health Department. The Fellow will have access to online Incident Command trainings. The Fellow may be called upon to represent the Multnomah County Health Department at the local, state, and national level in matters affecting multi-agency public health emergency preparedness planning and response activities.
**Additional Activities**

Epidemiology projects on other topics are limited only by the imagination of the applicant. Pertussis disease modeling, altered clinical presentation, and transmission is a particular area of opportunity, as Multnomah County is a participant in a Centers for Disease Control and Prevention (CDC) national enhanced surveillance system (called MAPS).

Other areas of interest include but are not limited to: Shigella and Hepatitis A disease modeling; Shigella clinical outcomes and disease presentation; Gonorrhea epidemiology as Multnomah County is a site for the CDC SSuN grant focusing on enhanced surveillance for gonorrhea; Hepatitis C epidemiology surveillance, re-infection, and treatment outcomes; baseline information on TB screening and LTBI treatment in primary care settings (related to recent recommendation for TB screening by US Preventive Health Taskforce); TB outbreak investigations; Campylobacter epidemiology and surveillance; Hepatitis B in persons from endemic countries; case-case analyses to compare risk or behavioral factor overlap between diseases to define populations disproportionately impacted by multiple diseases; the epidemiology of conditions affecting recently-arrived refugees; suicide surveillance; homelessness and displacement; firearm related injuries; cost-effectiveness of respite care for homeless persons ill with a reportable infectious disease; and cancer cluster investigations or other chronic disease projects.

**Mentors**

**Primary**

Frank Franklin BS, MPH, PhD, JD

Principal Epidemiologist, Director Community Epidemiology Services

**Secondary**

Russell Barlow BS, MPH, MS

Epidemiologist