

**ID: 59651813**

**Wastewater Surveillance, Infectious Diseases - Host Site Description**

**Wisconsin Department of Health Services**

**Assignment Location:** Madison, US-WI  
Wisconsin Department of Health Services  
Bureau of Communicable Diseases

**Primary Mentor:** Ian Pray, PhD, MPH  
Career Epidemiology Field Officer (CDC), Director of the Wisconsin Wastewater Surveillance Program  
Bureau of Communicable Diseases, Wisconsin Department of Health Services

**Secondary Mentor:** Rachel Klos, DVM, MPH  
Epidemiologist  
Bureau of Communicable Diseases, Wisconsin Department of Health Services

**Work Environment**

Hybrid

**Assignment Description**

The CSTE Applied Epidemiology Fellow will be assigned to the Communicable Diseases Epidemiology Section (CDES) within the Bureau of Communicable Diseases (BCD). BCD is responsible for the prevention and control of communicable diseases in Wisconsin. In total, the Bureau provides surveillance and epidemiological follow-up of more than 80 reportable communicable diseases.

The Fellow's assigned section, CDES, is responsible for maintaining and improving surveillance for most communicable diseases. This includes the wastewater surveillance program, which is managed by staff within CDES, and will be the primary assignment for the Fellow. Within the wastewater program, the Fellow will work alongside a small team of epidemiologists who are responsible for receiving, analyzing, and communicating wastewater data for the public and stakeholders. Currently the team consists of a lead epidemiologist (Ian Pray, primary mentor), a program manager, and 2 staff epidemiologist. The Fellow will have ample opportunities to learn and grow with this dedicated team. Activities will include assisting with maintenance and upgrades to the program's public data dashboard and surveillance reports to local health departments. The wastewater epi team also leads larger analytical projects to advance our understanding of wastewater data by comparing wastewater levels with hospital and laboratory data. The Fellow will have the opportunity to lead analytical projects in this field.

Beyond the wastewater activities, the Fellow will have the opportunity to integrate with other epidemiologists at CDES across a wide variety of disease areas. CDES's responsibilities include the epidemiologic investigation and response to: foodborne, waterborne, vectorborne, respiratory, mycotic, zoonotic, and invasive diseases; as well as most emerging and re-emerging diseases and communicable disease outbreaks.

The Fellow will be assigned physical space in CDES but will have flexibility to work remotely. Hybrid work schedules will have flexibility and may vary depending on the given project needs. Field work opportunities most commonly occur during outbreak situations. When appropriate, every effort will be made to facilitate the Fellow's participation in field work such as vector surveillance, on-site assessments or environmental sampling which are conducted as part of routine surveillance or an investigation. Wastewater-related field work will be available in the form of site-visits to laboratories and utility to improve engagement with stakeholders. Attendance at off-site meetings and conferences is encouraged, and will be available through a variety of wastewater-related workshops and site visits that occur throughout the year.

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Daily activities in BCD beyond the wastewater surveillance assignment, particularly early in the Fellowship, will be related to the Fellow's surveillance activities and major projects, learning the basics of disease surveillance, and becoming familiar with the various data sources and surveillance tools. With the mentors' guidance, the Fellow will develop an in-depth understanding of wastewater surveillance, and more broadly, a variety of communicable disease surveillance systems. Although not a primary duty, the Fellow may have the opportunity to conduct some routine or outbreak-related patient interviews to become familiar with this important component of surveillance. The Fellow will also be involved in the establishment, evaluation, or improvement of several additional disease surveillance systems.

With progressive gains in expertise, the Fellow will be encouraged to identify additional projects of interest during their fellowship. The Fellow will be expected to attend and participate in bi-weekly communicable disease meetings with the other program areas in CDES, bi-weekly wastewater surveillance program meetings, national and regional CDC wastewater surveillance calls, and encouraged to attend other meetings within the CDES that are of interest such as routine meetings with the Midwest Center of Excellence for Vectorborne Diseases, and gatherings of the BCD Epidemiology Community of Practice. While both mentors are available at any time and would expect routine contact with the Fellow, weekly meetings will be scheduled to review progress, discuss the work plan, and ensure any needs are being addressed.

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

We are committed to helping the Fellow develop analytical expertise. CDES staff routinely use SAS and R applications for epidemiologic purposes. While not used routinely, SPSS and STATA are available to the Fellow upon request. The fellow will have opportunities for training and to grow their abilities in these systems. Epidemiologists, statisticians, and other analysts within CDES and throughout the Division of Public Health are willing and able to provide technical support. The Fellow will have the opportunity to access and use multiple databases and data visualization tools such as Tableau. Work conducted within BCD will intensively use the Wastewater Surveillance database, an integrated SQL server that houses all of Wisconsin's wastewater data, and Wisconsin Electronic Disease Surveillance System (WEDSS), which is the State's web-based disease reporting and management system and is the system to which cases of reportable diseases are reported, laboratory data and electronic case reports are submitted, and case interview data are entered. The Fellow should also expect to use either SAS or R depending on their preference. Depending on specific project needs other potential data sources that may be accessed include vital statistics, hospitalizations, emergency department visits, EMS data, immunization registry, BRFSS, poison control center calls, cancer registry, birth defects registry, and air and water quality datasets. In addition, the Fellow will be encouraged to use ArcGIS or Tableau to visualize and map health data, and training courses for ArcGIS are available in-house.

**Projects**

**Surveillance Activity Title: Weekly wastewater surveillance reports for public health partners**

*Surveillance Activity Description:*

The Fellow will assist in the development and dissemination of weekly wastewater surveillance reports for wastewater partners. This weekly surveillance report is a tool used to inform local health departments and participating wastewater treatment facilities about local trends of SARS-CoV-2 in their area. Partners use the reports to communicate SARS-CoV-2 levels to local officials and make local public health recommendations. The reports also serve as a key touchpoint between the state-based surveillance program and local utilities who collect and ship the wastewater samples, allowing utilities to see the results of their work and receive direct communication from our program.

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The current version of the report contains a variety of graphical displays of SARS-CoV-2 concentrations over time for each local sewershed, along with comparisons against statewide wastewater levels. However, the report has not been significantly updated in over 2 years. As the wastewater program expands, we now conduct testing for influenza A and B, RSV, norovirus I and II, adenovirus, and genomic sequencing for SARS-CoV-2. Within the next 2 years, it is likely that several additional pathogen targets will be added to this list. The first task of the Fellow on this project will be to work with the wastewater epidemiology team to incorporate new graphics and metrics for newly added targets. Such updates could include a wide variety of data visualizations for displaying trends, categories, alerts, maps and other features for the new pathogen targets. Beyond the addition of targets, the Fellow may eventually work to add other useful features to these reports, including comparisons against available clinical or syndromic surveillance data, or comparisons against regional or national trends using CDC data.

Throughout this process, the Fellow will be encouraged to engage with both internal and external partners to gather ideas and test visualization methods. As a national wastewater Center of Excellence, the Wisconsin wastewater surveillance program collaborates frequently with other centers of excellence and CDC's National Wastewater Surveillance System; the Fellow will be able to work with epidemiologists across these networks to gather ideas and feedback on the format and communications presented in the report. The Fellow will also have the opportunity to present drafts and gather feedback from local health departments and utilities in order to better tailor the content to local needs.

*Surveillance Activity Objectives:*

The Fellow will:

- Understand the structure of the wastewater surveillance network in Wisconsin and be able to access and analyze wastewater data stored in our state wastewater database (this will help for future analyses)
- Update the current weekly wastewater surveillance report to include newly added pathogen targets
- Engage with national partners (wastewater centers of excellence) and local stakeholders (local health departments and utilities) to generate ideas and gather feedback for report

*Surveillance Activity Impact:*

Updating the weekly wastewater surveillance report to include currently monitored respiratory and enteric pathogens will immediately benefit local public health and healthcare partners who rely on knowledge of virus levels to inform public health decisions. Making this update will also reinforce the value of our wastewater utility partners, which is critical for maintaining their interest and commitment to our program. This project will also serve as an excellent introduction to the wastewater surveillance system in Wisconsin for the Fellow, which will set the Fellow up for impactful future analyses of wastewater data.

**Surveillance System Evaluation Title: Evaluating electronic case reports (eCRs) for routine disease surveillance and developing data validation methods.**

*Surveillance System Evaluation Description:*

Electronic case reporting (eCR) is the automated transmission of case report information from electronic health records (EHRs) to public health agencies. The implementation of eCR for a wide range of reportable diseases is a key component of data modernization efforts at the state and federal level. Electronic case reporting has been used for COVID-19 reporting in Wisconsin for several years. To date, automated eCRs have been received for only a small number of other conditions and eCRs have not been formally implemented for any vector-borne disease surveillance. Expansion of eCR reporting to a development environment for other diseases and conditions began in late 2023 and included erythema migrans (EM) rash. The goal of this project is to evaluate the performance of eCR reporting for EM rash surveillance during its initial 6-12 months, make recommendations for improving the process, and to use the lessons learned from

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the EM rash eCR evaluation to help develop data validation methods, in collaboration with other epidemiologists in the Bureau, that can be used more broadly when on-boarding eCRs for other vector-borne and non-vector-borne diseases.

The most common tickborne disease in the U.S. and in Wisconsin is Lyme disease, caused primarily by *Borrelia burgdorferi sensu stricto* and rarely by *Borrelia mayonii*. A new national case definition for Lyme disease surveillance was implemented in 2022, which resulted in laboratory-based only surveillance in Wisconsin for national case reporting. Because of this, cases identified solely by the characteristic EM rash often seen in Lyme disease cases are no longer included in Wisconsin's national surveillance reporting. However, Lyme disease can be diagnosed and treated in Wisconsin, and in other high-incidence Lyme disease states, based on EM rash alone and does not require laboratory testing. These clinically diagnosed cases, identified via physician-diagnosed EM rash, remain reportable in Wisconsin for state surveillance purposes. Based on data from the first two years using the new case definition, we believe EM rash is being significantly under-reported using traditional case reporting methods. With this recent change to surveillance and reporting practices, our goal is to use alternative data sources to identify provider-diagnosed EM rash reports while not increasing the reporting or investigative burden on partner agencies Automated eCRs have the potential to significantly improve disease reporting, especially for conditions where significant under-reporting is a concern, such as EM rash. As time and interest allows, the Fellow may also be able to expand their project to explore options for using eCRs to more fully characterize other clinical features of Lyme Disease. This project will afford the Fellow many valuable learning and quality improvement opportunities, including developing their analytic skills, informing future processes to modernize surveillance methods, and collaborating with other epidemiologists in BCD who are also working on eCR projects.

*Surveillance System Objectives:*

- Prepare a written summary for the Vectorborne disease (VBD) program summarizing EM rash data from the project period, including completeness of demographic data, timeliness of EM rash diagnosis to receipt of the eCR, predictive value positive for the report, and other key findings.
- Conduct eCR data validation with several representative health systems to determine if that health system can discontinue traditional case reporting of EM rash.
- Help to develop written methods and a checklist that can be used to standardize or create a framework for data validation of eCRs for the VBD program and other programs in BCD.
- Prepare and present findings of this project within DPH, to either the BCD Epidemiology Community of Practice or another similar group, and if deemed appropriate, submit an abstract to the Annual CSTE conference or other relevant public health conference.

*Surveillance System Impact:*

The Fellow's project will be critical toward helping the VBD program evaluate the full utility of eCRs and identify gaps that can be addressed to improve its overall function. Additionally, the lessons learned from this project will allow the Fellow to also work with other epidemiologists in BCD to create new data validation methods and a framework for the process that can then be used and applied moving forward within other program areas. This will be critical as data modernization efforts using eCR continue.

**Major Project Title: Wastewater surveillance network optimization (and other analytical projects)**

*Major Project Description:*

The Fellow will work closely with our wastewater epidemiology team at DHS through the fellowship period, and will have several opportunities to complete analytical projects using wastewater data. The epidemiology team maintains a long list of analytical projects that utilize wastewater data and are each critical to various aspects of the wastewater surveillance system. All of these potential projects would have public health impact both within Wisconsin and to the broader national wastewater epidemiology community. The wastewater epidemiology group meets weekly to discuss and review progress on these projects, and add new projects as needs emerge.

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Below are listing a few of the high-impact project that are available to the Fellow if interested:

**==Assess the demographic and socio-economic representativeness of the wastewater network in Wisconsin==**

The wastewater network in Wisconsin includes 45 wastewater treatment facilities that represent approximately 60% of the state's population. Wastewater treatment facilities were selected for participation during the COVID-19 pandemic response, when the priority was to identify and onboard new sites quickly. While sites were intentionally selected to promote geographic coverage with urban and rural representative, a formal analysis of the representativeness of this surveillance system has never been conducted. This project would aim to describe the current demographic profile of the populations represented within participating sewersheds - including age, race, ethnicity, rurality, socio-economic status, and other available indicators - and compare this profile to the statewide population in order to identify gaps in representation. This analysis would utilize spatial data for sewershed boundaries linked to publicly available demographic data available by census tract or zip code. Results from this analysis will be used to describe the current population served by wastewater surveillance in Wisconsin to interpret disease monitoring metrics, and will be used to make recommendations to adjust the locations of sites to improve representatives or include previously under-represented groups.

**==Optimize the wastewater network through evaluating sentinel sites==**

The current network of 45 wastewater treatment facilities in Wisconsin submitting twice weekly samples is incredibly valuable but costly to maintain (large number of samples), and requires many smaller, less equipped, facilities serving small populations to contribute samples. A more efficient sentinel surveillance structure with fewer sites representing a smaller proportion of the Wisconsin population could provide significant cost-saving on core monitoring activities, while allowing for staff and budget to focus on other critical projects. It could also allow for development of closer relationships and expertise among a smaller group of high performing sites. However, we have not yet evaluated the impact of reducing site coverage on the performance and utility of our wastewater system as a whole. Critical questions that would have to be answered before embarking on such a transition include: How much would accuracy and variability in the statewide or regional SARS-CoV-2 concentrations change when sites were removed? Which sites are more or less influential on the stability and quality of regional and statewide metrics, and therefore should be candidates for retention or removal from the current system? Are these optimal networks different for different pathogen targets and surveillance goals (e.g., routine monitoring, surge and emergency response)? More broadly, what would be the benefits and drawbacks from adopting a sentinel system like this, both in terms of the data, representativeness of the system (see above project), and relationship-building among local populations and stakeholders? Such questions could be approached through a detailed analysis of SARS-CoV-2 levels and other pathogen targets across the network, and comparing concentrations at the sewershed level (individual sites) against with geographically proximal sites, regional trends (within state) and statewide averages. The results of this analysis would be used to guide network optimize, sentinel site selection, and methods of aggregating wastewater findings at the regional and state level.

**==Internal dashboard for public health decision-making==**

The COVID-19 Wisconsin wastewater dashboard is the program's flagship public-facing dashboard showing SARS-CoV-2 levels across the state. During 2024, plans are in place to add influenza A/B and RSV to this public-facing dashboard. While this public dashboard will be a critical tool for the public and wastewater partners, there is a current need to develop for advanced and detailed metrics to aid in decision-making and communications, particularly during outbreaks and emergency responses. For this project, the Fellow would develop an internally-facing dashboard for health department staff and close partners that displays detailed metrics, trends, and visualizations not available to the public. This project would start with SARS-CoV-2, influenza, and RSV as core respiratory targets that require detailed monitoring during the respiratory seasons, but could expand to other wastewater targets at the program expands. The Fellow would be encouraged to collaborate with external partners across the wastewater Centers of Excellence to

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gather data visualization ideas, and solicit feedback from both internal and external partners on a final design of the internal dashboard.

*Major Project Objectives:*

- Provide recommendations to the wastewater surveillance team for optimizing the wastewater network to improve demographic and socio-economic representativeness of the wastewater network
- Make recommendations of the wastewater surveillance team about the overall size of the wastewater network and the impact on data quality of dropping sites
- Engage will national partners (wastewater centers of excellence) and local stakeholders (local health departments and utilities) to generate ideas and gather feedback for report
- Draft a manuscript related and submit a conference presentation for at least one of the above projects

*Major Project Impact:*

Two of the three projects above relate to evaluating and improving the wastewater surveillance network. These projects are critical to the sustained success of the wastewater program. Without adequate representation of all demographic and socio-economic groups in Wisconsin, the wastewater data and their application to public health actions become limited, and the system may lose the support and credibility of the population it serves. Assessing the representativeness, and adjusting the network to optimize representative if needed would be a major advancement in our network structure, and would serve as a model for other states, promoting both representativeness and equity within our surveillance system. Similarly, optimizing the wastewater network around a sentinel system would provide value for data quality, data interpretability and efficiency, and could serve as a model for other states and CDC to adopt. Finally, completing a detailed internal wastewater metrics dashboard would facilitate public health decision-making during critical public health responses, allowing for our program to effectively communicate wastewater data and data-driven insights to support public health responses across Wisconsin.

**Additional Project #1 Title: Evaluation and Summary of Jamestown Canyon Virus Surveillance**

**Project #1 Type: Major Project**

*Project #1 Description:*

Jamestown Canyon Virus infection (JCV) is a reportable mosquito-borne arboviral illness in Wisconsin and nationally. Wisconsin reports the highest number of JCV cases on average compared to any other state, but there have also been an increased number of human cases reported in other states in the Upper Midwest and Northeast in recent years. Clinical presentation of JCV is nonspecific and diagnostic testing for JCV at commercial laboratories is currently not available. To improve detection of JCV cases, Wisconsin DHS has conducted enhanced arboviral disease surveillance since 2011. DHS requests patient specimens be forwarded from commercial laboratories to the Wisconsin State Laboratory of Hygiene for additional testing if there was non-confirmatory laboratory evidence of an arboviral infection. Medical records are also requested and reviewed for all JCV cases with confirmatory laboratory evidence of infection. Enhanced arboviral disease surveillance has both improved case ascertainment but has also identified potential limitations of the confirmatory lab criteria used to differentiate between current and previous infections. Preliminary review of the JCV data suggest that a significant proportion of cases that meet the current confirmatory case criteria for JCV are not likely current JCV disease cases. A systematic review and analysis of these data are needed, followed by evidence-based recommendations for updates or changes to the case definition and surveillance plan.

National JCV surveillance data contributes to the characterization of this rare and emerging illness, and since Wisconsin reports the highest number of JCV cases on average, evaluation of our data is critical to both in-state and national understanding of JCV surveillance and risk. Furthermore, significant resources are required by DPH to obtain laboratory specimens and review medical records for enhanced surveillance activities. This highlights the importance of optimizing JCV surveillance in Wisconsin. The fellow will evaluate enhanced JCV surveillance activities with the goal of identifying

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process changes to improve surveillance data quality, specificity, sensitivity, and efficiency. The results of the surveillance evaluation will be summarized and shared in multiple formats, including posters or presentations and written publications. Results will also be used to inform discussions about possible changes to the arboviral disease national standardized case definition.

*Project #1 Objectives and Expected Deliverables:*

The Fellow will:

- Describe and characterize the current use of WEDSS for JCV case surveillance and assess gaps or variations in its use for case investigation across local jurisdictions and for enhanced surveillance activities.
- Summarize the impact of enhanced surveillance on JCV incidence, distribution, clinical features, and demographics.
- Recommend WEDSS and enhanced surveillance process improvements.
- Recommend changes to the arboviral disease national standardized case definition to optimize JCV surveillance.

*Project #1 Impact:*

The Fellow's work will improve the efficiency and data quality of JCV surveillance in Wisconsin, giving health care providers and the public more accurate information about disease burden, seasonality, clinical features, and risk factors. This work will also provide useful data to initiate and inform future discussions about national surveillance changes for arboviral diseases.

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

The state's emergency preparedness program is located in the Office of Preparedness and Emergency Health Care. This office works closely with staff in BCD and funds staff in many areas of public health including CDES staff. CDES regularly collaborates with and participates in preparedness activities. The Fellow will have the opportunity to meet with these staff to learn more about the program and will be encouraged to complete ICS trainings and other trainings as they are available. If actual events occur requiring activation of emergency preparedness plans, the Fellow would likely be an active participant in a response. Depending on the Fellow's interest in preparedness and response efforts and responses during the Fellow's time at DHS, time allocation may range from a few hours of trainings and exercises to several weeks of full-time preparedness responses efforts. Past fellows have contributed significantly to the COVID-19 response, mpox response, lung injury response (2019), and many more over the past decade.

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

The Fellow's placement within the Communicable Diseases Epidemiology Section (CDES) assures they will have ample opportunity to gain experience conducting effective outbreak investigations from experienced epidemiologists. One important responsibility of the section is to respond to acute health events. It is important that all Fellows placed in CDES have the opportunity to learn these important skills. In particular, the enteric diseases program investigates dozens of outbreaks (large and small) each year and the waterborne disease program routinely investigates multiple outbreaks of legionellosis. In recent years the section has also investigated outbreaks of blastomycosis, leptospirosis, toxoplasmosis, histoplasmosis, adenovirus, and hospital acquired infections among others. The Fellow will have the opportunity to participate in all aspects of an investigation from generating a hypothesis and developing a questionnaire and database, to interviewing cases, conducting data analysis, and writing the outbreak report. Depending on what occurs during the placement, and the particular interest of the Fellow, opportunities for participating in disease investigations could include, enteric diseases, legionella, healthcare-acquired infections, respiratory diseases, zoonotic

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or others. The Fellow should anticipate participating in, and leading, cluster or outbreak investigations during their fellowship.

**Please Describe the Fellow's Anticipated Role in the COVID-19 Response – Include Activities and Time Allocation**

While the COVID-19 response is no longer an active emergency response at the state or national level, the Fellow's role in wastewater surveillance will play a key role in one of the few activities (or response activities) that remain for COVID-19. The Fellow will be a core member of the team gathering COVID-19 wastewater data and communicating surveillance updates to stakeholders and public health leaders related to COVID-19. If future events lead to re-activation of the COVID-19 (or other responses) the Fellow will be encouraged to contribute to those efforts and their project goals will be adjusted accordingly.

**Please Describe Opportunities for Fellows to Work in Health Equity as well as Incorporating Diversity, Equity, and Inclusion into their Work**

Health equity is a major priority of DHS and DPH. The Fellow will have the opportunity to take part in health equity initiatives at the Division or Department level. The Office of Health Equity is a centralized hub that aligns and amplifies the diversity, equity, and inclusion efforts occurring across all DHS divisions and offices, and has staff that can help ensure the Fellow approaches projects through a health equity lens. One of the fellow's proposed major projects includes evaluating the wastewater surveillance system for demographic representativeness against the broader statewide population. This project will help our program identify gaps in representation of our data, which can be addressed to promote equity within or state and local public health systems.