

Master of Public Health

Applied Practice Experience

by

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MPH Candidate

submitted in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH

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6/9/2025 – 7/25/2025

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2025

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Chapter 1 - Portfolio Products

I completed my Applied Practice Experience with the Kansas Department of Health and Environment (KDHE) in Topeka, KS. My project focused on assessing the potential of wastewater monitoring for detecting West Nile Virus (WNV) in Kansas and evaluating global patterns of WNV and environmental surveillance. I worked mainly in the Bureau of Epidemiology and Public Health Informatics with Dr. John Anderson, a genomic and wastewater epidemiologist, along with the state public health veterinarian, Dr. Erin Petro. My responsibilities were to attend meetings, talk with other epidemiologists, present data related to my project, complete my training, and more. The documents that I produced with KDHE were maps of a global overview of West Nile Virus (WNV) and wastewater monitoring, spatial autocorrelation and average nearest neighbor reports, overview of dataset graphs, Autoregressive Integrated Moving Average (ARIMA) predictive graphs, time-series cross-correlation graphs, a literature review over WNV wastewater monitoring, and a presentation of our study to the Bureau of Epidemiology and Public Health Informatics.

Table 1.1 Summary of Portfolio Products

Portfolio Product		Description
1	Global Overview Maps of West Nile Virus and Wastewater Monitoring	The maps included six different maps to show a global overview of the impact of WNV with wastewater monitoring and environmental monitoring. This included the US, Canada, Europe, Asia, and Africa. Two maps included the mean center and spatial distribution for US, Canada, and Europe.
2	Average Nearest Neighbor Reports	The average nearest neighbor Geographic Information Systems (GIS) tool displays a spatial pattern of the reported human WNV incidence rates, based on whether those incidence rates show a dispersed, random, or clustered pattern.

3	Spatial Autocorrelation Reports	The spatial autocorrelation GIS tool generates a report measuring the reported human WNV incidence rate by state to discover if the rates were significantly clustered, significantly dispersed, or random.
4	Literature Review	Developed a paper intended to inform epidemiologists on previous research of wastewater monitoring for arboviruses, mostly WNV, and other diseases, to provide insight on the potential application of wastewater monitoring for WNV in Kansas.
5	Stock-and-flow Systems Thinking Diagrams	Created different systems thinking flow diagram for wastewater surveillance systems in Kansas, <i>Culex</i> mosquito surveillance in Kansas, bird surveillance for WNV (this surveillance is not performed in every state), and serological surveillance for humans and horses. The serological surveillance included how healthcare facilities report potential WNV cases in Kansas.
6	Statistical Analysis Graphs	The statistical analysis graphs included an overview graph of the datasets that included the wastewater WNV concentration data, google trends on mosquitoes and/or WNV data, serological surveillance (Immunoglobulin G & Immunoglobulin M), and bird observations on crows, blue jays, and robins. All datasets were set in Kansas. I also had a time-series cross-correlation graph and predictive model graphs.

7	Presentation	Created a presentation that informed KDHE epidemiologists of the initial results on the application of wastewater monitoring for WNV in Kansas.
8	Blog Posts	I wrote three blog posts on my experiences and skills I learned throughout my time at KDHE.
9	Final Stipend Report	Developed a final scientific report on my Applied Practice Experience, which included an abstract, introduction, methods, results, discussion, and conclusion.

Table 1.2 Portfolio Products and Competency Addressed

Portfolio Product		Number and Competency Addressed	
1	Global Overview Maps of West Nile Virus and Wastewater Monitoring	1	Apply epidemiological methods to the breadth of settings and situations in public health practice
5	Stock and Flow Systems Thinking Diagrams	22	Apply a systems thinking tool to visually represent a public health issue in a format other than a standard narrative
7 & 4	Presentation and Literature Review	19	Communicate audience-appropriate (i.e., non-academic, non-peer audience) public health content, both in writing and through oral presentation
8	Blog Posts	18	Select communication strategies for different audiences and sectors
9	Final Stipend Report	4	Interpret results of data analysis for public health research, policy or practice

Chapter 2 - Competencies

Table 2.1 Summary of MPH Foundational Competencies

Number and Competency		Description
1	Apply epidemiological methods to the breadth of settings and situations in public health practice	I applied spatial epidemiological methods to analyze the global impact of reported human WNV incidence rates and the global distribution of wastewater monitoring, producing maps and insights to inform KDHE epidemiologists.
4	Interpret results of data analysis for public health research, policy or practice	I translated the statistical and spatial analysis in a report for the Midwestern Public Health Training Center. The report provides valuable evidence for public health research on the potential application of wastewater monitoring for human WNV trends.
18	Select communication strategies for different audiences and sectors	I selected clear and concise communication for my blog posts to show the public health skills I gained at KDHE for public health students, public health officials, and the U.S. Department of Health and Human Services.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation to a non-academic, non-peer audience with attention to factors such as literacy and health literacy	I communicated the wastewater WNV monitoring results to public health professionals through an oral presentation and conveyed findings from a literature review on the potential application of wastewater monitoring for WNV.
22	Apply a systems thinking tool to visually represent a public health issue in a format other than a standard narrative	I applied a stock and flow systems thinking tool to visually illustrate wastewater-based monitoring, bird monitoring, human and equine monitoring, and mosquito monitoring.

Competency 1 – Geographic Information Systems software is a valuable tool in epidemiological practice for analyzing the spatial distribution of disease. I applied epidemiological methods using ArcGIS Pro to assess the global distribution of human WNV and wastewater monitoring implementation. This was accomplished by calculating incidence rates based on reported human WNV cases and population data that were used to visualize and analyze disease patterns across US states (specifically Kansas), Canada provinces, and European countries. I applied spatial statistic tools—including mean center and standard

distance—to evaluate the geographic distribution and central tendency of reported human WNV incidence rates in North America, Europe, and Kansas.

To further assess spatial patterns, I applied an average nearest neighbor and spatial autocorrelation analyses to determine whether human WNV incidence rates were statistically clustered, dispersed, or randomly distributed. These spatial analyses provided insight into potential epidemiological hotspots and helped identify potential areas for closer monitoring. Due to data limitations, I supplemented quantitative analyses with presence/absence classifications obtained from a literature review of human WNV circulation in Africa and Asia countries, classifying them as “Yes” or “No” based on available peer-reviewed sources.

To explore the global use of environmental and wastewater monitoring for WNV, I compiled geospatial data from wastewater monitoring dashboards in the US, Canada, and Europe; and conducted literature reviews for Africa, and Asia. I created point feature class to map countries that implemented or researched wastewater or environmental monitoring, effectively integrating spatial statistic methods and qualitative epidemiological data to inform a broader understanding of reported human WNV incidence and public health monitoring efforts worldwide. Although I initially selected Competency 3 (analyze quantitative and qualitative data), I transitioned to Competency 1 since the project emphasized the application of spatial epidemiology rather than qualitative analysis methods.

Competency 4 – This competency involves interpreting data analysis results in a way that informs public health research, policy, or practice. As a stipend recipient through the Midwestern Public Health Training Center, I developed a scientific report evaluating the role of wastewater monitoring for human WNV cases. My primary role was to interpret the results of both statistical and spatial analyses to assess whether wastewater could be a useful tool for monitoring human WNV trends. Through Autoregressive Integrated Moving Average (ARIMA) modeling, I discovered that wastewater WNV concentrations were significantly associated with reported human WNV cases in Kansas, with a five-month lead time. In contrast, the ARIMA model utilizing Google trends and immunoglobulin G testing data performed worse, highlighting the contribution of wastewater monitoring to human WNV trends for public health officials.

In addition to the time-series analysis, I interpreted spatial analysis results to assess regional clustering of human WNV incidence. Spatial autocorrelation revealed that human WNV incidence rates were randomly distributed in the US, Canada, and Kansas, suggesting no consistent spatial clustering in those regions. In contrast, Europe showed clear clustering, with a mean center located in Albania near the Mediterranean. These findings inform future public

health research by identifying areas where spatial patterns may support more targeted surveillance. I also incorporated global wastewater and environmental monitoring to visualize countries with implemented or researched environmental and wastewater monitoring methods. Together, these interpretations support further research into wastewater monitoring as a tool to understand trends in human WNV infections.

Competency 18 – This competency involves selecting appropriate communication strategies for different audiences and sectors. As part of my stipend from the Midwestern Public Health Training Center, I wrote a series of blog posts to communicate the technical work and public health skills I developed during my time with KDHE. The intended audience included public health students, public health officials, and the US Department of Health and Human Services. The blog posts were required to be both accurate and accessible.

To meet these needs, I selected several communication strategies. I applied plain language to explain complex methods like ARIMA modeling and GIS spatial analysis. I also included framing technical findings in terms of practical relevance for wastewater monitoring of human WNV trends for public health practice. I incorporated the ARIMA predictive graph to help my audience understand the statistical analysis I performed. I integrated real-world examples to maintain engagement across sectors. Each blog post was tailored to balance educational content for students and in-depth, technically accurate explanations for public health officials. These strategies enabled me to effectively translate research findings into meaningful public health narratives to support understanding in public health research and practice.

Competency 19 – At the end of my internship with KDHE, I delivered a professional presentation to public health staff with expertise in WNV and wastewater monitoring. I presented the results of our statistical analysis, illustrating that wastewater provides a better understating of human WNV trends. I explained the ARIMA model outputs, supported my points with predictive graphs and discussed next steps for KDHE's wastewater monitoring systems for WNV. In addition to the oral presentation, I developed a literature review to communicate the background and significance of wastewater monitoring for diseases, specifically WNV. I structured the review to inform both the KDHE team and public health professionals unfamiliar with wastewater monitoring and WNV, emphasizing how wastewater monitoring complements disease trends. Through both my oral presentation and literature review, I demonstrated my ability to convey complex public health data in a clear, engaging, and actionable way, tailored to a professional audience.

Competency 22 – At the start of my internship with KDHE, I applied systems thinking tools to create several stock-and-flow systems thinking diagrams representing mosquito surveillance, bird surveillance, human/horse infection surveillance, and wastewater monitoring. These visual models allowed me and others to conceptualize the different monitoring strategies used to track the spread of WNV beyond a traditional narrative. I incorporated the wastewater monitoring stock-and-flow diagram into my oral presentation to emphasize its relevance for public health agencies, while the other diagrams enhanced my understanding of multiple monitoring approaches across human and animal populations. These visual tools also provided my preceptors, who are experts in their respective fields, with a clear overview or complex interconnections within WNV monitoring systems. Additionally, I developed a stock-and-flow diagram for MPH 840 that illustrated the dynamics of wastewater monitoring for diseases in the community, further reinforcing my ability to translate public health issues into visual formats.

Table 2.1 MPH Foundational Competencies Course Mapping

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy or practice	x		x		
Public Health and Health Care Systems					
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					x
Planning and Management to Promote Health					
7. Assess population needs, assets and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design, implementation, or critique of public health policies or programs					x
9. Design a population-based policy, program, project or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify relevant communities and individuals and build coalitions and partnerships for influencing public health outcomes		x		x	x
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		x			x
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					
16. Apply leadership and/or management principles to address a relevant issue		x			x
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815				
19. Communicate audience-appropriate public health content, both in writing and through oral presentation to a non-academic, non-peer audience with attention to factors such as literacy and health literacy	DMP 815				
20. Describe the importance of cultural humility in communicating public health content		x			x
Interprofessional Practice					
21. Integrate perspectives from other sectors and/or professions to promote and advance population health		x			x
Systems Thinking					
22. Apply a systems thinking tool to visually represent a public health issue in a format other than a standard narrative			x	x	