



Communicating Wastewater Surveillance Information in Montana

Beth Hopkins

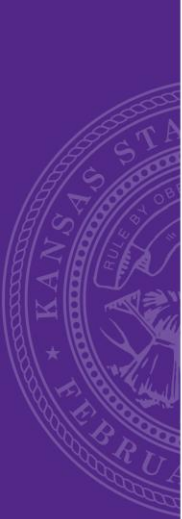
Master of Public Health Candidate

Infectious Diseases and Zoonoses

About Me

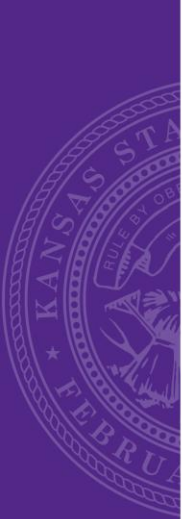
- Born and raised in Montana
- Education
 - Montana State University
 - Bachelor of Science – Cell Biology & Neuroscience
 - Kansas State University
 - Master of Public Health, Infectious Diseases and Zoonoses
 - Professional Interdisciplinary Studies Certificate
- Work





Presentation outline

- Overview of MT DPHHS CDEpi
- Wastewater Surveillance Overview
- APE Objectives and Products
- MPH Competencies
- IDZ Competencies
- Conclusion
- Acknowledgements

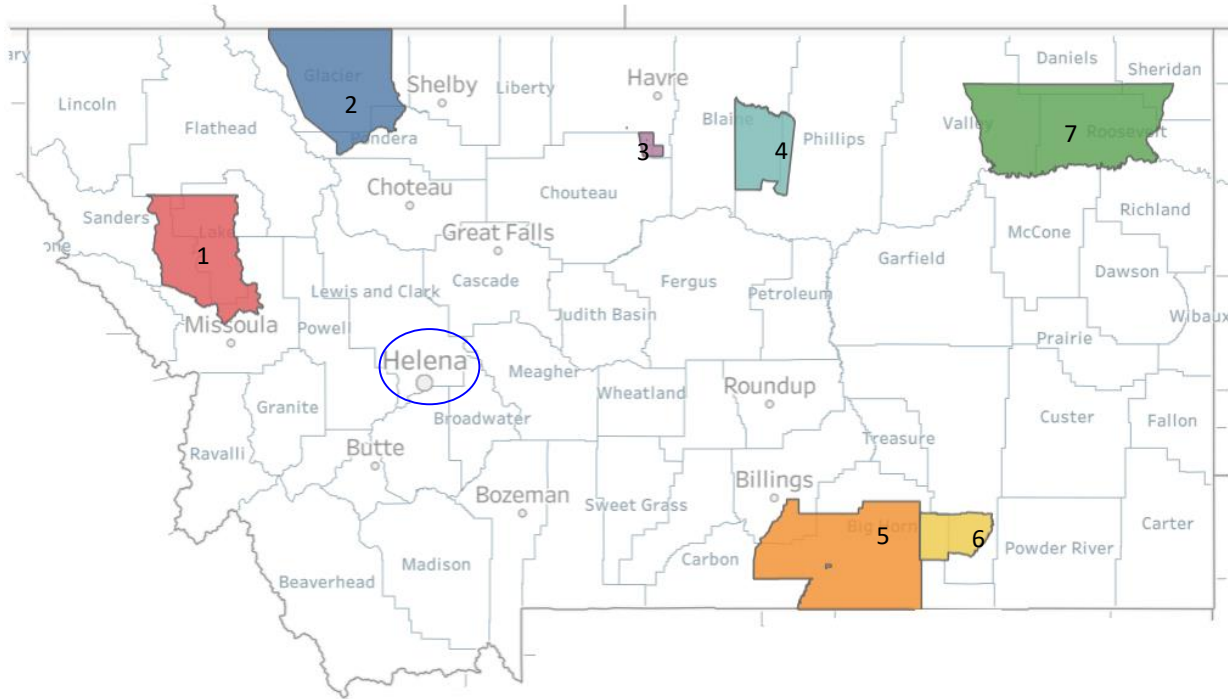


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Montana → Decentralized State

– 56 Counties - 12 Tribal Nations - 7 Reservations



1. Confederated Salish and Kootenai Tribes (CSKT)
2. Blackfeet
3. Rocky Boys
4. Fort Belknap
5. Crow
6. Northern Cheyenne
7. Fort Peck

Applied Practice Experience (APE)

- Montana Department of Public Health and Human Services (MT DPHHS)
 - Communicable Disease Epidemiology (CDEpi) Section
- Located in Helena, Montana (state capital)
- Dates: September 4, 2023 – October 20, 2023
- Preceptor: Rachel Hinnenkamp, MPH (lead epidemiologist)



DEPARTMENT OF
**PUBLIC HEALTH &
HUMAN SERVICES**



MONTANA
**COMMUNICABLE
DISEASE EPIDEMIOLOGY**



(Montana Historical Society, 2006)

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Overview of CDEpi

- Mission Statement

CDEpi's mission is "to create, maintain, support, and strengthen routine surveillance and detection systems and epidemiological investigation processes, as well as to expand these systems and processes in response to incidents of public health significance" (Montana Department, n.d.).

- Comprised of nine staff members

- including an administrative assistant, a nurse consultant, the section supervisor, a lead epidemiologist, and five additional epidemiologists.

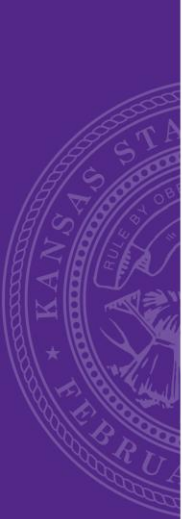
- Diseases they oversee

- respiratory, foodborne, vector-borne, waterborne, zoonotic, vaccine-preventable diseases, and more

- CDEpi's Role

- Decentralized state -> supportive role to local and tribal jurisdictions

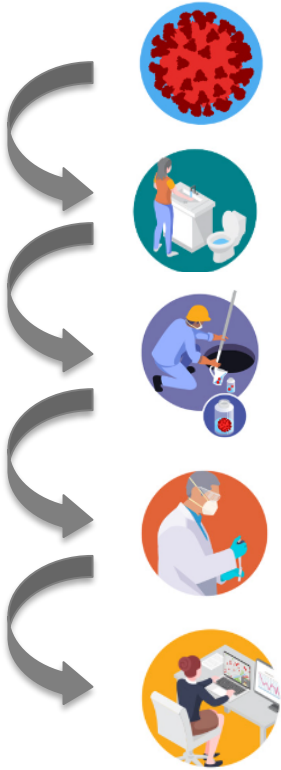




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Wastewater Surveillance (WWS) Explained



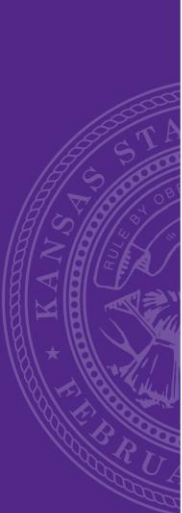
1. People can shed biomarkers (targets that are specific to a bacteria, viruses, - such as DNA, RNA, a protein) in their feces even if they don't have symptoms. (National, 2023)

2. The biomarkers in feces are flushed down the toilet and travels through the sewage system.

3. Before wastewater is treated, wastewater technicians take samples to get information about the biomarkers.

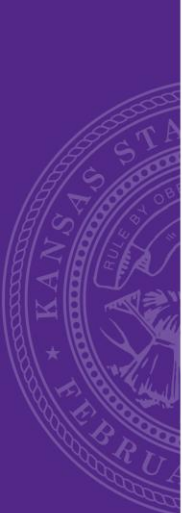
4. Laboratories test for the biomarkers and measure the biomarker levels in the wastewater.

5. Public health officials use wastewater data to better understand trends of the biomarkers in communities and make decisions, such as where to have mobile testing and vaccination sites.



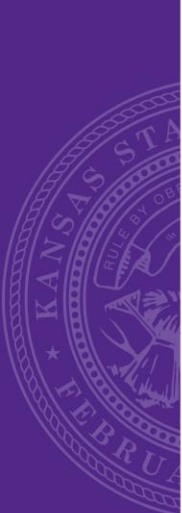
Wastewater Surveillance Background

- Detects and quantifies the presence of biomarkers (such as genetic material from bacteria or viruses) that are shed by an infected person in their feces (National, 2023).
- Wastewater/sewage
 - Includes water from household or building use (such as toilets, showers, and sinks) that can contain human fecal waste, as well as water from non-household sources (such as rain and industrial use) (Centers, 2023d).
- Polio eradication efforts in the 1940s was the initial push for wastewater surveillance (National, 2023).
 - COVID-19 was a recent catalysis to bring back wastewater surveillance (National, 2023).
- For COVID-19 in wastewater, PCR methods are used.



Benefits of WWS

- Nearly 80% of U.S. households use the public wastewater system (National, 2023).
- Independent of health care and testing
- Community-based data
- Forecast / predictive nature
- Best practice: use wastewater surveillance data in combination with other data sources
 - e.g., case data, hospitalization data, death data, syndromic surveillance (emergency room visits), community event and tourism information



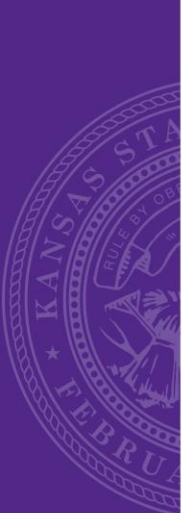
Limitations of WWS

- Concentration levels of biomarkers in wastewater does not directly translate to the number of cases in the community
- Data can be prone to errors -> weather diluting samples due to run off, “spiking” the sample when sewer tank dumps waste during sample collection
- No threshold point to trigger public health action for wastewater surveillance as a whole



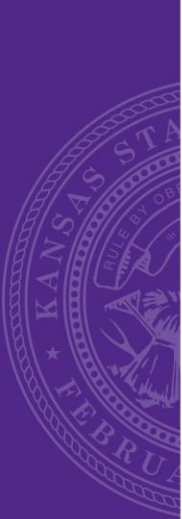
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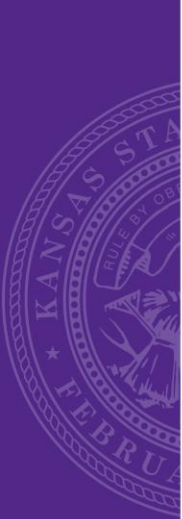
APE Objectives

- The primary focus areas of this project were to **increase knowledge of wastewater surveillance** and its role in public health action as well as to increase skills in **communicating wastewater information**.
- Expectations:
 - To attend internal meetings, National Wastewater Surveillance System (NWSS) meetings, a wastewater surveillance summit, onboard new testing sites, and report weekly laboratory wastewater data to NWSS.
 - To identify and execute plans to minimize the identified gaps in knowledge and resources.



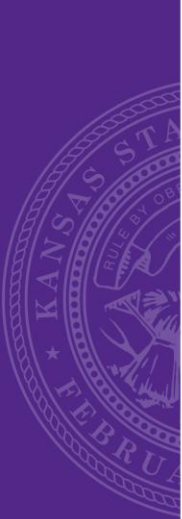
Montana's Program

- Federal funding
 - Epidemiology and Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases (ELC) Grant
- 6 active sites
 - Have had a wastewater sample collected in the past 6 months
- Additional sites in the onboarding process
- Targets testing
 - Primarily COVID-19 with interest in expanding to other targets
- Longest Established Testing Sites
 - Helena and East Helena in Lewis and Clark County
 - Testing since August 2020



Gaps in Knowledge and Resources

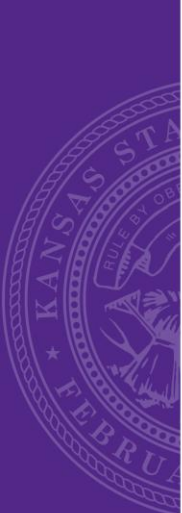
- Need for:
 - CDEpi internal flow chart of how the wastewater surveillance program runs
 - Montana specific web page of information for wastewater surveillance
 - Standard of communicating wastewater data to the public at the local and tribal health jurisdiction level
 - Trend comparison of wastewater surveillance and reported COVID-19 case data



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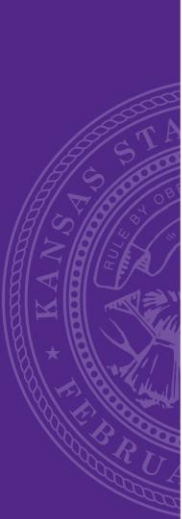


Creation of the Flow Chart

- Purpose: identify stakeholders and necessary steps in this program to help determine where roadblocks are occurring
- Internally created using a Canva template
- Information gathered from meetings with CDEpi section supervisor and preceptor
- While onboarding new sites, took notes of the steps and stakeholders involved

MONTANA'S WASTEWATER SURVEILLANCE PROGRAM FLOW CHART





Gaps in Knowledge and Resources

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The Importance of Communication

- Montana-based data and web page
 - Trusting local sources with local data
- Meeting people where they are at
 - Social media
 - 76% of surveyed Montanans reported using social media daily (Greater, 2019)

Montana Wastewater Surveillance Web Page

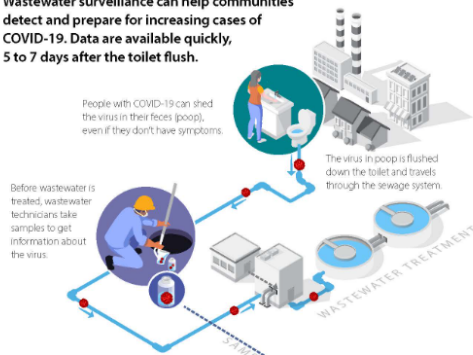
[Public Health & Safety](#) / [Communicable Disease Epidemiology](#) / [Diseases](#) / [Wastewater Surveillance](#)

Wastewater Surveillance

Wastewater surveillance is an important public health tool to track the spread of diseases in communities. This population-level data provides valuable insights into our communities without collecting person-specific data. This can help local public health agencies identify outbreak trends, direct prevention efforts to where they are most needed, and provide additional insight into disease spread that complements other public health surveillance data.

Wastewater Surveillance HOW DOES IT WORK? | COVID-19 |

Wastewater surveillance can help communities detect and prepare for increasing cases of COVID-19. Data are available quickly, 5 to 7 days after the toilet flush.



Collapse Menu



MONTANA
PUBLIC HEALTH
EMERGENCY PREPAREDNESS

Communicable Disease Epidemiology



To submit a question or comment to the Communicable Disease Epidemiology Program, please click on the suggestion box to access our online form.



[Diseases A-Z](#)



[Disease Reporting](#)

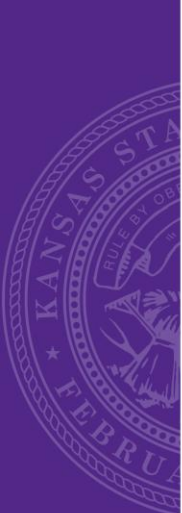


[Data and Reports](#)



[Infographics](#)

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What You Need to Know

What is wastewater?



How are diseases found in wastewater?



How is wastewater surveillance data used?



Resources



FAQS

How is the treated wastewater used when it leaves the wastewater plant? >

Treated municipal wastewater is used in a variety of different ways in Montana. It is used for agriculture, landscaping, centralized non-potable reuses, potable water reuses, impoundments (body of water within an enclosure), environmental restoration, and industry. These uses can be found and explained further here: [Regulations and End-Use Specifications Explorer \(REUSEExplorer\) | US EPA](#)

Wastewater Surveillance in Montana

Active* Sites in Montana Participating in Wastewater Surveillance Testing at of 10/2/2023

- East Helena
- Helena
- Livingston
- Chippewa Cree Tribe, Rocky Boy's Reservation in Box Elder
- City of Choteau
- Missoula

*Sites that have had a wastewater sample processed in the past 6 months

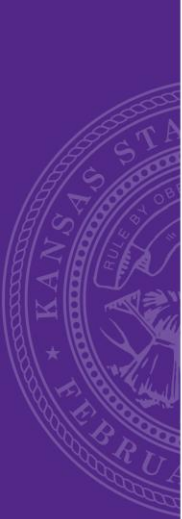
View the wastewater data [here](#).

Communicable Disease Epidemiology



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<https://dphhs.mt.gov/publichealth/cdepi/diseases/WastewaterSurveillance>



Gaps in Knowledge and Resources

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The Importance of Communication

- Montana-based data and web page
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- Meeting people where they are at
 - Social media
 - 76% of surveyed Montanans reported using social media daily (Greater, 2019)

Social media posts:

Posted by **any local or tribal health jurisdictions** for **any disease** to inform the **general public**.

Insert Logo Here

**The levels of (disease) in
(town's) wastewater have
(slightly, significantly)
INCREASED
compared to last week.**

scan or click for more information:

Insert Link Here

SCAN ME
Insert QR
Code Here

Insert Logo Here

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Social media posts:

Posted by **any local or tribal health jurisdictions** for **COVID-19** to inform the **general public**.

Insert Logo Here

**The levels of COVID-19 in
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Social media posts:

Example posts by “**Montana**” for **COVID-19** to give the local or tribal health jurisdictions a visual example.



The levels of COVID-19 in Montana's wastewater have
SLIGHTLY DECREASED
compared to last week.

scan or click for more information:
<http://bit.ly/mtdphsww>



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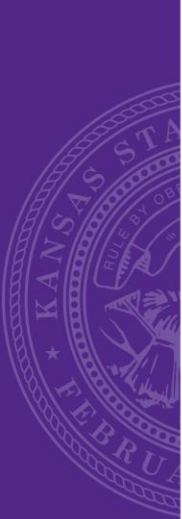
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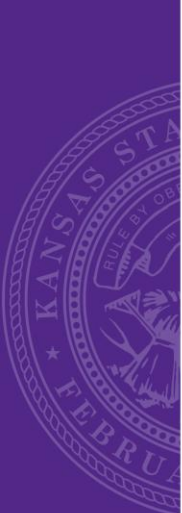




Gaps in Knowledge and Resources

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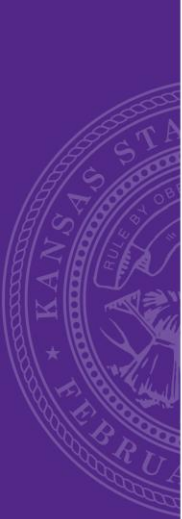
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Literature Review – Forecast Trends

Purpose: compare wastewater surveillance trends to reported COVID-19 case and hospitalization trends to determine its effectiveness in forecasting trend changes in clinical cases.

- Wisconsin: over 12 locations, that **no lead time** compared to clinical specimen collection dates (National, 2023).
- New Haven, Connecticut: **six-to-eight-days** ahead SARS-CoV-2 positive test result date, **zero-to-two-days** ahead of percent positive tests from specimen collection date, and **one to four days** ahead of local hospital admissions (Peccia et al., 2020).
- Sweden: **nineteen-to-twenty-one-days** ahead of hospitalizations (Saguti et al., 2021).
- Attica, Greece: **five-days** ahead of COVID-19 cases, **eight-days** ahead of hospitalizations, and **nine-days** ahead of Intensive Care Unit (ICU) admissions (Galani et al., 2022).



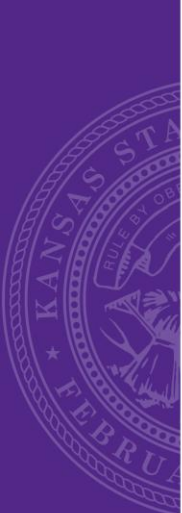
Trends – Collecting Data

Wastewater Surveillance Data

- Most Established Testing Sites:
Helena and East Helena
- Selected Date Range:
8/17/2020 – 8/16/2023
- Units: copies/ L wastewater
- Concentration Range: 0 to 241,818 copies/L wastewater

COVID-19 Reported Case Data

- Data pulled from the Montana Infectious Disease Reporting System (MIDIS)
- Filtered data
 - Helena and East Helena
 - Investigation Start Date
- Pivot Table (data analysis tool) in Excel to create Morbidity and Mortality Weekly Report (MMWR)



Trends

Helena

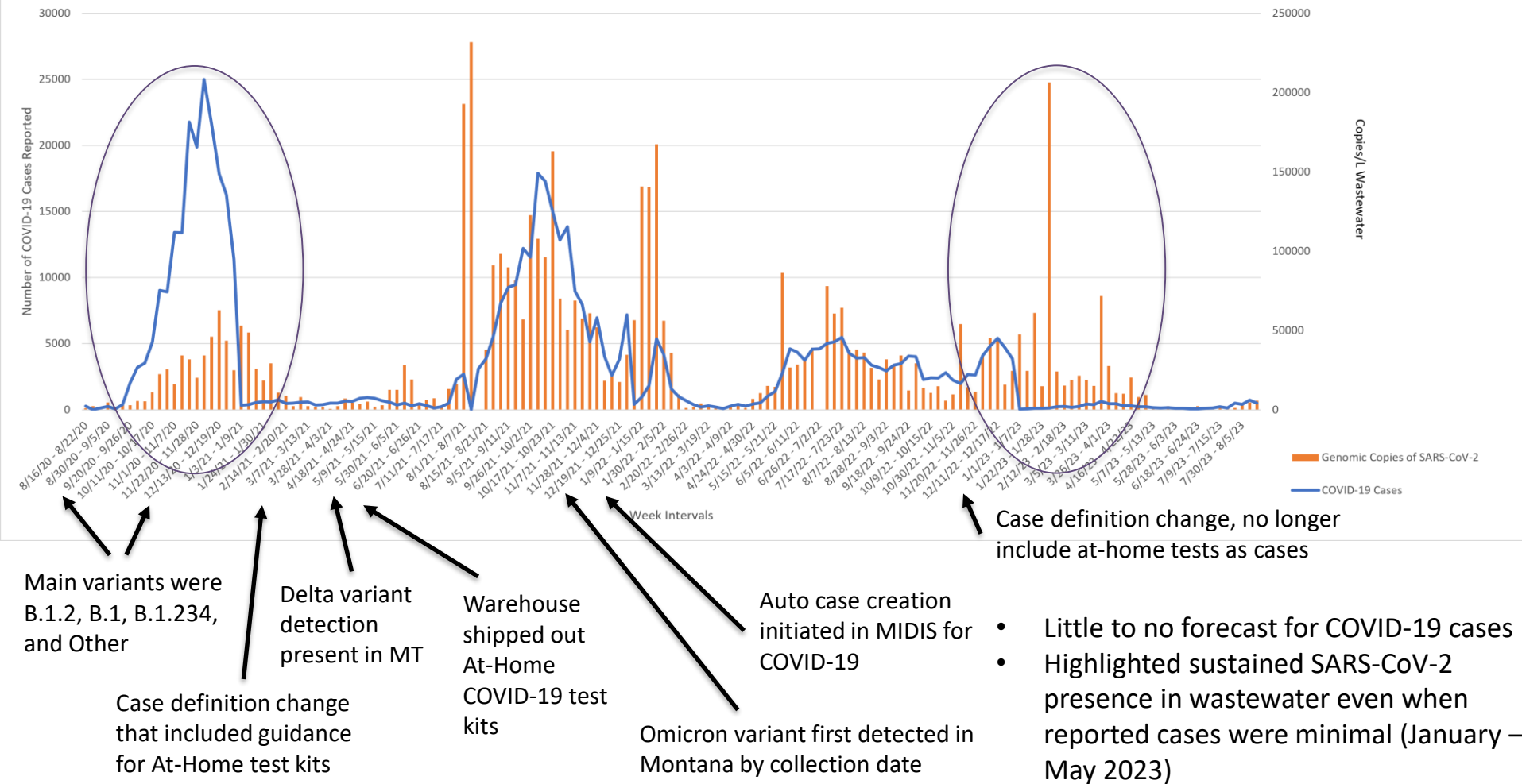
- Land Area: 16.8 sq miles
- Population Size: 32,362 in 2020
- Median Age: 39.9
- Race Demographics:
 - White: 91.71%
 - Two or more races: 4.79%
 - Native American: 1.16%
 - Other race: 0.84%
 - Asian: 0.82%
 - Black or African American: 0.68%
 - (World Population Review, n.d.b)
- Sewer shed population: 37,125 (Centers, 2023a)

East Helena

- Land Area: 4.0 sq miles
- Population Size: 1,935 in 2020
- Median Age: 42.8
- Race Demographics:
 - White: 94.29%
 - Asian: 2.79%
 - Two or more races: 1.82%
 - Native American: 1.09%
 - (World Population Review, n.d.a)
- Sewer shed population: 2,273 (Centers, 2023a)

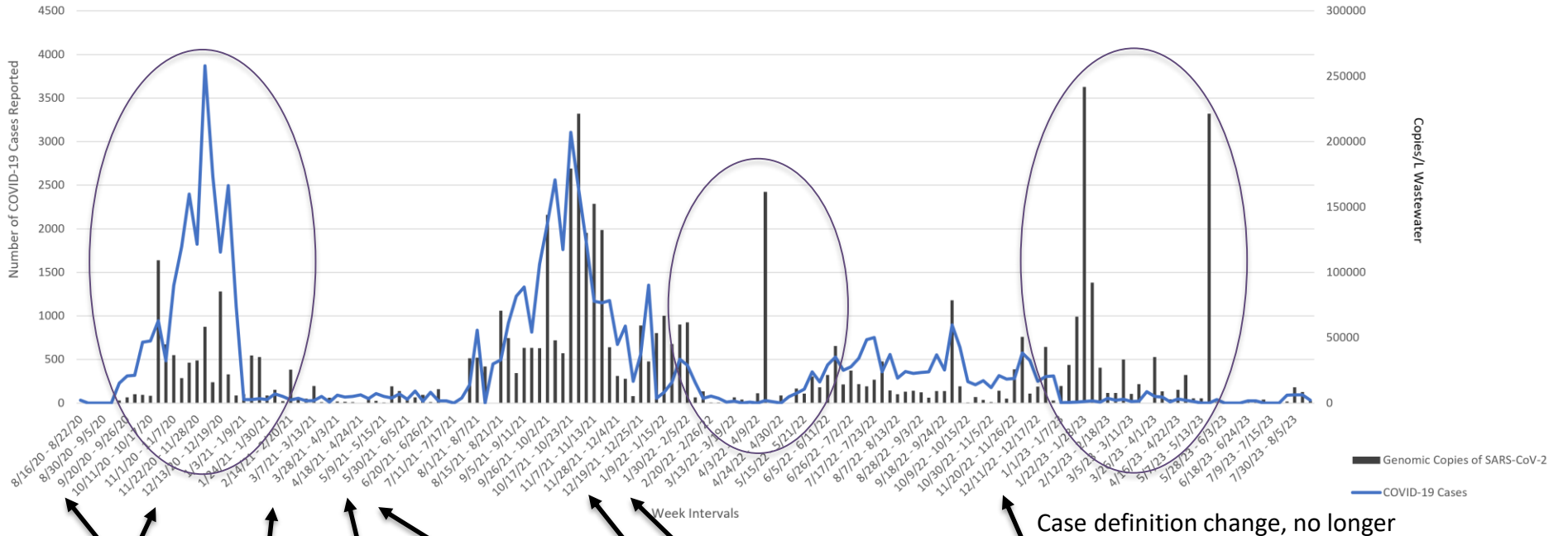
Helena

Trends of COVID-19 Cases and Wastewater Data in Helena, Montana
From August 16, 2020 through August 19, 2023



East Helena

Trends of COVID-19 Cases and Wastewater Data in East Helena, Montana
From August 16, 2020 through August 19, 2023



Main variants were B.1.2, B.1, B.1.234, and Other

Case definition change that included guidance for At-Home test kits

Delta variant detection present in MT

Warehouse shipped out At-Home COVID-19 test kits

Omicron variant first detected in Montana by collection date

Auto case creation initiated in MIDIS for COVID-19

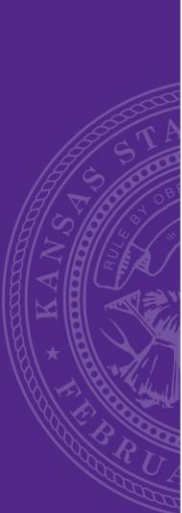
Case definition change, no longer include at-home tests as cases

- Little to no forecast for COVID-19 cases
- Helped Identify an Outlier (April 2022)
- Highlighted sustained SARS-CoV-2 presence in wastewater even when reported cases were minimal (January – May 2023)



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Competency 3: *Evidence-based Approaches to Public Health*

Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate

Accomplished By: Comparing concentrations of genomic copies of SARS-CoV-2 per liter of wastewater with COVID-19 reported cases were extracted from the Montana Infectious Disease Information System (MIDIS) using excel for comparing the two trends on a graph.

Products:

- * Analysis of the Trends of SARS-CoV-2 in Wastewater to Case Data for Two Sites in Montana



Competency 8: *Planning and Management to Promote Health*

Apply awareness of cultural values and practices to the design or implementation of public health policies or programs

Accomplished By: Incorporated Montanans' values of privacy, local data, tribal representation by creating a Montana-based wastewater surveillance web page. This web page informs the public of the community-based data while providing personal privacy.

Products:

- *Montana Wastewater Surveillance Web Page
- *Wastewater Surveillance Social Media Posts



Competency 18: *Communication*

Select communication strategies for different audiences and sectors

Accomplished By: During meetings with CDEpi, NWSS partners, and conversations with local and tribal health jurisdictions, the different audiences were identified. The need for quarterly meetings and newsletters for health jurisdictions and utility partners was identified.

Products:

- *Montana Wastewater Surveillance Web Page
- *Wastewater Surveillance Social Media Posts



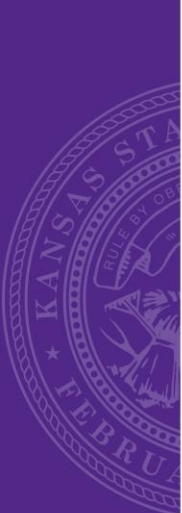
Competency 19: *Communication*

Communicate audience-appropriate public health content, both in writing and through oral presentation

Accomplished By: On the social media posts and web page, they were created by to ADA compliant and have easy to understand language by the public. Additionally, wastewater surveillance trends were communicated orally through a brief presentation internally to CDEpi.

Products:

- *Montana Wastewater Surveillance Web Page
- *Wastewater Surveillance Social Media Posts



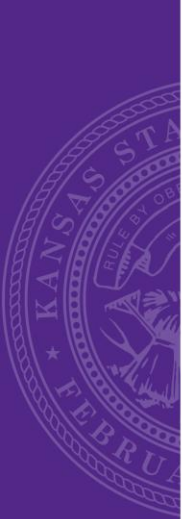
Competency 21: *Interprofessional and/or Intersectional Practice*

Integrate perspectives from other sectors and/or professionals to promote and advance population health.

Accomplished By: Multiple stakeholders across many disciplines worked together during the program process to ensure sites were onboarded and that sampling and testing were done effectively. Methods created in other disciplines were used for wastewater surveillance (e.g., PCR testing, sample collection methods, comparing disease trends, communicating through social media).

Product:

*Progress Mapping - Montana's Wastewater Surveillance Program
Flow Chart



Competency 22: *Systems Thinking*

Apply systems thinking tools to a public health issue

Process Mapping - using graphics to understand the process for solving public health problems

Accomplished By: Worked with the preceptor and section supervisor to identify stakeholders and necessary steps in the wastewater surveillance program process. Applied the steps while onboarding new sites and created the flow chart to map this process out.

Product:

*Progress Mapping - Montana's Wastewater Surveillance Program
Flow Chart



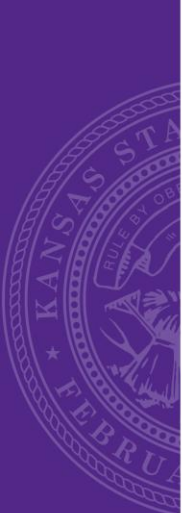
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IDZ Competencies

Summary of MPH Emphasis Area Competencies

MPH Emphasis Area: IDZ Emphasis Area Competency			
Number and Competency		Description	Course
1	<i>Pathogens/pathogenic mechanisms</i>	Evaluate modes of disease causation of infectious agents.	DMP 850 / ASI 540
2	<i>Host response to pathogens/immunology</i>	Investigate the host response to infection.	DMP 850 / ASI 540
3	<i>Environmental/ecological influences</i>	Examine the influence of environmental and ecological forces on infectious diseases.	DMP 710
4	<i>Disease surveillance</i>	Analyze disease risk factors and select appropriate surveillance.	DMP 710
5	<i>Disease vectors</i>	Investigate the role of vectors, toxic plants and other toxins in infectious diseases.	DMP 710



IDZ Competency 4: *Disease Surveillance*

Analyze disease risk factors and select appropriate surveillance.

Gap of Knowledge:

*Lack of testing or reporting at-home COVID-19 test results and the lack of access to health care led to inaccurate case data for public health.

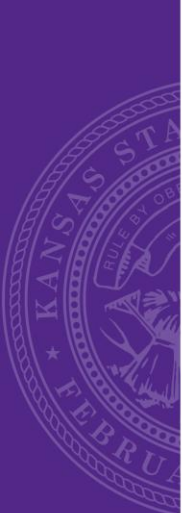
Solution:

*Wastewater Surveillance Program tests biomarkers of its target (e.g., SARS-CoV-2) and is independent of case data and health systems.



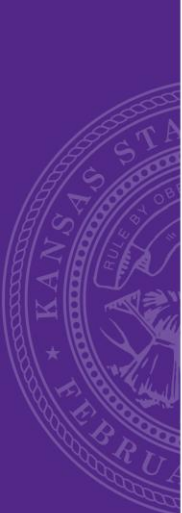
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Main Take Aways from the APE

- Public Health is multidisciplinary and requires many different stakeholders.
- Wastewater surveillance can be a useful tool to understand more about disease trends in communities.
- Constant adjustments and improvements are needed for programs to run more effectively.



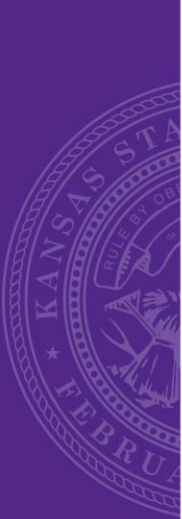
Future of Wastewater Surveillance in Montana

- Design and launch a Montana-based wastewater surveillance data dashboard using Tableau
- Update SAS code for improved data quality when comparing reported COVID-19 case trends to wastewater surveillance trends
- Determine an applicable analysis strategy to further define changing in trends
- Develop an onboarding packet for participating jurisdictions and utility sites
- Test for additional targets (e.g., influenza, RSV, norovirus, opioids, antimicrobial resistant organisms, etc.)
- Establish quarterly meetings and newsletters for health jurisdictions and utility partners
- Perform data analytics on click rates and page interactions to evaluate the effectiveness of the web page and social media posts



Presentation outline

- Overview of MT DPHHS CDEpi
- Wastewater Surveillance Overview
- APE Objectives and Products
- MPH Competencies
- IDZ Competencies
- Conclusion
- Acknowledgements



Acknowledgements

- Preceptor: Rachel Hinnenkamp, MPH
- Major Professor: Dr. Paige Adams
- Committee: Dr. Deborah Briggs and Dr. Robert Larson
- CDEpi Section
- Family



Thank you!

Any questions?

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