

PUBLIC HEALTH LABORATORY

ANNUAL REPORT



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Photo Credits

Front Cover: Jessica Cavazos,
Courtney Demontigny,
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Dunbar, Stephanie Peterson



Dear Reader,

On behalf of the Public Health Laboratory Division of the Minnesota Department of Health, I am pleased to present the fiscal year 2017 (July 1, 2016 - June 30, 2017) Annual Report and to highlight some of the many public health issues we addressed.

In April 2016, the Advisory Committee for Heritable and Congenital Disorders recommended the addition of three new disorders to Minnesota's newborn screening panel: X-linked adrenoleukodystrophy (X-ALD), mucopolysaccharidosis type I (MPS I), and Pompe disease. The laboratory began actively screening for X-ALD in February 2017. The story on page seven provides a glimpse of the extensive preparation done before we start screening Minnesota newborns for a new disorder. Screening for MPS I and Pompe disease began in August 2017 and will be included in the next report.

Our Environmental Laboratory Section continues to develop and use test methods for chemicals and toxins of concern to Minnesotans. Warm temperatures and pollutants (such as phosphorus and nitrogen compounds) can lead to large blooms of harmful algae. The toxins from these organisms can cause illness in humans and animals. Go to page nine to read about how the lab used newly-developed methods to monitor the drinking water in 11 communities for the presence of algal toxins.

We saw another infectious disease epidemic (or two...actually three) that kept the Infectious Disease Section busy. Unlike the Ebola and Zika virus outbreaks in previous years, these outbreaks were more familiar. The outbreaks happened in the spring and summer of 2017 and included measles, varicella (chicken pox), and mumps. These diseases are all vaccine-preventable, however low vaccination rates and/or poor immunity, resulted in the spread of these viruses between susceptible people. Details of how extensive the measles outbreak was can be found on page 14.

I never fail to be impressed with the enthusiasm, expertise, and professionalism of the public health laboratory staff. I am grateful for our dedicated staff, as well as our collaborative partners, all of whom contribute to addressing these public health issues.

Sincerely,

Joanne M. Bartkus
Joanne Bartkus, Ph.D.
Public Health Laboratory Director

At a Glance



369

MINNESOTA NEWBORNS
IDENTIFIED WITH A
DISORDER THROUGH
NEWBORN SCREENING



129,975

ENVIRONMENTAL AND
BIOMONITORING TESTS
PERFORMED TO IDENTIFY
TOXIC CHEMICALS



97,074

TESTS PERFORMED TO IDENTIFY
INFECTIOUS DISEASE TRENDS
AND OUTBREAKS

Glossary:

Acronym	Meaning
CDC	Centers for Disease Control and Prevention
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
PHL	Public Health Laboratory
U of M	University of Minnesota

Photo Credits

Jacque Marshall, Jessica Cavazos,
Courtney Demontigny

95

TRAININGS
PROVIDED BY PHL
STAFF TO EXTERNAL
STAKEHOLDERS

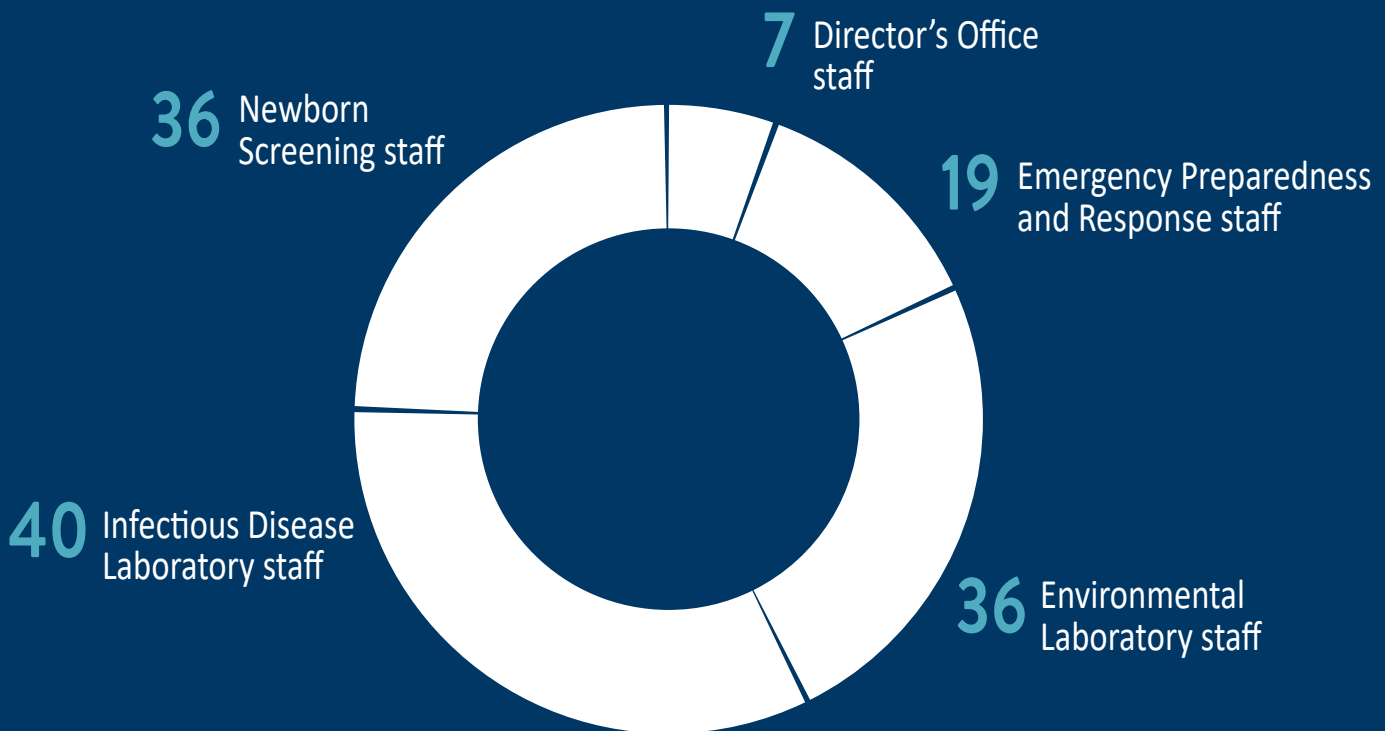


53

RARE, HIGHLY INFECTIOUS
BACTERIA IDENTIFIED WHICH
PROMPTED EARLY TREATMENT



PHL staff by section



Does not include contractors

Newborn Screening

Minnesota Newborn Screening screens infants at birth for 60 serious disorders, including hearing loss and critical congenital heart disease (CCHD). Newborn screening aims to identify disorders before symptoms appear so that affected infants can receive prompt diagnosis and treatment to prevent serious health problems, developmental delay, or death.

Almost every day, our program identifies an infant with one of these health conditions. For a complete list of the disorders on the Minnesota Newborn Screening Panel, visit: <http://www.health.state.mn.us/people/newbornscreening/program/newbornscreeningpanel.html>

Photo Credits

Section Photo: Chaco Dunbar

MNScreen: Meghan Pate

Photography, Sondra Rosendahl

X-ALD: Meghan Pate Photography

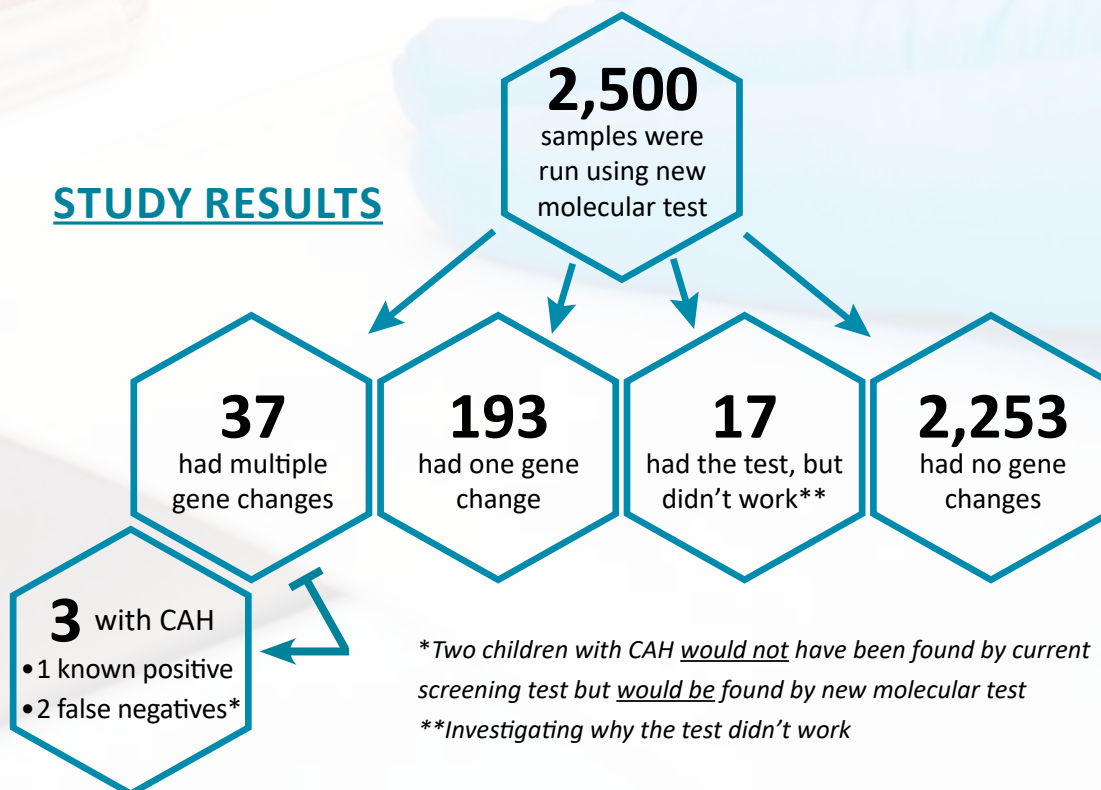


Grant and Partnership May Lead to Improved Screening for CAH

In June 2015, the Minnesota Newborn Screening Program received a grant from the March of Dimes to collaborate with the University of Minnesota Masonic Children's Hospital and the Centers for Disease Control and Prevention (CDC) to improve screening for congenital adrenal hyperplasia (CAH). Although CAH cannot be cured, it can be treated with medication.

The current method for CAH screening uses a biochemical test that measures a hormone that is elevated in infants who have CAH. The test has a high false positive rate (screening suggests the infant has CAH, but further testing reveals that the infant is healthy) and a higher than expected false negative rate (screening is within normal limits, but later these infants are diagnosed with CAH).

Grant funding was used to develop a second tier molecular test for CAH in an effort to reduce the number of false positive and false negative results. This test will look for changes to the CAH gene that are specific to Minnesota patients and their families. Individuals with multiple gene changes may or may not have CAH. Whether or not they have CAH depends on if the changes are located all on one gene (a carrier and not affected) or spread across both genes (affected with CAH). Currently, we are analyzing workflow, testing turnaround time, and cost to determine whether or not it makes sense to start using this molecular test in our lab.



MNScreen Increases Quality and Timeliness of Newborn Screening Results

In June 2017, Minnesota became the first state to have all of its 91 birth hospitals (99% of all Minnesota births) send pulse oximetry and hearing screening results to the Newborn Screening Program through an electronic reporting system, MNScreen. Obtaining results in this manner helps contribute to better understanding of the screening process, improved quality assurance for birth facilities, and enhanced patient follow-up. MNScreen has improved timeliness of results and has reduced reporting errors.

Our program has worked on the implementation of MNScreen since 2014. This involved working with individual hospitals and training hospital staff on how to use the secure software. A major motivator for hospitals to make the conversion from paper to electronic came in 2016 when MNScreen became a public health specialized registry for Meaningful Use. This means that eligible hospitals who conduct newborn pulse oximetry and hearing screening qualify for incentives under federal and state programs.

In the future, outpatient providers will also be able to use MNScreen to report diagnostic test results and refer newborns for early intervention as needed, helping to improve access and reduce disparities in care.



Implementation of Routine Screening for X-linked Adrenoleukodystrophy (X-ALD)

Implementing routine screening for a new condition requires a lot of time and work. In 2016, x-linked adrenoleukodystrophy (X-ALD) was added to Minnesota’s newborn screening panel. We began preparing right away.

First, we had to purchase new equipment and reagents. Once received, our lab staff were able to train on the new equipment and start developing new testing methodologies. When it comes to validating test methods for a new condition, we:

- Test specimens from individuals known to have the condition.
- Test “blind panels,” which are specimens from the Center for Disease and Prevention or other state labs that have known values, but the values are unknown to us.

The above steps check our ability to get similar results and ensure that our instruments and methods are working appropriately. To confirm test accuracy and help determine testing cutoffs, we tested 3,117 de-identified (meaning the infant’s name, date of birth, or any other identifying information is not attached to the blood spots) specimens.

Implementing routine screening does not end there. We also send messages to our partners and the public when we plan to begin screening for a new condition. For parents and providers who may receive an abnormal result, we develop fact sheets and resources for them. Last, we work with specialists around the state to develop follow-up guidelines for possible cases of X-ALD.

X-ALD is a condition that occurs in one in approximately 21,000 males. There are three types of X-ALD and the age of onset and symptoms vary (females may experience mild symptoms). If untreated, it can cause ADHD-like behavior, learning disabilities, seizures, paralysis, and death in some cases. Treatment is available and may include medication, supportive therapies, and bone marrow transplants.

**AS OF
SEPTEMBER 1, 2017:**

45,095
**INFANTS SCREENED
FOR X-ALD**

6
**CONFIRMED CASES
OF X-ALD**

1
**CONFIRMED FEMALE
CARRIER OF X-ALD**

Did You Know?

After the lab has run all of the tests necessary to screen for the conditions on the newborn screening panel, there is generally a small amount of dried blood spots left over. Unless parents request otherwise, these leftover blood spots go into safe storage at MDH. Because of these leftover dried blood spots, we are able to develop the tests needed when we add new conditions—like X-ALD.

Environmental Laboratory

The Environmental Laboratory protects the environment—and by extension, Minnesotans—by performing chemical, bacteriological, and radiological analyses of environmental samples including drinking water, surface water, waste water, air, soil, and hazardous waste. These testing services, which work to keep Minnesotans healthy and safe, are provided to programs at the county, state, and national level. The laboratory also develops new tests for detecting contaminants of emerging concern and measuring human exposure to environmental hazards throughout the state.

Photo Credits

Section Photo: Greg Mader

Readiness: Chaco Dunbar



A wooden dock with a metal railing extends from the bottom left towards the center of the frame, leading into a calm body of water. The sky is overcast with soft, grey clouds. The water reflects the dock and the sky. In the background, there are some trees and a distant shoreline.

Testing Minnesota Lakes for Harmful Algal Blooms

Harmful algal blooms (HABs), caused by blue-green algae (cyanobacteria), are becoming an increasing concern in Minnesota. These blooms can release toxins that are dangerous to humans and animals. We partnered with the MDH Drinking Water Protection (DWP) section and the Minnesota Pollution Control Agency (MPCA) to monitor lakes and streams for HABs. By testing area lakes and streams, we can ensure water safety for recreational and drinking purposes.

During summer 2016, DWP monitored 11 communities in Minnesota that acquire their drinking water from surface water sources (e.g., lakes and streams). Over a four-month period, water samples were collected from the local water treatment facilities and analyzed for toxins that can be dangerous for humans and animals.

During the same time, the MPCA Lake Assessment Monitoring group monitored 51 additional sites and collected 78 samples in Minnesota for the presence of toxins.

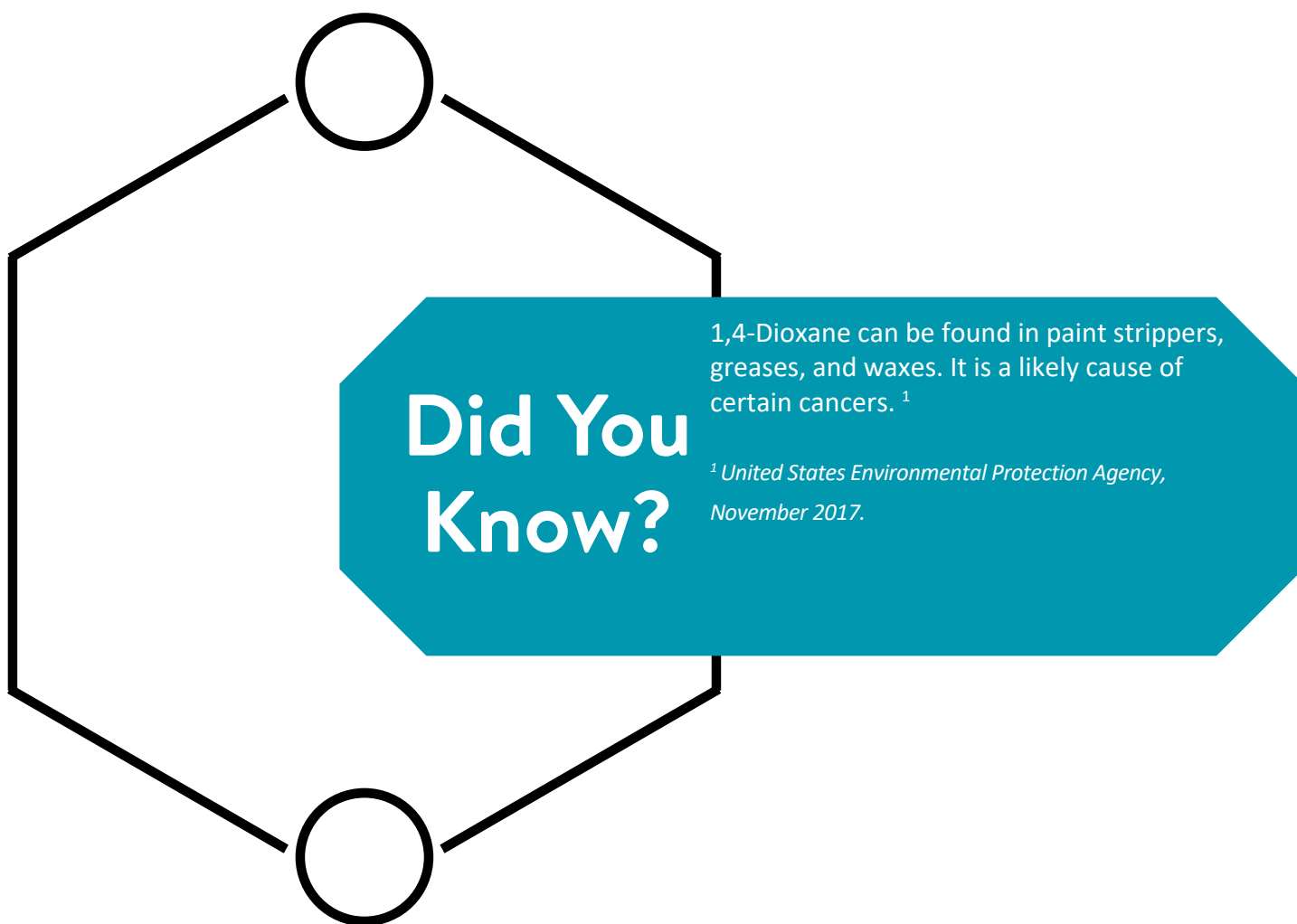
Increased nutrient pollution (e.g., fertilizer runoff), sunlight, and slow-moving water lead to HABs occurring more frequently, which poses an increased threat to our drinking and recreational water supplies. Water treatment facilities attempt to remove these toxins from water sources to keep water clean and safe, and this removal process seems to be working.

Developing New Methods to Identify Emerging Contaminants of Concern

We are developing new testing methods to identify various chemicals in the environment that could be dangerous to the health of Minnesotans. New testing methods allow us to identify chemicals at very low levels and detect chemicals we previously have been unable to find.

An example is our new method for detecting 1,4-Dioxane, which is an emerging contaminant. Through our testing, we realized that this particular contaminant is more common than previously understood. Other studies suggested it was also more toxic than previously thought. The data we provided to the Minnesota Pollution Control Agency (MPCA) was used to help clean up contamination sources, restore drinking water, and inform the public to keep humans, animals, and the environment healthy.

Our new testing methods are not only important to monitor ground and surface water in Minnesota, but our methods are being used by other labs throughout the country for environmental monitoring as well.



Multi-Agency Exercise Reviews Minnesota's Readiness

During October 17-21, 2016, we participated in a first-of-its-kind exercise to prepare for a nuclear power plant incident. The Northern Lights Exercise (NLE) was a week-long, large-scale exercise mimicking what would happen the weeks following a nuclear power plant incident.

The drill involved several state and federal agencies and organizations, as well as a few private industries, working together to identify and figure out how to address critical decisions in the later stages of a nuclear power plant incident.

The lab's role in the event of a nuclear incident is to detect radiation that may have been released from the plant. For this exercise, samples from water, soil, air filters, vegetation, and fresh eggs were collected from the area surrounding the power plant. Radioactive material was artificially added to the samples so that we could practice our test methods.

The data our lab provided during this exercise was used to mimic decisions such as:

- Considerations for fall harvest and spring planting for the farms in the surrounding area;
- Limits and conditions for the return of people who were evacuated;
- How to communicate the incident to the community, especially for pregnant women, children, and other vulnerable populations;
- Restrictions on drinking water, hunting, fishing, and wild vegetation;
- Assessment of the safety of Interstate 94 and the Mississippi River for commercial traffic and a plan for reopening the interstate; and the
- Development of a waste management plan for liquid, solid, and agricultural wastes after a nuclear incident.

This exercise was a great opportunity for all the agencies involved to identify and resolve Minnesota-specific issues that may arise if there were a radioactive incident in our state. Because of our involvement in NLE, we have a better idea of our strengths and will be able to prioritize areas for improvement that were identified through the exercise.



Infectious Disease Laboratory

The Infectious Disease Laboratory is composed of four laboratory units: emergency preparedness and response, microbiology, molecular epidemiology, and virology. Throughout the year, we detect and identify a variety of bacteria, viruses, parasites, and fungi that make Minnesotans ill. Clinical laboratories throughout the state are required to submit specific organisms for our lab to provide diagnostic, characterization, and surveillance services that are not otherwise available in Minnesota.

Photo Credits

Section Photo: Courtney
Demontigny

Antibiotic Resistance: Courtney
Demontigny



The background of the page is a close-up photograph of several petri dishes. Some dishes have red agar, while others have yellow agar. Some dishes have white labels with handwritten text. The text on the labels includes "CHRG 2", "APP", "1007", and "38 3012".

Legionnaires' Outbreak in Hopkins, MN

In September 2016, MDH epidemiologists saw a rise in the number of Legionnaires' disease cases in the Hopkins area. Legionnaires' disease is caused by inhaling water droplets that contain the bacterium *Legionella pneumophila* and often leads to pneumonia. While most cases are treated with antibiotics, it can be a fatal disease. By the end of the outbreak, there were 23 confirmed cases, 17 patients were hospitalized, and one individual died.

Working with our epidemiologists and area hospitals, we received samples from individuals identified with Legionnaires' disease. DNA testing of the bacteria found in patients confirmed that individuals were infected by the same source. Additional testing was taking place at nearby water sources to identify the source of the outbreak. Once the source was found, it was sanitized to prevent future infections. More detailed testing—whole genome sequencing—was performed on bacteria from both patient specimens and water samples to confirm that the bacteria found in the patients and in the water source were a match.

Fortunately, we have the lab instruments and staff expertise to respond to outbreaks like this and continue to keep Minnesotans healthy.

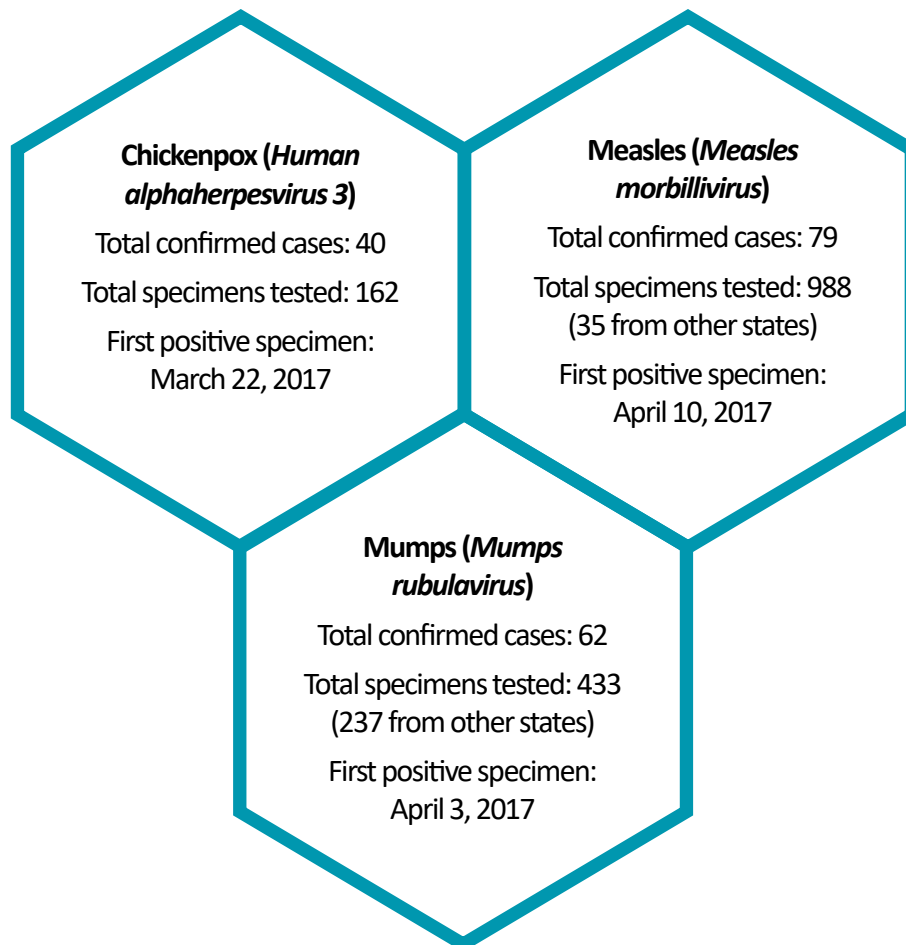
All Hands on Deck! Responding to Three Outbreaks at Once

Between April - September 2017, we responded to three vaccine preventable disease (VPD) outbreaks—measles, mumps, and chickenpox—at the same time. During the peak of the measles outbreak, we received 50 measles specimens per day and lab staff worked extended hours to make sure we tested all samples within 24 hours of receiving them. Fortunately, we have prepared for these unique events over the years, so we were able to respond to all three outbreaks simultaneously and continue routine lab work. We worked closely with MDH Infectious Disease Epidemiology, Prevention, and Control to prioritize incoming samples.

Measles, mumps, and chickenpox are highly contagious, have delayed symptom onset, no treatment, and can be costly. Our ability to quickly test for these viruses allowed for rapid follow-up with clinicians. The clinicians are then able to provide guidance to their patients to reduce the spread of outbreaks in the community.

Ruling out infection is just as important as identifying those infected with a VPD. For an individual family, it enables those who do not have the virus to return to their normal activities more quickly. For public health, it reduces the large amount of work that goes into investigating each potential case.

Measles, mumps, and chickenpox are serious diseases that are easily spread, especially through coughing and sneezing. However, they are preventable through vaccination. High vaccination rates are especially important when it comes to preventing outbreaks as well as protecting people who can't be vaccinated due to age or serious medical conditions.



Combating Antibiotic Resistance

In August 2016, the CDC introduced the Antibiotic Resistance Lab Network (ARLN), as a way to identify and combat antibiotic resistant microorganisms. Antibiotic resistance occurs when bacteria and fungus change so that antibiotics no longer work on them. Launching the ARLN was in response to a call from the White House, which recognized a need for a regional public health laboratory network in the United States. ARLN regional labs, the Center for Disease and Prevention, and state and local health department labs work together to ¹:

- Detect new antibiotic resistance and find trends to support national public health strategies
- Inform outbreak response of antibiotic resistance threats
- Prevent and combat future antibiotic resistance threats by creating better data
- Support innovations by providing samples for research

We were honored to be recognized for the good work we do that led to us being chosen as the ARLN Regional Laboratory for the central region. Already we have held on-site trainings for other state public health labs on detecting antibiotic resistant organisms.

¹ *Antibiotic Resistance Lab Network, Centers for Disease Control & Prevention, 20 December 2017. <https://www.cdc.gov/drugresistance/laboratories.html>*



Did You Know?

Antibiotic Resistance in the U.S.

- Sickens more than 2 million people each year
- Kills 23,000+/year (plus an additional 15,000 of *C. difficile*)
- Costs over \$20 billion dollars in healthcare expenses
- If we lose the war on antibiotic resistance, we lose the ability to treat patients with sepsis, cancer, organ transplants, and burn & trauma victims

Director's Office

The Director's Office provides documentation, training, and analytic support for division projects. The goals of the office are to align our division work with strategic goals, support collaboration among division sections and programs, and streamline division processes and procedures. Staff are also responsible for general administration and reporting, records management, audits, training, and the website for the division.

Photo Credits

Section Photo: Unsplash

A person in a dark shirt is gesturing with their right hand while speaking. They are seated at a wooden conference table. The background is blurred, showing an office setting with windows.

Standardized Training for New Employees

In 2015, we began developing a standardized training process to orient new employees to the Public Health Laboratory. New employees require a large amount of training and a standardized process is needed to provide them with an opportunity to understand the various jobs and roles of the lab.

We developed the process, including: training, standards, policies, etc. that each new employee would be required to complete. We also developed an electronic checklist to ensure each new employee completed each task. A small group of new employees piloted the training in December 2016 and offered feedback for improvements. By June 2017, 13 new employees completed the training checklist and four were in progress of completion.

We are pleased with the rollout of this new training system and are optimistic that it will benefit new employees to be successful in their roles with the lab.

Outreach and Partnerships

Quality partnerships between PHL and our stakeholders is one of the many reasons Minnesota is considered a leader in public health. Each year we continue to nurture and build these relationships, as well as seek out new partners, in order to strengthen public health across the state and the nation. By offering trainings to increase the knowledge and abilities of our clinical lab partners, in addition to collaborating on studies and new methodologies with other programs and agencies, we are better able to serve Minnesota and continue to realize the MDH mission of protecting, maintaining, and improving the health of all Minnesotans.

Photo Credits

Section Photo: Courtney Demontigny

Cytomegalovirus: CDC
Power of Knowledge: Kyle Christopherson





Sharing Knowledge Across the State and Nation

One of the reasons Minnesota is considered a leader in public health is due to the partnerships between clinical labs and public health professionals. We offer a variety of trainings throughout the year to increase the knowledge and abilities of our clinical lab partners and other public health labs across the country.

From July 2016 – June 2017, we developed and hosted eight new national and local trainings, educating 509 individuals across the country, including three U of M interns and one Mayo Clinic fellow.

Examples of trainings offered:

- **Biosafety:** Our training demonstrated how to perform risk assessments and tips to reduce risks. Attendees participated in interactive exercises including how to properly remove personal protective equipment and how to properly label and ship infectious substances.
- **Bioinformatics:** Our training provided public health labs from other states the necessary knowledge to identify bacteria and viruses using whole genome sequencing. Attendees learned how to collect and analyze the vast and complex amount of data to detect differences between similar strains and prevent outbreaks.
- **Antibiotic Resistance:** We partnered with the CDC to host a central region-workshop. Ten representatives from eight different state public health labs were in attendance. The objective of the workshop was to teach, demonstrate, and provide a hands-on experience using test platforms that characterize emerging resistance patterns among bacteria that cause outbreaks. The training allowed attendees to implement learned testing and detection strategies to facilitate faster detection of antimicrobial resistance outbreaks.
- **Clinical Lab Summit:** We gathered key partner labs for a half-day discussion regarding the role of public health and how clinical labs contribute to our public health goals.
- **Clinical Lab Teleconference Series:** We hold monthly teleconference meetings to share up-to-date information about what is happening at PHL and how this impacts our clinical lab partners.

Dried Blood Spots—Suitable for Cytomegalovirus Screening?

Cytomegalovirus (CMV) is a common virus, especially in young children. However, if a woman has an active CMV infection while pregnant, it can cause significant health problems like intellectual disabilities and hearing loss. Congenital cytomegalovirus (cCMV) occurs when a mother is infected with CMV and passes the infection to the fetus before birth. Each year, approximately 250 newborns in Minnesota are born with cCMV. Not all infants born with cCMV will require intervention or treatment:

- Approximately 80% appear to have no health problems from the virus
- 10% have significant health problems
- 10% have only hearing loss that presents at birth or develops in childhood

This infection has major public health implications because cCMV is thought to be the leading infectious cause of nonhereditary sensorineural hearing loss.¹ Early detection of cCMV could provide more treatment options and timelier intervention.

Recently, there has been increased interest in adding cCMV to the newborn screening panel by advocates. In 2015, we partnered with the University of Minnesota and the CDC to evaluate if dried blood spots might be suitable for universal screening of cCMV.

There are currently five hospitals consenting patients into this study. Any newborn with an abnormal result receives follow-up clinical care. In the coming year, we plan to increase locations and participation.

¹ *Sensorineural hearing loss (SNHL) occurs when there is damage to the inner ear (cochlea), or the nerve pathways from the inner ear to the brain.*



The Power of Knowledge: Harper's Story

The “Dear Parents/REFER Hearing Screening” letter was the beginning of our journey. After a healthy pregnancy and an uneventful planned C-section, we were notified prior to hospital discharge that Harper failed her hearing screening in one ear and we were instructed to follow up in 5-6 weeks with her provider. It seemed that fluid in the ears was common with C-section babies, so we weren't worried leading up to the follow-up appointment. The appointment confirmed not only hearing loss in one ear, but in both. We were shocked, but quickly began the process of more testing, new specialists, and learning terminology foreign to us.

With no family history of hearing loss, we were motivated to understand the cause. I had attended a program sponsored by the University of Minnesota – Next Steps for Families with Newly Diagnosed Hearing Loss. In that session, they covered a number of congenital causes of hearing loss – one of which was CMV. I called our pediatrician and requested that Harper be tested for CMV. She tested positive for CMV and began anti-viral treatment.

We will be forever grateful for the newborn hearing screen and all of our partnering medical professionals along the way. Without this, I'm confident we would have lost several months and perhaps the opportunity for anti-viral treatment. Hearing screening gives parents the gift of time, so that they may have more options for CMV treatment.



“We will be forever grateful for the newborn hearing screen and all of our partnering medical professionals along the way.”

Laboratory Performance and Budget

Every year, we strive for excellence through improved quality assurance, cutting-edge research and analysis, and public impact. This section highlights a few of our recognized achievements this year as well as our division budget.

In fiscal year 2017, our division operated on a budget of \$27.39 million. For more information about our budget this year, please contact our Director's Office staff. Our contact information is located on the back of this report.

Photo Credits

Section Photo: Jessica Cavazos

Budget: Courtney Demontigny



Awards and Honors

PHL Director, Joanne Bartkus was elected to serve as President-elect of the Association of Public Health Laboratories (APHL). She will begin her term as President in Spring 2018.

Kaitlin Houlihan was selected as an Informatics—Training in Place Program (I-TIPP) fellow through the CDC.

PHL Staff Star Honors Award:



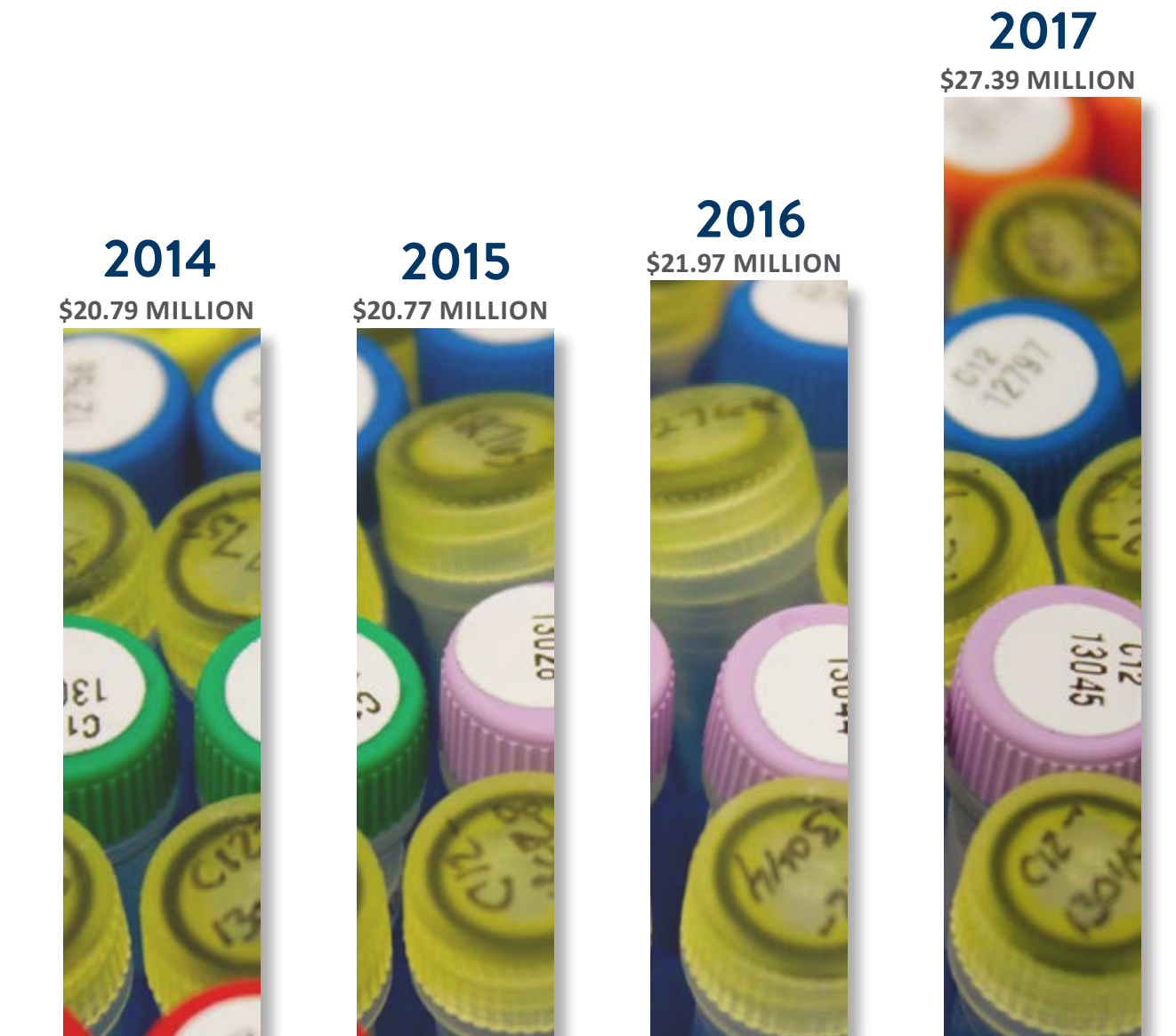
Maggie Dreon

Holly Winslow



The MDH Star Honors Program allows staff members to formally recognize colleagues at all levels for their exceptional accomplishments and outstanding contributions which are models of public service. A limited number of Star Honors are awarded each year.

PHL Budgets



For past annual reports and budgets, visit: www.health.state.mn.us/about/org/phl/annualreports.html
For a description of fund categories, visit: www.health.state.mn.us/about/org/phl/funds.html

Budget Breakdown by Fund Categories

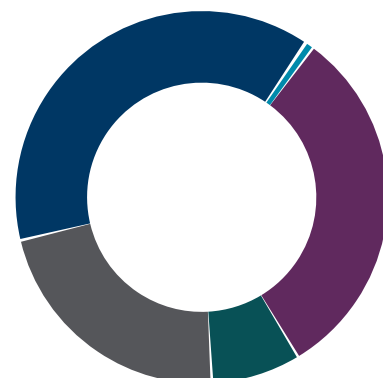
2014



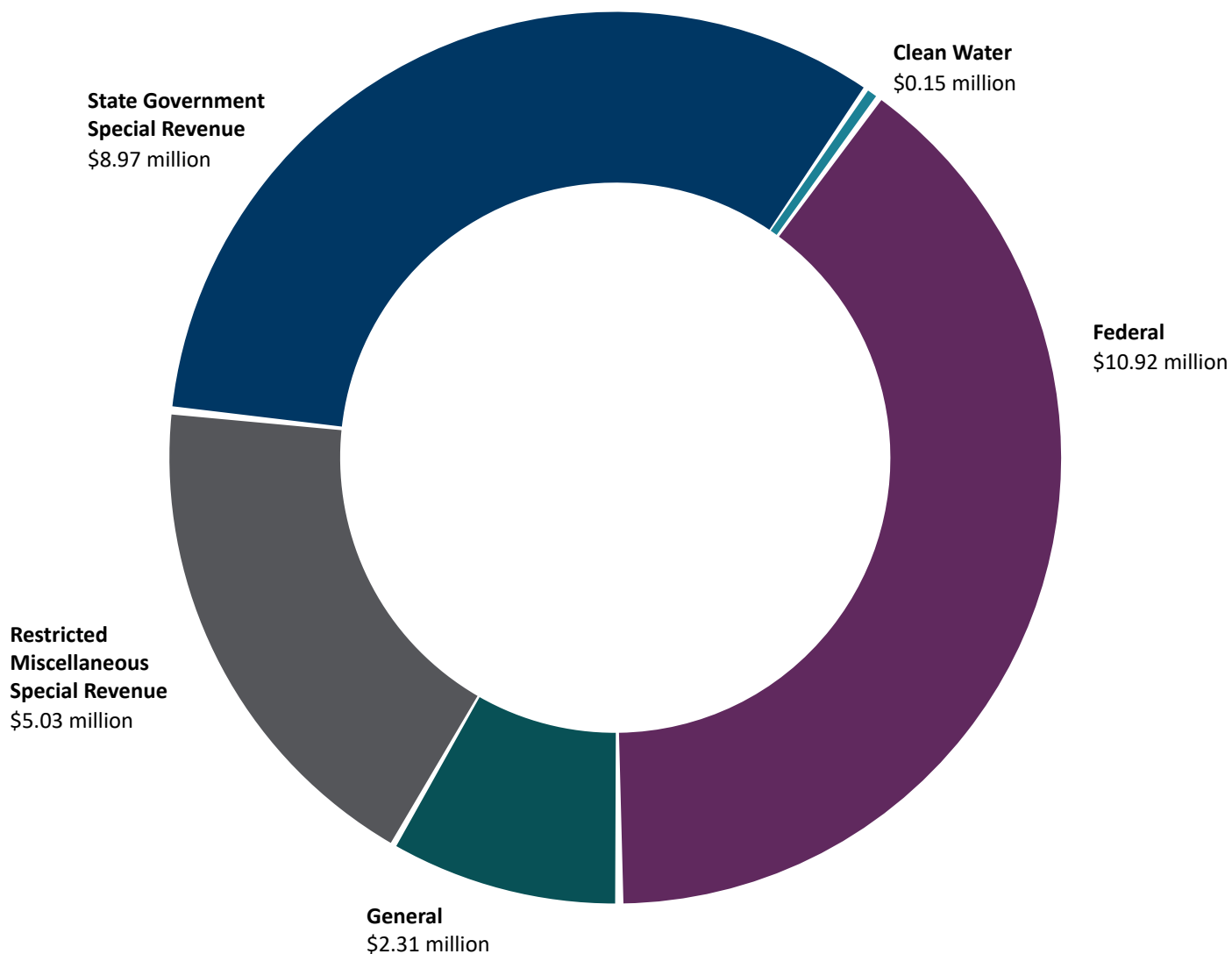
2015



2016



2017



Protecting, maintaining, and improving the health of all Minnesotans

MINNESOTA DEPARTMENT OF HEALTH PUBLIC HEALTH LABORATORY

mail

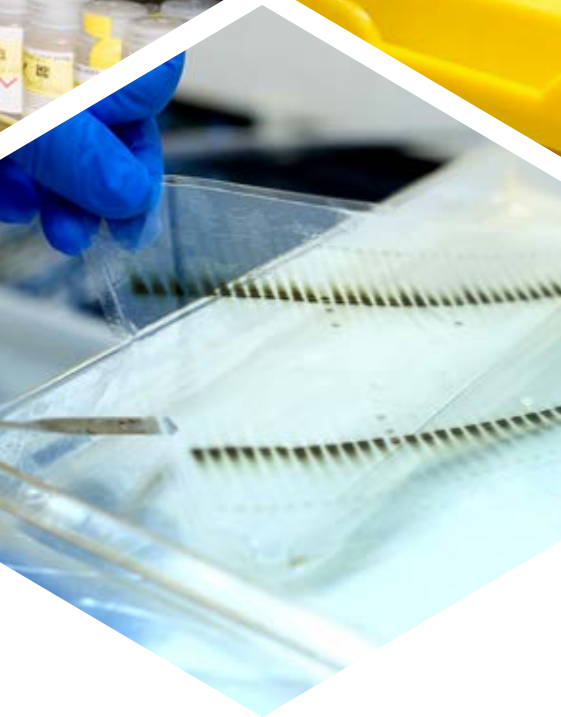
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SCIENCE • RESPECT • COLLABORATION • INTEGRITY • ACCOUNTABILITY