Public Health Laboratory

Annual Report

Fiscal Year 2023

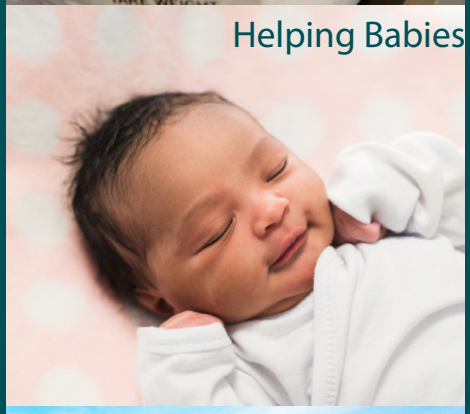
DEPARTMENT OF HEALTH

About PHL

The Minnesota Department of Health (MDH) Public Health Laboratory provides many services that help keep Minnesotans safe. Each section of the lab plays a different role in protecting the public's health by working together with partners at the local, state, and national levels.

Ready to Respond to Emergencies

The Public Health Laboratory responds to emergencies that involve potential chemical, biological, or radiological agents that threaten the health of Minnesotans. The laboratory performs analytical testing as needed and provide training to sentinel laboratories—clinical laboratories on the front lines of disease detection—and first responders across the state. MDH's Public Health Laboratory plays a role in multiple national laboratory networks, including the Laboratory Response Network (LRN), sharing testing capabilities and providing increased capacity for emergencies that occur in Minnesota and elsewhere in the United States.



Helping Babies Start Life Healthy

The Newborn Screening program screens infants for over 60 rare, serious, and hidden disorders, including hearing loss and critical congenital heart disease (CCHD). If left untreated, these disorders can lead to illness, physical disability, developmental delay, or death. Newborn screening aims to identify disorders before symptoms appear so affected infants can receive prompt diagnosis and treatment. Together with Minnesota's medical professionals, nearly 63,000 babies are screened each year.

Protecting Your Community From Environmental Health Hazards

The Environmental Laboratory performs chemical, bacteriological, and radiological testing of environmental samples for pollutants that may affect the health of Minnesotans. These samples include water, air, soil, and hazardous waste. The Environmental Lab also uses biomonitoring—identifying and measuring potentially toxic chemicals in the body—to help determine populations at risk for exposure to environmental hazards. Working with partners around the state, the lab tests well water for contamination after floods, performs routine monitoring of the environment and drinking water facilities, prepares to respond to radiologic emergencies, and supports public health biosurveillance activities.

Keeping You Healthy by Detecting Outbreaks and Emerging Infectious Diseases

The Infectious Disease Laboratory works to identify changes in known pathogens, detect emerging diseases, and identify sources of disease outbreaks in Minnesota and nationwide. The quick results provided are critical to identifying outbreaks before they spread. The lab tests for a wide variety of diseases, including influenza, rabies, tuberculosis, meningitis, and many different illnesses caused by contaminated food and water.

The Infectious Disease Laboratory staff members played a critical role during the COVID-19 pandemic. The lab was the first place in Minnesota to perform testing for the virus that causes COVID-19, processing hundreds of thousands of samples, and led the nation in whole genome sequencing to identify new SARS-CoV-2 variants.

At A Glance

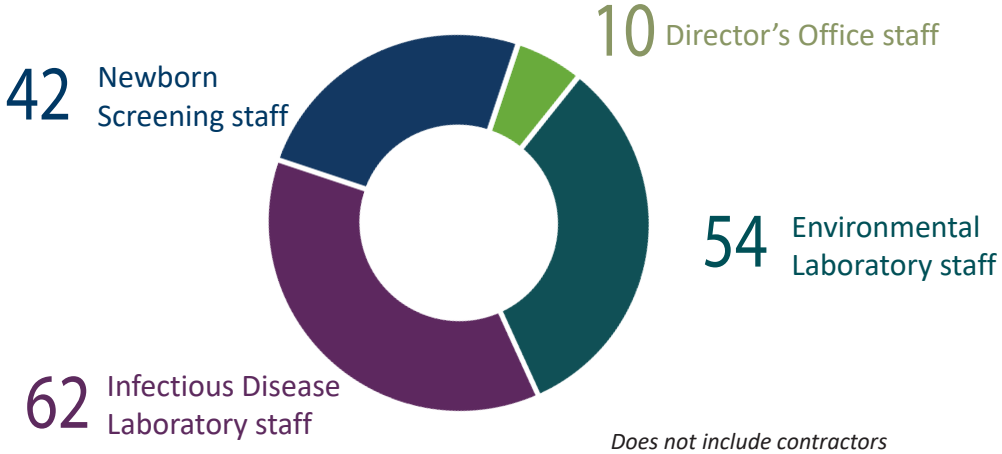
350
Minnesota newborns identified with a disorder through Newborn Screening

116,229
Environmental and biomonitoring tests performed to identify toxic chemicals

86,110
Tests performed to identify infectious disease trends and outbreaks

56
Rare, highly infectious bacteria identified which prompted early treatment

PHL Staff by Section



Does not include contractors

Minnesota is the First in the Nation to Screen all Newborns for cCMV

SCREENING FOR CONGENITAL CMV HELPS IDENTIFY INFANTS AT RISK FOR DEVELOPING HEARING LOSS.

Stephanie Steidl's son Hank was identified with congenital CMV (cCMV) through participation in the UMN-CDC-MDH cCMV pilot study shortly after he was born.

"I received the call that Hank was born with cCMV and what that meant. It meant he had a 15% chance of losing some degree of hearing by the time he was 3 years old. It meant his care plan would change to monitor common CMV complications more closely, like vision and hearing. It meant we would confirm this diagnosis with a blood draw and gather some baseline tests."

These additional exams found a few other complications that may have otherwise been missed.

Hank is now an active, wild, and joyful 5-year-old and is on track with his peers. Steidl credits the research study for identifying Hank's cCMV early, "Hank was lucky. Lucky because he was born at a hospital that was part of the study. Lucky because he got a diagnosis at birth that enabled us early intervention, starting early childhood services at just a few months old."

Hank Steidl

What is cCMV?

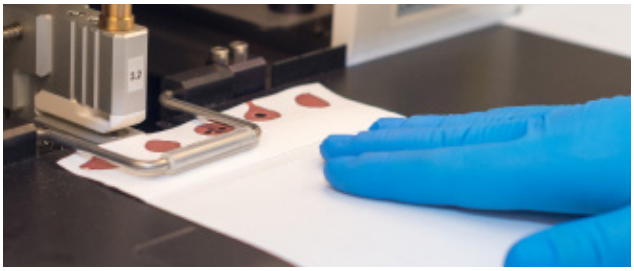
Cytomegalovirus, also known as CMV, is a common virus similar to viruses that cause bad colds, chicken pox, and cold sores.

Acquired CMV is infectious and can be passed from person to person. Congenital CMV (cCMV) occurs when a pregnant person develops an active CMV infection, and the virus passes through the placenta during pregnancy, which may affect fetal development. Although both are caused by the same virus–CMV–they have very different symptoms and outcomes.

When a baby is born with a CMV infection, it has cCMV. The virus can present itself in several ways: babies who have symptoms at birth, babies who look healthy at birth but will develop permanent hearing loss, and babies who are born without symptoms and are not expected to develop symptoms. Newborn screening cannot predict which group a baby will fall into.

Screening for cCMV will help identify infants at risk for developing hearing loss and who may benefit from follow-up monitoring and early access to interventions and treatment.

Congenital CMV (cCMV)	Acquired CMV
Virus passes from pregnant parent through the placenta to the developing fetus.	Passed from person to person, typically found in children under the age of 5.
1 in 200 births	1 in 3 young children
Most infants born with cCMV are healthy, but some have an increased risk of developing: ▪ Hearing loss ▪ Visual impairment ▪ Developmental delays ▪ Seizures	Mild, cold-like symptoms such as: ▪ Fever ▪ Sore throat ▪ Fatigue ▪ Muscle aches



Beginning the process to add cCMV to Minnesota's Newborn Screening Panel in early 2022 provided many unique challenges. As the first state in the country to screen all newborns for cCMV, Minnesota forged into uncharted territory.

Creating Testing Methods

Lab staff worked tirelessly to determine the best screening method and validate the test for laboratory use. Because CMV is an infectious disease, there is a greater risk of contaminated samples. Staff had to consider new laboratory processes and develop additional communication about proper specimen collection to share with labs, nurseries, and midwives.

Typical cCMV test methods use saliva or urine. Research by the University of Minnesota and the Centers for Disease Control and Prevention, in partnership with the Minnesota Department of Health (MDH), showed that it was feasible to screen for the presence of CMV DNA using dried blood spots—which are already collected for newborn screening.

Newborn Screening is Just the First Step

Screening does not provide a final diagnosis and cannot predict which babies will have or ever develop symptoms. Additional evaluations and monitoring are necessary to make those determinations. cCMV is a unique condition that involves careful coordination and communication among families and providers. Newborn screening staff develop a process across multiple teams at multiple time points during the diagnostic work-up.

Once a child has a confirmed cCMV diagnosis, the MDH's Children and Family Health Division's Longitudinal Follow-Up section connect families to timely information, services and supports. Staff consulted with multiple stakeholders and partners around the state to determine the appropriate follow-up protocol for babies identified with cCMV through newborn screening. This includes regular hearing exams, among other appointments, through the first five years of life. The newborn screening program worked closely with audiologists across Minnesota to develop guidelines for audiological monitoring of children with confirmed cCMV infections.

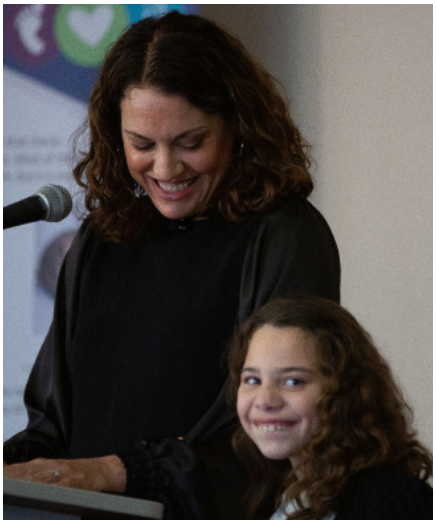
Minnesota Commissioner of Health Dr. Brooke Cunningham speaking at the cCMV media event.

Spreading the Word

An extensive communication effort provided over 12,000 Minnesota healthcare providers, specialists, clinic and nursery managers, clinical lab managers, and midwives with information about cCMV and their specific roles in helping children identified with the condition. The Newborn Screening Program created new education materials for providers and families, several new webpages, and a media event to increase the reach of the messaging.

Screening for cCMV began Feb. 6, 2023, and has already identified dozens of cases. The efforts of the newborn screening program and its partners will not only help Minnesotan children, but will also provide a model other states can use to help children across the country. For more information on cCMV, visit https://direc.to/khkv.

The Vivian Act



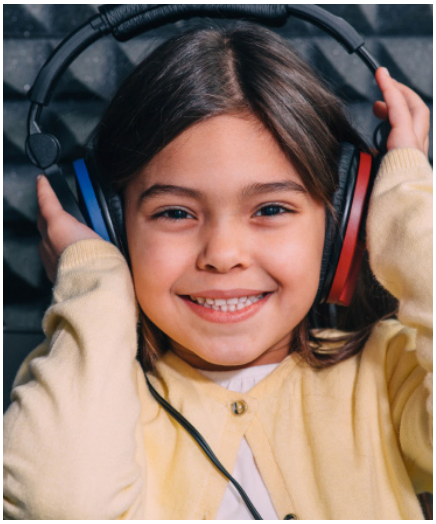
In 2021, the Minnesota legislature passed a law known as the Vivian Act. The law is named for Vivian Henrikson, who was identified with congenital cytomegalovirus (cCMV) shortly after birth.

Parents, clinicians, and the community advocated for passage of the legislation to promote education, awareness, and early detection of cCMV by:

- Raising awareness for cCMV among health care providers.
- Making information about cCMV, including preventative measures, available to health care providers, women who may become pregnant, expectant parents, and parents of infants.
- Establishing an outreach program to educate women who may become pregnant, expectant parents, and parents of infants about cCMV.

This legislation also required that the Advisory Committee on Heritable and Congenital Disorders review cCMV as a possible candidate for inclusion on the Newborn Screening Panel.

After careful review, the committee recommended that cCMV be added to the panel and then-Commissioner Jan Malcolm approved the recommendation in January 2022.



Health Effects of cCMV

Research suggests that about 20% of babies born with cCMV may experience some health concerns, such as hearing loss and developmental delays.

If a newborn tests positive for cCMV, MDH recommends urine testing to confirm the diagnosis, as well as a pediatric audiology evaluation, head ultrasound, and physical and vision examinations.

All babies born with a cCMV infection are at risk for developing hearing loss and may benefit from follow-up monitoring and early access to interventions and treatment. MDH recommends continued monitoring to detect any changes to hearing that can develop because of the infection. For more information on CMV and cCMV, visit https://direc.to/khks.

Newborn screening is comprised of three different components: blood spot screening, hearing screening, and congenital heart disease screening. These tests are completed shortly after a baby is born.

When a baby acquires CMV before birth it is called congenital CMV or cCMV.

Most babies found to have a cCMV diagnosis are not expect to have symptoms.

About 270 will be identified with cCMV via screening each year in Minnesota.

Screening for cCMV will help identify infants at risk for developing hearing loss and who may benefit from follow-up monitoring and early access to interventions and treatment.

MDH and the CDC created a surveillance program that helps identify cases that were missed by screening and determine if newborn screening has improved outcomes for those babies that were identified.

Number screened Feb 6 to Dec 31, 2023: 54,635 babies

Number of screening positives for CMV: 165 babies

Data collection and case confirmation is complete for 144 babies.

Number of confirmed positives: 134 babies

Testing Minnesota Children for Harmful Chemicals

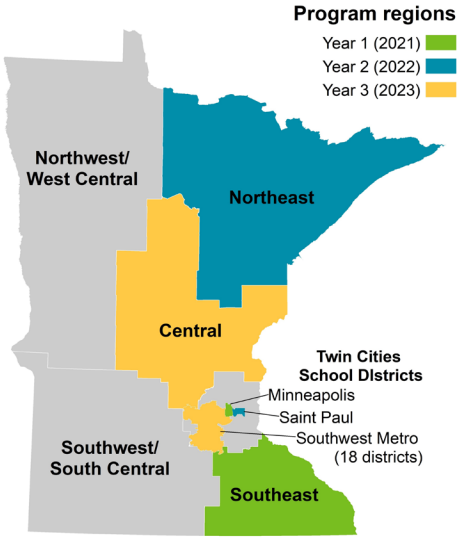
BIOMONITORING CAN PROVIDE CRITICAL INFORMATION TO IDENTIFY GROUPS AT RISK FOR CHEMICAL EXPOSURE.

The Healthy Kids Minnesota program began with communities speaking out. Neighborhoods in North Minneapolis wanted to know how air pollution and other environmental problems were affecting their children. In rural North-Central Minnesota, citizens sought answers on the human effects of pesticides and the chemicals used in private well water.

In 2018, a pilot program of biomonitoring—the testing of biological samples like blood or urine from people, or tissue from animals—in these areas yielded important results. In this case, children's urine was collected and sent to the Environmental Laboratory and analyzed for more than 45 chemicals including:

- Metals found in drinking water, air pollution, and some foods and products.
- Pesticides used in agriculture and to control pests in and around the home.
- Phthalates found in personal care products, toys, and some foods.
- Flame retardants found in household products like furniture and toys.
- Environmental phenols found in personal care products, toys, and some foods.
- Air pollution markers found in air pollution from industry and vehicles, smoking, eating some foods, and fires/smoke.

The children in rural areas, particularly kids living near agricultural fields, had higher levels of the pesticide 2,4-D in their urine than did kids from urban areas. Results also showed higher levels of chemicals from air pollution in the urine of children in Minneapolis, compared to both rural kids and the national average. See https://direc.to/kiua for more results from this study.



Healthy Kids Rolls Out Across Minnesota

The success of this project led to a five-year grant from the Centers for Disease Control and Prevention (CDC) to expand biomonitoring to more areas. This funded Healthy Kids Minnesota, a program for testing kids across Minnesota for dozens of potentially harmful chemicals.

Healthy Kids partners with local public health workers and public schools to collect urine samples from children aged 3 to 6 years. With parent/guardian consent, urine samples are collected from their children as part of the early childhood screening. After a sample has been analyzed, parents receive an explanation of the results.

Identifying Natural and Synthetic Contaminants

The Environmental Laboratory uses its sophisticated instruments and skilled staff to test the samples for contaminants. Biomonitoring has long had the ability to test for well-established substances like mercury and arsenic. A greater challenge lies in developing new testing procedures for the synthetic chemicals found in a wide range of consumer products.

For example, environmental phenols like bisphenol A, parabens, and triclosan are present in sunscreen, toothpastes, and lotions. Having such chemicals in the body doesn't necessarily lead to health effects. Scientists do not yet know what levels in the body are safe. The Healthy Kids Program adds valuable data to that research.

The chemicals being monitored by the Healthy Kids program do not stay in the body for long. They are flushed out the body regularly through urine, which is why urine samples are used for testing.

The five-year grant supporting Healthy Kids is set to expire soon. The Department of Health is working diligently to keep the program going. By gathering information about what potentially harmful chemicals are prevalent and where, we can help protect Minnesota children from a future crisis. See https://direc.to/kbgX for more information about Healthy Kids.

Healthy Kids Minnesota measures urine levels for over 60 chemicals in six categories.

Chemical Category	Children's Health
Metals in drinking water, air pollution, and some foods and products.	Health effects of concern in children and developing babies include learning and behavior problems, allergic reactions, damage to the heart and kidneys, and cancer.
Pesticides in agriculture and to control pests in and around the home.	Exposure to some pesticides may harm the nervous system, interfere with the body's natural hormone levels, or increase cancer risk. Infants and children are often more sensitive to the harmful effects of pesticides than adults.
Environmental phenols in personal care products, toys, and some foods.	Air pollution may cause heart and lung problems, and cancer. Effects on brain development are a growing concern. Air pollution may be more harmful for kids because their lungs and organs are developing. It may also trigger asthma attacks in kids with asthma.
Phthalates in personal care products, toys, and some foods.	Many phthalates are considered "endocrine-disrupting" chemicals. This means that they can affect the body's natural hormones. Hormone changes can affect development in infants and children. Scientists are still learning what levels may be unsafe.
Flame retardants in household products like furniture and toys.	Scientists are still studying how these flame retardants affect people's health. Some may interfere with the body's natural hormones, which can affect development in infants and children. Some may harm the nervous system, reproductive system, or cause cancer.
Air pollution markers in air pollution from industry and vehicles, smoking, eating some foods, and fires/smoke.	Polycyclic Aromatic Hydrocarbons (PAHs) in air can irritate eyes and breathing passages, and lead to asthma and other respiratory problems. They may be especially harmful for children because their lungs and other organs are still developing. Some PAHs may cause cancer.

PFAS: First New Drinking Water Contaminant Since 1996

MINNESOTA LED THE WAY, TRACKING PFAS FOR DECADES.

For more than 20 years, the Environmental Laboratory has analyzed soil and water for a class of human-made chemicals called per- and polyfluoroalkyl substances (PFAS). PFAS are nearly ubiquitous in consumer products, especially in cosmetics, non-stick cookware, and coatings on food packaging. They are known as "forever chemicals" because they take millions of years to decompose. Once ingested, PFAS take years to flush out of the body.

The Minnesota Public Health Laboratory and the Minnesota Pollution Control Agency have been monitoring PFAS since 2002. In the last decade, the Environmental Protection Agency (EPA) has been establishing regulations for monitoring and controlling the spread of PFAS. It is the first time since 1996 that any new chemicals have been proposed as a newly regulated drinking water contaminant.

Specifically, six out of the thousands of analytes of PFAS have been chosen for regulation. Researchers are actively studying the health effects of these six analytes, but early conclusions are worrying. Two analytes, PFOA and PFOS, are known to be carcinogens. Manufacturers have mostly phased PFOA and PFOS out of new products, but the existing compounds persist in the environment and can accumulate to dangerous levels. Other varieties of PFAS remain central to manufacturing.

Measuring, Analyzing, and Monitoring for PFAS

The EPA has designed a contamination and regulation action plan. Under the proposed drinking water regulations, if drinking water samples for an area show PFOA and/or PFAS above 1.3 parts per trillion, the Environmental Laboratory and its sampling partners will increase monitoring of the site. If the rate gets above 4 parts per trillion, a filtration system will be installed in the area's water treatment plants to remove the PFAS particles. Water-treatment plants will treat the PFAS it collects as hazardous waste.

Another initiative involves testing fish for PFAS. This is a primary method for checking contamination in lakes, streams, and other non-potable water sources. Water samples are also taken from such sources, and from wells near landfills. The Public Health Laboratory partners with the Minnesota Pollution Control Agency in this effort; visit https://direc.to/khYQ for Pollution Control's information on PFAS.

PFAS are a large group of human-made chemicals and are used in many commercial products.

PFAS seeps into groundwater, which becomes drinking water.

More than 5,000 structures and 9,000 identified chemicals are present in the environment and will remain so for generations.

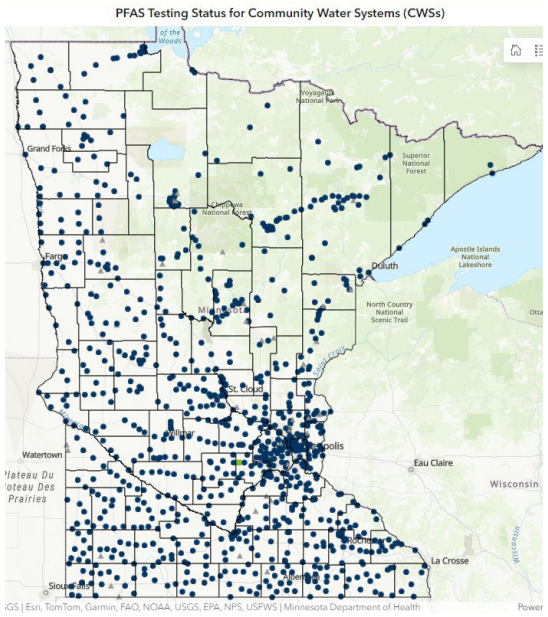
Some PFAS can stay in people's bodies for many years.

Testing for PFAS Occurring Around the State

The number of geographical areas of Minnesota being sampled is rapidly expanding. Previously, the East Metro of Minneapolis/Saint Paul was of primary concern for PFAS contamination. Now sampling is rolling out across every corner of the state. See https://direc.to/kgGS for an interactive dashboard for PFAS testing.

Currently, around 50 sample submissions arrive at the Environmental Laboratory each week, but that number is expected to grow. Three staff members and three lab instruments are devoted to checking drinking water for PFAS. Two additional staff members are working on related biomonitoring projects.

As with so many major health concerns, the Public Health Laboratory is collecting vital information about PFAS in our environment. The recent expansion of this work strengthens our national effort to understand and combat the threat.



State agencies have developed multiple efforts to ensure consistent and accurate PFAS analytical results.

Despite this important work, it is currently impossible to quantitatively measure the vast majority of PFAS in the environment.

1.3

parts per trillion is equivalent to

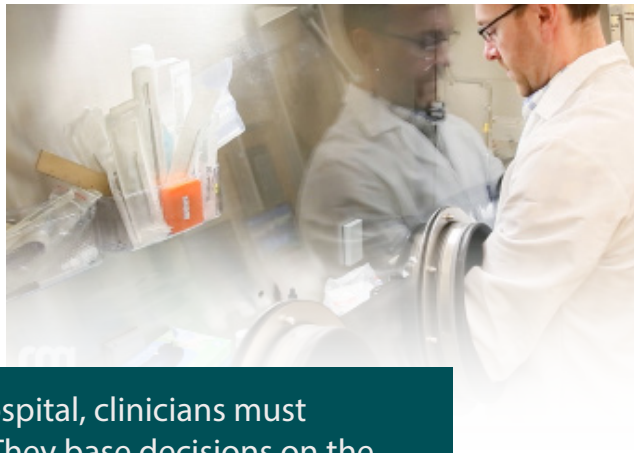
of food coloring in

14 million gallons of water.

That's enough water to fill 21 Olympic-sized swimming pools.

Testing Reveals Which Drugs Are Involved in Overdoses

MORE ACCURATE INFORMATION ENABLES BETTER CARE.



When a person experiencing an overdose arrives in a hospital, clinicians must make quick judgments on proper treatment protocols. They base decisions on the patient's behaviors and symptoms and potentially on the information provided by the patient. Health professionals have often suspected they were working from inadequate and incomplete information when treating overdoses.

In 2017, the opioid epidemic claimed a then-record 421 Minnesotan lives. The problem extended beyond opioids alone; many overdoses resulted from a combination of substances. To gain more information, the Minnesota Department of Health initiated the Minnesota Drug Overdose and Substance Use Surveillance Activity (MNDOSA) project.

A handful of hospitals in Northeast Minnesota and the Twin Cities signed up to participate in the program. When a doctor in one of these hospitals has a patient whose case warrants further study, they direct a sample of blood or urine to be sent to the Minnesota Environmental Laboratory. The lab uses an advanced instrument, a liquid chromatography high resolution mass spectrometer (LC-HRMS), to detect the presence of more than 1,000 different compounds in a single sample, including:

- Opioids
- Cocaine
- Amphetamines
- Heroin
- Cathinone (the stimulant in khat)
- Synthetic cannabinoids
- Caffeine
- Marijuana
- Cotinine (a metabolite of nicotine)

The lab sends individual patients' results to the site leads at hospital systems, who choose how to disseminate the information. For the purposes of the MNDOSA program, the samples are de-identified, meaning that all individual patient information is removed. MNDOSA's results are used as population-level data, showing what substances are involved in overdoses, in which combinations, and in which areas of the state.

Finding Deadly Combinations

Over the past five years, the project has uncovered many important insights. (See https://direc.to/kgGY for more on MNDOSA.) Results of the project show an increase in the rate at which multiple drugs have been implicated in overdoses. Opioids and amphetamines are an especially common combination, found in around half of all samples analyzed.

The MNDOSA project also revealed the inadequacy of the information doctors work with in overdose cases. For almost every category of illicit substances, doctors underestimated the percentage of patients with the drug in their system.

MNDOSA

Minnesota Drug Overdose and Substance Use Surveillance Activity

MDH developed MNDOSA to understand substance misuse and drug overdose patterns in real time.

MNDOSA...

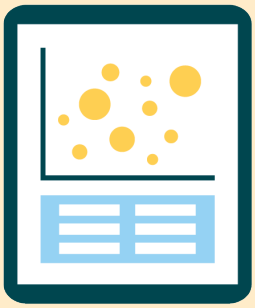
helps identify clusters of substance misuse.

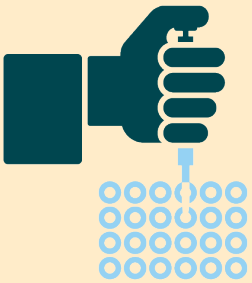
illuminates the types of substances used in Minnesota.

analyzes cases seen in the emergency department as a result of substance misuse.

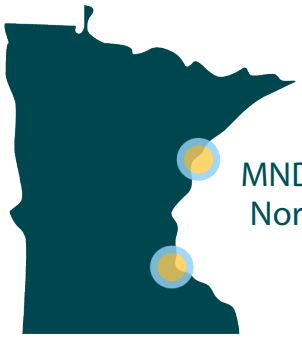
can inform clinicians, community partners, and the public about substance use trends and can guide prevention efforts.

MDH uses a high-resolution testing method that can identify over 1,000 substances.



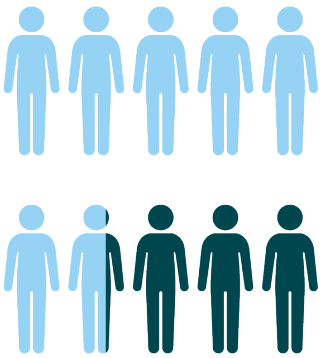


MDH tests samples from MNDOSA cases with severe or unusual symptoms of substance use to identify the substances involved.



MNDOSA currently operates in Northeast Minnesota and the Metro area.

68% of MNDOSA cases are missed through traditional hospital-based overdose surveillance.



The Need to Expand Across Minnesota

The MNDOSA data applies only to two hospital systems within Minnesota. Legislation being considered at this writing would expand MNDOSA throughout all eight hospital regions of Minnesota and increase the funding to cover more samples being submitted to the lab.

In the most general sense, MNDOSA has firmly established that opioids are not solely to blame for the recent increase in overdoses. By revealing the combination of substances at play, the program gives information to health professionals that is critical to addressing the latest patterns of abuse and to saving lives.

Wastewater Testing Helps Fight COVID-19, Other Infectious Disease

WASTEWATER SURVEILLANCE CAN PROVIDE EARLY WARNING OF THE SPREAD OF INFECTIOUS DISEASE.

When the Department of Health and other American public health institutions fight an infectious disease like COVID-19, it is important to know where the pathogen is spreading. Traditionally, it is discovered after people have reported the symptoms and received diagnoses at hospitals.

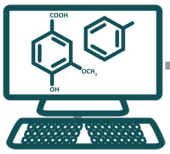
Studying wastewater data can help scientists detect infectious diseases in a community even before data from doctor's offices or hospitals is reported to public health officials.

How wastewater surveillance works

People infected with SARS-CoV-2 can shed viral RNA (genetic material from the virus) in their feces, even if they have no symptoms.

A sample of wastewater from a sewershed (the area served by a wastewater collection system) is collected before it is treated at the water treatment plant.

The samples are sent to environmental or public health laboratories for SARS-CoV-2 testing.



Health departments submit testing data to CDC through the online NWSS Data Collation and Integration for Public Health Event Response (DCIPHER) portal.

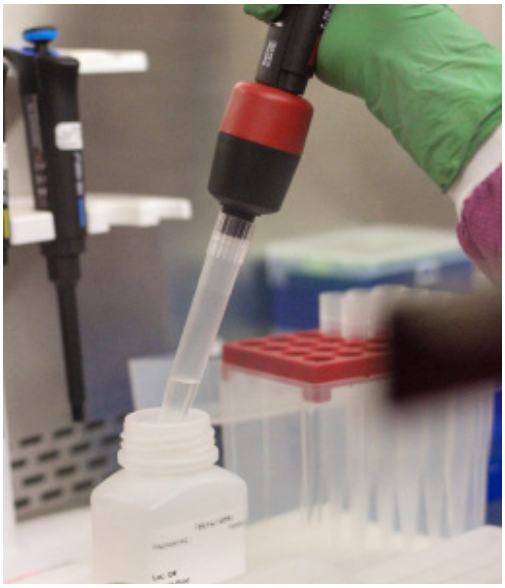
The NWSS DCIPHER system analyzes the data and reports results to the health department for use in their COVID-19 response. The results are available to the public through CDC's COVID Data Tracker: **covid.cdc.gov/covid-data-tracker**

Wastewater Testing on a National Scale

In September 2020, the Centers for Disease Control and Prevention (CDC), along with the Minnesota Department of Health and several other state institutions, established a system for earlier detection. The National Wastewater Surveillance System (NWSS) tests samples from sewage to discover whether pathogens have spread throughout an area.

The program began with a focus on COVID-19. When a person is infected with SARS-CoV-2, the virus that causes COVID-19, the virus and its genetic material is shed in feces, which when become part of the wastewater system. As part of the NWSS program, samples are taken from wastewater just before it enters treatment plants. The samples are then tested for the presence of the SARS-CoV-2 RNA.

This process does not allow for diagnosing individual people. Instead, it provides valuable population-level data to complement, but not replace, other sources of information about infection rates.



Testing Sites Throughout Minnesota

The Minnesota Department of Health and the Metropolitan Council set up wastewater sampling in the metro area, and the University of Minnesota set up a network of 44 sites around the state to monitor. The samples are sent to MDH for testing, after which MDH sends the test results to the CDC.

Currently, the Minnesota Environmental Laboratory is in the process of adding more sample testing locations, devoting instrumentation and two full-time technicians to the effort.

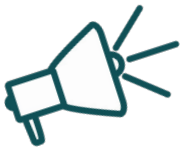
Detecting Disease Variants Earlier

The SARS-CoV-2 virus has a remarkable ability to mutate into new variants. This gives vaccine manufacturers and other health institutions little time to develop a response to each. NWSS has proven especially effective in uncovering new variants of the disease faster than could be possible otherwise. As the threat from COVID-19 wanes, some participating laboratories have begun testing for other pathogens, including flu, polio, mpox, and antimicrobial-resistant organisms.

The COVID-19 pandemic put the threat of infectious disease at the front of public awareness. It also demonstrated the phenomenal ability of the modern health infrastructure, ranging from public health institutions to for-profit vaccine manufacturers, to collaborate and respond effectively. Wastewater testing has proven to be another important tool in the global effort to combat infectious disease.

There are currently 44 monitoring sites and work is underway to add additional sites throughout Minnesota.

Studying wastewater data can help scientists detect infectious diseases in a community even before data from doctor's offices or hospitals get reported to public health officials.



This is the first time wastewater has been used to monitor infectious diseases on a national scale in a coordinated effort.

New Antimicrobial-Resistant Organisms Threaten Public Health

ANTIMICROBIAL RESISTANCE IS RECOGNIZED AS KILLING AT LEAST 1.27 MILLION PEOPLE WORLDWIDE.

One of the greatest advances in medical science—the discovery and production of antibiotics to treat and cure people of deadly infectious diseases—has saved millions of lives worldwide since Alexander Fleming discovered (partially by accident) the antimicrobial properties of penicillin mold in 1928.

However, bacteria, viruses, parasites, and fungi are evolving, developing ways to defeat or resist antimicrobial agents like antibiotics. The emergence of antimicrobial-resistant organisms means that infections typically defeated by common antimicrobials have become more difficult to treat, leading to more illnesses and deaths.

The CDC estimates that drug-resistant bacteria cause 23,000 deaths and 2 million illnesses each year in the United States.

Antibiotic resistance also threatens animal health, agriculture, and the economy.

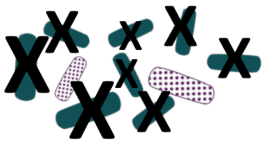
6 of the 18 most damaging antibiotic resistance threats cost the U.S. more than $4.6 billion annually.

How Antimicrobial Resistance Happens

Antimicrobial resistance involves bacteria and other pathogens that live in and on our bodies developing the ability to survive the drugs designed to kill them. It does not mean the human body itself is resistant to antibiotics, antifungals, or other medicines.

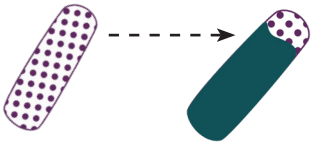
The pathogens then proliferate further and can even pass on the genes responsible for antimicrobial resistance to other organisms.

Among many bacteria, a few are drug resistant.



Antibiotics kill bacteria causing illness, as well as good bacteria protecting the body from infection.

The drug-resistant bacteria can now grow and take over.



Some bacteria give their drug resistance to other bacteria.

Adapted from Centers for Disease Control and Prevention

The Minnesota Public Health Laboratory has been involved in recent outbreaks of two separate organisms that resist carbapenems, valuable antibiotics that fight bacterial infections. If carbapenem resistance becomes widespread, millions of infections will become much more difficult to treat.

Outbreak One: E. coli in Dogs

In 2022, a dog underwent an operation for a head wound at the University of Minnesota Veterinary Medical Center. A carbapenem-resistant *Escherichia coli* (*E. coli*) was found at the site of the wound. The dog lives in a congregate animal rescue facility that supplies therapy animals to assisted living communities.

The Infectious Disease Laboratory used its sophisticated instrumentation to determine the gene responsible for carbapenem resistance in the organism: bla_{NDM}. The lab then evaluated samples from 73 dogs from the animal rescue facility and discovered the bla_{NDM} gene in 27 of them. They were colonized by the *E. coli*, meaning that they carried the organism, but they were not infected, in that they did not have symptoms.

Of the 27 colonized dogs, 20 had been imported from other nations. So far, there have been no documented cases of transmission from animals to humans of the *E. coli*. Scientists do not yet know how readily the pathogen can spread from dogs to humans.

Outbreak Two: CRPA in Eye Drops

Another antimicrobial-resistant organism has been uncovered across the United States. In October 2022, the CDC discovered an outbreak of carbapenem-resistant *Pseudomonas aeruginosa* (CRPA). The Minnesota Department of Health sent an alert to labs throughout the state to send any isolates of CRPA to the Public Health Laboratory.

As dozens of CRPA cases were isolated in other states, the CDC investigated each to discover a common source for the organism. A culprit was found: Artificial Tears Lubricant Eye Drops. The product's manufacturer initiated a voluntary recall after a recommendation by the Food and Drug Administration (FDA).

In mid-March 2023, the Minnesota Public Health Laboratory received an isolate from South Dakota that tested positive for CRPA. The CDC is investigating the case.

On March 21, 2023, the CDC released an update stating that 68 patients in 16 states have been identified as contracting VIM-GES-CRPA. Just four healthcare facilities, all of which used eye drops from the same manufacturer, are linked to 37 of the patients. Many patients contracted eye infections, eight suffered vision loss, and three died. Since March 21, several more cases have been found, but still none in Minnesota.

By detecting, characterizing, and monitoring such threats quickly after a specimen is discovered, the Minnesota Public Health Laboratory and the rest of the American public health infrastructure gather the information necessary to prevent future epidemics.

The Minnesota Department of Health Public Health Laboratory is one of seven public health laboratories across the nation chosen by the CDC to provide testing in a national surveillance system that monitors and responds to drug resistance throughout the country.

Infectious Disease staff perform highly specialized tests that allow them to respond to outbreaks, characterize and track different mechanisms of resistance, and to detect new kinds of resistance in the pathogens that most concern public health officials.

Mpox, Ebola Threats Rise and Fall

EFFECTIVE DISEASE SURVEILLANCE AND RAPID LABORATORY DIAGNOSIS ALLOWS FOR QUICK DETECTION AND RESPONSE.

The COVID-19 pandemic heightened public attention on infectious disease in general. So far, no other disease has proven as devastating, thanks both to the varying traits of the diseases and the United States' robust health infrastructure, which includes the Minnesota Infectious Disease Laboratory.

Mpox

In May 2022, the United States experienced a surge in mpox (formerly known as "monkeypox") diagnoses. Mpox is a viral disease spread among humans and animals that is endemic in Central and West African countries but rarely found elsewhere in the world.

Though the mpox and smallpox viruses are in the same genus, Orthopoxvirus, an mpox infection is much less severe. (Neither is related to chicken pox.) The typical symptoms of the mpox variant diagnosed in the United States are a painful rash and mild flu. It is very rarely fatal.

Doctors, however, were caught unprepared for the disease. Most had only read about orthopoxviruses in medical school. The Infectious Disease Laboratory became the go-to resource for medical professionals unsure of how to collect samples.

First Mpox Testing in Minnesota

In coordination with the CDC, the Infectious Disease Laboratory became the first to test for mpox in Minnesota. By mid-July 2022, the lab was receiving around 50 samples per day, six days a week. Each day, a handful of samples would test positive for mpox.

After a peak of positive mpox test results in August, the lab saw a sudden drop-off in mid-October. Since Nov. 5, 2022, only a handful of cases have been confirmed in Minnesota. For data about the mpox outbreak, visit https://direc.to/kgGV.

A full analysis is underway to determine why the threat of mpox has apparently passed. Some credit must go to the Public Health Laboratory's dissemination of information about the disease. Communities affected by mpox curtailed dangerous behaviors and learned about and received the vaccine. The building housing the Public Health Laboratory became the first mpox vaccine clinic in the state.

Public health laboratories across the country have an early and critical role when it comes to an infectious disease outbreak.

Lab surveillance testing may find clusters of a new or rapidly spreading contagion, before hospital cases are tied together.

When it comes to new contagions, public health laboratories are often the first to develop, test, and perform diagnostic testing early on in an outbreak.

Ebola

Another disease that made headlines in 2022 was Ebola. On Sept. 20, the Ugandan government declared an outbreak of Ebola virus disease that claimed 39 lives out of a total of 74 cases in one month.

However, no suspected cases were found in the United States, and the risk of importing the disease was always assessed as low. The Minnesota Infectious Disease Laboratory did not receive any samples for Ebola testing. Of the handful of samples submitted to labs across the country, all tested as negative.

There are many reasons why Ebola is very unlikely to cause a pandemic in the United States. Many African countries have burial practices that promote transmission of the virus. Also, American hospitals have testing, quarantine, and treatment systems that excel at keeping people alive and preventing transmission.

The Minnesota Public Health Laboratory's Emergency Preparedness and Response unit is critical to Minnesota's public health response and intervention system, capable of responding to public health emergencies 24/7.

Our scientists use state-of-the art methodologies and sophisticated instrumentation unavailable to most facilities.

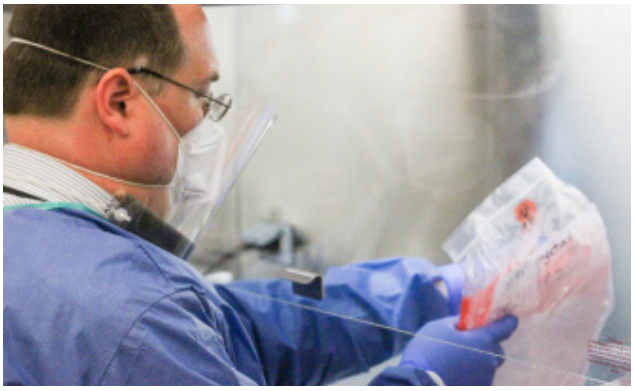
The laboratory is equipped with a Biosafety Level 3 containment facility, which protects laboratory scientists in handling and containing highly infectious agents or samples of unknown origin.

We work closely with state and federal agencies as well as local and federal law enforcement to prepare for rapid response in the event of an emergency.

Other Diseases

Other diseases, such as avian influenza, pose greater dangers. Another ongoing threat is from vaccine-preventable diseases, including mumps, measles, and diphtheria. If vaccination rates fall below 95%, these diseases can spread rapidly.

As the immediate threat from COVID-19 recedes, the Minnesota Infectious Disease Laboratory continues to provide the tools and personnel to combat it and any other infectious diseases quickly and effectively.



Lab Construction Brings Immediate Benefits

A 2020 BONDING PROJECT PROVIDED FUNDS TO REPAIR AND UPGRADE THE BUILDING.

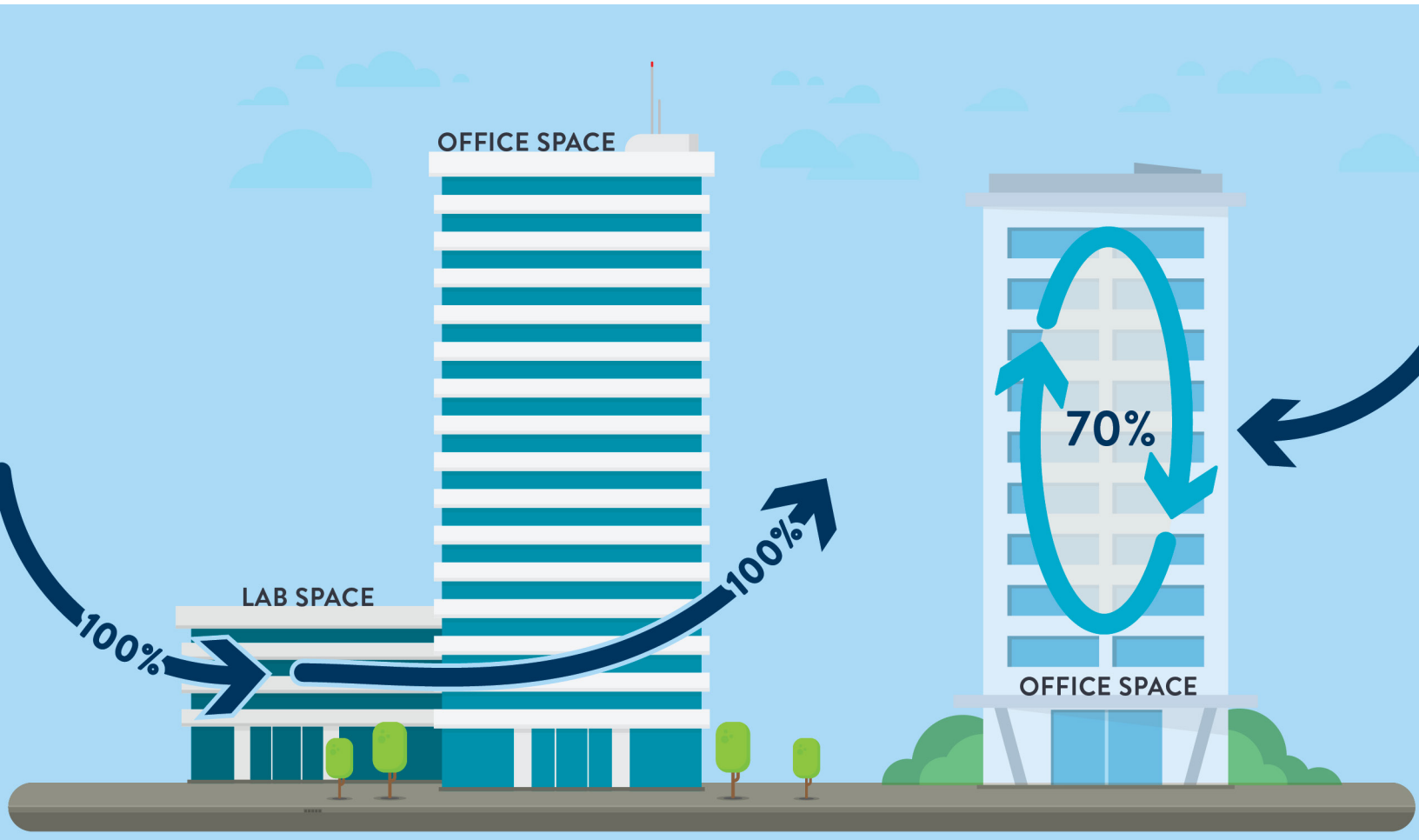
In January 2014, a flood caused by building engineering failures caused millions of dollars' worth of damage to the Agriculture and Health Laboratory building. The building had to shut down temporarily. Although its basic functions were restored quickly, plenty of problems remained that could only be resolved through a major bonding project.

The Minnesota Legislature approved a bonding project in 2020 to complete a major overhaul of the building. The scope encompassed both overdue repairs and upgrades of aging systems that were reaching their life expectancy dates.

New Airflow System

An example of a much-needed renovation was found in the building's airflow system. In every building, air is brought in from the outside, heated or cooled, and then distributed throughout the interior. For most buildings, around 70% of the air can be recirculated.

In a public health laboratory that deals with hazardous materials, no air can be recirculated. Within lab space, technicians often must wear protective hoods, gloves, etc., to shield them from possible contamination. The air used in labs cannot be brought into nearby office space or remain for long in laboratories, because particles in the air present safety concerns for employees. Also, the particles could drift into samples, which would throw test results into doubt.



Before the renovation, the laboratory building's airflow system was inefficient and aging. Sometimes, lab activity had to stop temporarily because ventilation was not working properly, which wasted time and money. Temperatures within the building fluctuated dramatically, because the heating and cooling systems could not keep up with demand. Because of the renovated system, labs can now expect consistent airflow and conduct their important testing with a minimum of interruptions.

Other Important Renovations

The overhaul of the airflow system constitutes just one important initiative of the reconstruction. Another is installing more energy-efficient lighting. Some space designated for laboratories on the third floor had never been finished due to lack of funds; now, because of the bonding project, those laboratories will be fully functional.

The Public Health Laboratory has gained increasing importance to the welfare of Minnesotans because of threats like COVID-19, antibiotic-resistant organisms, and PFAS, along with the first-in-the-nation addition of an infectious disease, cCMV, to a state newborn screening panel. The ongoing lab construction is a critical component in maintaining our state's ability to contend with these issues and whatever unpredictable challenges lie ahead.

New Air Valves

Airflow is critical in labs that cannot use any recirculated air. The valves in the old airflow system would often get stuck, making it difficult to maintain optimal air balance in lab spaces until they were fixed. The new system will allow for better control and is more efficient, so critical testing can proceed with a minimum of disruptions.

New Ventilation Controls and Displays

Along with the new valves, a new control system was added to the airflow system. This will allow for better communication between the air valves and the building automation system. Display screens were also added so lab users can get immediate visual and audible indications of airflow issues.

Energy-Efficient Lighting

The new LED lighting meets the Capitol Complex lighting standard for energy efficiency.

Newly Functional Laboratories

Lab spaces have been built out to allow for flexibility and changing future lab needs.

Ongoing Projects

HERE ARE SOME OF THE MANY ONGOING PROJECTS AT THE PUBLIC HEALTH LABORATORY.

A major remodel improved the rooms devoted to **accessioning**, the process by which the Environmental Laboratory, the Infectious Disease Laboratory, the Newborn Screening Program, and the Agricultural Laboratory receive samples from outside sources. More than 15 people work full-time in the space to process hundreds of samples every day.

The new open-floor concept removes obstacles to workflow and allows for greater flexibility in the event of a drastic change in sample volume, as occurred during the height of the pandemic. A key addition was a room in which clients can drop off samples in a refrigerator or freezer without interrupting the receiving process.

The **Diversity, Equity, Inclusion, and Belonging (DEIB)** collaborative spans all sections of the Public Health Laboratory. The group focuses on **building a foundation of DEIB principles** throughout the division.

In such efforts, **engaging employees and empowering** them to drive the discussion is more effective and meaningful than top-down approaches. The DEIB collaborative has also provided resources to supervisors and managers, such as **inclusive language for position descriptions and evaluations of potential interview questions.**

A new **Education Outreach Program is conducting science-based interactive programming with Minnesota's youth.** The goals are to spark interest in public health career pathways and to increase awareness of the valuable work done by the Minnesota Public Health Laboratory. The initiative is focused on inclusion and equity, **creating a bridge to the sciences for underserved communities and individuals.**

The Environmental Laboratory is **significantly expanding its testing capabilities for a class of human-made chemicals called per- and polyfluoroalkyl substances (PFAS).** At this writing, their scientists are starting to test **lakes, streams, and other non-potable water sources for PFAS**, using a new method provided by the Environmental Protection Agency (EPA). The lab is also **examining the tissue of fish for PFAS** and testing for new analytes (types) of PFAS through a sophisticated technique called high-resolution mass spectrometry.

Led by the Public Health Laboratory, the Minnesota Department of Health and its partners – the University of Minnesota and the Mayo Clinic – were named one of the country's five **Pathogen Genomics Centers of Excellence by the Centers for Disease Control and Prevention (CDC)**. The program aims to **improve the ability to detect and respond to future infectious disease threats and emergencies**.

One project is working to **address the higher rate at which children in under-served and Black, Indigenous, and People of Color (BIPOC) communities contract COVID-19 and related illnesses**. Another is **developing new methods for quickly and efficiently identifying the sources of foodborne disease outbreaks**.

Thanks to a grant from the CDC, the Newborn Screening Program has established a **surveillance program to measure the effectiveness of screening newborns for cCMV**. Because screening does not identify every case, it is **crucial to track how many children are missed during screening but diagnosed at a later time**. Metrics will also show how well the program helps children access the necessary monitoring and treatment.

Data and Quality, affectionately known as "DQ" or "the ice cream team," is a new unit in the Newborn Screening Program. It **brings together the epidemiologists, data analysts, quality specialists, and interoperability specialists who work with data**. The unit is looking for new ways to use the data points the program has collected to seek out new data and **improve the program's current data-based operations**.

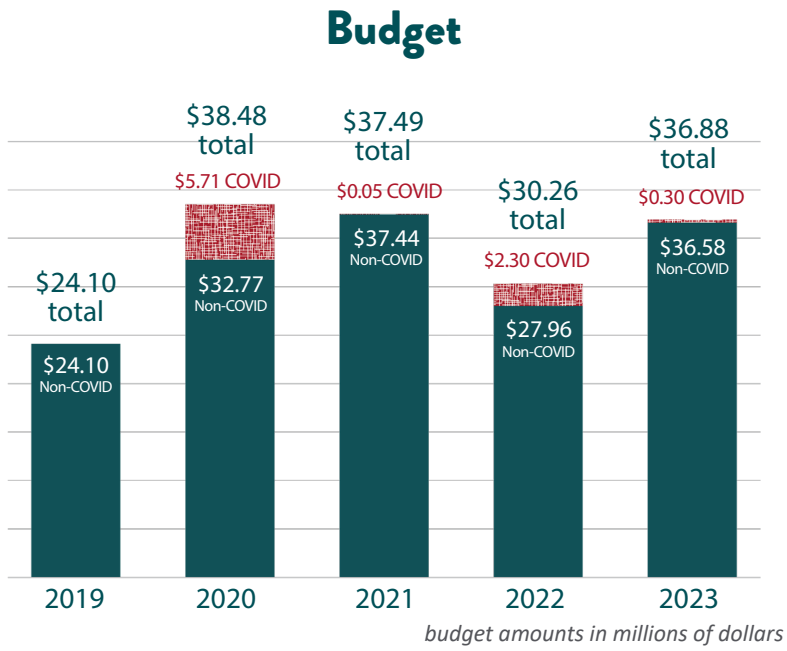
In August 2023 and January 2024, Minnesota Commissioner of Health Dr. Brooke Cunningham approved the Newborn Screening Advisory Committee's recommendations to add **new conditions to the Minnesota Newborn Screening Panel**, the list of conditions screened for at birth:

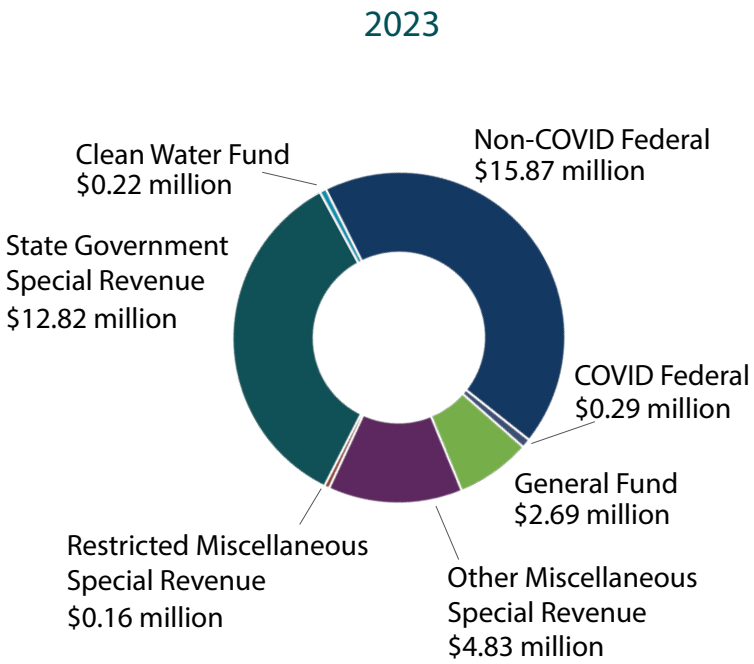
- Mucopolysaccharidosis type II (MPS II)
- Guanidinoacetate methyltransferase (GAMT) deficiency
- Krabbe disease
- Duchenne muscular dystrophy

Together, these conditions cumulatively impact about **one in 100,000 children born each year**. Early diagnosis and treatment **may help prevent or delay some of the severe health outcomes**.

PHL Budgets

In fiscal year 2023, the Public Health Laboratory operated on a budget of $36.88 million, not including special COVID funding. 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.





For past annual reports and budgets, visit: https://www.health.state.mn.us/about/org/phl/annualreports/index.html

For a description of fund categories, visit: https://www.health.state.mn.us/about/org/phl/funds.html

Protecting, maintaining, and improving the health of all Minnesotans

MINNESOTA DEPARTMENT OF HEALTH
PUBLIC HEALTH LABORATORY

mail

PO Box 64899
St. Paul, MN 55164-0899

visitor

601 Robert Street North
St. Paul, MN 55155-2531

phone

651.201.5200

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Go to https://direc.to/kTqN or scan the QR code below to schedule an in-person tour.

The entire PHL Annual Report is available online:

https://direc.to/m9TM