



SAINT LOUIS COUNTY
Public Health

Vector-Borne Disease Prevention Program 2021 Annual Report

**SAINT LOUIS COUNTY DEPARTMENT OF PUBLIC HEALTH
6121 NORTH HANLEY ROAD, BERKELEY, MO 63134**

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Saint Louis County Department of Public Health

Mission

To promote, protect, and improve the health and environment of the community.

Vision

Healthy people, healthy environment, equitable communities.

Values

We believe in:

- Being a public health leader in the community
- Providing equitable access to services and resources
- Being responsive to the changing needs of our community
- Operating in an ethical, transparent, and fiscally responsible manner
- Serving our community with dignity and respect

Vector-Borne Disease Prevention Program

Mission

The Saint Louis County Department of Public Health Vector Control Program protects the health of Saint Louis County residents and visitors by providing comprehensive vector-borne disease surveillance and implementation of Integrated Pest Management (IPM) strategies and principles in an environmentally friendly approach.

Vision

To protect the public health of Saint Louis County residents and visitors by providing a comprehensive vector control program that utilizes all aspects of IPM in an ecologically sound manner.

Report Preparation

This report was prepared by the St. Louis County Department of Public Health, Division of Communicable Disease Prevention.

- Vector-Borne Disease Prevention Program
- Epidemiology Program

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Notes about the Data

Data about vector-borne diseases were obtained from the Missouri Health Surveillance Information System (WebSurv), which is maintained by the Missouri Department of Health and Senior Services (MDHSS). Missouri's communicable disease reporting law, 19 CSR 20-20.020, requires reporting of certain vector-borne diseases within a dedicated time to the local health authority or to MDHSS. Reportable conditions are listed in [Appendix B](#), and are classified according to the National Notifiable Disease Surveillance System (NNDSS) case definitions.

Executive Summary

The Vector-Borne Disease Prevention Program provided services throughout all unincorporated St. Louis County in addition to 69 municipalities in 2021. Services included adult mosquito surveillance, larvicidal treatment, ULV applications, rodent surveillance and control, and responses to service requests and complaints.

In 2021, there were 225 mosquito trap sites throughout St. Louis County. Gravid traps were utilized to collect female *Culex* spp. mosquitoes to test for the presence of West Nile Virus.

From June through September of 2021, 52,185 female *Culex* spp. mosquitoes were collected. Average gravid trap counts ranged from 199.2 in June to 57.8 in September. Average trap counts were overall highest in the South Central and North Central regions. In June 2021, the North region had the highest average trap count of 463.7 compared to all other months and regions. Climate, structural factors, and advantageous breeding sites can all impact high trap counts.

There were 1,193 pools collected and tested from June through September 2021. Of those, 94 West Nile Virus positive pools were detected (7.9%). As expected, the percent positive pools increased from June (3.3%) to September (17.6%).

In 2021, 43 cases of human vector-borne illness were reported to the St. Louis County Department of Public Health. The vast majority were tickborne (90.7%).

The Vector-Borne Disease Prevention Program received a total of 396 service requests with the majority relating to adulticide services. The program typically has 5 full-time Vector Control Specialists and 10 seasonal Vector Control Assistants.

Starting 2021, the program switched from utilizing ELISA (enzyme-linked immunosorbent assay) for testing for West Nile Virus in mosquitoes collected to utilizing RT-PCR (reverse transcriptase-polymerase chain reaction).

Introduction

Background

In 2020, the National Association of County and City Health Officials (NACCHO) conducted a survey of the 1,664 vector control organizations in the United States to assess mosquito surveillance and control capabilities. Results from this report indicate that 72% of vector control organizations were classified as “Needs Improvement” in at least one core competency area.¹ When results were limited to only local health departments, the percentage classified as “Needs Improvement” increased to 86%. This is a slight decrease from the 90% of local health departments classified as “Needs Improvement” from the 2017 NACCHO vector survey. The NACCHO report underscores the need for continued attention toward and funding of vector surveillance and control efforts at the local level. See [Appendix A](#) of this report for additional details on the NACCHO report and to see the St. Louis County Department of Public Health (DPH) Vector-borne Disease Prevention Program (VBDP) scores on both the core and supplemental mosquito surveillance and control competencies.

The St. Louis County DPH VBDP is tasked with providing vector control services to St. Louis County residents and visitors. These services include not only comprehensive mosquito surveillance and control, but also surveillance and/or control of other arthropod vectors, as well as rodent abatement services. This report presents information on common vectors in the St. Louis County region, describes the activities conducted by the St. Louis County DPH VBDP, and provides surveillance data for calendar year 2021.

The impact of the COVID-19 pandemic on both public health activities (including vector control services) and the residents of St. Louis County can be found throughout this report. The pandemic affected not only individuals’ recreational activities, healthcare-seeking behaviors and access, and employment trends, but also the ability of the VBDP to recruit seasonal staff and devote their full attention to vector-related activities. It will be important to keep the pandemic in mind when reading through the 2021 Vector-Borne Disease Prevention Program Annual Report to provide context for the data and commentary provided.

About the St. Louis County Department of Public Health Vector-Borne Disease Prevention Program

The St. Louis County DPH VBDP provides full-scale vector control operations for the majority of the 523 square miles that comprise St. Louis County. These operations include adult mosquito surveillance, testing of adult mosquitoes for the presence of arboviral disease, larvicidal treatment of mosquito breeding sites, Ultra-Low Volume (ULV) and barrier applications for the control of adult mosquitoes, as well as rodent abatement activities in public areas. The VBDP conducts these operations throughout all unincorporated St. Louis County, as well as 69 municipalities (in 2021) within the county who contract with the VBDP to provide vector control services for their residents. All operations are conducted in accordance with Integrated Pest Management (IPM) principles and are overseen by Vector Control Specialists who are licensed and certified by the Missouri Department of Agriculture in Public Health Pest Control. St. Louis County DPH Vector Control Specialists must attend recertification training every three years

¹ https://www.naccho.org/uploads/downloadable-resources/Vector-control_2020-assessment-report_Final.pdf

through the Missouri Department of Agriculture to maintain their licenses in Public Health Pest Control. The VBDP also utilizes Vector Control Assistants, seasonal employees who provide additional resources during the busy summer months. Vector Control Assistants are overseen by Vector Control Specialists and are required to complete online vector control training courses developed by the Centers for Disease Control and Prevention (Vector Control for Environmental Health Professionals), as well as an online information security awareness course (required for all DPH staff).

Vector-Borne Disease Prevention Program Services

- Adult mosquito surveillance to monitor the presence and distribution of disease-carrying mosquitoes
- Arboviral disease testing of adult mosquitoes to determine the presence and distribution of arboviral disease in the adult mosquito population
- Larvicidal treatment of mosquito breeding sites to reduce the number of adult mosquitoes
- ULV applications for the control of the adult mosquito population
- Barrier applications for the control of the adult mosquito population
- Rodent surveillance and control in public areas and easements
- Response to service requests and complaints regarding mosquito and rodent activity
- Inspections, technical assistance, and control recommendations to Saint Louis County residents, at no cost

Integrated Pest Management

Integrated Pest Management (IPM) is an evidence-informed, ecosystem-based strategy that focuses on long-term prevention of target organisms through a combination of control techniques that are practical and effective to protect public health, as well as the environment. These techniques include surveillance, prevention, education, source reduction, and chemical control methods. All control methods are surveillance-driven and do not occur until predetermined action thresholds are met. After surveillance results indicate that control methods are warranted, pesticide treatments are made with the goal of removing only the target organism. Pest control products are selected and applied in a manner that reduces pesticide resistance and minimizes risks to human health, non-target species, beneficial organisms, and the environment.





Disease Vectors in St. Louis County

Although St. Louis County and the state of Missouri are home to dozens of species of mosquitoes and ticks, most are not relevant vectors for disease in humans. In St. Louis County, as in the state of Missouri and the United States as a whole, most human vector-borne disease is

caused by ticks. Notable vectors of human tickborne disease in Missouri include: *Amblyomma americanum* (the lone star tick); *Dermacentor variabilis* (the American dog tick); and *Ixodes scapularis* (the blacklegged tick). Additionally, the St. Louis County region has recently seen cases of such emerging tickborne pathogens as Heartland and Bourbon viruses. However, tick surveillance with a public health focus has not been routinely conducted in Missouri. Because of the significant public health threat of tickborne illness, the VBDP is developing a tick surveillance program.

The majority of VBDP activities involve the surveillance and control of mosquito populations to minimize human illness. **Table 1** below presents information on four common genera of disease-causing mosquitoes found in St. Louis County. See [section II.C](#) of this report for further information on human vector-borne illness.

Table 1: Common Mosquito Vectors in St. Louis County

Name	<i>Culex</i>	<i>Aedes</i>	<i>Psorophora</i>	<i>Anopheles</i>
	 (<i>Cx. pipiens</i>)	 (<i>Ae. albopictus</i>)	 (<i>Ps. ciliata</i>)	 (<i>An. quadrimaculatus</i>)
St. Louis species	<ul style="list-style-type: none"> • <i>Cx. pipiens</i> • <i>Cx. quinquefasciatus</i> • <i>Cx. erraticus</i> • <i>Cx. restuans</i> 	<ul style="list-style-type: none"> • <i>Ae. albopictus</i> • <i>Ae. vexans</i> 	<ul style="list-style-type: none"> • <i>Ps. ciliata</i> • <i>Ps. ferox</i> 	<ul style="list-style-type: none"> • <i>An. punctipennis</i> • <i>An. quadrimaculatus</i>
Egg laying and habitat	<ul style="list-style-type: none"> • Floating rafts of ~200 eggs • Ditches, standing water, vacant pools, some containers • Prefers polluted waters with high organic content 	<i>Ae. albopictus</i> <ul style="list-style-type: none"> • Small containers such as birdbaths, flowerpots, buckets, kiddie pools, clogged gutters, tires <i>Ae. vexans</i> <ul style="list-style-type: none"> • Flood plains 	<ul style="list-style-type: none"> • Temporary rain pools 	<ul style="list-style-type: none"> • Ponds with growing vegetation, canals, irrigation ditches, sluggish streams
Relevant information	Active after dusk and just before dawn	Aggressive biters, especially during the day	Relatively large mosquito, aggressive biters, active during the day	Active during the day or night
Diseases transmitted	West Nile virus, Saint Louis encephalitis, and Eastern equine encephalitis	<i>Ae. albopictus</i> <ul style="list-style-type: none"> • Chikungunya, dengue fever, yellow fever, Zika virus <i>Ae. vexans</i> <ul style="list-style-type: none"> • Canine heartworm 	West Nile virus has been detected in certain <i>Psorophora</i> spp.	Malaria, yellow fever, canine heartworm, West Nile virus has been detected in certain <i>Anopheles</i> spp.

Vector Control Management Areas

The VBDP divides St. Louis County into five Vector Control Management Areas (VCMAs). As noted in **Table 2**, each of these areas contains sections of unincorporated St. Louis County, as well as independent municipalities. The five VCMAs range in size and differ in population density and geographic features, though all regions are fairly uniform with respect to common mosquito breeding sites. Weather permitting, the VBDP conducts trapping and adulticiding activities from Sunday to Thursday on a rotating schedule by VCMA.

Table 2: Description of the St. Louis County Vector Control Management Areas

Region	Size ranking	# trap sites	Jurisdictions	Notable features	Common mosquito breeding sites
North	3	31	<ul style="list-style-type: none"> • Unincorporated St. Louis County • 5 municipalities 	<ul style="list-style-type: none"> • Populated, with a few rural areas • Flood plains, areas not accessible by vehicle 	Standing water, ditches, creeks, swamps, retention basins, drainage culverts, some storm water sewers, some catch basins
North Central	4	40	<ul style="list-style-type: none"> • Unincorporated St. Louis County • 12 municipalities 	<ul style="list-style-type: none"> • Densely populated 	Standing water, ditches, creeks, retention basins, drainage culverts, storm water sewers, catch basins
South	2	49	<ul style="list-style-type: none"> • Unincorporated St. Louis County • 5 municipalities 	<ul style="list-style-type: none"> • Populated, with a few rural areas • Meramec River flood plain 	Standing water, ditches, creeks, swamps, retention basins, drainage culverts
South Central	5	35	<ul style="list-style-type: none"> • Unincorporated St. Louis County • 11 municipalities 	<ul style="list-style-type: none"> • Moderately populated 	Standing water, ditches, creeks, retention basins, drainage culverts, storm water sewers, catch basins
West	1	63	<ul style="list-style-type: none"> • Unincorporated St. Louis County • 6 municipalities 	<ul style="list-style-type: none"> • Contains most diverse mosquito habitats • Densely populated and rural areas • Missouri and Meramec River flood plains 	Standing water, ditches, creeks, swamps, retention basins, drainage culverts

2021 Climate Information

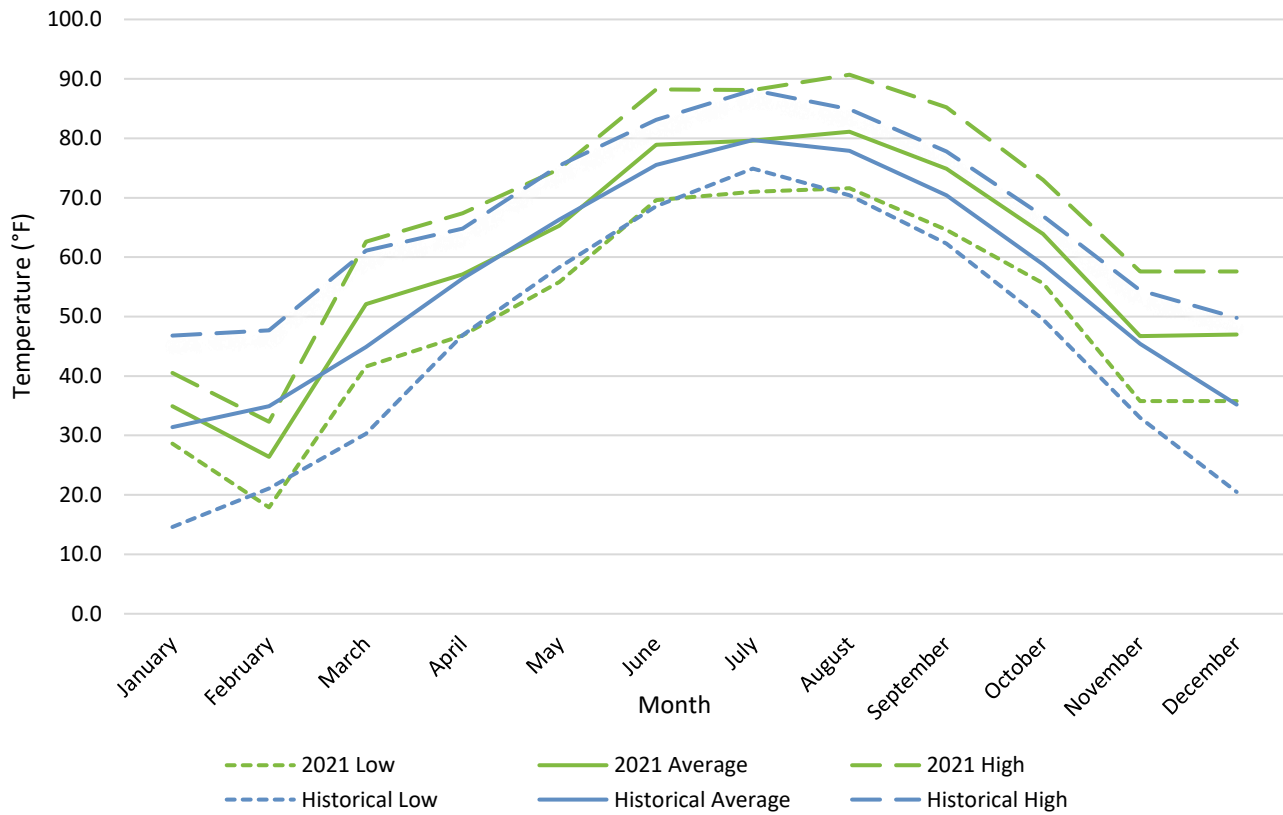
The weather patterns leading into and during the mosquito breeding season can influence mosquito abundance and West Nile virus (WNV) activity. **Figures 1 and 2** below present average monthly temperatures and precipitation for 2021, compared with historical averages.

Temperatures in 2021 were largely similar to historical averages, especially during the primary months of the mosquito season.

Monthly precipitation in 2021 was characterized by large spikes and particularly dry or wet months. A dryer-than-average May could have resulted in less favorable breeding conditions early in the season; however, June ended up being a wetter-than-average month which could have created more favorable breeding conditions, especially if the rainfall resulted in swampy

conditions. In contrast, large rainstorms in July and August may have washed out breeding sites, resulting in less favorable breeding conditions. See **Figures 3a** and **3b** below for further details regarding the impact of climate conditions on monthly average trap counts, which are a good indicator of mosquito breeding conditions.

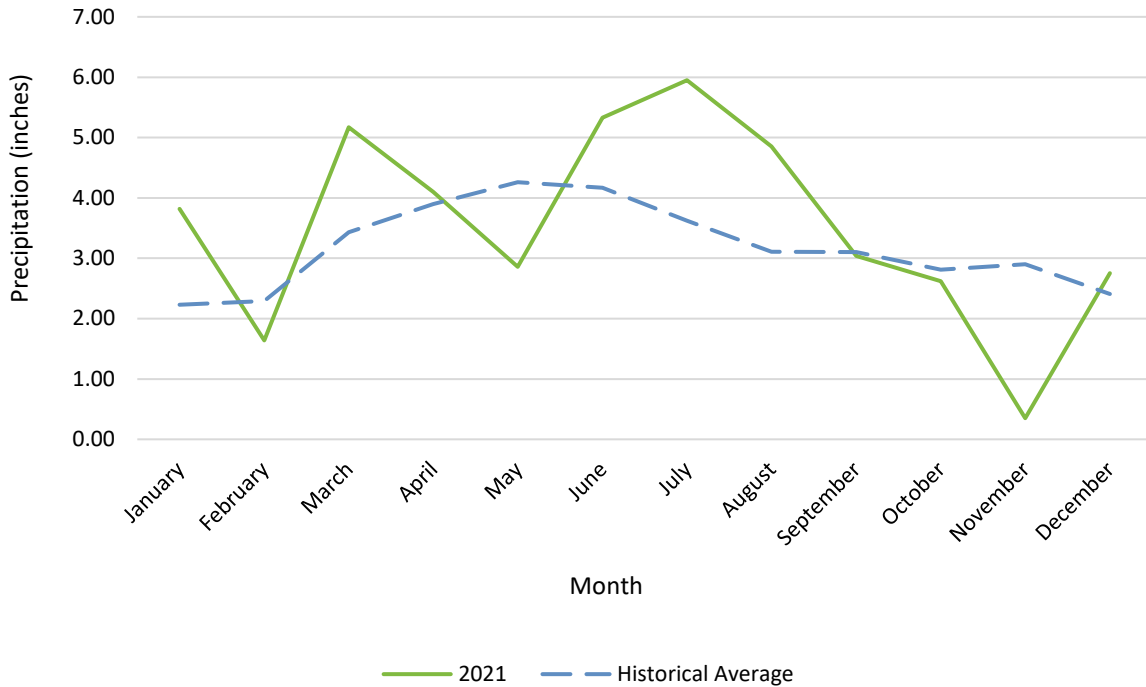
**Figure 1: High, Average, and Low Monthly Temperatures (°F)
St. Louis, MO, 2021 and Historical Data***



Sources: http://www.weather.gov/media/lx/climate/stl/temp/temp_stl_monthly_seasonal_averages.pdf, <http://www.weather.gov/lx/cliplot>

* Data from 01/1836 – 12/2023

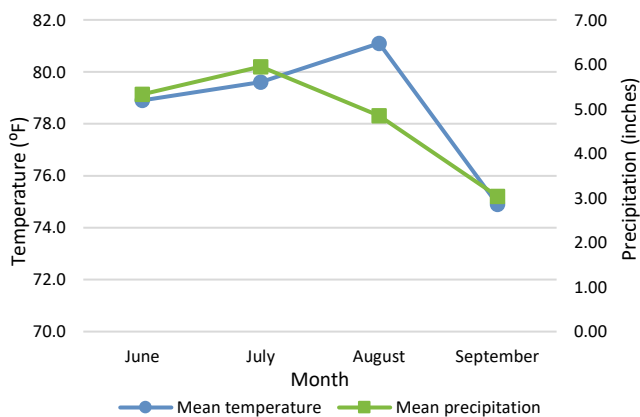
**Figure 2: Monthly Precipitation (Inches)
St. Louis, MO, 2021 and Historical Average***



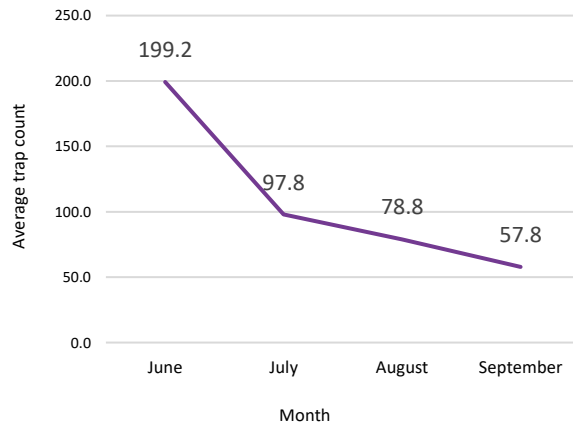
Source: http://www.weather.gov/media/lx/climate/stl/precip/precip_stl_monthly_seasonal.pdf

* Data from 01/1870 – 12/2023

**Figure 3a: Monthly Precipitation (inches)
and Average Temperature (°F)
St. Louis, MO, 2021**



**Figure 3b: Monthly Average Trap Counts
(Female *Culex* spp.)
St. Louis, MO, 2021**



Sources: <http://www.weather.gov/lx/cliplot> , http://www.weather.gov/media/lx/climate/stl/precip/precip_stl_monthly_seasonal.pdf

Arboviral Vector and Disease Surveillance

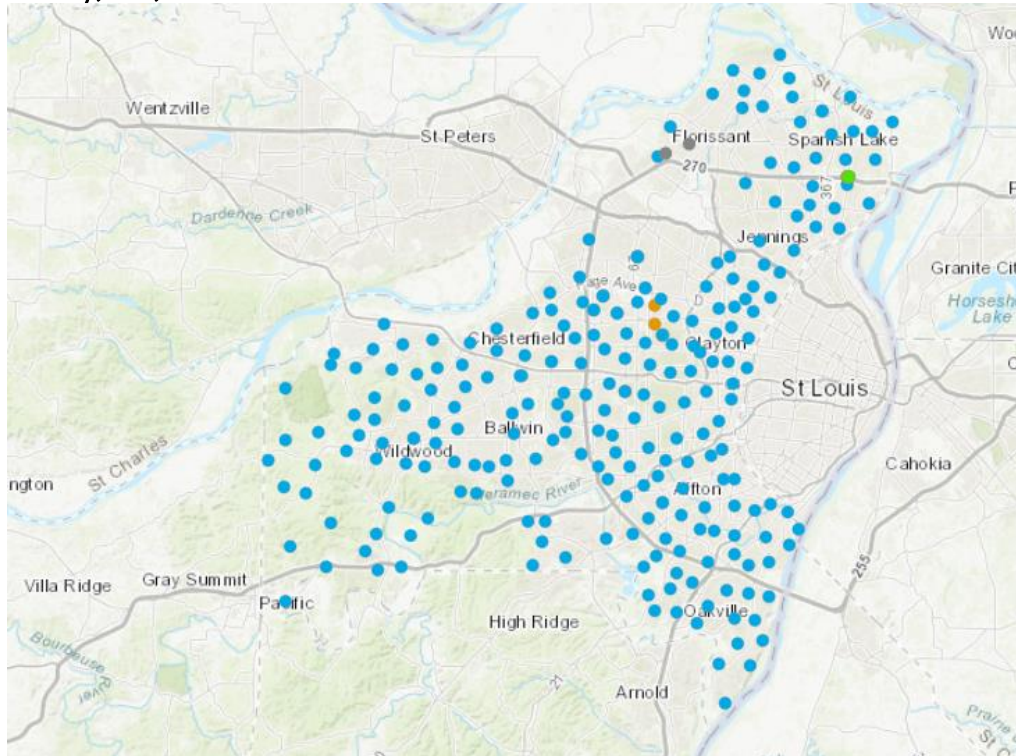
Description of Surveillance Activities, Traps, and Tests

The St. Louis County Department of Public Health (DPH) Vector-Borne Disease Prevention Program (VBDP) monitors adult disease-carrying mosquito populations and tests adult *Culex* spp. mosquitoes for the presence of vector-borne disease. There are 225 mosquito trap sites located throughout St. Louis County (Figure 4). The most common type of mosquito trap used by the VBDP, the gravid trap, is primarily used to collect gravid female *Culex* spp. mosquitoes to test for the presence of West Nile virus (WNV), although gravid traps are also useful for collecting several other species of mosquitoes including *Aedes albopictus*. Gravid traps are spaced equally throughout Vector Control Management Areas (VCMAs) based on the flight range of *Culex* spp. mosquitoes (~5 miles). Specific trap locations are selected according to several factors, including population density, ease of access (e.g., parks and easements), and desirability as a mosquito breeding site.

In prior years, in addition to gravid traps, the VBDP placed Sentinel 2 traps and carbon dioxide-baited CDC Light traps at locations throughout the County. These are designed to attract *Aedes* spp. (*Ae. aegypti* and *Ae. albopictus*, in particular) and other mosquito species for identification and surveillance. Due to limited staff, the VBDP was only able to set gravid traps in 2021. The inability to recruit and retain Vector Control Assistants to fully supplement surveillance activities caused the VBDP to shift resources to focus on *Culex* and WNV surveillance.

Weather and staff resources permitting, gravid traps are set five days per week throughout the mosquito season. These traps are set during the afternoon and retrieved the following morning. Sentinel 2 and CDC Light traps may be set on any weekday throughout the mosquito season and are retrieved the following morning. Mosquitoes collected from all traps are identified and sorted by sex and species. Female *Culex* spp. mosquitoes are then tested for the presence of WNV using a reverse transcriptase-polymerase chain reaction (RT-PCR). Surveillance data are used to determine where to concentrate mosquito control efforts and how best to utilize VBDP resources. The VBDP also provides surveillance data to programs within DPH, as well as other local, state, and federal programs.

**Figure 4: Mosquito trap sites
St. Louis County, MO, 2021**



Vector Surveillance Tables

Gravid traps made up all the traps set because surveillance and control of *Culex* spp. mosquitoes capable of transmitting WNV are currently the focus of the VBDP’s mosquito activities. As described above, the geographic distribution of traps throughout St. Louis County is dictated by population density and the presence of suitable mosquito breeding sites. Although traps can be set throughout mosquito season, the majority of traps are set from June to August, largely due to increased *Culex* spp. activity, as well as an increase in VBDP staffing and resources during these months. See **Tables 3a** and **3b** below for additional information on the VCMA of traps set each month.

**Table 3a: Number of Mosquito Traps Set by Month and Vector Control Management Area
St. Louis County, MO, 2021**

		Jun	Jul	Aug	Sep	2021 total
North	Gravid	6	44	24	6	80
North Central	Gravid	18	36	27	6	87
South	Gravid	24	34	28	0	86
South Central	Gravid	29	24	37	6	96
West	Gravid	28	48	34	5	115
Total		105	186	150	23	464

**Table 3b: Mosquito Traps Set, by Vector Control Management Area
St. Louis County, MO, 2021**

	N	%
North	80	17.2
North Central	87	18.8
South	86	18.5
South Central	96	20.7
West	115	24.8
Total	464	100.0

A total of 1,200 female *Culex* spp. mosquito pools (Table 4) and over 52,000 female *Culex* spp. mosquitoes (Table 5) were collected during the 2021 mosquito season. Average trap counts (Table 6 and Figure 5) were highest in June, driven by trap counts in the North, North Central, and South Central VCMAs. The North Central region typically has high trap counts compared with the other VCMAs due largely to the region’s dense population, advantageous breeding sites, and such structural factors as its combined sewer system.

**Table 4: Number of Mosquito Pools Collected, by Month and Vector Control Management Area (female *Culex* spp.)
St. Louis County, MO, 2021**

Vector Control Management Area	Jun	Jul	Aug	Sept	2021 total
North	64	85	59	6	214
North Central	113	93	53	8	267
South	57	59	53	0	169
South Central	147	79	59	10	295
West	86	104	55	10	255
Total	467	420	279	34	1,200

**Table 5: Number of Mosquitoes Collected, by Month and Vector Control Management Area (female *Culex* spp.)
St. Louis County, MO, 2021**

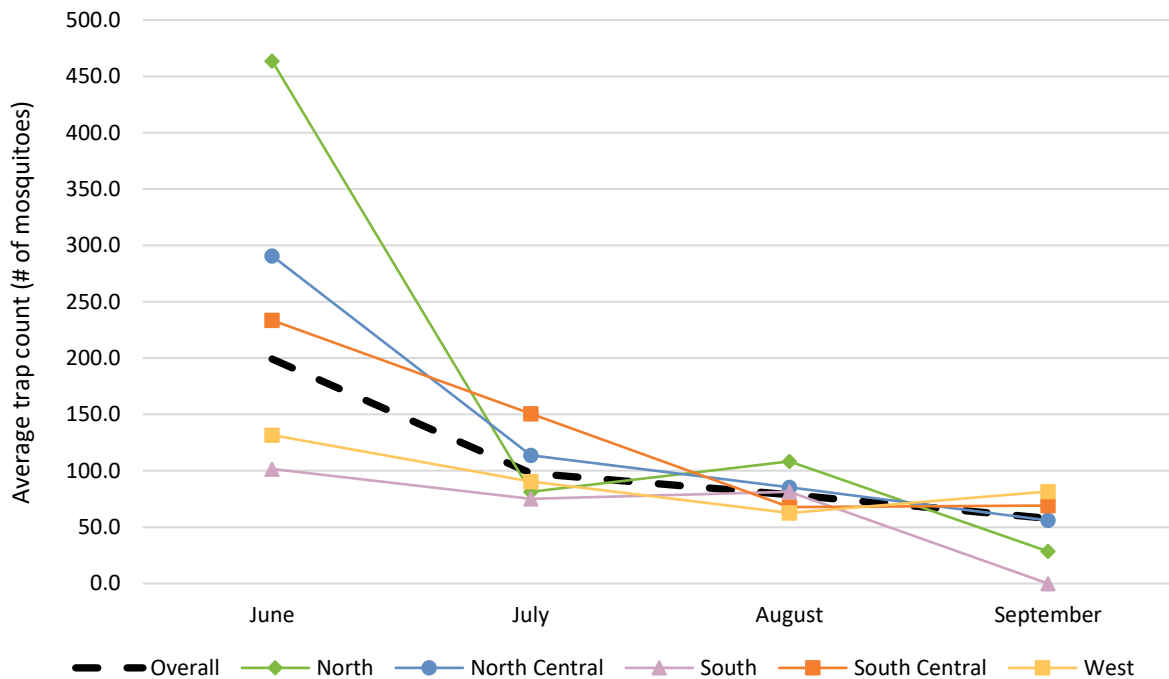
Vector Control Management Area	Jun	Jul	Aug	Sept	2021 total
North	2,782	3,586	2,603	171	9,142
North Central	5,233	4,096	2,217	336	11,882
South	2,440	2,559	2,280	0	7,279
South Central	6,775	3,614	2,509	415	13,313
West	3,689	4,343	2,219	408	10,569
Total	20,919	18,198	11,738	1,330	52,185

Table 6: Average Gravid Trap Counts, by Month and Vector Control Management Area (female *Culex* spp.)

St. Louis County, MO, 2021

Vector Control Management Area	Jun	Jul	Aug	Sept	2021 total
North	463.7	81.5	108.5	28.5	114.3
North Central	290.7	113.8	85.3	56.0	138.2
South	101.7	75.3	81.4	0.0	84.6
South Central	233.6	150.6	67.8	69.2	138.7
West	131.8	90.5	62.6	81.6	91.9
Overall average	199.2	97.8	78.8	57.8	112.7

Figure 5: Average Trap Counts by Month and Vector Control Management Area (female *Culex* spp.)
St. Louis County, MO, 2021



Ninety-four WNV positive (WNV+) pools (7.9% of all pools tested) were identified during the 2021 mosquito season (Tables 7 and 8). WNV first amplifies in birds, peaking in July and August, with mosquito populations soon following.² The proportion of WNV+ pools increased from 3.3% in June to 8.8% in July to 12.9% in August to ending in September at a high of 17.6%. The proportion of WNV+ pools was notably lower in the South Central region, something that has been observed in previous years. The proportion of WNV+ pools in 2021 was lower than what was observed in 2020 and 2019 (10.1%), and much lower than the proportion of WNV+ pools in 2018 (12.7%). In the years prior to 2018, the VBDP used Rapid Analyte Measurement Platform

² https://www.cdc.gov/westnile/resources/pdfs/13_240124_west_nile_lifecycle_birds_plainlanguage_508.pdf

(RAMP®) testing to identify WNV+ mosquitoes and prior to 2021 used enzyme-linked immunosorbent assay (ELISA). Because of that, direct comparison of 2021 RT-PCR results with previous years is not possible.

Table 7: Number of West Nile Virus Positive Pools, by Month and Vector Control Management Area St. Louis County, MO, 2021

Vector Control Management Area	Jun	Jul	Aug	Sept	2021 total
North	0	8	9	1	18
North Central	3	10	5	1	19
South	2	5	10	0	17
South Central	5	4	7	1	17
West	5	10	5	3	23
Total	15	37	36	6	94

Table 8: Percent of West Nile Virus Positive Pools, by Month and Vector Control Management Area St. Louis County, MO, 2020

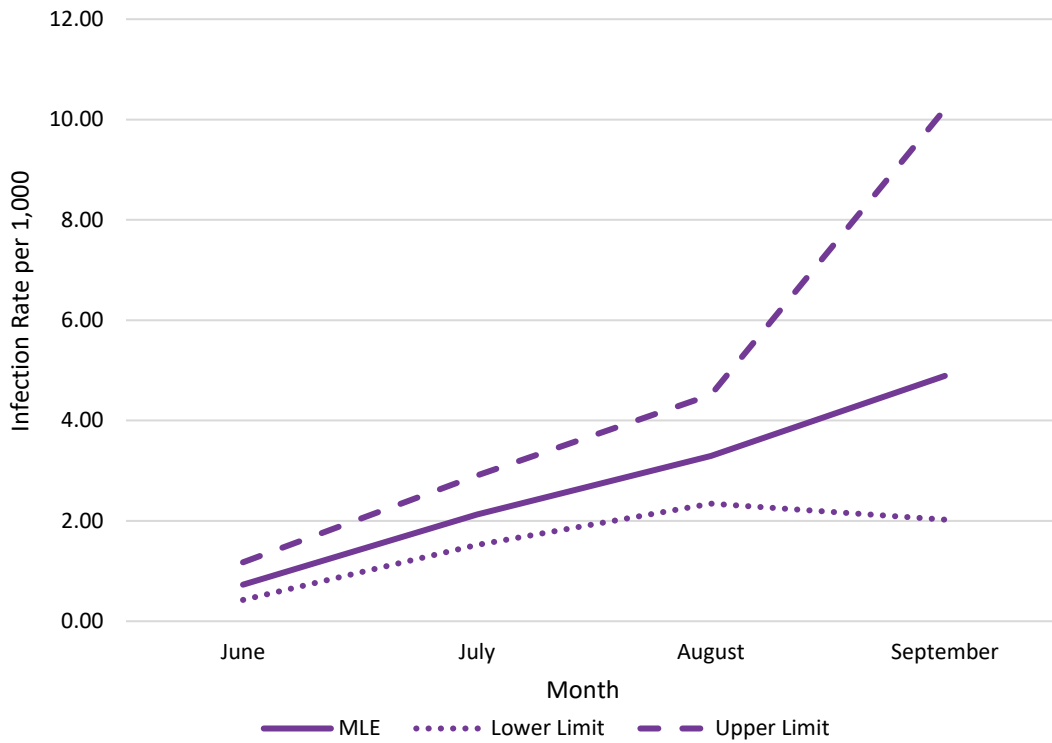
Vector Control Management Area	Jun	Jul	Aug	Sept	2021 total
North	0.0	9.4	15.3	16.7	8.7
North Central	2.7	10.8	9.4	12.5	7.1
South	3.5	8.5	18.9	0.0	10.1
South Central	3.4	5.1	11.9	10.0	5.8
West	5.8	9.6	9.1	30.0	9.0
Total	3.3	8.8	12.9	17.6	7.9

To estimate the proportion of infected mosquitoes in pooled samples, DPH uses the maximum likelihood estimation (MLE) method, which calculates the most likely infection rate given the testing results. In contrast to the minimum infection rate, which estimates the lower bound of possible infection rates, the MLE is preferred if the assumptions of small pool size and low infection rates are violated. The results below present point estimates calculated using bias-corrected MLE and skewness-corrected 95% confidence intervals (CIs).³

The monthly MLE ranged from a low of 0.73 per 1,000 (95% CI 0.42 to 1.17) in June to a high of 4.89 per 1,000 (95% CI 2.02 to 10.21) in September (**Figure 6**). The increase in infection rates from June to September reinforce the mosquito and WNV data presented above in Tables 5 and 8 (**Figure 7**).

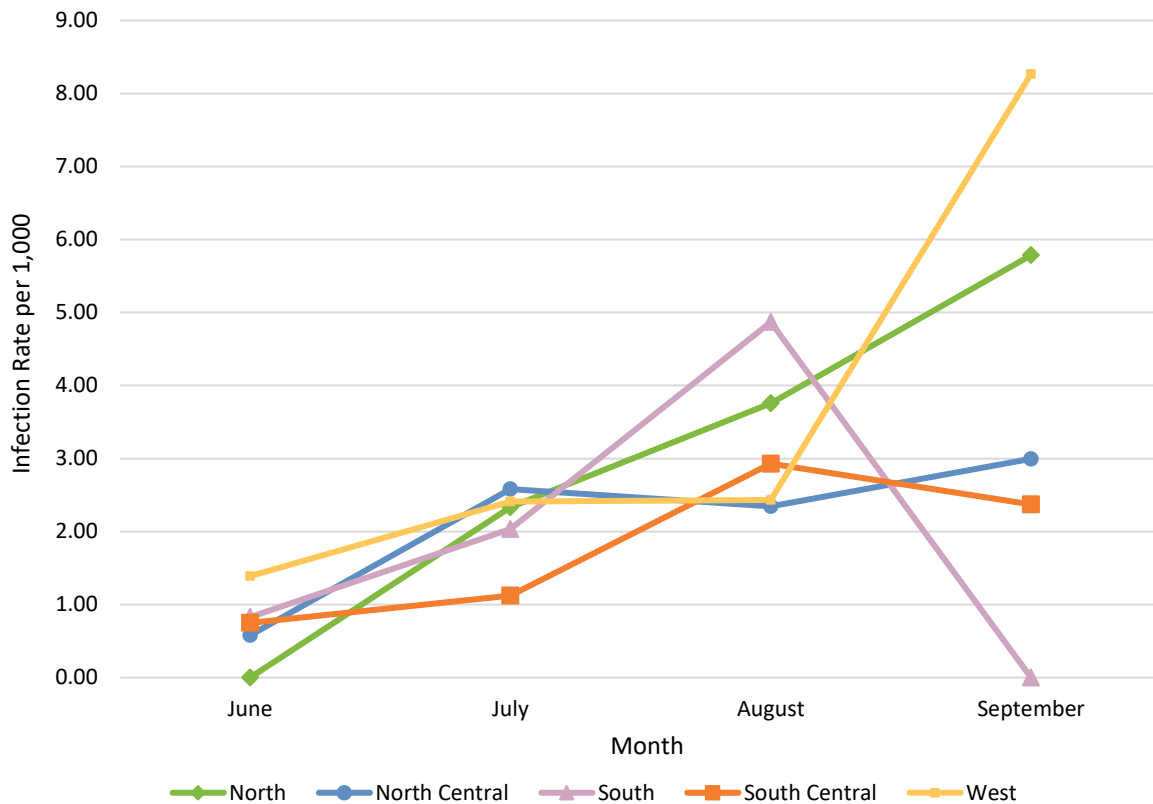
³ <https://www.cdc.gov/westnile/resourcepages/mosqSurvSoft.html>

**Figure 6: Maximum Likelihood Estimation (MLE) Mosquito Infection Rates and 95% Confidence Intervals* by Month
St. Louis County, MO, 2021**



*MLE and 95% confidence intervals calculated using CDC mosquito surveillance software (<https://www.cdc.gov/westnile/resourcepages/mosqSurvSoft.html>, accessed on 1/24/2024) in accordance with the method described in: Biggerstaff BJ (2013) PooledInfRate, version 4.0: a Microsoft office Excel Add-In to compute infection rates from pooled data. Centers for Disease Control and Prevention, Fort Collins, CO, USA.

**Figure 7: Maximum Likelihood Estimation (MLE) Mosquito Infection Rates*, by Month and Vector Control Management Area
St. Louis County, MO, 2021**



*MLE calculated using CDC mosquito surveillance software (<https://www.cdc.gov/westnile/resourcepages/mosqSurvSoft.html>, accessed on 01/24/2024) in accordance with the method described in: Biggerstaff BJ (2013) PooledInfRate, version 4.0: a Microsoft office Excel Add-In to compute infection rates from pooled data. Centers for Disease Control and Prevention, Fort Collins, CO, USA.

Human Vector-borne Disease

Vector-borne illness, including arboviral diseases as well as those caused by bacteria/rickettsia, protozoa, and helminths, are responsible for causing a substantial burden of human morbidity and mortality throughout the world. Clinically, these illnesses vary in presentation and severity, ranging from asymptomatic infections and mild febrile illness to hemorrhagic and neuroinvasive disease. With a few notable exceptions (e.g., yellow fever, Japanese encephalitis), vaccinations are unavailable to prevent vector-borne infections. Changes in climate, land use, human travel, and commercial trade have dramatically increased the global distribution of vector-borne diseases and introduced a myriad of new conditions previously unseen in Missouri and other non-tropical areas of the Western Hemisphere.

In Missouri, depending on how certain conditions are classified, at least 20 vector-borne diseases are considered reportable to the state of Missouri and notifiable nationally. See [Appendix B](#) for a list of these conditions, along with the case definitions used by the Council of State and Territorial Epidemiologists and the Missouri Department of Health and Senior Services to identify confirmed, probable, and suspected cases of each disease. In addition to the morbidity and mortality due to naturally occurring vector-borne diseases, several conditions

(plague, Q fever, and tularemia) are considered to be potential bioterrorism agents. Because of this, cases of these illnesses are of particular interest to public health investigators. When cases of any reportable vector-borne illness are received by St. Louis County DPH, communicable disease investigators work with the VBDP to ensure that proper control measures are implemented to prevent/minimize the further spread of disease. (See [Appendix D](#) for the Communicable Disease Prevention and Vector Control Notification and Response of Human Arboviral Disease Case Subtype(s) Protocol.)

Human WNV disease was first reported in St. Louis County (and in the state of Missouri) in 2002 and has been a nationally notifiable disease since 2005. During the period from 2002 to 2021, a median of 4 cases of human WNV disease (both neuroinvasive and non-neuroinvasive) were reported in St. Louis County residents each year, with a peak of 57 cases occurring in 2002 when the virus was first reported (**Figure 8**). Notably, the number and pattern of human cases of WNV in St. Louis County are similar to those in the neighboring City of St. Louis, though the City has a population of approximately 320,000 (compared with approximately one million St. Louis County residents). The total number of cases in Missouri from 2002 to 2021 was 632. The proportion of Missouri cases reported in St. Louis County from 2002 to 2021 ranged from 0.0% (in 2019) to 100.0% (in 2020) (**Table 9**). It is likely that many factors, including population susceptibility, national focus, climate, and access to healthcare and laboratory services contributed to the variations in the geographic and temporal distribution of human WNV cases.

**Figure 8: Probable and Confirmed Human West Nile Virus Cases
St. Louis County and the City of St. Louis, MO, 2002 to 2021**

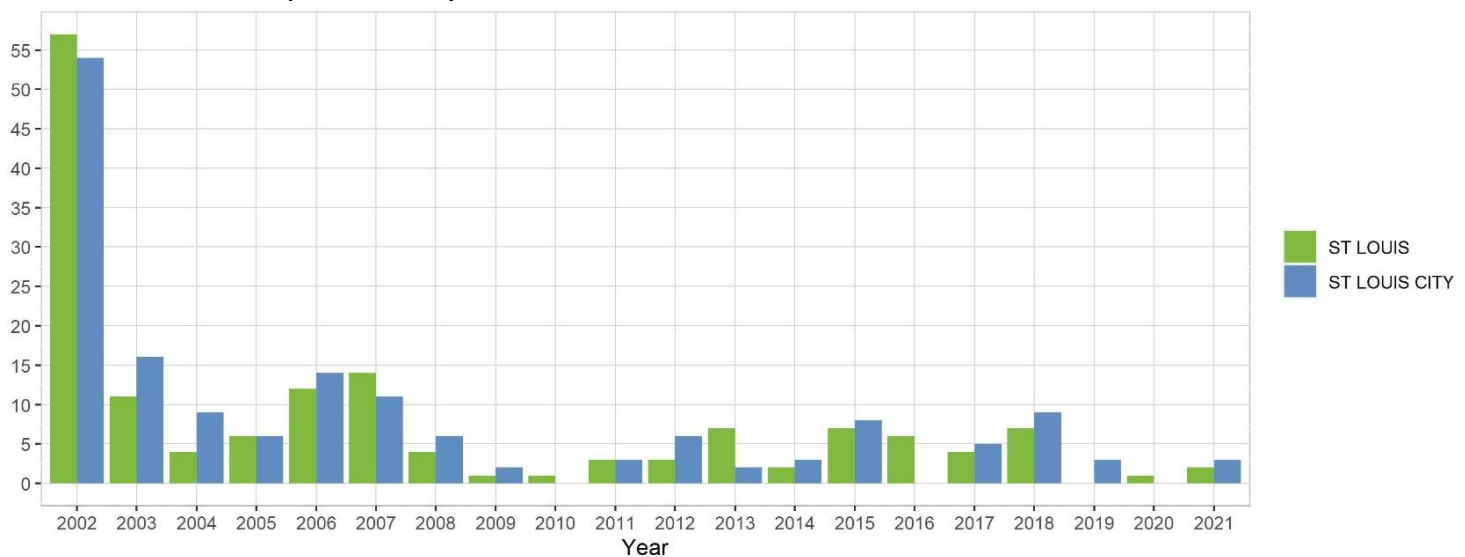
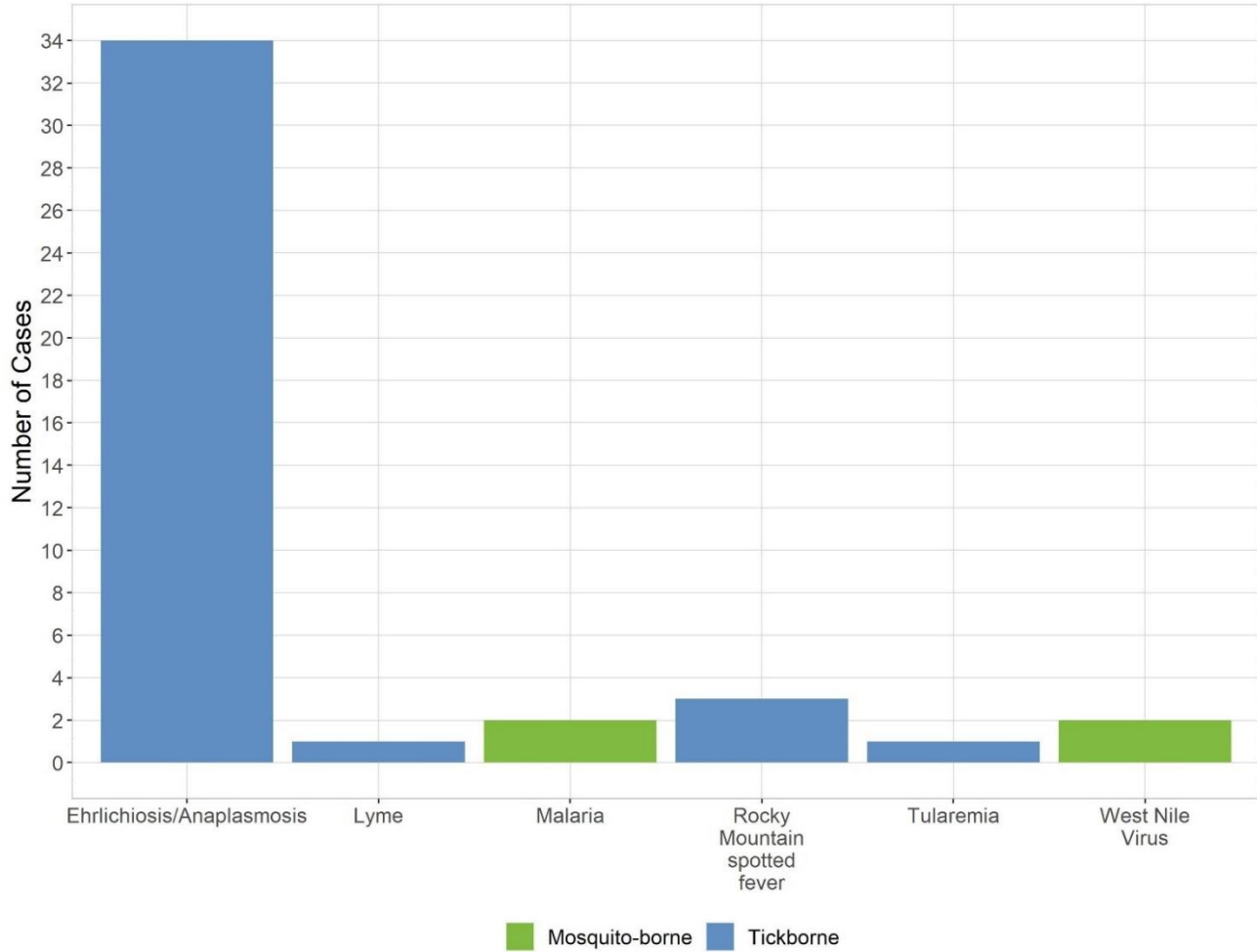


Table 9: Human West Nile Virus Case Counts and Percent of Missouri Cases in the County St. Louis County and Missouri, 2002 to 2021

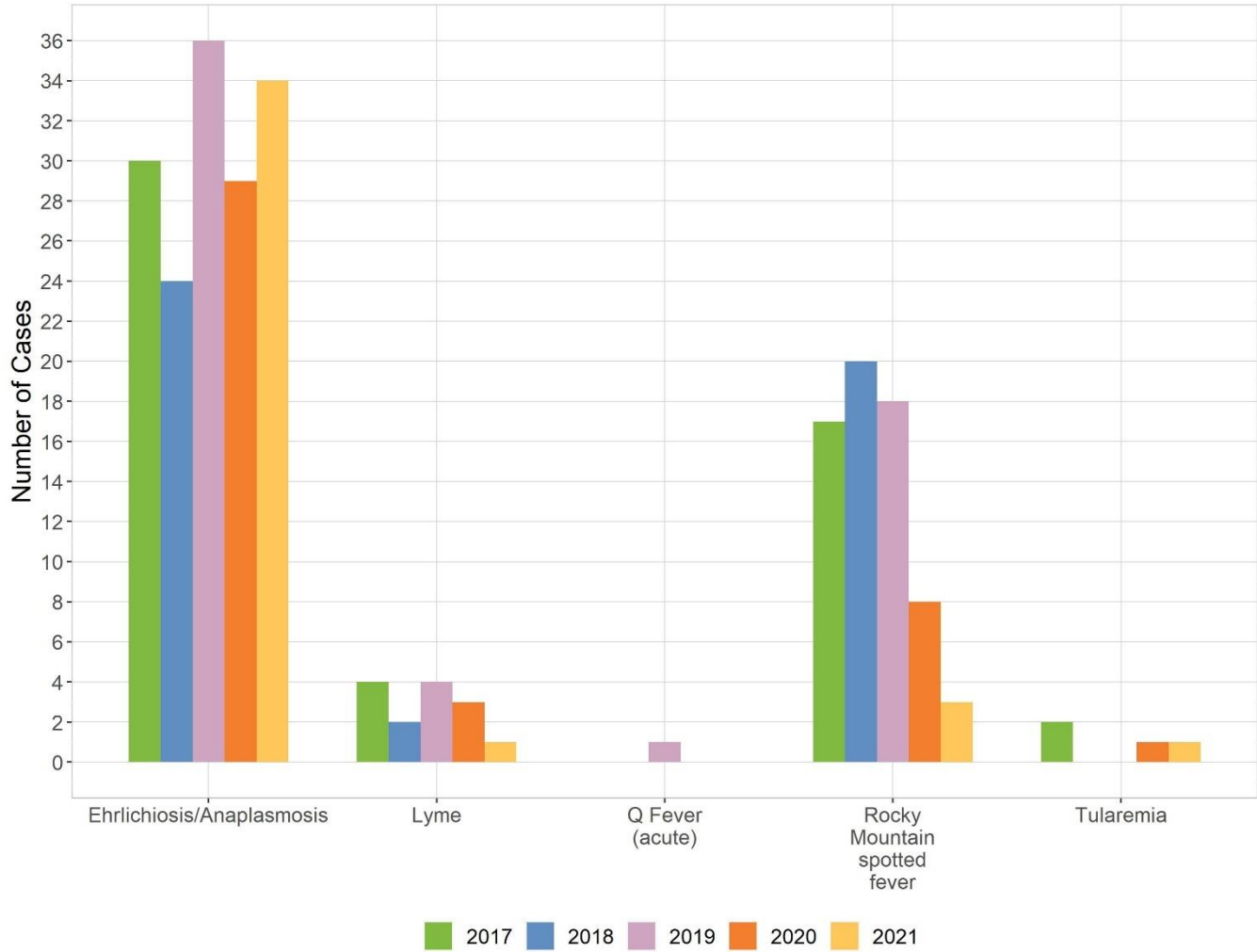
Year	St. Louis	Missouri	Percent of MO Cases	Year	St. Louis	Missouri	Percent of MO Cases
2002	57	168	33.9	2012	3	20	15.0
2003	11	64	17.2	2013	7	29	24.1
2004	4	36	11.1	2014	2	13	15.4
2005	6	30	20.0	2015	7	29	24.1
2006	12	62	19.4	2016	6	11	54.5
2007	14	77	18.2	2017	4	19	21.1
2008	4	15	26.7	2018	7	23	30.4
2009	1	5	20.0	2019	0	5	0.0
2010	1	3	33.3	2020	1	1	100.0
2011	3	10	30.0	2021	2	12	16.7

In 2021, 43 cases of human vector-borne illness were reported to the St. Louis County DPH (**Figure 9**). Nearly all (90.7%) of these were tickborne. The 39 cases of tickborne illness reported in 2021 represented a significant decline compared with the previous three years (4.9% decline from 2020, 33.9% from 2019, and 15.2% from 2018) (**Figure 10**). This decline was likely due – at least in part – to the impact of the COVID-19 pandemic on both healthcare-seeking behavior and recreational activities. Additionally, the case definition for Rocky Mountain spotted fever changed in 2020 which may have resulted in fewer cases meeting case definition.

**Figure 9: Human Cases of Mosquito-Borne and Tickborne Illness
St. Louis County, MO, 2021**



**Figure 10: Human Cases of Tickborne Illness
St. Louis County, MO, 2017 to 2021**



Mosquito Control Activities

Larviciding Activities

The St. Louis County Vector-Borne Disease Prevention Program (VBDP) monitors roughly 6,000 known mosquito breeding sites throughout unincorporated St. Louis County and contracting municipalities. The types of sites monitored include ditches, ponds, lakes, creeks, canals, swamps, marshes, sewers, storm water retention basins, and any other areas where standing water is present, and the potential exists for mosquito breeding to occur. Sites are regularly monitored by Vector Control Specialists and Vector Control Assistants for the presence of mosquito breeding activity throughout the mosquito season. Sites in which mosquito breeding is identified or where conditions show a high potential for mosquito breeding are treated with an appropriate EPA-registered mosquito control product. See [Appendix E](#) for a list of larvicides used by the VBDP. All mosquito control products are applied in accordance with the product label. Whenever possible, the VBDP uses biologically- and environmentally-friendly mosquito control products and application methods that minimize potential impacts on beneficial organisms and the environment.

In 2021, larviciding occurred from March to October, with VBDP staff spending a total of 1,199 hours on larviciding activities (**Table 10**). At least 122 hours of larviciding occurred in each month from May to September, with 28.3% of the total number of hours occurring in unincorporated St. Louis County and 71.7% occurring in municipalities. Larviciding routes received an average of four larvicide applications throughout the 2018 season. Field staff inspected over 15,000 potential mosquito breeding sites (73.5% in municipalities) and administered over 25,300 applications of larvicide (75.1% in municipalities). Compared with 2020, in 2021 the VBDP reported a 38.6% decrease in the number of larviciding hours, a 32.5% decrease in the number of larviciding sites inspected, and a 39.4% decrease in larvicide applications. Although multiple factors likely contributed to the decrease in larviciding in 2021, the largest contributor was the difficulty in recruiting and maintaining Vector Control Assistants throughout the season. Maintaining seasonal assistants is a constant challenge, and the pandemic only served to exacerbate this problem.

**Table 10: Mosquito Larviciding, by Month and Jurisdiction
St. Louis County, MO, 2021**

	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	2021 Total
Larviciding Hours	21.00	56.00	122.00	269.00	329.00	227.00	144.00	31.00	1,199.00
Municipal	0.00	17.00	104.00	171.00	248.00	180.00	132.00	8.00	860.00
Unincorporated	21.00	39.00	18.00	98.00	81.00	47.00	12.00	23.00	339.00
Larvicide Sites Inspected	111	568	2,090	2,904	4,260	2,600	1,822	717	15,072
Municipal	0	184	1,807	1,866	3,157	2,135	1,738	191	11,078
Unincorporated	111	384	283	1,038	1,103	465	84	526	3,994
Larvicide Applications	279	1,211	3,381	4,904	7,281	4,316	2,684	1,276	25,332
Municipal	0	505	3,044	3,376	5,575	3,500	2,620	412	19,032
Unincorporated	279	706	337	1,528	1,706	816	64	864	6,300

Adulticiding Activities

To control the adult mosquito population, the St. Louis County VBDP conducts nighttime Ultra-Low Volume (ULV) mosquito adulticide applications using truck-mounted ULV machines throughout unincorporated St. Louis County and contracting municipalities. During the mosquito season, ULV applications are conducted five nights per week, as weather conditions allow. When conducting ULV operations, control efforts are focused on areas where arboviral disease has been identified in the mosquito population, followed by areas where surveillance has indicated the presence of higher numbers of mosquitoes with the potential to transmit disease. The VBDP works with local beekeepers (both amateur and professional) to minimize the impact of ULV spraying on bee populations. Residents that maintain bee hives on their properties can request that their addresses be placed on a “No Spray” list or they can request to be notified via email when the VBDP will be conducting ULV operations in their areas so that they may take appropriate actions to protect their hives. Residents may also call the VBDP’s “Spray Hotline” (314-615-4BUG), which is updated every evening with the locations of that night’s ULV operations. In addition to ULV spraying, the VBDP administers barrier applications in areas such as parks and ballfields for both routine and special event control of adult mosquito populations.

In 2021, the VBDP devoted 259.86 total hours to adulticiding, with 42.6% of these in unincorporated St. Louis County, and 57.4% in various municipalities (**Table 11**). In addition, 3.0 hours were spent administering barrier applications; most of these were by request. The amount of time necessary for control activities of adult mosquito populations dropped sharply in October, with the onset of cooler nighttime temperatures. Because mosquito activity was still observed, however, the VBDP shifted its focus and resources to larviciding. Compared with the previous year, in 2021 the VBDP reported a 35.3% decrease in adulticiding hours. As with larviciding, this decrease was largely due to limited staffing resources.

**Table 11: Mosquito Adulticiding and Barrier Applications, by Month and Jurisdiction
St. Louis County, MO, 2021**

	June	July	August	September	October	2021 Total
Adulticiding Hours	37.03	71.25	109.75	41.83	0.00	259.86
Municipal	29.00	37.50	56.92	25.83	0.00	149.25
Unincorporated	8.03	33.75	52.83	16.00	0.00	110.61
Barrier Applications Hours	0.00	1.00	0.00	1.00	1.00	3.00

Rodent Control Activities

The Vector-Borne Disease Prevention Program (VBDP) works to control rodents which are capable of spreading disease to humans within St. Louis County. The St. Louis County VBDP’s Rodent Control Program is a complaint-driven program that investigates citizen complaints on public and private property as a reactive approach to rodent control. County residents notify the VBDP when rat activity is observed, initiating an investigation by a Vector Control Specialist in the area of the complaint. Based upon the Specialist’s findings during the complaint investigation, proper control methods are utilized using Integrated Pest Management, or, if on private property, professional recommendations for proper treatment methods are given to the property owner. The VBDP also conducts proactive rodent control measures. These measures include: retreatment of areas where activity has been previously identified; assessing neighborhoods for evidence of rodent activity; and surveying/treating areas with historically high rodent populations.

In 2021, 687 total rodent inspections were conducted, with 7.3% of these occurring in unincorporated St. Louis County, and 92.7% in various municipalities (**Table 12**). Additionally, 228 rodenticide applications were administered (98.7% in municipalities). Compared with 2020, slightly more rodent abatement activities were performed in 2021 (increases of 7.9% and 1.3% in rodent inspections and applications, respectively).

**Table 12: Rodent Abatement Activities, by Month and Jurisdiction
St. Louis County, MO, 2021**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	2021 Total
Rodent Inspections	5	7	73	74	57	80	97	96	84	43	39	32	687
Municipal	5	7	68	69	52	72	91	85	81	39	39	29	637
Unincorporated	0	0	5	5	5	8	6	11	3	4	0	3	50
Rodenticide Applications	1	0	18	14	19	32	48	32	28	20	14	2	228
Municipal	1	0	18	14	19	30	46	31	27	20	14	2	222
Unincorporated	0	0	0	0	0	2	2	1	1	0	0	0	6

Additional Services and Summary of Service Requests

In addition to service requests for rodent- or mosquito-related issues, the St. Louis County Department of Public Health (DPH) Vector-Borne Disease Prevention Program (VBDP) responds to service requests from St. Louis County residents regarding stinging insects. After inspecting the property and/or area for stinging insects, the VBDP provides either advice (if on private property) or treatment (if appropriate and on public property). In 2021, the VBDP conducted eight stinging insect inspections (75.0% in unincorporated St. Louis County) and administered seven stinging insect applications (57.1% in unincorporated St. Louis County) (**Table 13**).

**Table 13: Stinging Insect Activities, by Month and Jurisdiction
St. Louis County, MO, 2021**

	August	September	October	November	2021 Total
Stinging Insect Inspections	5	1	1	1	8
Municipal	1	0	1	0	2
Unincorporated	4	1	0	1	6
Stinging Insect Applications	4	0	1	2	7
Municipal	2	0	1	0	3
Unincorporated	2	0	0	2	4

Although mosquito surveillance and control activities are concentrated in the summer months, the VBDP responds to service calls year-round. When requests are received, each request is assessed and the VBDP responds appropriately. In 2021, the VBDP received 396 service requests for the inspection and control of adult mosquito populations, mosquito breeding sites, stinging insect populations, rodent populations, rodent habitats, and numerous other vector-related concerns (**Table 14**). Of these 396 requests, 53.3% were for adulticiding services, 21.7% were for control of mosquito breeding sites, 23.0% were for rodent control, and 5.0% were for other services. Compared with 2020, in 2021 the VBDP saw increases in the number of stinging insect service requests but decreases (sometimes quite dramatic) in the number of all other types of service requests (**Table 15**).

**Table 14: Summary of Service Requests, by Month and Jurisdiction
St. Louis County, MO, 2021**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	2021 Total
Adulticide Service Requests	0	0	0	2	14	22	109	41	23	0	0	0	211
Municipal	0	0	0	2	8	12	42	20	13	0	0	0	97
Unincorporated	0	0	0	0	6	10	67	21	10	0	0	0	114
Mosquito Breeding Service Requests	1	0	1	3	11	14	24	24	6	2	0	0	86
Municipal	0	0	0	3	6	9	12	6	4	1	0	0	41
Unincorporated	1	0	1	0	5	5	12	18	2	1	0	0	45
Rodent Service Requests	6	0	7	7	8	17	8	15	7	8	4	4	91
Municipal	5	0	6	4	6	13	6	7	6	8	2	3	66
Unincorporated	1	0	1	3	2	4	2	8	1	0	2	1	25
Stinging Insect Service Requests	0	0	0	1	0	0	0	2	2	2	1	0	8
Municipal	0	0	0	1	0	0	0	0	0	2	0	0	3
Unincorporated	0	0	0	0	0	0	0	2	2	0	1	0	5
Miscellaneous Service Requests	1	0	1	0	0	1	0	4	0	1	1	3	12
Total Service Requests	7	0	8	13	33	53	141	82	38	12	5	4	396

**Table 15: Service Requests by Year
St. Louis County, MO, 2017 to 2021**

	2017	2018	2019	2020	2021	% Change 2020 to 2021
Adulticide Service Requests	465	486	644	362	211	↓ 41.7%
Mosquito Breeding Service Requests	194	186	189	124	86	↓ 30.7%
Rodent Service Requests	310	229	63	100	91	↓ 9.0%
Stinging Insect Service Requests	33	27	8	6	8	↑ 33.3%
Miscellaneous Service Requests	110	81	2	14	12	↓ 14.3%
Total Service Requests	1,112	1,009	904	606	396	↓ 34.7%

2021 Vector-Borne Disease Prevention Program Updates and Achievements

Vector-Borne Disease Prevention Program (VBDP) Updates

- 2021 staffing and activities
 - 5 full-time Vector Control Specialists
 - 10 seasonal Vector Control Assistants
- Switched from ELISA to PCR testing

Presentations

- 8/12/2021: Virtual Panel Discussion on Vector-Borne Diseases – St. Louis Science Center

Appendix A: The National Association of County and City Health Officials 2020 Vector Control Assessment

In 2020, the **National Association of County and City Health Officials (NACCHO)** conducted a second iteration of the **Vector Control Assessment** to 1,664 vector control organizations in the United States, representing all organizations identified by NACCHO, the Centers for Disease Control and Prevention (CDC), and the American Mosquito Control Association. This second addition expanded the prior 2017 questionnaire to include items related to tick surveillance and control.

Of the **483 survey respondents**:

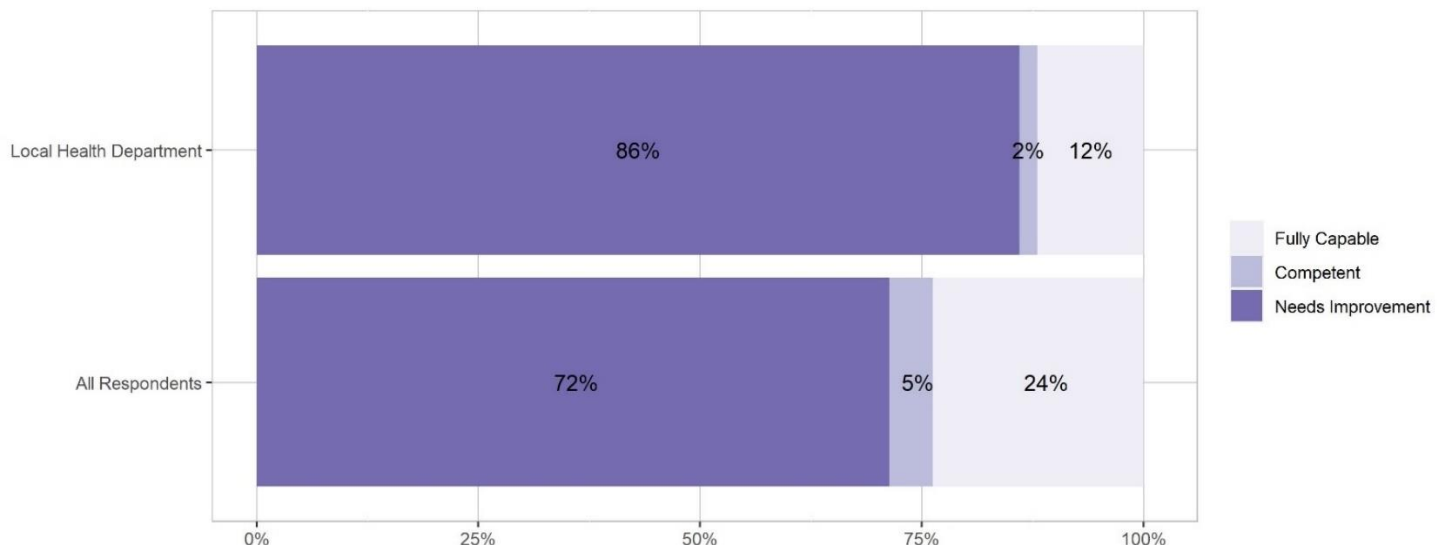
- 47% were from local health departments;
- 29% were from mosquito control districts;
- 19% City/County Department (e.g., local departments that do not sit within a health department, such as public works); and
- 5% were from other departments (e.g., State Health Departments, environmental health services, tribal programs).

A total of 348 programs responded to both the 2017 and 2020 assessments.

Using a **CDC framework for vector control competency** as guidance, five core competencies were used to rank each organization.

- A **Fully Capable** vector control organization performs all core and supplemental competencies.
- A **Competent** vector control organization performs all core competencies.
- A **Needs Improvement** vector control organization fails to perform one or more core competency.

Appendix A: Results of the NACCHO 2020 Vector Control Assessment*



*226 Local Health Department Respondents; 283 total Respondents

**2021 Mosquito Surveillance and Control Assessment –
Core and Supplemental Competencies**

✓ = Currently conducted by the Saint Louis County
Department of Public Health Vector-Borne Disease Prevention

Core Competencies

- ✓1. Routine mosquito surveillance through standardized trapping and species identification
- ✓2. Treatment decisions using surveillance data
- ✓3. Larviciding, adulticiding, or both
- ✓4. Routine vector control activities (e.g., chemical, biological, source reduction, or environmental management)
- 5. Pesticide resistance testing **Coming soon!**

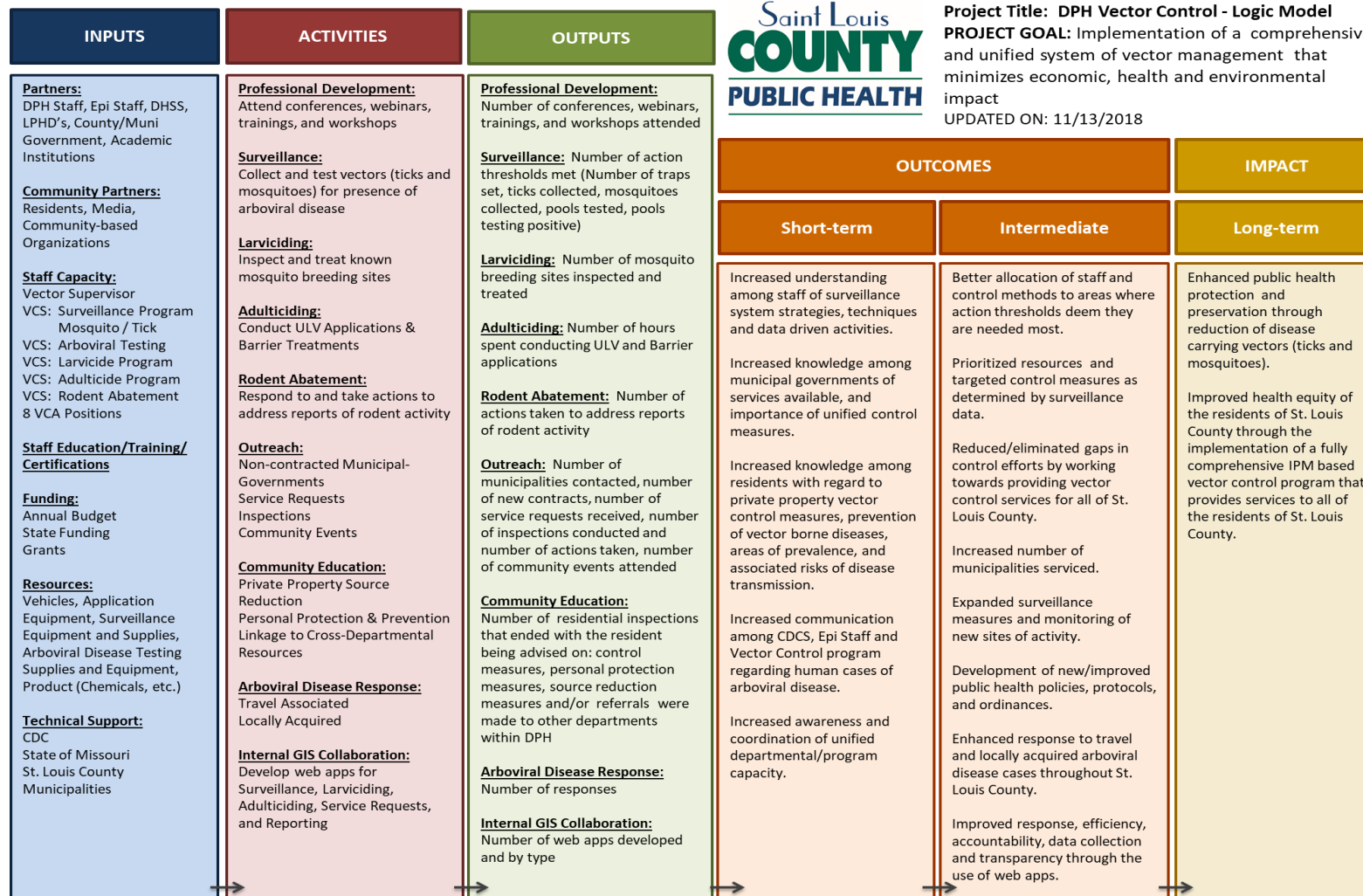
Supplemental Competencies

- ✓6. Licensed pesticide application
- ✓7. Vector control activities other than chemical control (e.g., biological, source reduction, or water management)
- ✓8. Community outreach and education activities
- ✓9. Regular communication with local health departments regarding surveillance and epidemiology
- ✓10. Cooperation with partner vector control programs

Appendix B: Vector-borne Diseases and Conditions Reportable in Missouri in 2021

Condition	Link to case definition
Anaplasmosis/Ehrlichiosis	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Ehrlichiosis.pdf https://ndc.services.cdc.gov/case-definitions/ehrlichiosis-and-anaplasmosis-2008/
Arboviral diseases, neuroinvasive and non-neuroinvasive <ul style="list-style-type: none"> • California serogroup viruses, including La Crosse virus • Chikungunya virus • Eastern equine encephalitis • Powassan virus • Saint Louis encephalitis virus • Venezuelan equine encephalitis virus • West Nile virus • Western equine encephalitis virus 	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Arbovirus.pdf https://ndc.services.cdc.gov/case-definitions/arboviral-diseases-neuroinvasive-and-non-neuroinvasive-2015/
Babesiosis	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Babesiosis.pdf https://ndc.services.cdc.gov/case-definitions/babesiosis-2011/
Dengue	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Dengue.pdf https://ndc.services.cdc.gov/case-definitions/dengue-virus-infections-2015/
Lyme-like disease, Lyme disease	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Lyme.pdf https://ndc.services.cdc.gov/case-definitions/lyme-disease-2017/
Malaria	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Malaria.pdf https://ndc.services.cdc.gov/case-definitions/malaria-2014/
Plague	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Plague.pdf https://ndc.services.cdc.gov/case-definitions/plague-2020/
Q Fever	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/QFever.pdf https://ndc.services.cdc.gov/case-definitions/q-fever-2009/
Rocky Mountain spotted fever	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/RMSF.pdf https://ndc.services.cdc.gov/case-definitions/spotted-fever-rickettsiosis-2020/
Tularemia	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/Tularemia.pdf https://ndc.services.cdc.gov/case-definitions/tularemia-2017/
Yellow fever	http://health.mo.gov/living/healthcondiseases/communicable/communicabledisease/cdmanual/pdf/YellowFever.pdf https://ndc.services.cdc.gov/case-definitions/yellow-fever-2019/
Zika	https://ndc.services.cdc.gov/case-definitions/zika-virus-disease-and-zika-virus-infection-2016-06-01/

Appendix C: Vector-Borne Disease Prevention Program Logic Model



Appendix D: Communicable Disease Control Services and Vector Control Notification and Response of Human Arboviral Disease Case Subtype(s) Protocol

California Serogroup Viruses including La Crosse Virus	Venezuelan Equine Encephalitis Virus
St. Louis Encephalitis Virus	West Nile Virus
Eastern Equine Encephalitis Virus	Western Equine Encephalitis Virus
Zika Virus	Dengue Virus
	Chikungunya Virus

I. PROTOCOL

The Saint Louis County Department of Public Health (DPH), Division of Communicable Disease Control Services (CDCS) is charged with protecting the health of Saint Louis County residents and visitors by investigating human cases of arboviral disease, as well as providing comprehensive surveillance and control of potential disease carrying vectors. When a case of human arboviral disease is identified, CDCS Investigators will work with the CDCS Vector Control Program (VCP) to minimize the potential for further spread of virus. Information on this process can be found below. Additional information in the investigation of human arboviral disease cases may be found in the Missouri Department of Health and Senior Services (MDHSS) [Communicable Disease Investigation Reference Manual](#) (CDIRM).

II. PURPOSE

The purpose of this protocol is to provide a consistent and uniform approach for the investigation and follow-up (including environmental assessment and mitigation) of human arboviral disease cases in Saint Louis County.

III. DIVISION OF COMMUNICABLE DISEASE CONTROL SERVICES, ORGANIZATION AND RESPONSIBILITIES

A. Director, Division of Communicable Disease Control Services, Saint Louis County DPH

1. During business hours, all calls concerning reportable diseases and/or conditions are routed to CDCS. After normal business hours, the Division Director of CDCS or a designee may be notified by the DPH answering service or the MDHSS Department Situation Room (DSR) about an unusual event. Typically, human cases of arboviral disease would not be considered unusual events warranting immediate, after-hours action by the CDCS Division Director.
2. The CDCS Division Director or designee assigns cases for follow-up.

3. The CDCS Division Director will determine if a press release is necessary for specific disease occurrences (e.g., the first human arboviral disease case of a calendar year).
4. The CDCS Division Director will provide timely notification of locally-acquired human arboviral disease cases to municipalities for which the Saint Louis County DPH provides vector or pest control services.

B. Communicable Disease Control Services Case Investigators, Saint Louis County DPH

1. CDCS Investigator(s) and Epidemiologists work together to conduct ongoing surveillance to monitor health status, respond to community health problems, and identify threats to public health. Investigation and surveillance of reportable diseases/conditions are accomplished by following the guidelines presented in the MDHSS [CDIRM](#).
2. Information gathered from any investigation is relayed to the CDCS Manager and Epidemiology Program Supervisor. As appropriate, information may also be relayed to the Director of the Saint Louis County Department of Public Health, the CDCS Division Director, and/or the Senior Epidemiology Specialist of the MDHSS Eastern District (ED) Office.
3. The CDCS Manager or appropriate CDCS Investigator is responsible for communicating with the VCP Supervisor or other VCP staff, as appropriate.

C. Communicable Disease Control Services Vector Control Program, Saint Louis County DPH

1. The CDCS VCP provides vector control operations, including adult mosquito surveillance, testing of adult mosquitoes for the presence of arboviral disease, larvicidal treatment of mosquito breeding sites, and Ultra-Low Volume (ULV) applications for the control of adult mosquitoes throughout much of Saint Louis County. These activities are conducted in accordance with Integrated Pest Management (IPM) principles and are overseen by Vector Control Specialists who are licensed and certified by the Missouri Department of Agriculture in Public Health Pest Control.
2. When information on an individual with probable or confirmed arboviral disease is received by the VCP, assessment and mitigation activities are undertaken by Vector Control Specialists as described below.
3. The VCP Supervisor or appropriate Vector Control Specialist is responsible for communicating with the CDCS Manager or other CDCS Investigators, as appropriate.

IV. PROCEDURE

A. Communicable Disease Control Services Case Investigators

1. Upon receipt of a neuroinvasive or non-neuroinvasive arboviral disease subtype report, appropriate CDCS staff will verify the diagnosis and obtain pertinent epidemiologic

information (e.g., demographic, clinical, and laboratory information) and ensure the appropriate data is entered into WebSurv.

2. The CDCS Investigator will follow the MDHSS [CDIRM](#) for the case definition and human investigation process.
3. If it is the first arboviral disease subtype of the year, the CDCS Investigator will notify both the CDCS Division Director and CDCS Manager. The CDCS Division Director will decide if a press release is necessary. Additionally, the CDCS Division Director will notify the DPH Director of the first human case of an arboviral disease subtype of the year. Examples of situations which may indicate a press release include:
 - a. The “beginning of the mosquito season” (i.e., a prevention message informing the public about measures they can take to prevent mosquito bites);
 - b. The first West Nile virus (WNV) case and death of the season; or
 - c. The first locally acquired confirmed case of Zika virus.
3. The CDCS Investigator will notify the VCP of all probable/confirmed reportable arbovirus cases within one business day.
 - a. The CDCS Investigator will email the VCP Supervisor and his/her designated backup. Within the email, the following people should be cc’ed:
 - i. all CDCS Nurse Investigators;
 - ii. the CDCS Manager;
 - iii. the CDCS Division Director; and
 - iv. the CDCS Epidemiology Program Supervisor.
 - b. The email should include the following information:
 - i. Identified arbovirus;
 - ii. WebSurv Condition ID number;
 - iii. Street name and 100 block, municipality, and ZIP code; and
 - iv. Work location/address, if appropriate and available.

Note: For probable/confirmed cases with local transmission by an Aedes spp. mosquito, (e.g., a case of Zika or chikungunya), the VCP will need the exact street address.

B. Environmental Assessment and Mitigation Summary Form

1. For each notification, the VCP will fill out the Environmental Assessment and Mitigation Summary form and fax it to the CDCS office at 314-615-8346. This should be done within three business days from the initial notification.
2. CDCS will fax the Environmental Assessment and Mitigation Summary Form to MDHSS for all probable/confirmed Zika cases. Additionally, CDCS will attach the form with the corresponding human arboviral condition report.

C. Vector Control Program, Travel-Acquired Cases

1. The Vector Control Specialist assigned to the case will survey the patient's location to determine the extent/presence of the associated vector and potential vector habitat.
2. The Vector Control Specialist will verify that the treatment of known breeding sites is current and reapply treatment to sites as needed.
3. The Vector Control Specialist will conduct an environmental survey to determine the presence of any previously unknown breeding sites and apply proper treatment as needed.
4. The Vector Control Specialist, or other appropriate VCP staff, will conduct ULV treatment of the area using truck-mounted sprayers to reduce adult mosquito populations.

D. Vector Control Program, Locally-Acquired Cases

1. The Vector Control Specialist assigned to the case will survey the patient's location to determine the extent/presence of the associated vector and potential vector habitat.
2. The Vector Control Specialist will verify that the treatment of known breeding sites is current and reapply treatment to sites as needed.
3. The Vector Control Specialist will conduct an environmental survey to determine the presence of any previously unknown breeding sites and apply proper treatment as needed.
4. The Vector Control Specialist, or other appropriate VCP staff, will conduct ULV treatment of the area using truck-mounted sprayers to reduce adult mosquito populations.
5. The Vector Control Specialist will conduct intensified larval and adult mosquito control according to CDC recommendations (e.g., within a 150 yard radius around the local transmission source), as needed.
6. The VCP, in conjunction with other CDCS staff, will conduct a public education campaign. Components of this campaign may include:
 - a. Distribution of brochures/door hangers to residents advising them to eliminate standing water/adult mosquito harborage; and
 - b. Mosquito control/bite prevention recommendations.

E. Communication with Saint Louis County Municipalities

1. In accordance with HIPAA guidelines, the CDCS Division Director will provide timely notification to municipalities for which the Saint Louis County DPH provides vector or pest control services.

F. Patient Data Protection

1. All client information will be managed in accordance with the [Health Insurance Portability and Accountability Act of 1996 \(HIPAA\)](#), and data management guidelines established by DHSS and the Saint Louis County DPH.

Appendix E: Abatement Products

Product	Active Ingredient	EPA Registration No.	Application
AquaDUET	Prallethrin Sumithrin Piperonyl Butoxide	1021-2562-8329	Adulticide
Aqua-Reslin	Permethrin Piperonyl Butoxide	432-796	Adulticide
Summit BTI	B.t.i.	6218-47	Larvicide
VectoLex WSP	Bacillus sphaericus	73049-20	Larvicide
VectoMax WSP	Bacillus sphaericus B.t.i.	73049-429	Larvicide
Fourstar Briquets (45)	Bacillus sphaericus B.t.i.	83362-3	Larvicide
Fourstar Briquets (180)	Bacillus sphaericus B.t.i.	83362-3	Larvicide
Fourstar MGB	Bacillus sphaericus B.t.i.	85685-3	Larvicide
AquaBAC xt	B.t.i.	62637-1	Larvicide
CocoBear	Mineral Oil	8329-93	Larvicide/Pupicide
Mavrik	Tau-fluvalinate	2724-478	Perimeter Control
Final	Brodifacoum	12455-89	Rodenticide
Terad 3	Cholecalciferol	12455-106	Rodenticide
Maki	Bromadiolone	7173-187	Rodenticide