Arbovirus Testing
in Public Health Laboratories

2018 Survey Report

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APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES®

CONTENTS

BACKGROUND

Arboviruses, also known as arthropod-borne viruses, are single or double-stranded RNA viruses which are primarily transmitted to humans through a bite from an infected arthropod.[1] Endemic arboviruses have evolved and occur naturally in the United States and are readily transmitted in local geographical locations throughout the country, while exotic arboviruses are imported from other regions of the globe and include emerging or re-emerging viruses (e.g., Zika, dengue and yellow fever viruses). To date, introductions of exotic arboviruses have not had sustained, local transmission in the US, however in areas where the appropriate vector is endemic to the US instances of local transmission can and do occur.

Symptoms of arboviruses range from asymptomatic to life threatening.[2] Both laboratory testing of clinical specimens and environmental surveillance of potential reservoir and vector species is necessary to detect and monitor these diseases.

When local transmission is sustained, year after year without travel associated reintroduction, an arbovirus can be classified as endemic. Exotic viruses, on the other hand, are viruses that are newly introduced into a locality, only sporadically seen in that locality, or are newly emerging. Increase in travel leads to a rise in exotic arboviral diseases in a particular location.

The Zika outbreak exemplified the importance of public health laboratories in the surveillance and response to arbovirus threats in the US. In 2016, at the height of the outbreak in the US, there were more than 5,000 symptomatic Zika cases reported in US states and more than 36,000 symptomatic cases reported in the US territories.[3] Without the US Centers for Disease Control and Prevention (CDC) development of the specialized Zika diagnostic tests and public health laboratories' effective response, many Zika cases would have been undiagnosed. Fortunately, rapid implementation of these tests enabled public health laboratories to detect Zika cases more rapidly, allowing for effective public health responses limiting the spread of disease.

Zika is only the most recent example of an arboviral disease outbreak, but emerging, re-emerging and endemic arboviruses, such as Eastern Equine Encephalitis, will continue to impact the population in the future. One of the best ways to prepare for these potential health threats is by having strong public health laboratory infrastructure and surveillance systems in place.

One major challenge to ensuring that public health laboratories have the capacity and capabilities to respond to endemic and epidemic arboviruses is the lack of standardization of arbovirus testing services between jurisdictions. Endemic arboviruses of public health concern vary between geographic locations, thus warranting different prioritization of clinical or environmental testing performed, but minimum standards of testing capabilities would benefit all jurisdictions. Environmental testing which includes testing services for arthropod samples, animal samples and sentinel samples, is the most diverse and least standardized arbovirus testing service among public health laboratories.

The purpose of this survey was to assess arbovirus-testing capabilities among public health laboratories in the United States and its territories to better understand public health laboratories capability and capacity to provide valuable arbovirus testing. The Arbovirus Testing in Public Health Laboratories Survey, led by APHL, was completed in 2018.

METHODS

The survey consisted of 15 questions and was divided into two categories, laboratory testing of clinical specimens and environmental surveillance. Environmental surveillance included sentinel animal surveillance, arthropod surveillance and animal testing. Questions pertained to testing menu, methods, practices and availability of trained laboratory personnel. The survey was delivered by email to 105 APHL member laboratories and was administered through Qualtrics. Public health laboratories were asked to complete the survey based on current arbovirus capabilities as of June 2018.

APHL received a survey response rate of 82.9% from all public health laboratories. Specifically, 50 out of 53 (94.3%) state public health laboratories (SPHLs) and 37 out of 52 (71.2%) local public health laboratories (LPHLs) responded. US Territories and Washington, DC are included in the SPHL count.

RESULTS

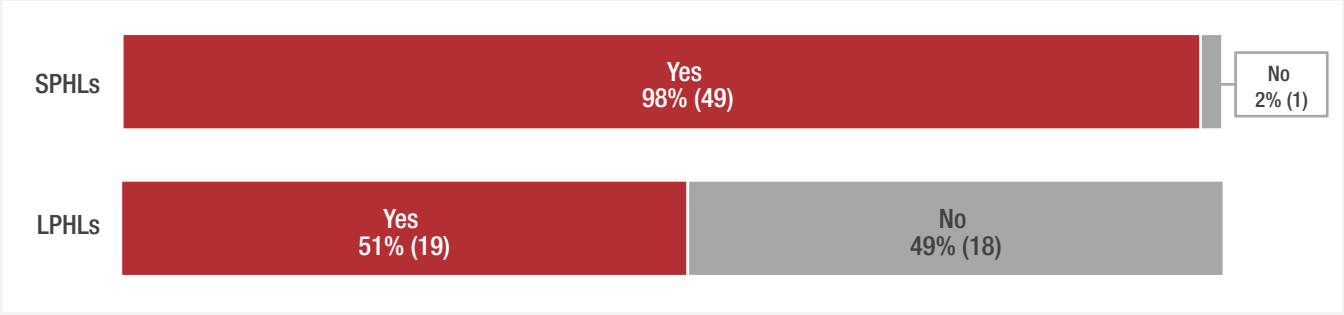
Section I: Laboratory Testing of Clinical Specimens for Arboviruses

The goal of this survey section was to identify the extent of SPHL and LPHL capability to test clinical specimens for arboviruses. Additionally, the survey characterized testing methods in use and numbers of trained staff in public health laboratories. The following survey results pertained to the 50 SPHLs and 37 LPHLs that responded to the survey. LPHLs, in general, are smaller and have a more limited testing menu than their SPHL counterparts. It is expected and appropriate for LPHLs to test for fewer arboviruses than SPHLs which have a wider range of testing capabilities.

In-house Testing

Ninety-eight percent (49 of 50) of responding SPHLs and 51.4% (19 of 37) of LPHLs reported performing one or more in-house laboratory test(s) for the detection of arboviruses in clinical samples (**Figure 1**).

Figure 1: Percent of Public Health Laboratories Performing In-House Clinical Laboratory Testing of Arboviruses.



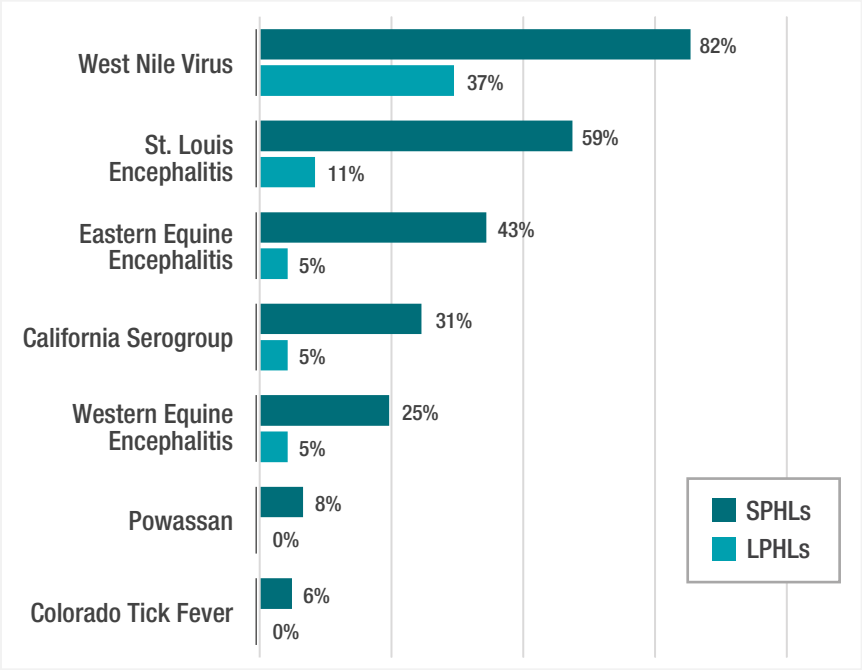
Arboviruses Tested

Of the laboratories that indicated performing in-house testing, they were further asked to specify which arboviruses they currently tested among the seven endemic arboviruses (**Figure 2**) and the six exotic arboviruses (**Figure 3**).

Endemic Arboviruses

The percent of SPHLs performing in-house testing for individual endemic viruses ranged from 81.6% (West Nile virus) to 6.1% (Colorado Tick Fever), while the percent for LPHLs ranged from 36.8% (West Nile Virus) to 0% (Powassan and Colorado Tick Fever). While it is important to note that arboviruses of public health significance differ between jurisdictions, many SPHLs are not testing for all the agents found in their jurisdiction. For example, Powassan is emerging and has been reported in 14 states, and while case counts are actually low, the number of cases are likely higher because testing and surveillance are not yet supported. Only four states reported testing for it.

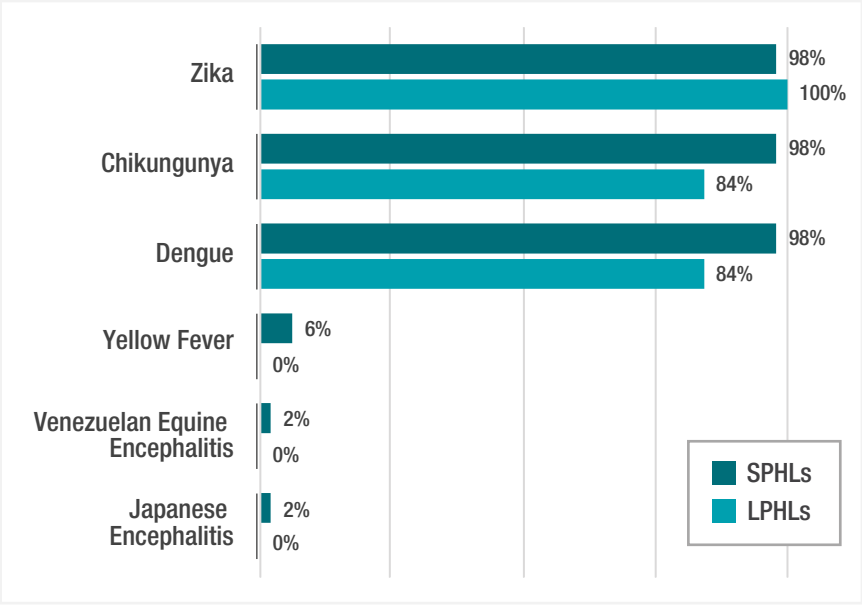
Figure 2: Percent of Public Health Laboratories Performing Laboratory Testing of Clinical Specimens for Endemic Arboviruses.



Exotic Arboviruses

Public health laboratory testing for exotic arboviruses is needed to detect travel-associated and imported cases. SPHLs and LPHLs reported testing Zika, Dengue and Chikungunya at more than 84% of laboratories. The high number of testing of all three arboviruses is likely due to CDC's deployment of the CDC Trioplex rRT-PCR assay, which detects all three viruses, in 2017.[4] In 2018 Zika testing was performed at 98% of SPHLs and 100% of LPHLs. However, SPHLs and LPHLs performed Yellow fever, Venezuelan Equine Encephalitis and Japanese encephalitis testing at less than 7% of laboratories. Additionally, one SPHL indicated testing for six additional arboviruses, including Mayaro virus, Oropouche virus, Murray valley encephalitis virus, Ross River virus, Barmah forest virus and Heartland virus.

Figure 3: Percent of Public Health Laboratories Performing Laboratory Testing of Clinical Specimens for Exotic Arboviruses.



Assays Performed

The 68 public health laboratories that performed in-house arbovirus clinical testing specified which assays they used to detect specific arboviruses. Due to the limited number of arboviruses tested at LPHLs, data are combined to include all public health laboratories. The elected assay performed by the public health laboratory varied among arboviruses. For endemic arboviruses, ELISA and IFA were the preferred testing method (**Table 1**), while for the exotic viruses, NAT testing was favored (**Table 2**).

Endemic Arboviruses

Table 1. Public Health Laboratories Implementing Specific Testing Method(s) for Endemic Arboviruses.

Arbovirus	ELISA		IFA		MIA		PRNT	NAT	Other	Total
	IgM	IgG	IgM	IgG	IgM	IgG				
California Serogroup	5	1	9	7	0	0	2	2	0	15
Colorado Tick Fever	0	0	0	1	0	0	1	0	1	3
Eastern Equine Encephalitis	9	3	9	7	4	1	4	5	0	22
Powassan	3	0	0	0	1	1	1	2	0	4
St. Louis Encephalitis	11	4	9	7	12	1	7	5	0	31
Western Equine Encephalitis	2	1	9	7	0	0	2	1	0	13
West Nile Virus	33	16	5	5	16	3	7	10	0	47

Note: Due to the limited number of arboviruses tested at the local level, SPHL and LPHL data have been combined.

Exotic Arboviruses

Table 2: Public Health Laboratories Implementing Specific Testing Method(s) for Exotic Arboviruses.

Arbovirus	ELISA		IFA		MIA		PRNT	NAT	Other	Total
	IgM	IgG	IgM	IgG	IgM	IgG				
Chikungunya	21	6	1	1	0	0	4	62	0	64
Dengue	20	5	1	1	1	1	6	61	0	64
Japanese Encephalitis	0	0	0	0	0	0	1	1	0	1
Venezuelan Equine Encephalitis	0	0	0	0	0	0	1	1	0	1
Yellow Fever	1	0	0	0	0	0	2	2	0	3
Zika	52	4	1	0	2	2	6	63	0	67

Note: Due to the limited number of arboviruses tested at the local level, SPHL and LPHL data have been combined.

Staff Trained

The number of trained staff varied among assay types as well as between state and local laboratories. Among laboratories performing the assay method for one or more arboviruses, they reported an average of at least four staff trained per assay; lower for neutralization assays. LPHLs did not identify any trained staff performing neutralization assays, while SPHLs identified a cumulative total of 24 trained staff across all reporting SPHLs. For all assay types, there was a large range in the number of trained staff identified. Molecular assays had the largest range, with one to 16 staff at SPHLs and two to 10 staff at LPHLs (**Table 3**).

Table 3: Staff Trained at Public Health Laboratories for Clinical Testing of Arboviruses.

Assay	SPHLs (n=49)			LPHLs (n=19)		
	Laboratories Performing Assay Method	Average # Trained Staff	Range of # Trained Staff	Laboratories Performing Assay Method	Average # Trained Staff	Range of # Trained Staff
Serology	47	4.0	1 to 11	13	3.9	1 to 9
Molecular*	47	4.5	1 to 16	18	4.1	2 to 10
Neutralization**	7	3.4	2 to 5	0	0.0	0

* One state did not report using molecular methods but has two staff training; this is not included in the table above.

** One state did not report running neutralization assays but reported having seven staff trained; this is not included in the table above.

Section II: Laboratory Testing of Environmental Samples

Not only is environmental surveillance and testing performed differently in each jurisdiction, it is also less regulated and standardized nationally than is testing of clinical samples. Also, arbovirus environmental surveillance testing is performed at a variety of governmental and non-governmental agencies. The first aim of this survey section is to better understand the number of jurisdictions performing environmental surveillance and which agencies are most commonly associated with environmental surveillance testing (**Table 4**). Public health laboratories were able to select one or more agency. The second aim is to review the number of public health laboratories completing in-house environmental surveillance testing and the frequency of testing for specific viruses.

Environmental Surveillance Occurring in Public Health Laboratory Jurisdictions

The survey assessed each jurisdiction's environmental arbovirus surveillance testing capabilities, which includes mosquito, animal and sentinel animal samples. According to survey results, 49 out of 50 (98.0%) SPHLs and 25 out of 37 (67.6%) LPHLs reported that some level of environmental arbovirus surveillance is performed within their jurisdiction. While environmental testing is an important component of a comprehensive arboviral surveillance program, it often occurs in places other than the public health laboratory within a state or locality and sometimes occurs in multiple laboratories. The frequency of agency type performing surveillance is addressed in **Table 4**.

Reasons Environmental Surveillance is Not Completed in Jurisdiction

In the 12 local and one state jurisdictions where environmental surveillance was not performed, public health laboratories were asked to provide additional information why these services were not currently provided. LPHLs reported testing being centralized at the state level, whereas the SPHL reported a lack of arboviruses in the area.

Table 4: Agency Where Environmental Surveillance Testing is Performed.

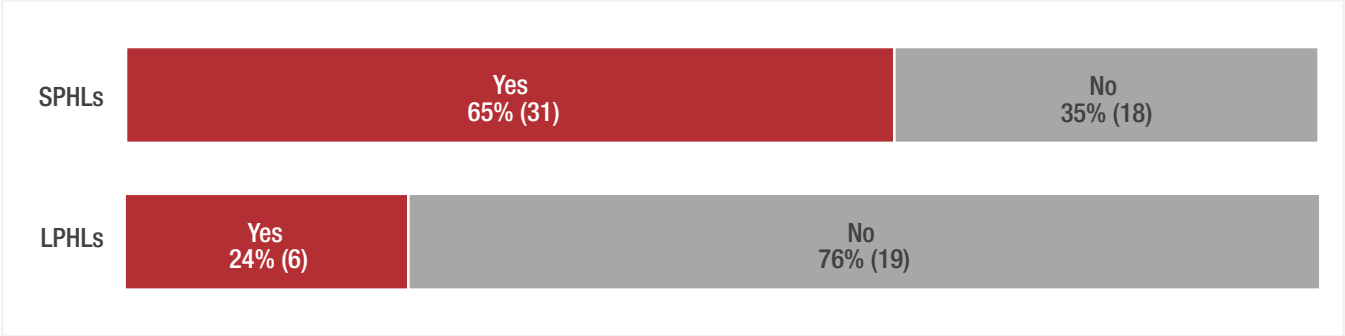
Agency	SPHL (n=48)		LPHL (n=25)		Total (n=73)	
State public health laboratory	34	71%	7	28%	**41**	**56%**
Local mosquito and vector control agencies	18	38%	8	32%	**26**	**36%**
University or other research laboratory	17	35%	5	20%	**22**	**30%**
Regional or local public health laboratory	4	8%	6	24%	**10**	**14%**
Other	4	8%	2	8%	**6**	**8%**
Unsure	0	0%	2	8%	**2**	**3%**

Note: Public health laboratories were able to report more than one agency performing testing in their jurisdiction. Agencies in the "Other" category included environmental health and surveillance laboratories, agricultural laboratories, epidemiology services, animal health and food safety agencies, and the military.

In-house Testing

Public health laboratories indicated if their laboratory performed in-house environmental arbovirus testing, but this question did not capture testing volume or which types of samples were tested. 31 out of 49 (64.6%) SPHLs and 6 out of 25 (24%) of LPHLs indicated they performed in-house environmental testing for animal samples, vector samples or both (**Figure 4**).

Figure 4: In-house Environmental Surveillance Testing for Arboviruses.



Note: These data represent only the laboratories that indicated testing was performed in their jurisdiction by any agency. This question did not capture volume or sample type. Note that there were some discrepancies in the responses between this figure and Table 4; three SPHLs indicated that environmental surveillance testing is not performed in-house, but reported that it is being performed at the SPHL. These laboratories may have an environmental lab on-site that is not technically part of the SPHL.

Arboviruses Testing

The public health laboratories that reported performing environmental surveillance testing indicated which arboviruses they tested in-house. It is important to note that arbovirus distribution will vary across jurisdictions, thus it is not expected that all public health laboratories will test for the same arboviruses. Rather arboviruses tested should reflect the arboviruses of public health significance in that jurisdiction.

Endemic Arboviruses

The number of public health laboratories performing environmental testing for specific endemic viruses depended greatly on the virus. While nearly all reporting public health laboratories tested for West Nile Virus (n=36), 20 or fewer public health laboratories tested for other endemic arboviruses. More specifically, fewer than 10 public health laboratories tested for Western equine encephalitis and Powassan viruses. No public health laboratories reported testing for Colorado Tick Fever (**Table 5**). Further evaluation on the reasons behind the infrequent offering of testing for certain endemic arboviruses is needed.

Table 5: Number of Public Health Laboratories Performing Environmental Testing for Specific Endemic Arboviruses.

Arbovirus	SPHL (n=31)		LPHL (n=6)		Total (n=37)	
West Nile Virus	30	97%	6	100%	36	97%
Eastern Equine Encephalitis	18	58%	0	0%	18	49%
St. Louis Encephalitis	17	55%	3	50%	20	54%
California Serogroup	10	32%	0	0%	10	27%
Western Equine Encephalitis	7	23%	1	17%	8	22%
Powassan	3	10%	0	0%	3	8%
Colorado Tick Fever	0	0%	0	0%	0	0%

Exotic Arboviruses

Environmental surveillance testing for exotic arboviruses was less prevalent in public health laboratories than for endemic arboviruses. While over 50% of reporting public health laboratories performed environmental surveillance testing for Zika, all other exotic viruses were tested at fewer than 12 public health laboratories. Chikungunya virus was tested at 11 public health laboratories, dengue virus at 10, yellow fever virus at two, and Venezuelan equine encephalitis virus at one public health laboratory. No public health laboratories reported testing for Japanese encephalitis virus (**Table 6**).

Table 6: Number of Public Health Laboratories Performing Environmental Testing for Specific Exotic Arboviruses.

Arbovirus	SPHL (n=31)		LPHL (n=6)		Total (n=37)	
Zika	16	52%	5	83%	**21**	**57%**
Chikungunya	9	29%	2	33%	**11**	**30%**
Dengue	7	23%	3	50%	**10**	**27%**
Yellow Fever	2	6%	0	0%	**2**	**5%**
Venezuelan Equine Encephalitis	1	3%	0	0%	**1**	**3%**
Japanese Encephalitis	0	0%	0	0%	**0**	**0%**

Other Arboviruses

In addition to those endemic or exotic arboviruses listed above, one public health laboratory reported testing for Highland J virus, while two public health laboratories stated they employed cell culture assays to detect several arboviruses (including those negative for West Nile virus and Zika). Additionally, two public health laboratories indicated having testing capability for selected arboviruses, but testing is only performed when requested.

Assays Performed

Endemic Arboviruses

Among the types of environmental surveillance tests performed in-house, arthropod surveillance was the most common method for both endemic and exotic arboviruses. For endemic viruses, arthropod surveillance was the most selected testing type, although the preferred method varied by virus. For exotic arboviruses, NAT sentinel animal surveillance and arthropod surveillance were the only two assay methods employed (**Table 7**).

Table 7: Number of Public Health Laboratories Performing Environmental Tests for Endemic Arboviruses.

Arbovirus	Sentinel Animal Surveillance			Arthropod Surveillance	Animal Testing	Total
	ELISA	PRNT	NAT			
California Serogroup	0	0	2	8	0	**10**
Colorado Tick Fever	0	0	0	0	0	**0**
Eastern Equine Encephalitis	3	1	3	14	7	**18**
Powassan	0	0	1	2	0	**3**
St. Louis Encephalitis	1	2	5	16	3	**20**
West Nile Virus	3	2	9	30	9	**36**
Western Equine Encephalitis	0	0	2	6	1	**8**

Note: The "Total" column refers to the overall number of public health laboratories that reported performing in-house testing for the indicated arbovirus.

Exotic Arboviruses

Table 8: Type of Environmental Tests Performed for Exotic Arboviruses.

Arbovirus	Sentinel Animal Surveillance			Arthropod Surveillance	Animal Testing	Total
	ELISA	PRNT	NAT			
Chikungunya	0	0	1	9	0	10
Dengue	0	0	0	9	0	9
Japanese Encephalitis	0	0	0	0	0	0
Venezuelan Equine Encephalitis	0	0	0	1	0	1
Yellow Fever	0	0	0	2	0	2
Zika	0	0	4	16	0	20

Note: The "Total" column refers to the total number of public health laboratories that reported performing in-house testing for the indicated arbovirus.

Section III: Comparing Testing of Clinical and Environmental Specimens for Arboviruses

General

To understand the number of laboratories completing in-house clinical testing compared to environmental testing, the responses of the 73 public health laboratories that responded to both questions were compared. Arbovirus laboratory testing of clinical specimens is more common at public health laboratories than environmental surveillance testing. Of the 61 public health laboratories that perform in-house clinical testing for arboviruses, only 35 also performed environmental surveillance testing (**Table 9**).

Table 9: Number of Public Health Laboratories Completing In-House Clinical and/or Environmental Surveillance Testing (n=73).

Type of Laboratory	Clinical		Environmental		Both	
State	48	66%	31	42%	31	42%
Local	13	18%	6	8%	4	5%
Total	61	84%	37	51%	35	48%

Arboviruses Tested

Among the public health laboratories that responded to both clinical and environmental survey questions, the survey captured which specific arboviruses were tested. West Nile Virus was the most frequent endemic arbovirus tested both clinically and environmentally at public health laboratories (n=29) (**Table 10**). Zika was the most frequent exotic arbovirus tested both clinically and environmentally at the same public health laboratories (n=18) (**Table 11**).

Table 10: Number of Public Health Laboratories Testing for Both Clinical and Environmental Samples of Endemic Arboviruses.

Arbovirus	SPHLs (n=31)		LPHLs (n=4)		Total (n=35)	
West Nile Virus	28	90%	1	25%	29	83%
St. Louis Encephalitis	13	42%	0	0	13	37%
Eastern Equine Encephalitis	14	45%	0	0	14	40%
California Serogroup	7	23%	0	0	7	20%
Western Equine Encephalitis	3	10%	0	0	3	9%
Powassan	2	6%	0	0	2	6%
Colorado Tick Fever	0	0	0	0	0	0%

Table 11: Number of Public Health Laboratories Performing Testing for Both Clinical and Environmental Samples of Exotic Arboviruses.

Arbovirus	SPHLs (n=31)		LPHLs (n=4)		Total (n=35)	
Zika	16	52%	2	50%	18	51%
Dengue	7	23%	2	50%	9	26%
Chikungunya	9	29%	1	25%	10	29%
Yellow Fever	2	6%	0	0%	2	6%
Japanese Encephalitis	0	0%	0	0%	0	0%
Venezuelan Equine Encephalitis	0	0%	0	0%	0	0%

DISCUSSION

The survey results indicated that the majority of public health laboratories reported performing in-house laboratory testing to detect at least some arboviruses in clinical samples. Nevertheless, the proportion of public health laboratories testing for specific arboviruses ranged significantly. While the majority of public health laboratories performed testing for West Nile Virus, chikungunya, dengue and Zika, substantially fewer public health laboratories reported testing for other endemic and exotic arboviruses. For endemic viruses, there is a gap in availability of testing in the public health system.[5] Every jurisdiction should have the ability to test or have access to testing for endemic viruses in its region. The number of jurisdictions reporting the capability to test for each virus is lower than the amount of jurisdictions that have each agent in their region. For example, West Nile Virus is found in most states, yet only 82% of SPHLs reported testing for it, and Powassan has been found in 13 states and only four SPHLs reported having the ability to test for it (**Table 12**).

At this time, there is no regional public health laboratory network established to have testing done by another state, and for the rarer arboviruses like Powassan, testing is not available at commercial laboratories, furthering the gap of testing capacity. The limited ability to test for these viruses means that effective surveillance cannot be established, and the true burden of the disease remains unknown.

Testing methods implemented in different laboratories varied depending upon the specific arbovirus being tested. Public

Table 12: Number of States Where Arbovirus Testing Compared to Number of States with Arbovirus Prevalence.

Arbovirus	Number of SPHLs Conducting Arbovirus Testing (n=49)		Number of States Where Arbovirus Cases Were Detected (n=50)	
West Nile Virus	40	82%	47	94%
St. Louis Encephalitis	29	59%	14	28%
Eastern Equine Encephalitis	21	43%	23	46%
California Serogroup	14	29%	31*	62%
Western Equine Encephalitis	12	24%	26**	52%
Powassan	4	8%	13	26%
Colorado Tick Fever	3	6%	8	16%
Zika	48	98%	2	4%
Dengue	48	98%	44	88%
Chikungunya	48	98%	31	62%
Yellow Fever	3	6%	0	0%
Japanese Encephalitis	1	2%	0	0%
Venezuelan Equine Encephalitis	1	2%	0	0%

Note: Prevalence data taken from CDC, 2013-2019.
* Prevalence data for California Serogroup taken from CDC, 1964-2010.
** Prevalence data for Western Equine Encephalitis taken from Army Public Health Center, 2012.

health laboratories most frequently performed serological assays to detect endemic arboviruses, while they were more likely to perform nucleic acid-based assays to detect exotic arboviruses. This is largely reflective of the documented lower sensitivity of NATs for detecting acute infections of the more common endemic arboviruses (i.e., West Nile Virus and St. Louis encephalitis virus) compared to exotic arboviruses.[6]

Laboratories reported having an average of four staff trained on serology or molecular assays. Having about four staff trained on any assay provides ample ability to regularly run testing and quickly respond to a reasonable surge in testing. Laboratories with only one person trained risk having to delay testing when the one staff member is absent due to leave or illness. Of note, laboratories performing neutralization testing reported having between two to five people trained. Although in each laboratory performing neutralization testing, the number of staff is most likely sufficient for the volume of testing—because only seven laboratories perform neutralization testing, 24 staff in the entire public health laboratory system are trained to perform this testing. Neutralization testing is required to confirm serology tests and seven laboratories with 24 staff provides inadequate capacity to confirm serology tests if surveillance testing increased or if there were a surge in testing due to increased disease activity.

While the majority of public health laboratories reported that they perform in-house testing for clinical arbovirus samples, fewer reported testing environmental samples. This result is not surprising considering surveillance testing often occurs at a variety of agencies and differs between jurisdictions. According to this survey, public health laboratories reported that one third of environmental surveillance testing for arboviruses occurs at non-public health laboratories (**Table 4**). Of the public health laboratories performing in-house testing, the majority tested for West Nile Virus (36 laboratories), Eastern Equine Encephalitis (18 laboratories), St. Louis encephalitis (20 laboratories) and Zika virus (21 laboratories), however, 10 or fewer laboratories tested for other endemic or exotic arboviruses. For public health laboratories performing environmental testing, it was focused primarily on arthropods and less on reservoir hosts.

Ongoing surveillance of human specimens, arthropod and animal samples is critical for early detection and continued monitoring of future arbovirus outbreaks. To ensure public health laboratories can perform both clinical and environmental surveillance, it is vital to address any gaps affecting capabilities and capacity to perform arbovirus testing. All public health laboratories that have arboviruses circulating within their jurisdictions should maintain some minimum capacity to perform testing to support disease surveillance. While testing of clinical samples is generally a priority, environmental surveillance is key for early detection of arboviral activity. Environmental testing can serve as an early warning indicator preceding human infections, thus allowing time for important public health interventions to reduce disease burden. Given that arboviral diseases continue to be a major threat to public health in the US, it should be a priority to ensure that there is proper funding, adequate staffing, and sufficient training opportunities to maintain laboratory capabilities for both clinical and environmental testing.

LIMITATIONS

The intent of this survey was to better understand clinical and environmental arbovirus testing among public health laboratories. As the preliminary survey tool, testing questions were developed to capture a general understanding of public health laboratories and their current ability to perform environmental and clinical testing. However, the survey did not capture testing volume for arboviruses. Arbovirus testing may occur infrequently or at low volumes; therefore, the numbers in this survey may over-represent the amount of clinical and environmental testing performed at public health laboratories.

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ASSOCIATION OF PUBLIC HEALTH LABORATORIES

The Association of Public Health Laboratories (APHL) works to strengthen laboratory systems serving the public's health in the US and globally. APHL's member laboratories protect the public's health by monitoring and detecting infectious and foodborne diseases, environmental contaminants, terrorist agents, genetic disorders in newborns and other diverse health threats.

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