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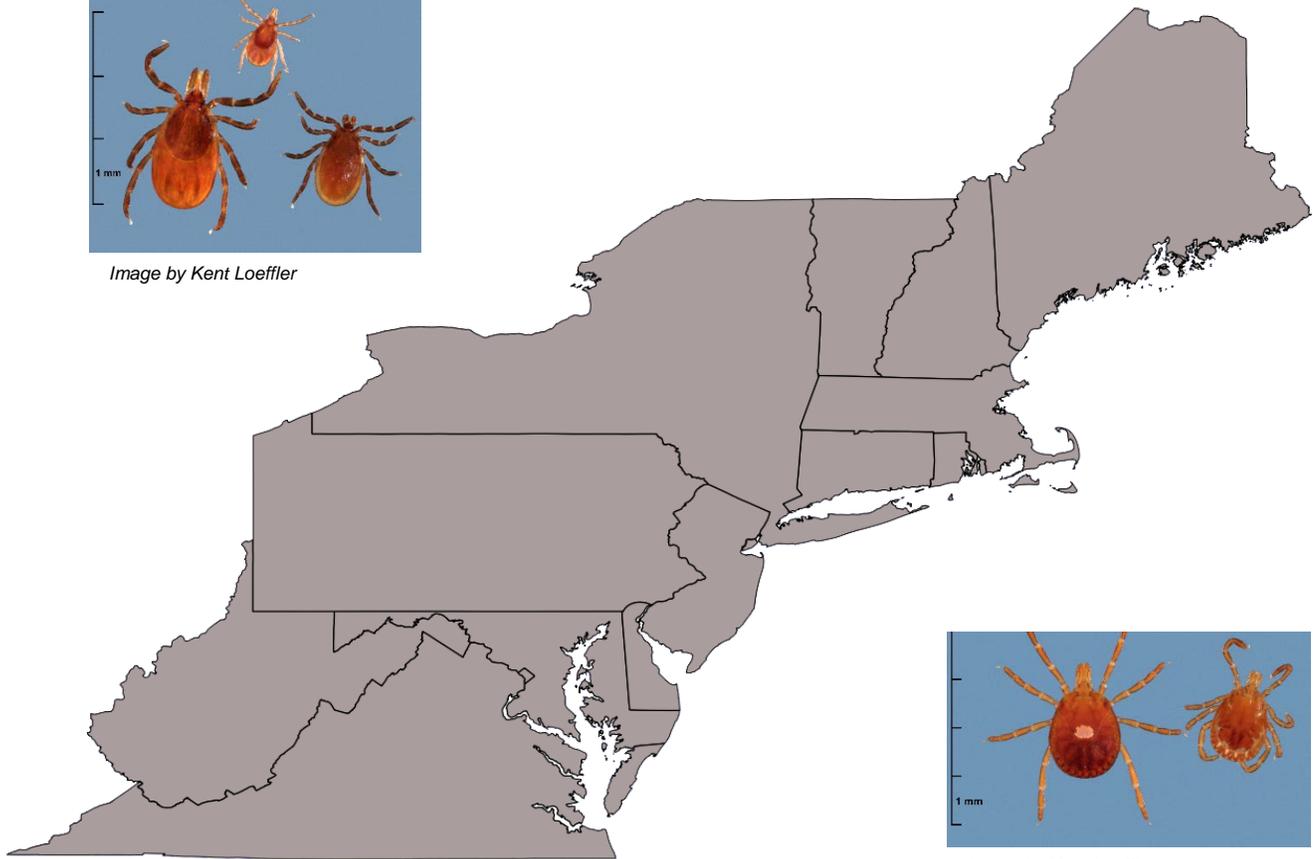


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Tick Surveillance & Control

Summary of Program Operations for Northeast States

Emily M. Mader, MPH MPP, Annie Geiger, Laura C. Harrington, PhD

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Executive Summary

Background and Methods

The Northeast Regional Center for Excellence in Vector-Borne Diseases (NEVBD) collaborated with our partner Regional Centers of Excellence in Vector-Borne Diseases (MCE-VBD, PacVec, WCGVBD, and SER-COE-VBD) to develop and distribute an online survey to gauge nationwide involvement in tick surveillance and control activities, and assess barriers to the development of related programs across various agencies and jurisdictions. NEVBD conducted an in-depth analysis of the responses from states in the Northeast region of the US. Results are summarized in this report.

A 45-question online survey was distributed following a chain referral, or snowball, sampling approach. The survey was initially distributed to 147 individuals working in state, county, and local public health and vector control agencies, who were encouraged to disseminate the survey through their professional networks to those involved in tick surveillance or control activities who could appropriately respond. The questions were divided into five sections: tick surveillance program objectives, tick surveillance program methods, pathogen testing methods, tick control, and barriers to program development and operation. Questions in each section were designed to elucidate program capacity to conduct these activities, and the methods employed. Analysis of descriptive statistics were conducted for all questions.

Results

Respondent Demographics

Forty-three individuals provided responses to the survey from the Northeast region. The majority of respondents were from New Jersey and New York; there were no respondents from the District of Columbia. The jurisdiction with the largest number of respondents was the state, with the majority of state-level respondents working for either health agencies or academic institutions. Public works and mosquito control agencies were most frequently represented at the county jurisdiction level. One respondent represented a federal jurisdiction.

Program Overview

The majority of surveillance activities of all types were conducted at the state-level, by health and academic agencies. At the county level, departments of public works and mosquito control agencies implemented the majority of surveillance programs. Most programs operated passive surveillance programs and *ad hoc* active surveillance programs rather than routine active surveillance. Financial support for surveillance programs comes primarily from federal grants and cooperative agreements, state appropriations, and county or municipal taxes.

When asked about specific surveillance objectives, respondents most frequently reported the detection of ticks by species (n=31, 72%), followed by the detection of pathogens in ticks (n=23, 53%). Four tick species were ranked at either medium or high levels of importance to the majority of reported surveillance programs: *Ixodes scapularis*, *Amblyomma americanum*, *Haemaphysalis longicornis*, and *Dermacentor variabilis*. Financial support for tick testing and control is limited in the Northeast. Less than half (44%) of programs covered by survey respondents financially support pathogen testing in ticks, and fewer respondent programs (28%) financially support tick control activities. No respondents in the Northeast region reported performing or financially supporting pesticide resistance monitoring for their tick control programs.

Program Barriers

The most common barrier to developing and/or enhancing tick surveillance and tick control programs, across jurisdiction and program type, was funding constraints, followed by competing priorities for limited program resources, lack of trained personnel, and lack of guidelines or best practices. Respondents indicated that tick control programs faced a larger barrier from lack of evidence-based, large-scale tick management practice recommendations, while tick surveillance programs faced a larger barrier from lack of access to testing labs/resources, and lack of coordination among agencies/units. Respondents indicated that tick surveillance and tick control programs would benefit from the establishment of adequate, sustained funding to support program operations and personnel, and the development of best practices and guidance for programs to establish both surveillance and control operations.

Recommendations

1. Prioritize tick surveillance program funding and support through municipal, county, and state mechanisms

Increased and sustained funding will enhance the continuity of tick surveillance program operations across time, and expand the flexibility of personnel across agencies to conduct this work in the context of otherwise limited resources.

2. Develop and disseminate standardized tick surveillance guidance, with recommendations targeted toward tick vectors of medical importance in the Northeast region

We recommend the development of nuanced guidance for tick surveillance that can be adapted for varying contexts, target species, geographies, and limitations for programs operating in the Northeast region.

3. Support ongoing evaluations of tick control tools and integrated tick management approaches

We recommend a continued and expanded investment in exploring integrated tick management approaches that can be implemented in various settings, including residential neighborhoods and recreational outdoor spaces. Vital components to these assessments are the evaluation of cost-effectiveness and acceptance of various approaches by the public and communities.

4. Compile a reference list of state and academic laboratories in the Northeast region conducting tick-borne pathogen testing

We recommend compiling a reference list of laboratories in the Northeast region that are able to conduct tick-borne pathogen testing activities, making note of the capacity of these laboratories to provide tick-borne pathogen testing services to outside organizations and associated costs.

5. Provide guidance and resources for the standardization of tick-borne pathogen testing

We recommend developing a reference compendium of protocols published in the peer-reviewed literature that meet the minimum criteria for acceptability of pathogen detection assays, as delineated by the CDC guidance for pathogen testing in *Ixodes scapularis* ticks. We also recommend an accreditation process similar to that which applies to veterinary laboratories be developed and applied to other tick testing facilities to ensure high standards of quality, accuracy, and reliability of these services across the region.

6. Develop and disseminate training resources to support data sharing, reporting, and communication

Availability of digital tools and education for their use will enhance the ability of agencies to track tick populations over time and communicate public health risks to the general population. We recommend the development of training resources specifically focused on key activities that will facilitate broader sharing of tick surveillance information to multiple stakeholder audiences, incorporating existing tools, such as the CDC guidance for *Ixodes* spp. ticks and the use of ArboNET for collection and dissemination of county-level tick surveillance data.

7. Establish a Northeast tick surveillance working group to advance efforts in tick surveillance for the region

We recommend a continued focus on understanding the current practices, challenges, and priorities of tick surveillance and control programs within the Northeast. This may be facilitated through the establishment of a Northeast tick surveillance working group and peer-to-peer learning programs, including stakeholders from across the region operating at various jurisdiction levels.

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Background

The Northeast Regional Center for Excellence in Vector-Borne Diseases (NEVBD) collaborated with our partner Regional Centers of Excellence in Vector-Borne Diseases (MCE-VBD, PacVec, WGCVBD, and SER-COE-VBD) to develop and distribute an online survey to gauge nationwide involvement in tick surveillance and control activities, and assess barriers to the development of related programs across various agencies and jurisdictions. Results from this survey will provide needed context on the entities currently conducting tick surveillance and tick control activities and the methods they employ, and can serve as a baseline for targeted support and collaboration to develop and enhance these programs.

NEVBD conducted an analysis of the responses from states in the Northeast region of the US. Results are summarized in this report. A national summary of survey results will be published elsewhere.

Methods

A 45-question online survey was produced using the Qualtrics online software program. The questionnaire utilized a series of multiple choice, Likert scale, and free text response questions. The questionnaire consisted of five question sets: tick surveillance program objectives, tick surveillance program methods, pathogen testing methods, tick control, and barriers to program development and operation. Questions in each set were designed to elucidate program capacity to conduct these activities, and the methods employed. The following definitions were provided to respondents in the survey introduction and periodically within the body of the questionnaire:

- *Tick Surveillance*: the collection of tick specimens and other relevant environmental samples to identify tick species in a given area and/or test for the presence of tick-borne pathogens; this does not include the monitoring and reporting of clinical cases of tick-borne disease in human patients.
- *Tick Control*: the implementation of practices to reduce or eliminate the presence of ticks in the environment.
- *Active Surveillance*: focused collection of tick samples from the field for identification, testing or analysis.
- *Passive Surveillance*: accepting tick samples submitted by the public, veterinarians, physicians, etc., for identification, testing or analysis.

Distribution of the survey followed a chain referral, or snowball, sampling approach. The survey was initially distributed to 147 individuals working in state, county, and local public health and vector control agencies across the United States. Participants were encouraged to disseminate the survey through their professional networks to those involved in tick surveillance or control activities who could appropriately respond. Analysis of descriptive statistics were conducted for all questions.

Results for the Northeast Region

Respondent Demographics

Forty-three individuals provided responses to the survey from the Northeast region. Figure 1 displays the response frequency across Northeast states, and Figure 2 provides detail on the agency type and jurisdiction of these respondents. The majority of respondents were from New Jersey and New York; there were no respondents from the District of Columbia.

The jurisdiction with the largest number of respondents was the state, with the majority of state-level respondents working for either health agencies or academic institutions. Departments of public works and mosquito control agencies were most frequently represented at the county jurisdiction level. One respondent represented a federal jurisdiction. Respondents were asked to indicate their ability to comment on various aspects of tick surveillance and control program operations; Figure 3 displays the percentage of respondents who were able to comment on different question sets within the survey.

Figure 1. Survey Respondent Distribution across States in the Northeast Region

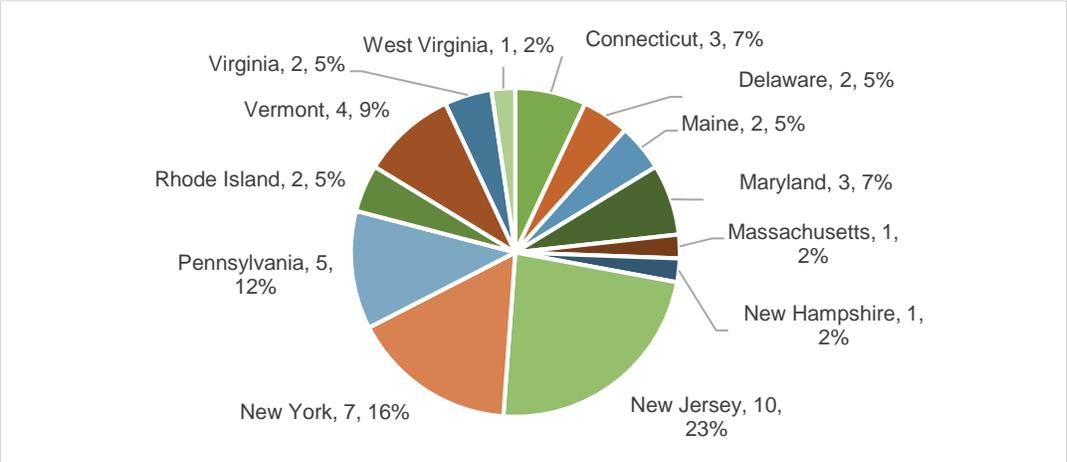


Figure 2. Survey Respondents by Agency Type and Jurisdiction

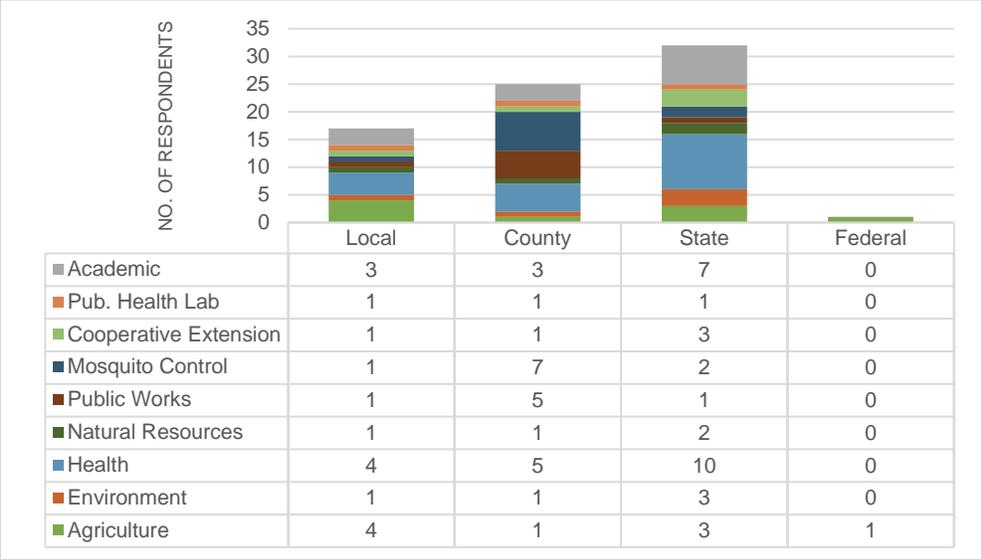
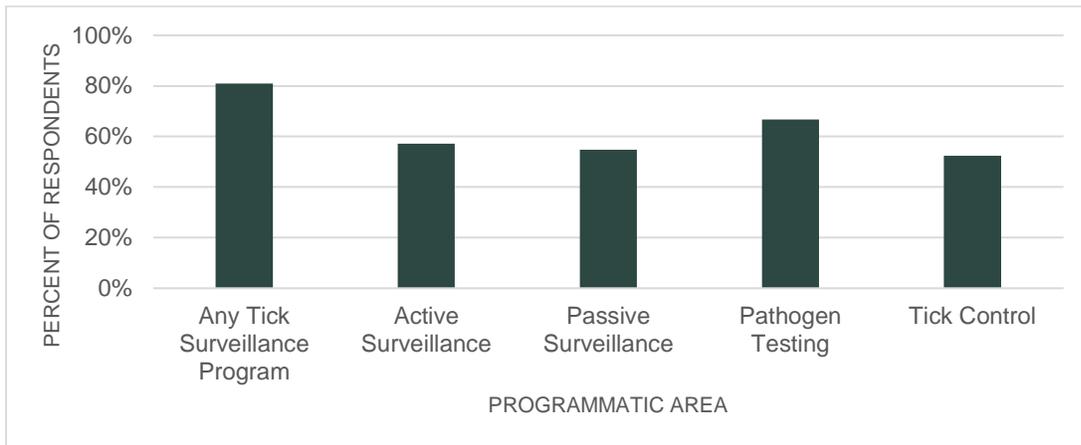


Figure 3. Respondent Ability to Comment on Tick Surveillance and Control Program Operational Areas



Surveillance Program Operations

The majority of surveillance activities of all types operated at the state-level, by health and academic agencies (Figure 4). At the county level, the majority of surveillance programs were conducted by public works and mosquito control agencies. More respondents indicated that their programs operated passive surveillance programs and *ad hoc* active surveillance programs compared to routine active surveillance.

The top program funding sources for all surveillance program types listed by respondents were federal grants and cooperative agreements (n=16), county or municipal taxes (n=13), and state appropriations (n=11) (Figure 5). Several respondents also indicated that *ad hoc* surveillance program operations are often unfunded and only completed when resources become available internally.

Figure 4. Respondent Surveillance Program Involvement by Agency Type & Jurisdiction

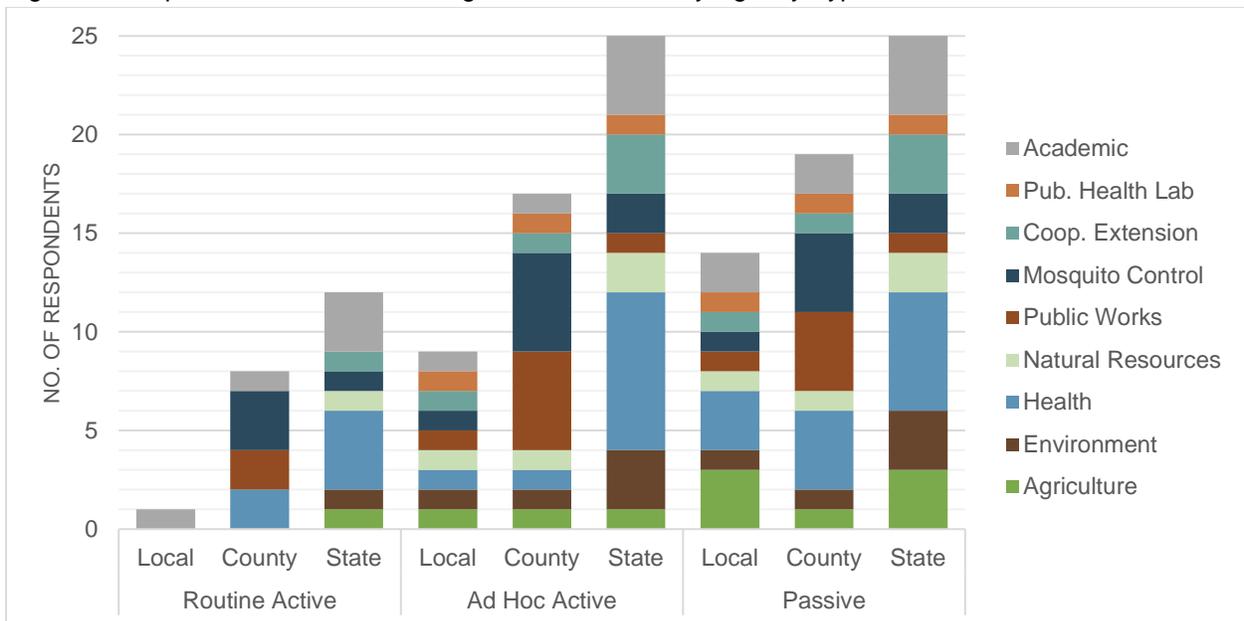
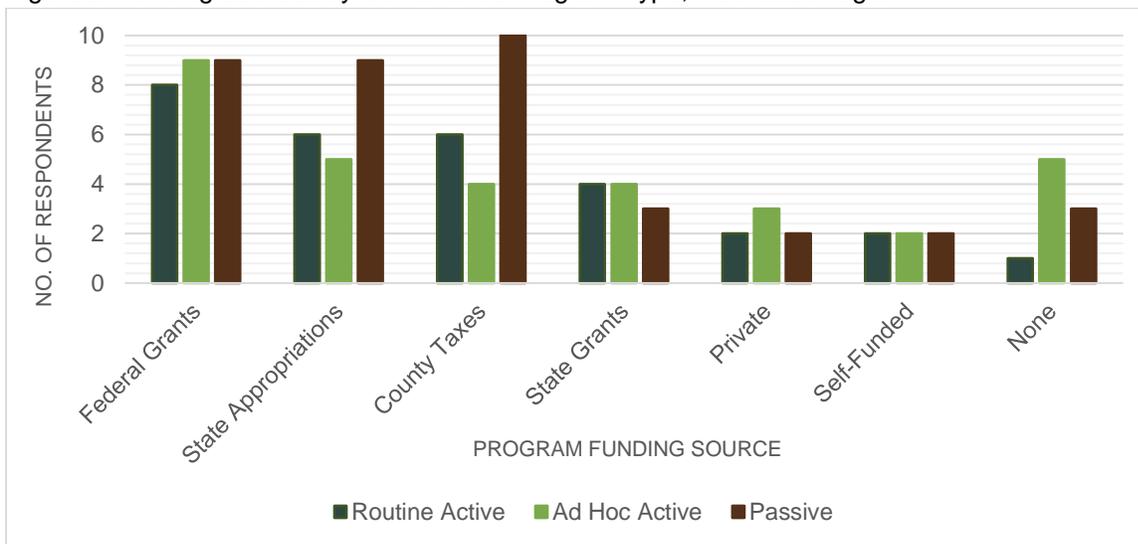


Figure 5. Funding Sources by Surveillance Program Type, Northeast Region



Program Objectives

Table 1 displays the response distribution across different surveillance program objectives identified by respondents. The most commonly identified surveillance program objective reported by respondents was the detection and identification of ticks by species (n=31, 72%), followed by the detection of pathogens in ticks (n=23, 53%). Evaluating the prevalence of tick-borne pathogens in reservoir hosts was only identified as a program objective by two respondents.

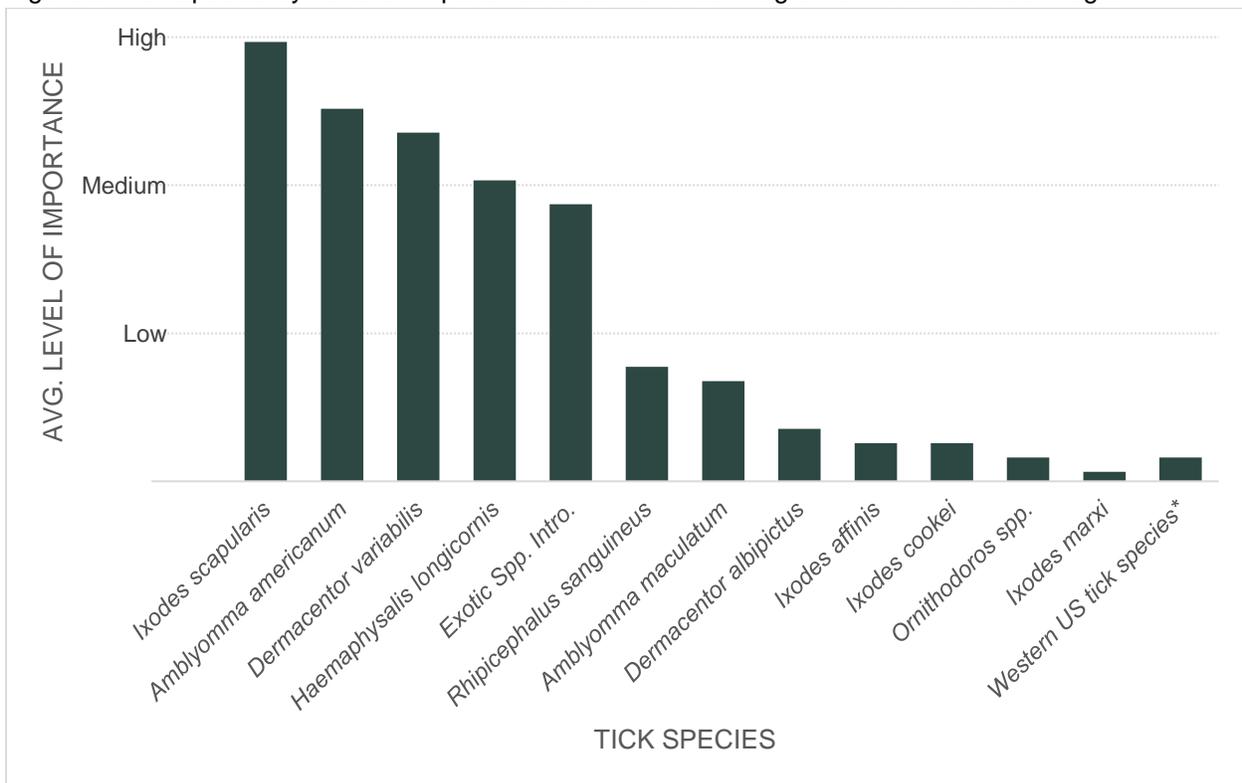
Table 1. Surveillance Program Objectives Identified by Respondents, Northeast Region

SURVEILLANCE PROGRAM OBJECTIVE	NO. OF RESPONDENTS (%)
Detect the presence of ticks by species	31 (72%)
Detect the presence of tick-borne pathogens in ticks	23 (53%)
Monitor the current distribution of tick species	21 (49%)
Monitor the emergence of new tick species	21 (49%)
Monitor the geographic spread of tick species	20 (47%)
Evaluate the prevalence of tick-borne pathogens in ticks	20 (47%)
Monitor the abundance of ticks that are of public health concern	18 (42%)
Assess infection rates of ticks that are of public health concern	18 (42%)
Evaluate tick abundance by species	16 (37%)
Evaluate or calculate risk of tick-borne illness to humans	14 (33%)
Evaluate the prevalence of tick-borne pathogens in reservoir hosts	2 (5%)

Tick Species of Importance

Respondents were asked to identify ticks of importance to surveillance programs in their organization/jurisdiction, and rank their level of importance by low, medium, high, or not important. These ranked responses were averaged across the region, by tick species. Figure 6 displays the frequency of respondents identifying tick species as important by the average level of importance for that species across all respondents.

Figure 6. Tick Species by Level of Importance to Surveillance Programs in the Northeast Region



* The following tick species are grouped in this category: *Dermacentor andersoni*, *Dermacentor occidentalis*, *Ixodes pacificus*, *Rhipicephalus annulatus*, and *Rhipicephalus microplus*. The geographic ranges for these species do not include any state within the NEVBD Northeast US catchment area.

Four species represented the majority of responses, and were ranked at either medium or high levels of importance to regional surveillance programs: *Ixodes scapularis*, *Amblyomma americanum*, *Haemaphysalis longicornis*, and *Dermacentor variabilis*.

Active Surveillance Methods

Twenty-four respondents (56%) were able to comment on the operations of active tick surveillance activities in their organization or jurisdiction. The most commonly-identified methods for active surveillance were using tick dragging and tick flagging, followed by use of CO₂-baited traps (Figure 7). Respondents were asked to provide additional details on the dragging and flagging methods employed by surveillance programs. The use of transect paths was the most common method reported, followed by the use of timed collections (Figure 8).

Figure 7. Active Tick Surveillance Methods Reported by Northeast Respondents

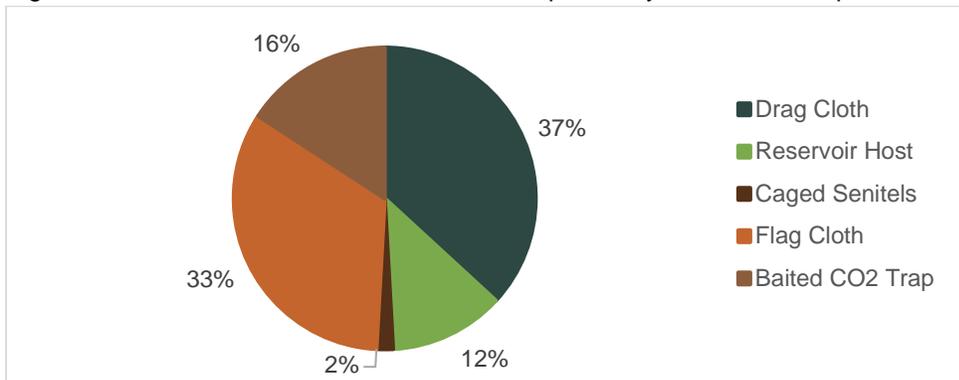
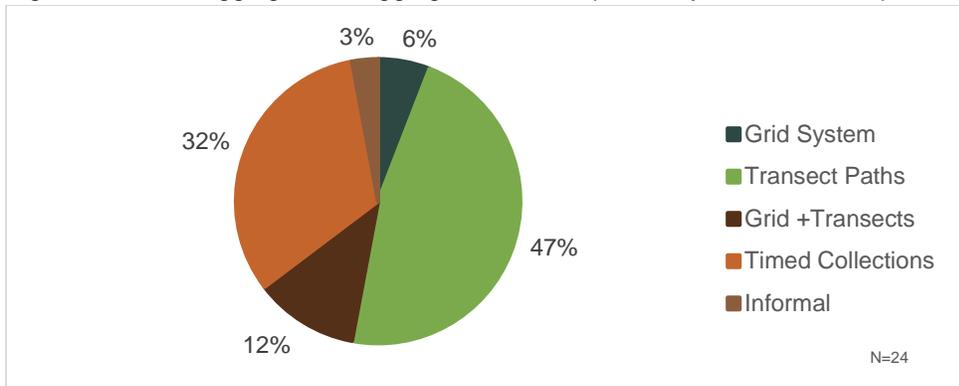
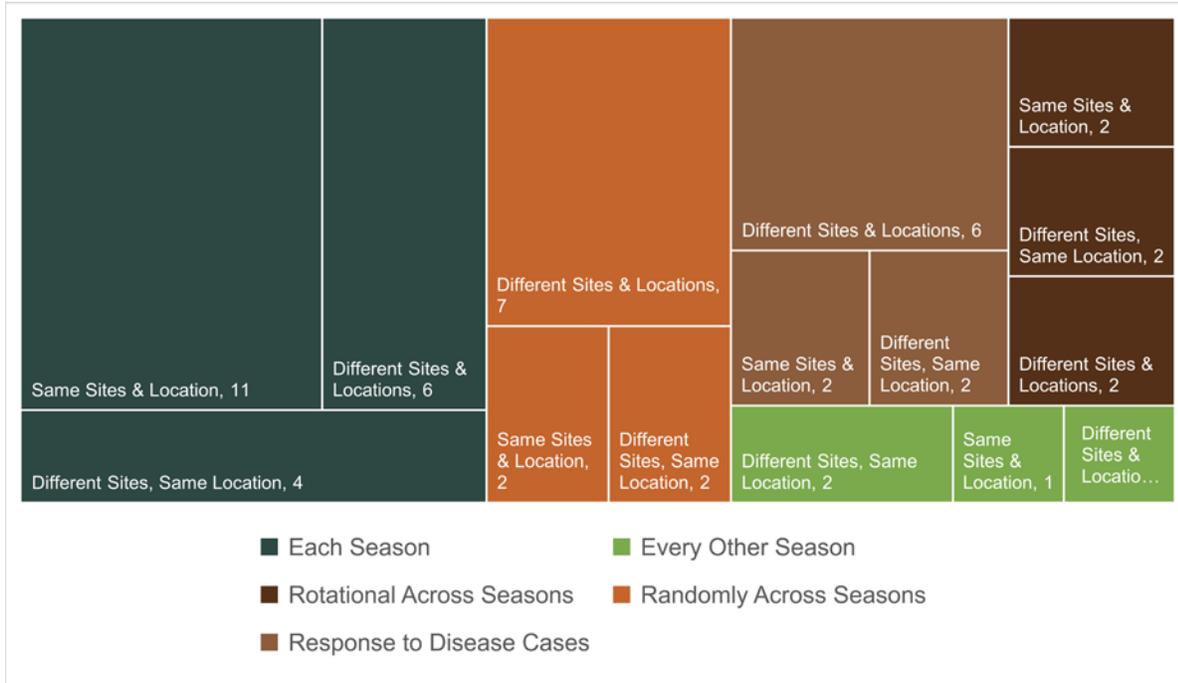


Figure 8. Tick Dragging and Flagging Methods Reported by Northeast Respondents



Respondents were asked to describe the sampling approach(es) employed by the active surveillance programs in their organization/jurisdiction; respondents were provided with the following definition for this question: “For the purposes of this survey, **sampling site** is defined as a specific patch within a landscape identified through GPS coordinates. A location, such as a state park, can have multiple sites within it.” Figure 9 displays a tree map of the sampling approach responses; five categories for sampling frequency (e.g., every season, every other season) are assigned a different color and consist of three rectangles capturing the different site selection arrangements. Larger rectangles represent a larger number of respondents, with the number of respondents reported in each rectangle. The most common approach indicated by respondents was to sample the same sites in the same locations each year. Most respondents (14, 58%) reported that their programs usually sample a site more than once per season, followed by just once per season (6, 25%).

Figure 9. Active Surveillance Sampling Approaches Reported by Northeast Respondents



Passive Surveillance Methods

Twenty-four respondents (56%) stated that they were able to comment on the operations of passive tick surveillance activities in their organization or jurisdiction. The most commonly employed passive surveillance methods reported by respondents were passive surveillance of ticks found on humans and of ticks found on pets (Figure 10). Jurisdictions served by these programs were predominantly single counties within the state (10, 42%) and the entire state (11, 46%). Two respondents reported that programs in their organization/jurisdiction served the entire United States and some international submissions. The most commonly-identified sources of passive surveillance for tick sample submissions were the general public, veterinarian offices, and medical providers (Figure 11).

Figure 10. Passive Tick Surveillance Methods Reported by Northeast Respondents

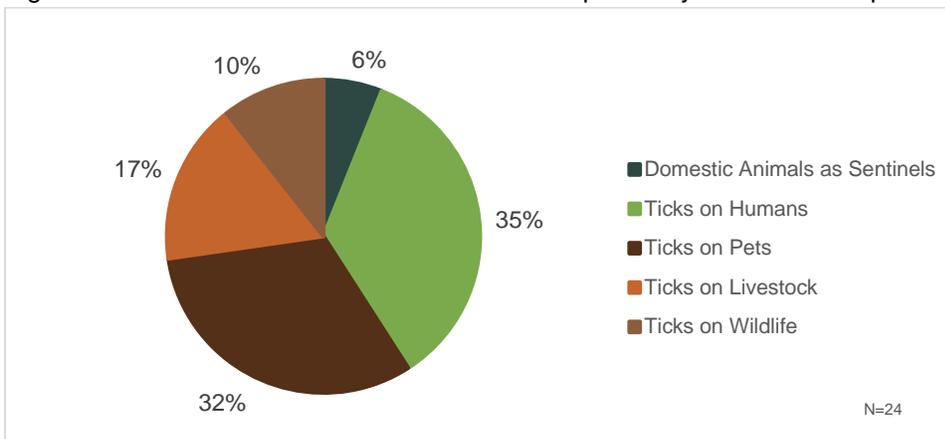
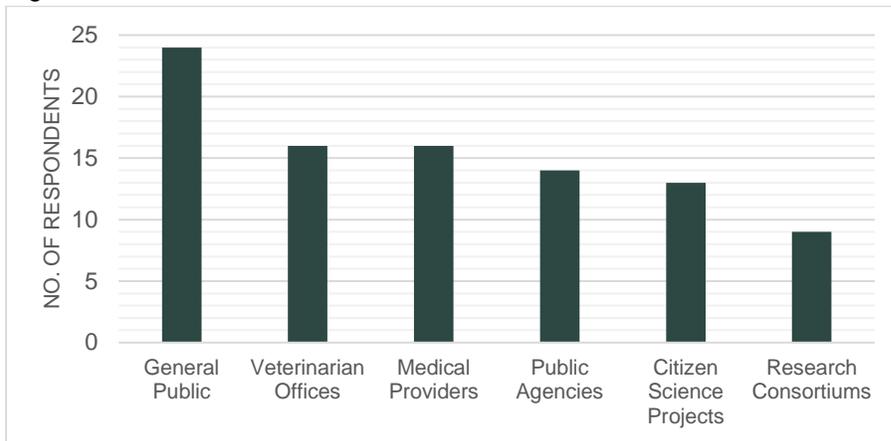


Figure 11. Sources of Passive Surveillance Tick Submissions

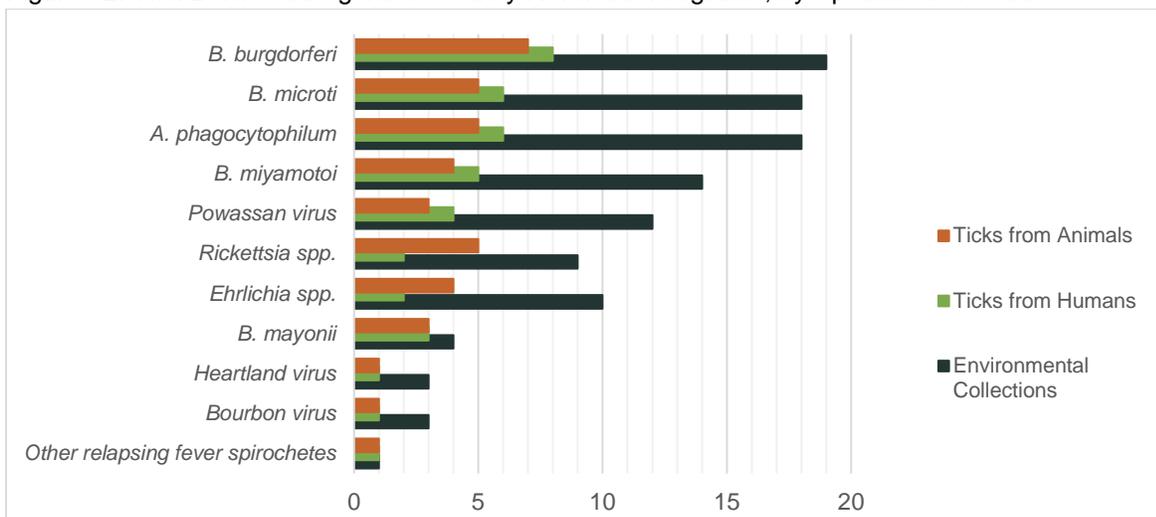


Tick-Borne Pathogen Testing Practices

Twenty-eight respondents (65%) stated that they were able to comment on the operations of tick pathogen testing activities in their organization or jurisdiction. Of these respondents, 19 (68%) reported that their organization or jurisdiction paid for or otherwise financially supported the testing of ticks for pathogens, meaning that fewer than half (44%) of the Northeast programs covered by survey respondents financially support the testing of ticks for pathogens.

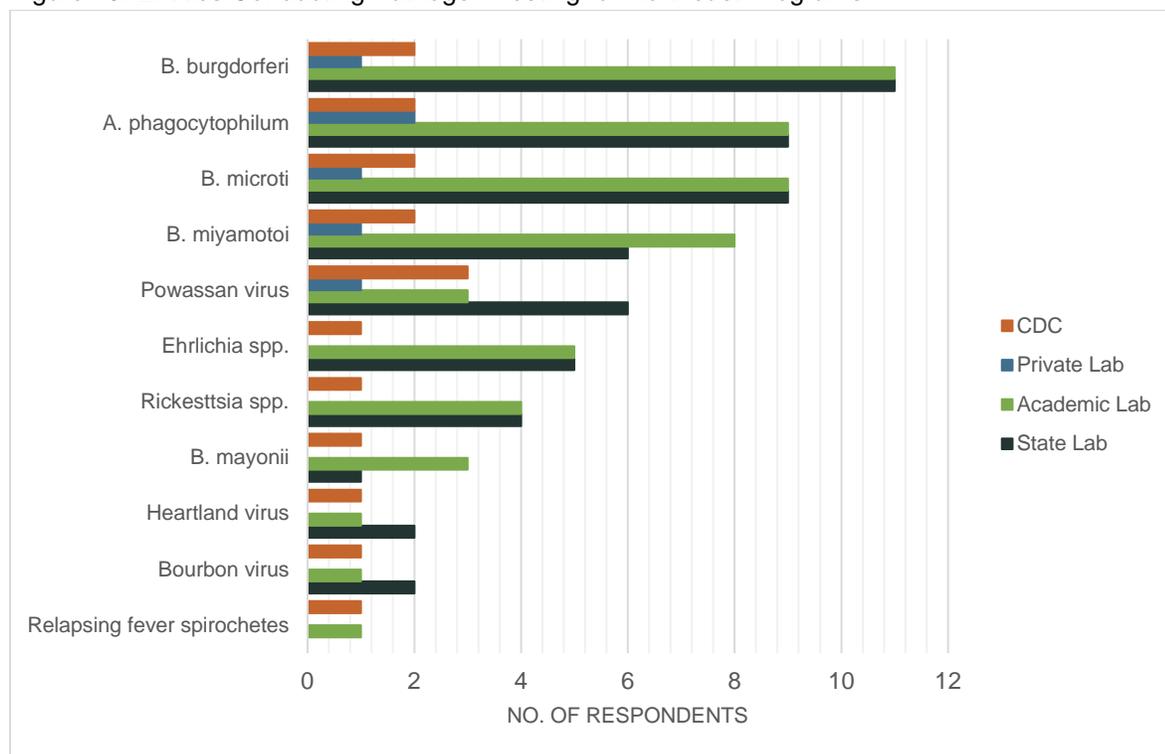
Respondents were asked to list the tick-borne pathogens tested for by their organization/jurisdiction and the specimen source (Figure 12). The most commonly tested pathogens were *Borrelia burgdorferi*, *Babesia microti*, and *Anaplasma phagocytophilum*¹. The majority of specimens tested were environmental samples collected through surveillance efforts. Respondents were also asked to indicate the entity conducting testing by the pathogen tested (Figure 13). Most samples were tested by either a state lab or an academic lab.

Figure 12. Tick-Borne Pathogens Tested by Northeast Programs, by Specimens Tested



¹ *B. burgdorferi* sensu stricto and sensu lato were not specified in the survey question.

Figure 13. Entities Conducting Pathogen Testing for Northeast Programs



Tick Control Methods

Twenty-two respondents (51%) stated that they were able to comment on the operations of tick control activities in their organization or jurisdiction. Of these respondents, 12 (55%) reported that their organization or jurisdiction paid for or otherwise financially supported tick control, meaning that less than one-third (28%) of the Northeast programs covered by survey respondents financially support tick control activities. Figure 14 displays the agencies and jurisdictions responsible for tick control activities, as reported by survey respondents. The most commonly reported tick control methods employed by these programs² include the application of chemical pesticides to vegetation, treatment of wild animal tick hosts (rodents or deer) with topical pesticides, and vegetation modification (Table 2). The most commonly used products for tick control reported by respondents were chemical/synthetic pesticides containing deltamethrin and *lambda*-Cyhalothrin, and devices for topical application of permethrin or fipronil to rodents (Figure 15).

² These programs may include both operational tick control programs and experimental research on tick control methods, which may include the use of experimental formulations not yet available commercially.

Figure 14. Organizations Conducting Tick Control by Jurisdiction Level in the Northeast

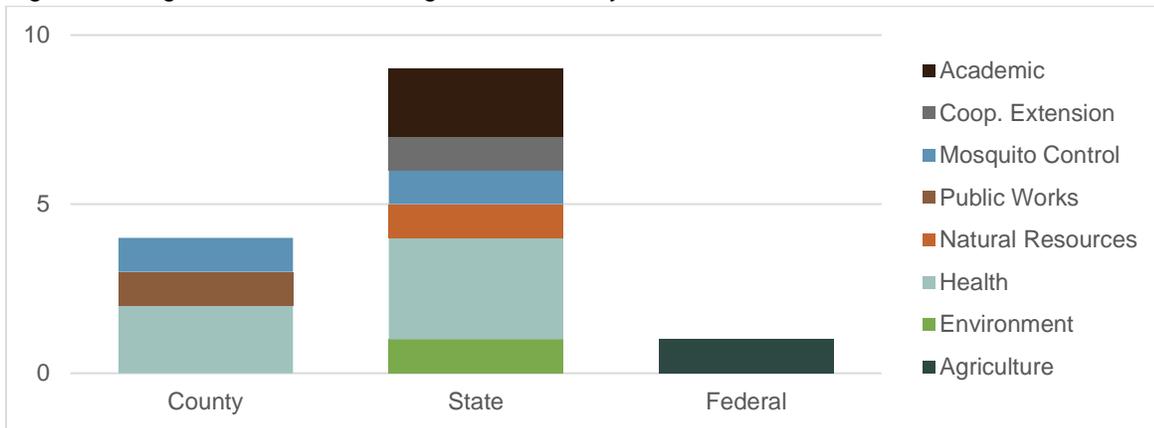
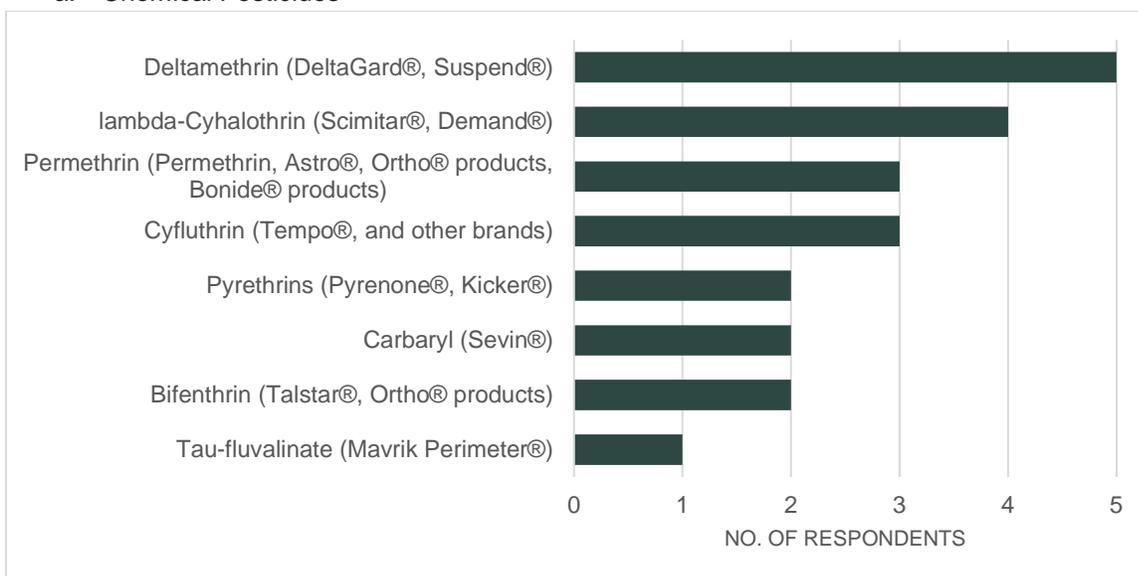


Table 2. Tick Control Methods Utilized by Northeast Programs²

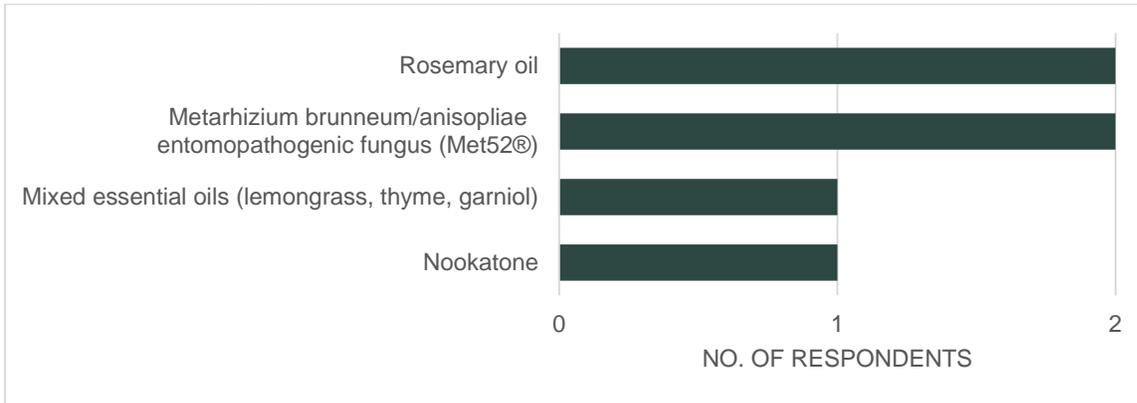
CONTROL METHOD	HOW CONTROL METHOD IS PERFORMED		
	By Program	Contracted to Private Company	Joint Effort of Multiple Programs
<i>CONVENTIONAL/SYNTHETIC PESTICIDES</i>	5	2	2
<i>BOTANICAL PESTICIDES/BIOPESTICIDES</i>	1	1	1
<i>HOST SPECIES REDUCTION</i>	2	2	3
<i>HOST SPECIES EXCLUSION</i>	1	3	0
<i>TREATMENT OF HOST SPECIES WITH PESTICIDE</i>	3	4	4
<i>VEGETATION MODIFICATION</i>	2	0	4

Figure 15. Pesticides and Host Treatments Used by Tick Control Programs in the Northeast

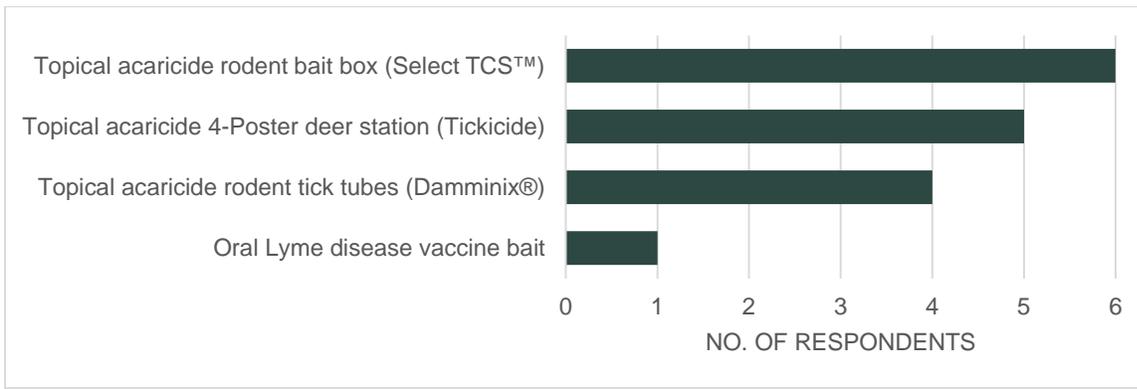
a. Chemical Pesticides



b. Botanical/Biopesticides



c. Host Treatments



No respondents in the Northeast region reported supporting pesticide resistance monitoring for their tick control programs.

Surveillance Program Communication Approaches

Respondents were asked a series of questions related to how information from programs in their jurisdiction or organization was shared with both the public and stakeholder audiences. The most commonly reported methods for sharing information from tick surveillance, tick-borne pathogen testing, and/or tick control programs were sharing results with partner agencies within the state, drafting summary reports sent to specific stakeholder audiences, drafting educational materials to inform the public, and sharing data with academic partners for analysis (Table 3).

Respondents were asked to identify barriers to sharing information specifically with public audiences, as well as barriers to sharing program data with partners and stakeholders. The highest-ranked barriers to sharing data with the public included a lack of time, lack of funds to develop public-facing materials, and lack of software to develop public facing materials (Figure 16). Cultural and language barriers did not appear to be major impediments to programs communicating information to the public. The highest-ranked barriers to sharing program data with partners and stakeholders were time and effort of preparing data for sharing, lack of minimum data set requirements, lack of necessary software, and lack of

standardized protocols across agencies (Figure 17). Institutional policies and personal data protection laws did not appear to be major impediments to sharing data with partners and stakeholders.

Table 3. Information Sharing Practices of Tick Surveillance, Pathogen Testing, and/or Tick Control Programs in the Northeast

METHOD OF COMMUNICATION	NO. OF RESPONDENTS
RESULTS SHARED WITH PARTNER AGENCIES WITHIN STATE	16
RESULTS DRAFTED INTO SUMMARY REPORTS SENT TO SPECIFIC STAKEHOLDER AUDIENCES	13
RESULTS DRAFTED INTO EDUCATIONAL MATERIALS TO INFORM PUBLIC/COMMUNITIES	12
DATA SHARED WITH ACADEMIC PARTNERS FOR ANALYSIS	12
RESULTS DRAFTED INTO SUMMARY REPORTS AVAILABLE ONLINE	9
RESULTS INCORPORATED INTO MAPS MADE AVAILABLE ONLINE	9
RESULTS SHARED WITH LOCAL HEALTH DEPARTMENTS	9
DATA MADE AVAILABLE TO THE PUBLIC ONLINE	9
RESULTS SHARED WITH MEDICAL PROVIDERS	8
RESULTS SHARED WITH PARTNER AGENCIES IN NEIGHBORING STATES	7
DATA PUBLISHED IN PEER REVIEWED PUBLICATIONS	6
REPORTED TO CDC THROUGH ANNUAL ELC OR EIP REPORTS	4
REPORTED TO CDC THROUGH APPROPRIATE DATABASES	3
INFORMATION SHARED THROUGH PUBLIC PROGRAMS	1

Figure 16. Barriers to Sharing Tick Surveillance Information with the Public

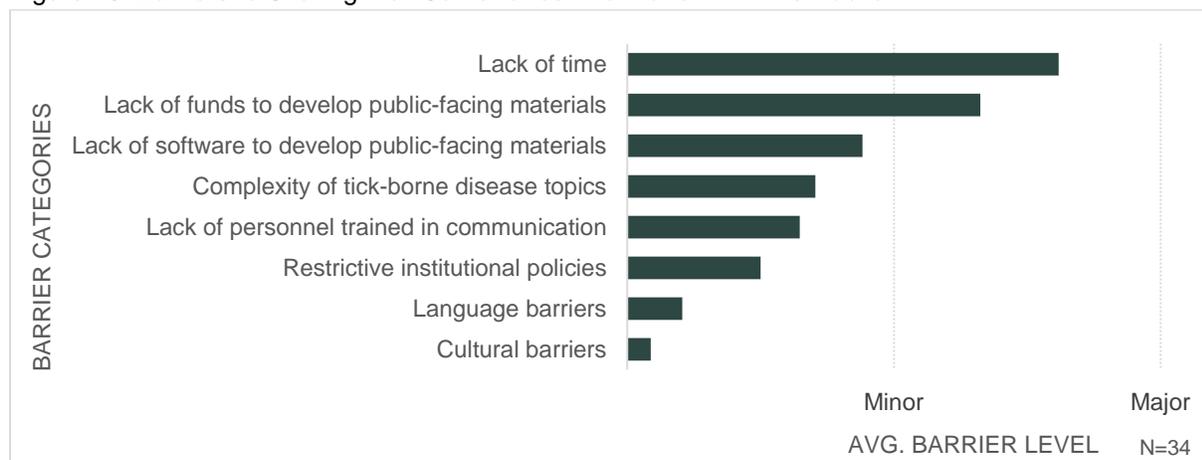
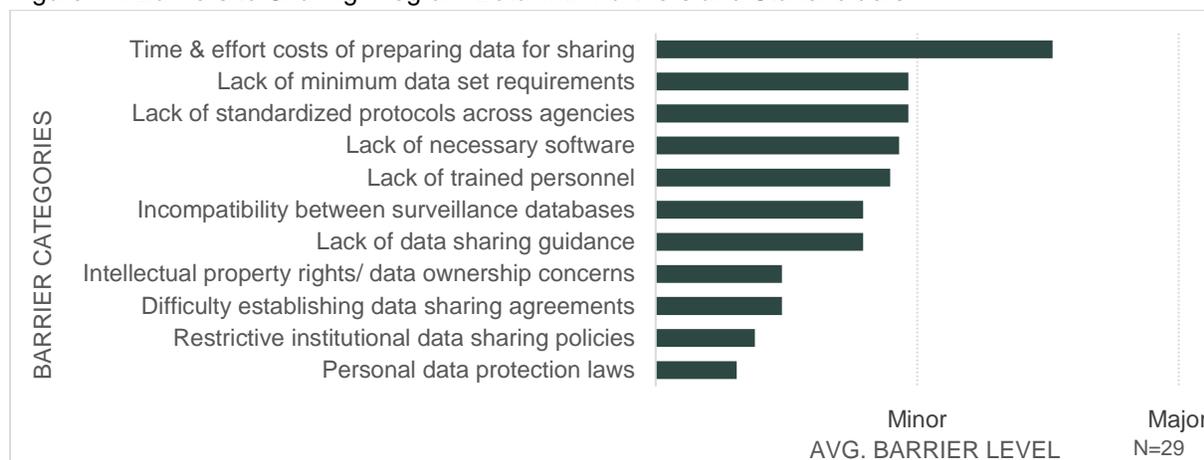


Figure 17. Barriers to Sharing Program Data with Partners and Stakeholders



Barriers to Tick Surveillance Program Development and Enhancement

Respondents were asked to indicate barriers to developing and/or enhancing tick surveillance and tick control programs within their jurisdiction; Figure 18 displays these responses by jurisdiction level. The most common barrier across jurisdiction and program type was funding constraints, followed by competing priorities for limited program resources, lack of trained personnel, and lack of guidelines or best practices. Respondents indicated that tick control programs faced a larger barrier from lack of evidence-based, large-scale tick management practices, while tick surveillance programs faced a larger barrier from lack access to testing labs/resources, and lack of coordination among agencies/units.

Respondents were given the opportunity to provide feedback about how to overcome these barriers to tick surveillance and tick control program development. Table 4 provides a summary of these open-ended text responses. Generally, respondents indicated that tick surveillance and tick control programs would benefit from the establishment of adequate, sustained funding to support program operations and personnel. In addition, there is a need to develop and disseminate best practices and guidance for programs to establish both surveillance and control operations. Several respondents felt that in the absence of evidence-based, cost-effective control measures, tick control activities would only be conducted on an as-needed basis in local areas, as opposed to routine application as a statewide level.

Ten respondents also provided general feedback on topics not otherwise covered in the survey questionnaire. A prevalent theme in these responses was that government agencies hold the key to sanctioning and funding tick surveillance and control programs, and law makers will not prioritize these activities in the absence of evidence-based guidelines and methods. There also appeared to be concerns on the appropriate delineation of roles and responsibilities in these tick surveillance, control, and public education efforts across public agencies. Lack of access to tick-borne pathogen testing was mentioned by several respondents, with one particularly calling attention to the issue of the proliferation of non-accredited labs offering pathogen testing services in the region.

Figure 18. Barriers to Tick Surveillance and Control Program Development and Enhancement among Northeast Programs

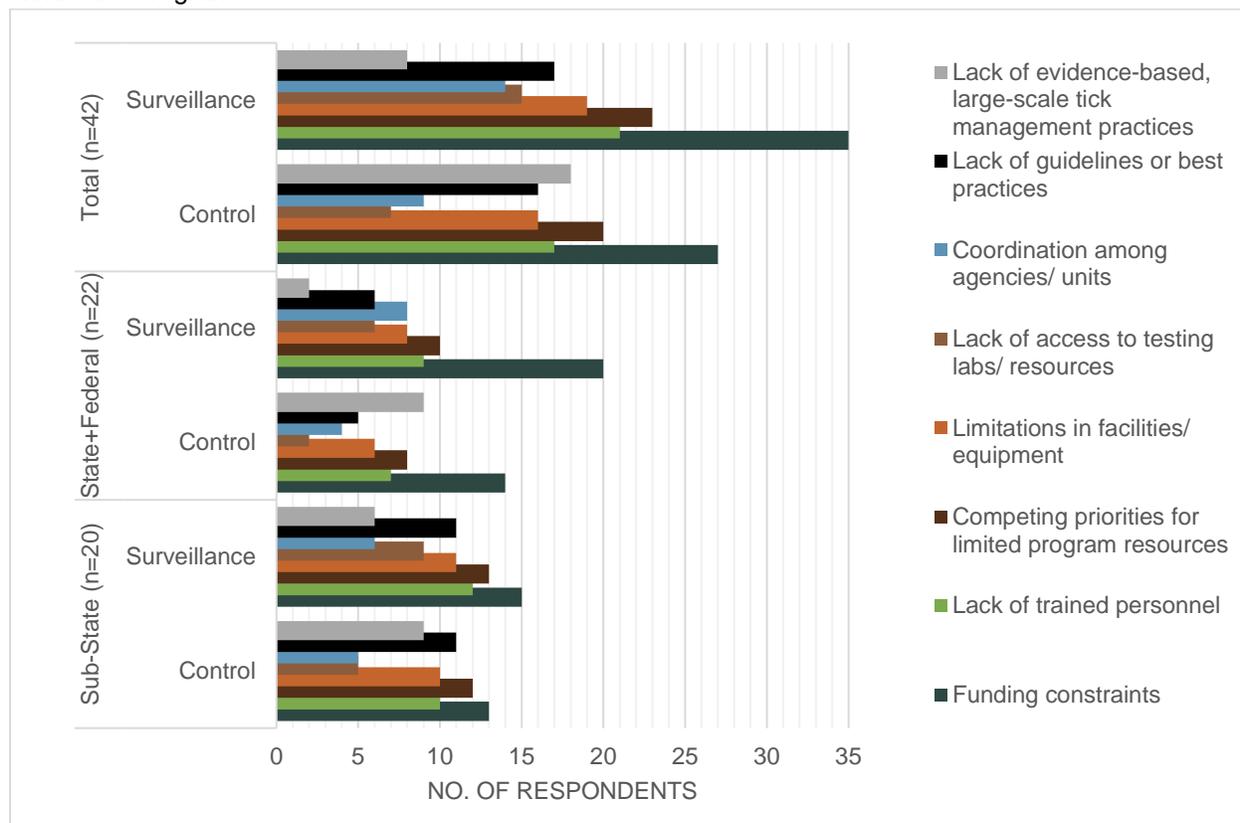


Table 4. Summary of Open-Ended Responses on Recommendations to Address Tick Surveillance and Control Program Barriers

THEME	NO. OF RESPONDENTS
TICK SURVEILLANCE PROGRAM BARRIERS (N=27)	
Expanded and sustained funding	11
Guidance and standardization of methods	10
Increased coordination and communication across agencies	9
Increased training and/or availability of trained personnel	5
Prioritization of these activities by stakeholders and leaders	4
Central data reporting system	2
Access to pathogen testing services	2
TICK CONTROL PROGRAM BARRIERS (N=23)	
Expanded and sustained funding	8
Evaluation of methods for efficacy and cost-effectiveness	7
Guidance and standardization of methods	5
Prioritization of these activities by stakeholders and leaders	5
Education and partnership with private sector	3
Tick control is not within agency purview/not feasible within jurisdiction	2
Increased understanding of tick habitat ecology	1
Increased coordination and communication across agencies	1

Implications and Recommendations

I. Financial support and prioritization of tick surveillance activities

Respondents indicated through several question sets and open-ended commentary that a primary barrier to the development and enhancement of tick surveillance programs was a lack of adequate funding. Several active surveillance programs described in survey responses operate on an ad hoc basis: activities under these tick surveillance programs are not implemented routinely each season. Reasons listed for this ad hoc approach to surveillance centered on the lack of sustained funding to incorporate tick surveillance activities into a yearly, routine program. Many respondents indicated that both active and passive tick surveillance activities happen only in the context of funding windfalls under existing programs, or through sponsored projects conducted by academic and private partners. This can result in gaps of tick surveillance data across multiple years in some jurisdictions, inhibiting our ability to understand the establishment of tick species and tick-borne pathogens in areas across the northeast and our ability to meaningfully inform public health action on tick-borne disease threats.

Furthermore, respondents from several agencies reported that while they conduct tick surveillance when the opportunity arises, this is not the primary focus of either their agency or their employment. Should agencies adopt tick surveillance and control activities, there will be a need to not only hire additional personnel to conduct these activities, but also to provide training to current employees on tick surveillance methods. The lack of sustained funding impedes the ability of programs to hire and retain personnel with specific training in tick surveillance, as well as provide on-the-job training for personnel currently working in agencies that may wish to expand their capacities to address tick surveillance.

Recommendations

1. Prioritize tick surveillance program funding and support through municipal, county, state, and federal mechanisms

Increased and sustained funding will enhance the continuity of tick surveillance program operations across time, and expand the flexibility of personnel across agencies to conduct this work in the context of otherwise limited resources. Increased and sustained funding is vital to support the expanded workforce that will be necessary to conduct tick surveillance and control efforts across the region. Increased and sustained funding is also necessary to expand the capacity of state and other accredited laboratories to conduct responsive tick-borne pathogen testing as more programs initiate and expand tick surveillance programs across the region. In the absence of adequate funding, these valuable activities will remain under-implemented. It is imperative that public funding for these programs be prioritized by municipal, county, state, and federal mechanisms to ensure that our workforce and public health infrastructure is able to detect and respond to tick-borne disease threats in the region. We call for increased advocacy in this area, and recommend the development of information and guidance for states, counties, and municipalities to engage with policy and decision makers in this effort. We also recommend new funding mechanisms be explored and created by state agencies, and existing funding mechanisms be strengthened by federal agencies, to broaden the availability and opportunity to receive financial support for tick surveillance program operations.

II. Standardized guidance for tick surveillance and tick control methods

The lack of standardized guidance for tick surveillance and tick control programs was cited as a major barrier to program development and enhancement by a large proportion of survey respondents. Guidance for tick surveillance would provide recommendations on methods for collecting ticks in the field, including what materials and tools to use, how to structure sampling sites, how often to sample, how to process specimens collected, and how to target specific species. This guidance would ideally also cover standardized procedures for data entry, data sharing, and incorporating surveillance data into tools that can inform public health action. In the absence of this guidance, programs conducting tick surveillance may not be using best practices to gather accurate and actionable data on the presence of tick species and tick-borne pathogens in their area.

Responses to this survey indicated that tick control guidance would ideally provide recommendations on the implementation of evidence-based tick control methods that have been evaluated for efficacy and cost-effectiveness. This would not only support the implementation of effective tick control approaches, but also support the acceptance of these approaches by policy makers and communities.

Recommendations

1. Develop and disseminate standardized tick surveillance guidance, with recommendations targeted toward tick vectors of medical importance in the Northeast region

Building on the recently published tick surveillance guidance drafted by the Centers for Disease Control and Prevention ([Surveillance for *Ixodes scapularis* and pathogens found in this tick species in the United States](#)), we recommend the development of nuanced guidance for tick surveillance that can be adapted for varying contexts, geographies, and limitations for programs operating in the Northeast region. Programs interested in adopting tick surveillance activities will have a wide variety of constraints and capabilities influencing when, where, and how tick surveillance is conducted. Responsive tick surveillance guidance will incorporate these factors, providing recommendations for a gold standard of tick surveillance methodologies as well as additional best practice options that may be available to programs with limited resources. This guidance should also include recommendations on minimum data set requirements to support the standardization of data collection and management, facilitate the sharing of tick surveillance data at a regional scale, and incorporate the use of the new tick module in the CDC ArboNET surveillance system. It will be important to provide tick surveillance guidance for multiple tick species of medical importance in the Northeast region, including *Ixodes scapularis*, *Amblyomma americanum*, *Dermacentor variabilis*, and *Haemaphysalis longicornis*.

2. Support ongoing evaluations of tick control tools and integrated tick management approaches

Tick control was implemented by a small number of survey respondents (less than one-third), with many citing the absence of evidence-based, large-scale tick control approaches as a factors impeding the adoption of these activities. We recommend a continued and expanded investment in exploring integrated tick control approaches that can be implemented in various settings, including residential neighborhoods and recreational outdoor spaces. Vital components to these assessments are the evaluation of cost-effectiveness and acceptance of various approaches by the public and communities.

III. Access to accredited tick-borne pathogen testing resources

Less than half of the tick surveillance programs operating in the Northeast financially support tick testing services, and a large proportion of respondents indicated that programs in their organization or jurisdiction rely on academic laboratories to conduct tick-borne pathogen testing. Open-ended commentary provided by some respondents indicated that tick surveillance would be of little use to their program in the absence of tick-borne pathogen testing, and the lack of access to laboratory services played a role in the prioritization and support of tick surveillance activities in their jurisdiction.

Recommendations

1. Compile a reference list of state and academic laboratories in the Northeast region conducting tick-borne pathogen testing

As more programs across the region choose to initiate tick surveillance activities, access to tick-borne pathogen testing services will become increasingly vital to the efficacy and sustainability of these programs. We recommend compiling a reference list of both state and academic laboratories in the Northeast region that are able to conduct tick-borne pathogen testing activities, making note of the capacity of these laboratories to provide tick-borne pathogen testing services to outside organizations and their associated costs. The aim of this reference list is to facilitate communication and collaboration between low-resource organizations and those who are available to provide needed tick-borne pathogen testing services. The CDC also provides pathogen detection services for five human pathogens in *Ixodes scapularis*; the only cost of this service to states is shipping. Increased advertisement of this service may raise awareness of and engagement with this service among tick surveillance programs in the region.

2. Provide guidance and resources for the standardization of tick-borne pathogen testing

The recently published tick surveillance guidance drafted by the Centers for Disease Control and Prevention ([Surveillance for *Ixodes scapularis* and pathogens found in this tick species in the United States](#)) includes recommendations on the minimum criteria for acceptability of pathogen detection assay. The guidance specifically recommends the use of molecular testing schemes that have been published in the peer-reviewed literature, with multiple targets for each pathogen, established limits of detection, and an internal control. We recommend developing a reference compendium of protocols published in the peer-reviewed literature that meet the minimum criteria for acceptability, as delineated by the CDC guidance. We also recommend an accreditation process similar to that which applies to veterinary laboratories be developed and applied to other tick testing facilities to ensure high standards of quality, accuracy, and reliability of these services across the region.

IV. Public Health Data Sharing and Communication

Respondents highlighted several barriers to sharing tick surveillance program data with both the public and with partner agencies and collaborators. These barriers centered on a lack of access to necessary software, lack of training in the use of software, lack of minimum dataset requirements, and lack of standardized protocols across agencies. Variance in data collection and management practices impedes the ability of programs to share and compare findings on a regional scale. Furthermore, programs that do not have the in-house ability to develop public-facing documents have limited efficacy in their ability to communicate public health risk from ticks and tick-borne pathogens to communities and stakeholders.

Recommendations

1. Develop and disseminate training resources to support data sharing, reporting, and communication

Availability of digital tools and education for their use will enhance the ability of agencies to track tick populations over time and communicate public health risks to the general population. We recommend the development of training resources specifically focused on key activities that will facilitate broader sharing of tick surveillance information to multiple stakeholder audiences. Targets for these training programs include tutorials in the operation of open-source and low-cost software programs that can be used to enter and track tick surveillance data, and share or otherwise transfer digital data to public health and academic partner agencies. These trainings should incorporate existing tools, such as the CDC guidance for *Ixodes spp.* ticks and the use of ArboNET for collection and dissemination of state- and county-level tick surveillance data. In addition, training on the use of software programs to develop public-facing informational documents will increase the feasibility of tick surveillance programs to communicate data and recommendations to the public.

V. Continued Evaluation of Tick Surveillance Program Operations and Infrastructure

Several limitations to this report are important to acknowledge. The questionnaire used in this survey was developed at a broad, high-level of detail to accommodate the variability in potential responses. Due to this design approach, there are several components of tick surveillance program operations in the region that would benefit from continued investigation, including:

- Evaluation of pathogen testing practices for *Borrelia burgdorferi*, distinguishing between *B. burgdorferi sensu stricto* and *B. burgdorferi sensu lato*
- Survey of software programs currently in use by surveillance programs for data collection, analysis, and dissemination
- Evaluation of active tick surveillance methods employed to target specific tick species
- Evaluation of contextual barriers to employing tick surveillance guidance and best practices experienced by programs operating across the region in various geographies and jurisdictions
- Full census of ongoing tick surveillance programs and tick control programs operating in the Northeast region

Recommendations

1. Establish a Northeast tick surveillance working group to advance efforts in tick surveillance for the region

We recommend a continued focus on understanding the current practices, challenges, and priorities of tick surveillance and control programs within the Northeast. This may be facilitated through the establishment of a Northeast tick surveillance working group, including stakeholders from across the region operating at various jurisdiction levels. The formation of this working group will provide a platform from which the public health community can engage in discourse, planning, and collaboration to achieve region-wide goals for tick surveillance and control.

Appendix: Detailed State Summaries

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Connecticut

I. Respondent Demographics

Three individuals responded from organizations operating in the state of Connecticut. Table CT-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: Local-Health, State-Academic, and State-Agricultural.

Table CT-1. Demographic Summary of Connecticut Respondents

Agency Type	Jurisdiction		Level of Surveillance Program Involvement		
	Local	State	Directly Involved	Supervisory	Disease Surveillance
Agricultural	1	1	1	1	0
Health	1	0	0	1	0
Academic	0	1	1	1	1
Level of Program Involvement	Local	State			
Directly Involved	0	2			
Supervisory	1	1			
Disease Surveillance	0	1			

All three respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction/organization. All three respondents were familiar with passive surveillance programs, but only the State-Academic respondent was familiar with any form of active surveillance.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The three respondents identified state and local agriculture agencies, as well as local and county health agencies, and academic institutions.

Respondents indicated that tick surveillance programs were funded through the mechanisms highlighted in Table CT-2 below. The State-Academic respondent indicated that their program collaborates with an academic institution in a neighboring state. Respondents were asked to indicate the objectives of the tick surveillance program(s) operating in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure CT-1, Figure CT-2).

Table CT-2. Overview of Tick Surveillance Programs Operating in Connecticut

Respondent	Funding Source	Program Type(s)	Years of Operation
Local-Health	Community/municipal tax-based funding	Not reported	Not reported
State-Agriculture ^a	State funding through appropriations	Passive surveillance	1990 - present
State-Academic	Federal funding through grants/cooperative agreements	<ul style="list-style-type: none"> • Routine active surveillance • Ad hoc active surveillance • Passive surveillance 	2011 - present

^a Partners with academic institution in neighboring state

All three respondents indicated that detecting pathogens in ticks and evaluating pathogen prevalence in ticks were current program objectives. The State-Agricultural and State-Academic respondents indicated that monitoring tick species of public health importance, for both general abundance as well as infection rates, were also current program objectives. The State-Academic respondent indicated that monitoring for the emergence of exotic species was a program objective; this respondent clarified via open-text response that exotic species are monitored during routine sampling activities of ongoing surveillance programs, and is not a deliberate program activity.

Figure CT-1. Current Surveillance Objectives for Connecticut Programs

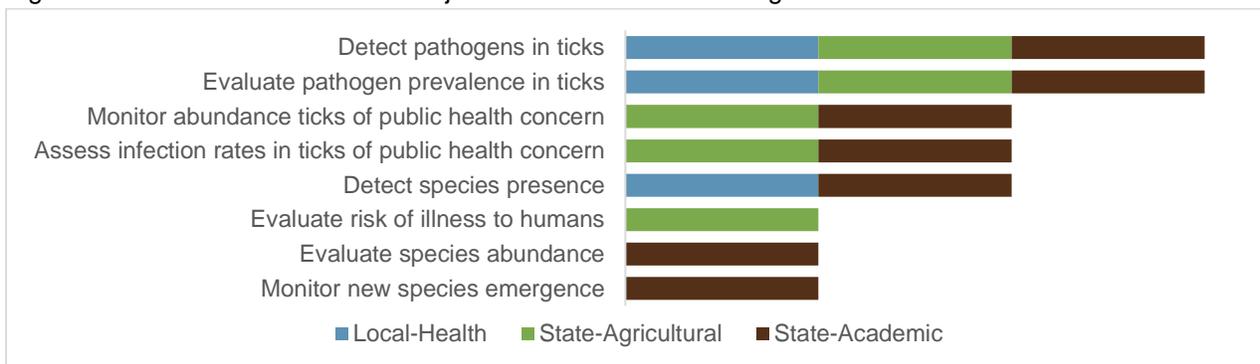
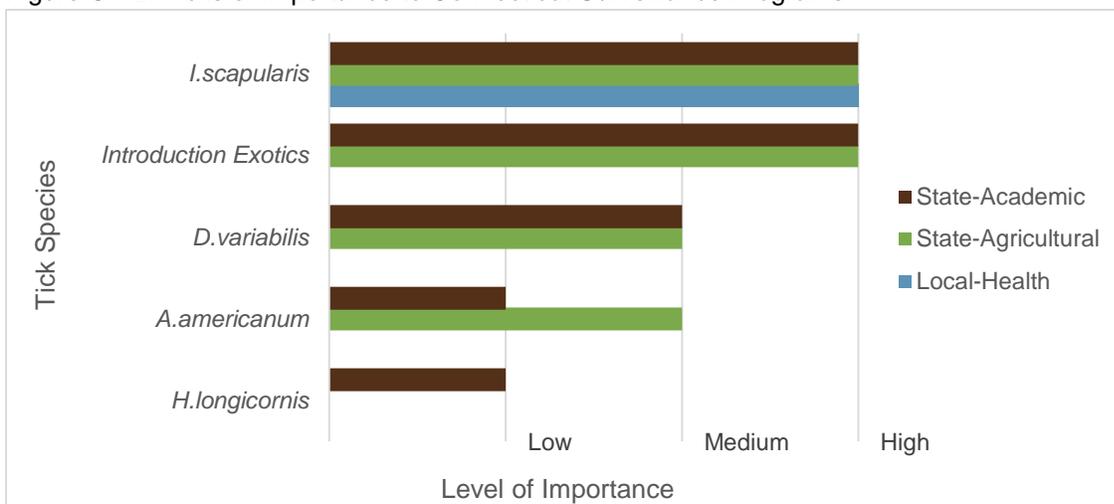


Figure CT-2. Ticks of Importance to Connecticut Surveillance Programs



Surveillance Program Operations

Active Surveillance Methods

Only the State-Academic respondent indicated that programs in their jurisdiction/organization were directly involved in active tick surveillance activities. Table CT-3 details the methods used in this program.

Table CT-3. Active Surveillance Methods Used in Connecticut Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Academic	<ul style="list-style-type: none"> • Drag cloths • Flag cloths 	<ul style="list-style-type: none"> • Timed collections 	Usually sampled once per week during the sampling period (~16 weeks)

The sampling approach used by this program is to randomly sample sites across seasons, visiting different sites in different locations. Sites for this program include public lands where preliminary sampling revealed populations and permission to sample could be obtained. Other sites include residential locations enrolled in ongoing experiments.

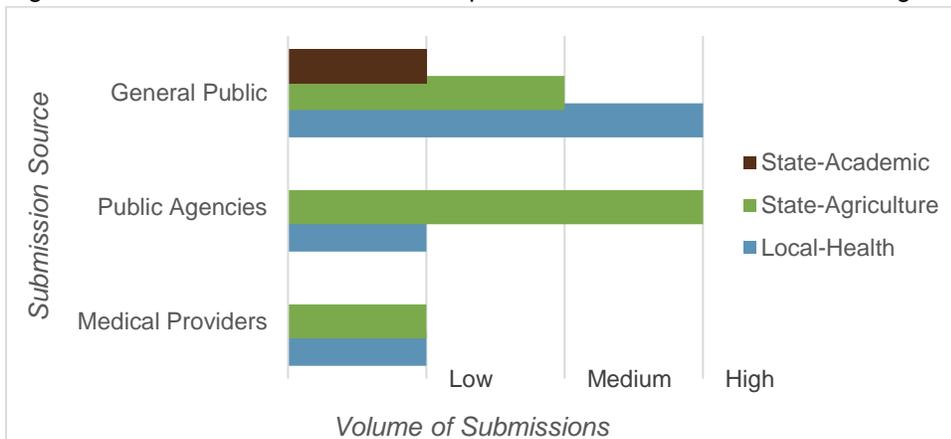
Passive Surveillance Methods

All three respondents indicated that the programs in their jurisdiction/organization were directly involved in passive tick surveillance activities. Table CT-4 provides an overview of the passive surveillance methods and jurisdictions served by these programs, and Figure CT-3 summarizes the sample submissions to the programs.

Table CT-4. Passive Surveillance Operations for Connecticut Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Academic	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Entire state
State-Agriculture	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Entire state
Local-Health	<ul style="list-style-type: none"> • Ticks found on humans 	Single county within state

Figure CT-3. Passive Surveillance Sample Submissions for Connecticut Programs



Pathogen Testing

Only the State-Agriculture and State-Academic respondents indicated that programs in their jurisdiction/organization paid for or otherwise supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table CT-5.

Table CT-5. Tick-borne Pathogens and Samples Tested in Connecticut Programs

Respondent	Pathogens Tested	Samples Tested	Lab conducting test
State-Academic	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. mayonii</i> <i>B. miyamotoi</i> Powassan virus	Ticks from humans	Not reported
State-Agriculture	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i>	Ticks from humans	Not reported
Local-Health	<i>B. burgdorferi</i>	Ticks from humans	State lab

III. Tick Control Program Operations

Respondents were asked to answer questions related to tick control program funding and operations. The only respondent that indicated the program in their jurisdiction/organization financially supports tick control efforts was State-Academic.

Tick Control Methods

Table CT-6 summarizes the tick control methods used by Connecticut programs. The State-Academic respondent indicated that their program collaborates with both an academic institution in a neighboring state and a private integrated tick management company in their tick control efforts.

Table CT-6. Tick Control Methods Used in Connecticut Programs

Respondent	Control Method	Products Used	How Conducted
State-Academic	Application of chemical pesticides	Cyfluthrin	Contracted out to private company
	Treatment of host species with pesticides	Rodent bait boxes	Contracted out to private company

Resistance Monitoring

None of the respondents indicated support of resistance monitoring by programs in their jurisdiction/organization.

IV. Program Information Dissemination

Respondents were asked to indicate how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table CT-7).

Table CT-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Connecticut

Respondent	Information Sharing Practices
State-Academic	<ul style="list-style-type: none"> Reported to CDC through Annual Reports
State-Agriculture	<ul style="list-style-type: none"> Summary reports available online Summary reports for specific stakeholder audiences Results shared with local health departments Results shared with medical providers
Local-Health	<ul style="list-style-type: none"> Summary reports available online

Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders. The State-Agriculture respondent did not report any barriers to sharing information with the public or sharing data with partners. The top barriers for sharing information with the public included a lack of time, lack personnel trained in communication, and lack of funds to develop public-facing materials (Figure CT-4). The top barrier to sharing program data with partners was the time and effort costs of preparing data for sharing (Figure CT-5).

Figure CT-4. Barriers to Sharing Tick-Related Information with the Public for Connecticut Programs

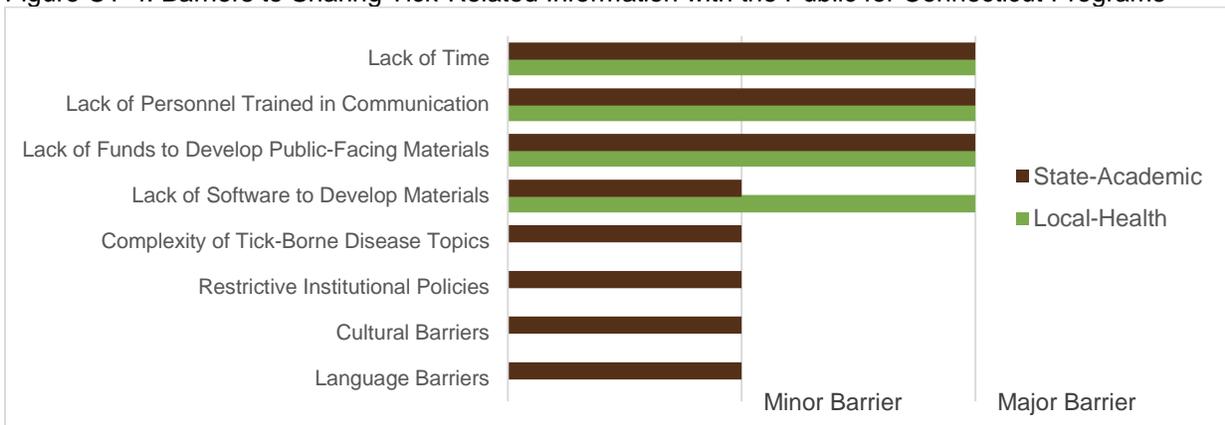
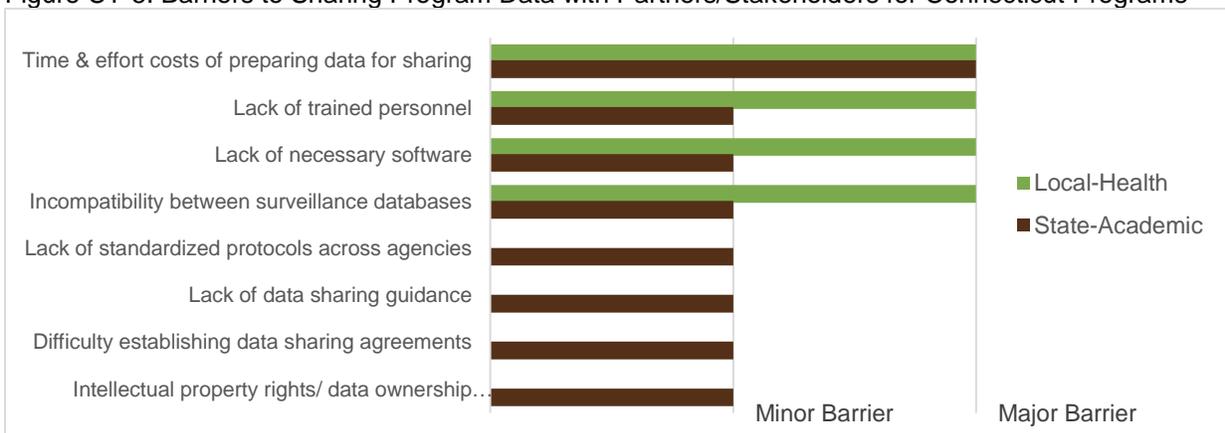


Figure CT-5. Barriers to Sharing Program Data with Partners/Stakeholders for Connecticut Programs

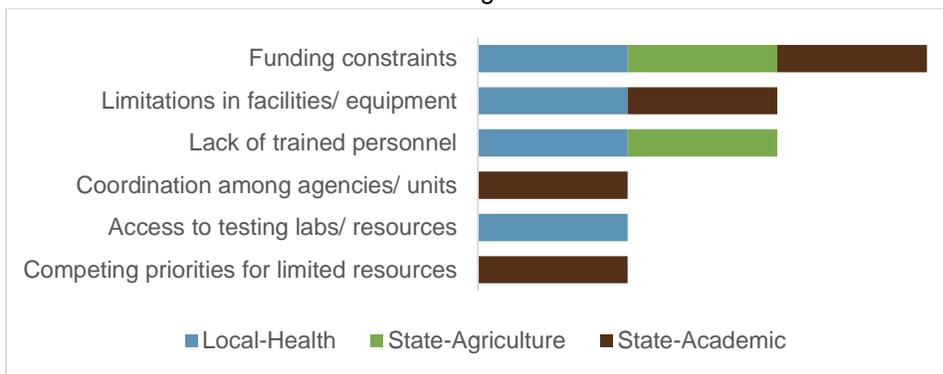


V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures CT-6a, CT-6b). All three respondents selected funding constraints and lack of trained personnel as program barriers. The State-Agriculture respondent did not report any barriers to tick control program development. Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The Responses are summarized in Table CT-8.

Figure CT-6. Barriers to Development/Enhancement in Connecticut Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs

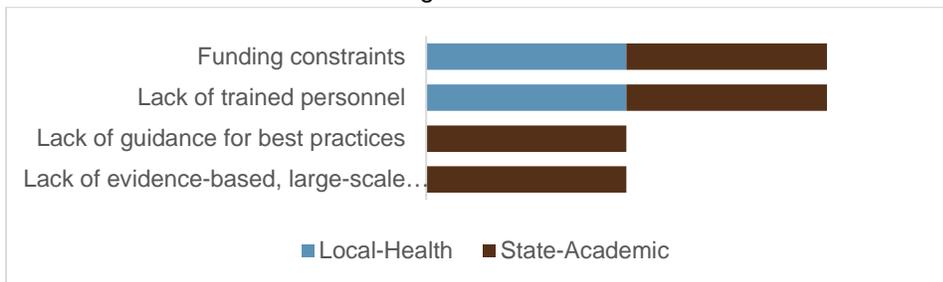


Table CT-8. Addressing Barriers to Tick Surveillance and Tick Control Programs in Connecticut

Respondent	Addressing Barriers to Tick Surveillance	Addressing Barriers to Tick Control
State-Academic	<ul style="list-style-type: none"> Increased communication and coordination between all groups with active tick surveillance programs More funding for laboratory personnel 	Increased education about research in evidence-based management practices for both practitioners and consumers
State-Agriculture	Continuous funding for tick surveillance from federal agencies, similar to mosquito surveillance programs	

Delaware

I. Respondent Demographics

Two individuals responded from organizations operating in the state of Delaware. Table DE-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: State-Health, State-Mosquito.

Table DE-1. Demographic Summary of Delaware Respondents

Agency Type	Jurisdiction	Level of Surveillance Program Involvement		
	State	Directly Involved	Supervisory	Disease Surveillance
Health	1	1	0	1
Natural Resources	1	0	1	0
Mosquito Control	1	0	1	0

Both respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction/organization. Both respondents were familiar with ad hoc active surveillance programs, and the State-Health respondent was also familiar with routine active surveillance and passive surveillance programs.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The two respondents identified state health, state agriculture, state natural resources, state mosquito control, and state cooperative extension agencies.

Respondents indicated that surveillance programs were funded through the mechanisms highlighted in Table DE-2 below, and that these programs were initiated in 2018. The State-Mosquito respondent indicated that their program collaborates with two academic institutions within the state on tick surveillance, while the State-Health program indicated collaborating with a federal organization in a pilot tick surveillance project.

Table DE-2. Overview of Tick Surveillance Programs Operating in Delaware

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Health ^a	None	Ad hoc active surveillance	2018 – 2018
State-Mosquito ^b	<ul style="list-style-type: none"> State funding through appropriations Federal funding through grants/cooperative agreements 	<ul style="list-style-type: none"> Routine active surveillance Ad hoc active surveillance 	2018 - present

^a Partners with federal organization

^b Partners with two in-state academic institutions

Respondents were asked to indicate the objectives of the tick surveillance program(s) operations in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure DE-1, Figure DE-2). Both respondents indicated that detecting pathogens in ticks and evaluating pathogen prevalence in ticks were current program objectives. Both respondents identified four tick species of high importance to their surveillance programs: *I. scapularis*, *A. americanum*, *D. variabilis*, and the introduction of exotic species.

Figure DE-1. Current Surveillance Objectives for Delaware Programs

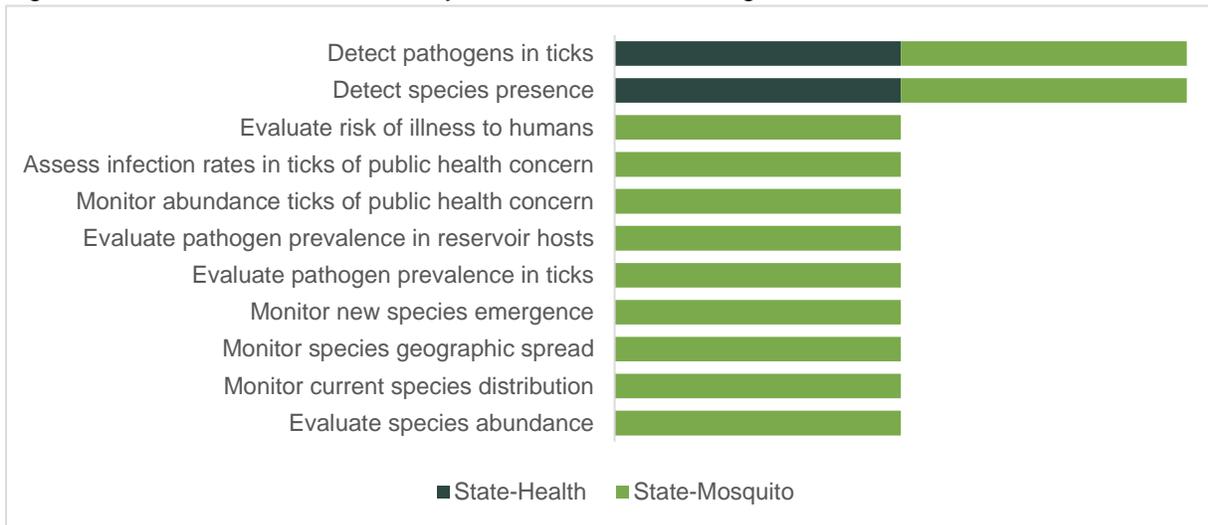
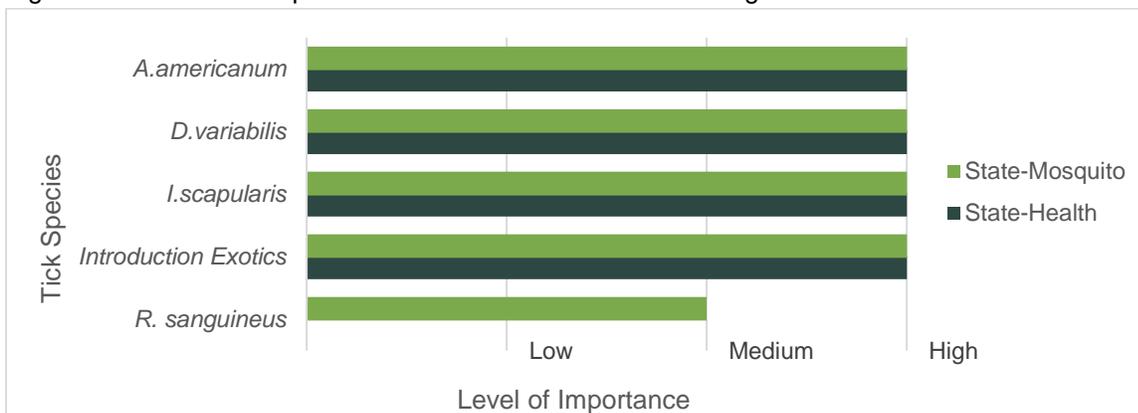


Figure DE-2. Ticks of Importance to Delaware Surveillance Programs



Surveillance Program Operations

Active Surveillance Methods

Both respondents indicated that programs in their jurisdiction/organization were directly involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table DE-3.

Table DE-3. Active Surveillance Methods Used in Delaware Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Health	<ul style="list-style-type: none"> • Drag cloths • CO₂-baited traps 		Pilot project trial
State-Mosquito	<ul style="list-style-type: none"> • Drag cloths • Active collection from host/reservoir animals • Flag cloths 	<ul style="list-style-type: none"> • Using both grid systems and transect paths • Timed collections 	Usually sampled more than once per season

The State-Mosquito program randomly sampled sites, visiting different sites in both the same locations and different locations across seasons. Sites were selected for this program to provide statewide geographic coverage by county and regions within counties, and by habitat types within these areas. Sites were also selected in locations where the human incidence of Lyme disease was known to be relatively high.

The State-Health program participated in a pilot project to collect ticks from state parks. Parks were selected in each of the counties of the state.

Passive Surveillance Methods

Only the State-Mosquito program indicated that programs in their jurisdiction/organization were directly involved in passive tick surveillance activities. Table DE-4 provides an overview of the passive surveillance methods and jurisdictions served by this program.

Table DE-4. Passive Surveillance Operations for Delaware Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Mosquito	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets • Ticks found on wildlife 	Entire state

The State-Mosquito respondent indicated that low volumes of samples are submitted from the following groups:

- Veterinarian Offices
- General Public
- Medical Providers
- Public Agencies

Pathogen Testing

Both respondents provided feedback on the testing of tick samples for pathogens within their jurisdictions. Only the State-Mosquito program reported that programs in their jurisdiction/organization paid for or otherwise supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table DE-5.

Table DE-5. Tick-borne Pathogens and Samples Tested in Delaware Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Health	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> Powassan virus <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i> <i>F. tularensis</i>	Environmental collections	Private lab
State-Mosquito	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i>	Ticks from animals Environmental collections	State-owned lab
	Powassan virus	Environmental collections	

III. Tick Control Program Operations

Respondents were asked to answer questions related to tick control program funding and operations. The only respondent that indicated the program in their jurisdiction/organization financially supports tick control efforts was State-Mosquito.

Tick Control Methods

Table DE-6 summarizes the tick control methods and products used by the State-Mosquito program.

Table DE-6. Tick Control Methods Used in Delaware Programs

Respondent	Control Method	Products Used	How Conducted
State-Mosquito	Application of conventional or synthetic chemical pesticides	<ul style="list-style-type: none"> • Bifenthrin • Cyfluthrin • Deltamethrin • <i>lambda</i>-Cyhalothrin • Permethrin • Pyrethrins • <i>tau</i>-fluvalinate 	Performed in-house
	Application of botanical pesticides/biopesticides	<ul style="list-style-type: none"> • All potential 25(b) products 	Performed in-house
	Treatment of host species	<ul style="list-style-type: none"> • Rodent bait boxes • Tick tubes • Oral Lyme vaccine bait 	<ul style="list-style-type: none"> • Contracted out to private company • Performed in-house
	<ul style="list-style-type: none"> • Host species reduction programs • Vegetation modification 		Performed in-house

Resistance Monitoring

The State-Mosquito respondent indicated that while not currently conducted, acaricide resistance monitoring might be an activity that their organization performs as the tick control program grows.

IV. Program Information Dissemination

Respondents were asked to indicate how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table DE-7).

Table DE-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Delaware

Respondent	Information Sharing Practices
State-Health	<ul style="list-style-type: none"> • Results not yet available
State-Mosquito	<ul style="list-style-type: none"> • Summary reports available online • Results incorporated into maps made available online • Results drafted into educational materials to inform public/communities • Reported to CDC through appropriate databases • Results shared with local health departments • Results shared with partner agencies within state • Data made available to public online • Data shared with academic partners for analysis

Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders. The State-Health respondent stated that barriers to communication with the public as well as sharing data with partners were unknown at the time of survey completion.

The barriers to communicating tick-related information to the public and sharing program data with partners and stakeholders identified by the State-Mosquito respondent are summarized in Table DE-8. All of these barriers were listed as minor barriers.

Table DE-8. Barriers to Sharing Tick-Related Information and Data for Delaware Programs

Respondent	Barriers to Public Communication	Barriers to Sharing Program Data
State-Mosquito	<ul style="list-style-type: none"> • Lack of funds to develop public-facing materials • Lack of software to develop materials • Language barriers • Lack of time • Complexity of tick-borne disease topics 	<ul style="list-style-type: none"> • Lack of standardized protocols across agencies • Time and effort costs of preparing data for sharing • Lack of necessary software • Incompatibility between surveillance databases • Difficulty establishing data sharing agreements

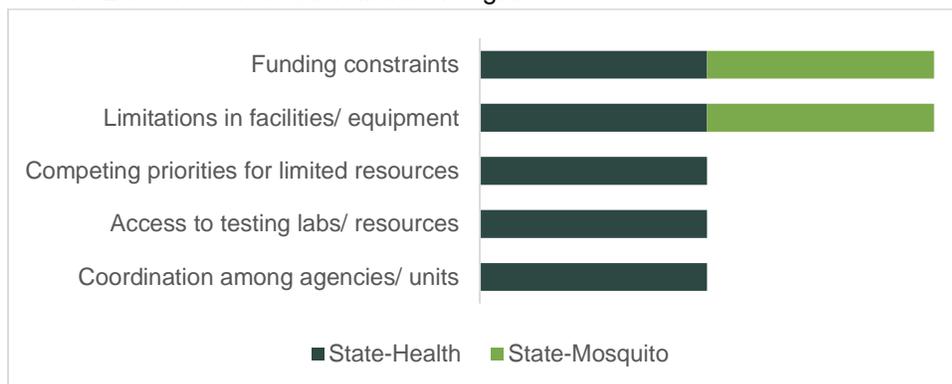
* All barriers listed as minor barriers by State-Mosquito respondent

V. Barriers to Program Development and Enhancement

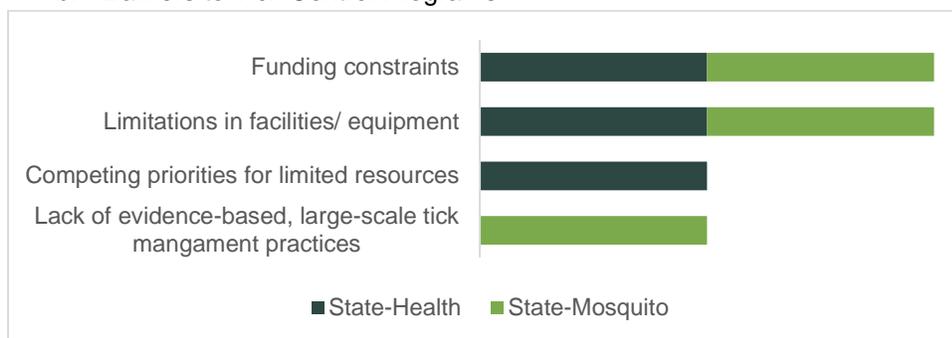
Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures DE-3a, DE-3b). All respondents selected funding constraints and lack of trained personnel as program barriers.

Figure DE-3. Barriers to Development/Enhancement in Delaware Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The State-Health respondent reported that enhanced collaboration between state and federal agencies would help resolve barriers to tick surveillance programs, while increased funding would help resolve barriers to tick control programs.

Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. The State-Mosquito respondent provided a detailed response summarizing tick surveillance and control responsibilities for their agency. In brief, the Delaware General Assembly authorized via statute that the state mosquito control section would incorporate tick control responsibilities, including surveillance, pathogen assessment, host dynamics, and control measures. These operations received permanent state funding in July 2018, and much of the information the State-Mosquito respondent reported in this survey details activities they anticipate completing in the near future, but have not necessarily started. The respondent made clear that any activities related to tick-borne disease tracking in human or veterinary populations, as well as public education efforts on tick-borne diseases, fell outside their scope of work to organize and operate.

Maine

I. Respondent Demographics

Two individuals responded from organizations operating in the state of Maine. Table ME-1 below displays the jurisdiction level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: State-Health, State-Academic.

Table ME-1. Demographic Summary of Maine Respondents

Agency Type	Jurisdiction	Level of Program Involvement		
	State	Directly Involved	Supervisory	Disease Surveillance
Health	1	0	1	1
Cooperative Extension	1	1	0	0
Academic	1	1	0	0

Both respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction/organization. Both respondents were familiar with routine active surveillance programs, ad hoc active surveillance programs, and passive surveillance programs.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The two respondents identified state health and state cooperative extension agencies.

Respondents indicated that surveillance programs were funded through the mechanisms highlighted in Table ME-2 below. The State-Health respondent indicated that their program collaborates with the State-Academic respondent’s program. Both programs also collaborate with a medical research center in the state.

Respondents were asked to indicate the objectives of the tick surveillance program(s) operations in their jurisdiction or organization, as well as the relative importance of specific tick species to that program (Figure ME-1, Figure ME-2). Both respondents largely indicated the same current priorities for their programs. The State-Health respondent indicated that they monitor for the emergence of exotic tick species through passive submissions to their tick identification program, as well as through ad hoc active surveillance conducted through rapid response surveys following a case of human illness or a cluster of complaints. Both respondents identified *Ixodes scapularis* as highly important and *Dermacentor variabilis* as of medium importance to their surveillance programs. Both also identified *Amblyomma americanum*

and the introduction of exotic species as important, but at varying levels. The State-Academic respondent also listed several ticks of low importance to their surveillance program.

Table ME-2. Overview of Tick Surveillance Programs Operating in Maine

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Health ^{a,b}	<ul style="list-style-type: none"> Federal funding through grants/cooperative agreements Small grants from private medical research center 	Passive surveillance	1989 - present
State-Academic ^b	<ul style="list-style-type: none"> State funding through grants Federal funding through grants/cooperative agreements 	<ul style="list-style-type: none"> Routine active surveillance Ad hoc active surveillance Passive surveillance 	2018 - present

^a partners with State-Academic
^b partners with in-state medical research center

Figure ME-1. Current Surveillance Objectives for Maine Programs

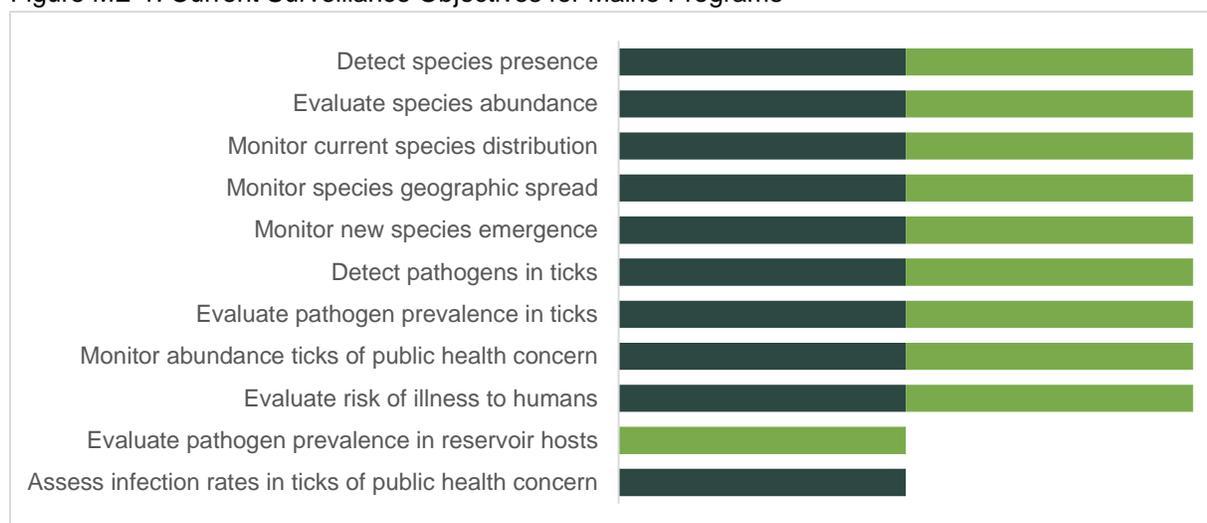
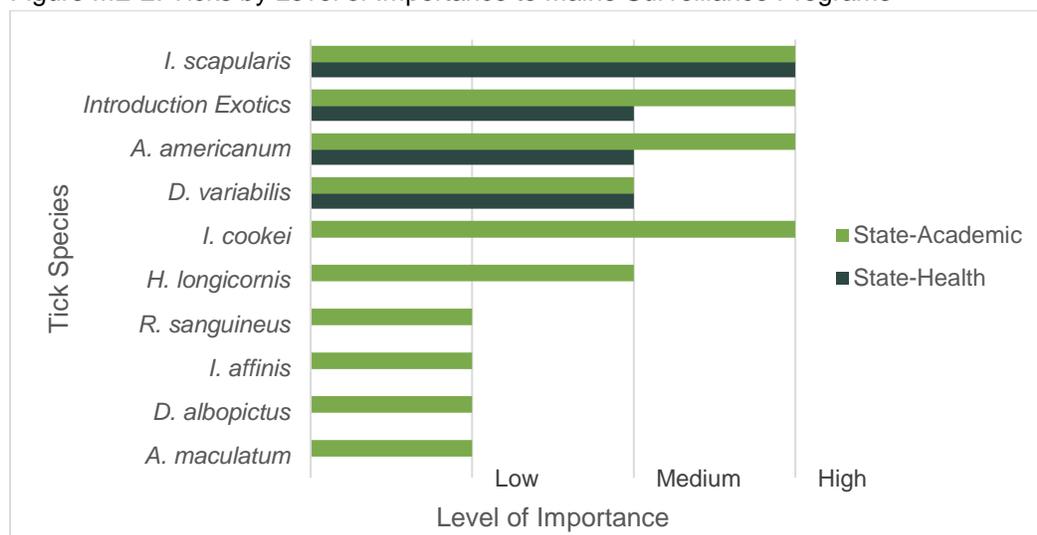


Figure ME-2. Ticks by Level of Importance to Maine Surveillance Programs



Surveillance Program Operations

Active Surveillance Methods

Both respondents indicated that programs in their jurisdiction/organization were directly involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table ME-3, and Table ME-4 summarizes the sampling arrangements used in these programs.

Table ME-3. Active Surveillance Methods Used in Maine Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Health	<ul style="list-style-type: none"> • Drag cloths • Active collection from host/reservoir animals • Flag cloths 	<ul style="list-style-type: none"> • Using both grid systems and transect paths • Time collections 	Usually more than once
State-Academic	<ul style="list-style-type: none"> • Drag cloths • Active collection from host/reservoir animals • Flag cloths 	<ul style="list-style-type: none"> • Using both grid systems and transect paths • Time collections 	Usually more than once

Table ME-4. Sampling Arrangements Used in Maine Active Surveillance Programs

Respondent	Sampling Arrangement/ Season	How Sites Selected
State-Health	<ul style="list-style-type: none"> • Same sites in same location each season • Randomly sample different sites in different locations across seasons • Sites also sampled in response to disease cases 	<ul style="list-style-type: none"> • Use of historical areas • Areas funded by specific grants/projects • Rapid response areas dictated human disease cases
State-Academic	<ul style="list-style-type: none"> • Same sites in same location each season • Randomly sample different sites in same locations across seasons • Sites also sampled in response to disease cases 	

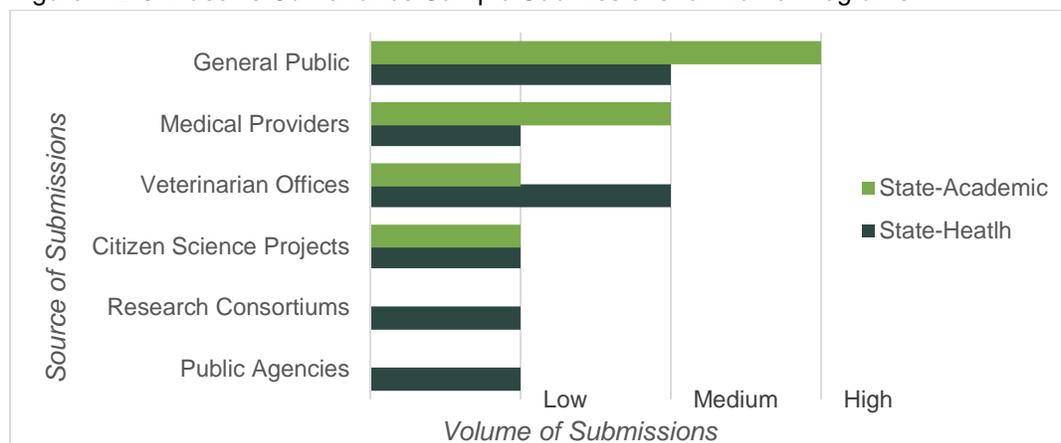
Passive Surveillance Methods

Both respondents indicated that their programs in their jurisdiction/organization were directly involved in passive tick surveillance activities. Table ME-5 provides an overview of the passive surveillance methods and jurisdictions served by these programs, and Figure ME-3 summarizes the sample submissions to both programs, by volume of specimens received.

Table ME-5. Passive Surveillance Operations for Maine Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Health	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Entire state
State-Mosquito	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock • Ticks found on wildlife 	Entire United States

Figure ME-3. Passive Surveillance Sample Submissions for Maine Programs



Pathogen Testing

Both respondents reported that programs in their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table ME-6.

Table ME-6. Tick-borne Pathogens and Samples Tested in Maine Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Health	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> Powassan virus	Environmental collections	Private lab
State-Mosquito	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> Powassan virus	Ticks from humans Ticks from animals Environmental collections	Academic lab

III. Tick Control Program Operations

Respondents were asked to answer questions related to tick control program funding and operations. Neither respondent indicated their organization pays for or otherwise financially supports tick control activities.

Tick Control Methods

The State-Health respondent indicated their program is involved in host species reduction. No other control activities were reported by either respondent.

Resistance Monitoring

No resistance monitoring activities were reported by either participant.

IV. Program Information Dissemination

Respondents were asked to indicate how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table ME-7).

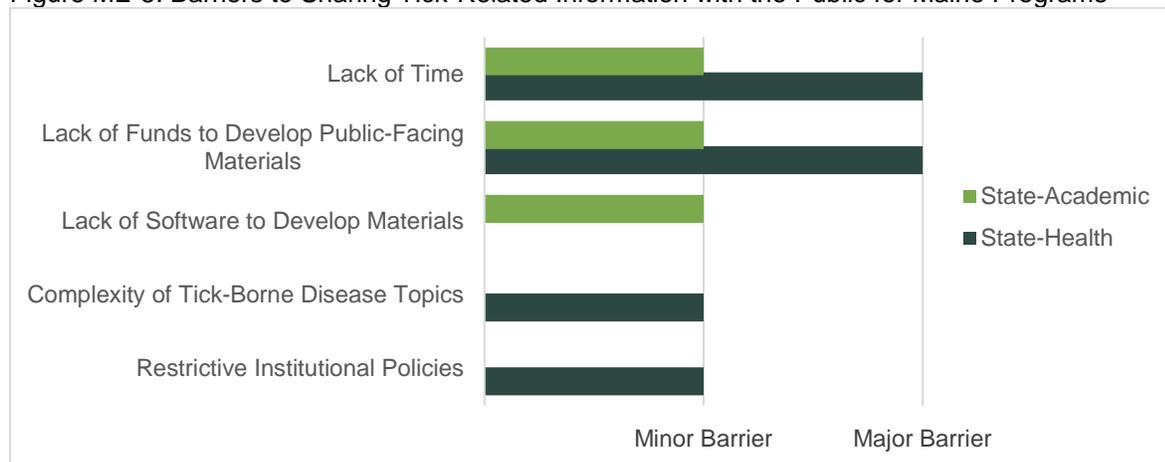
Table ME-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Maine

Respondent	Information Sharing Practices
State-Health	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder groups • Reported to CDC through annual reports • Results shared with partner agencies within the state
State-Academic	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder groups • Results drafted into educational materials to inform public/communities • Results shared with partner agencies within the state • Results shared with partner agencies in neighboring states

Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders. The top barrier for sharing information with the public was a lack of funds to develop materials (Figure ME-5).

The State-Health respondent did not report any barriers to sharing data with partners, while the State-Academic respondent indicated lack of necessary software and lack of data sharing guidance presented minor barriers to sharing data.

Figure ME-5. Barriers to Sharing Tick-Related Information with the Public for Maine Programs

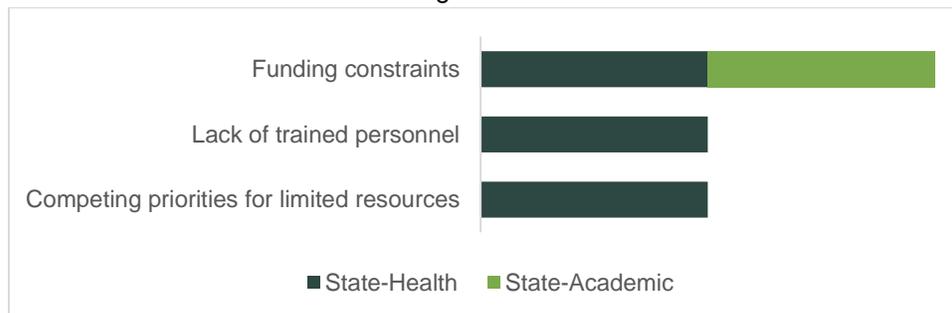


V. Barriers to Program Development and Enhancement

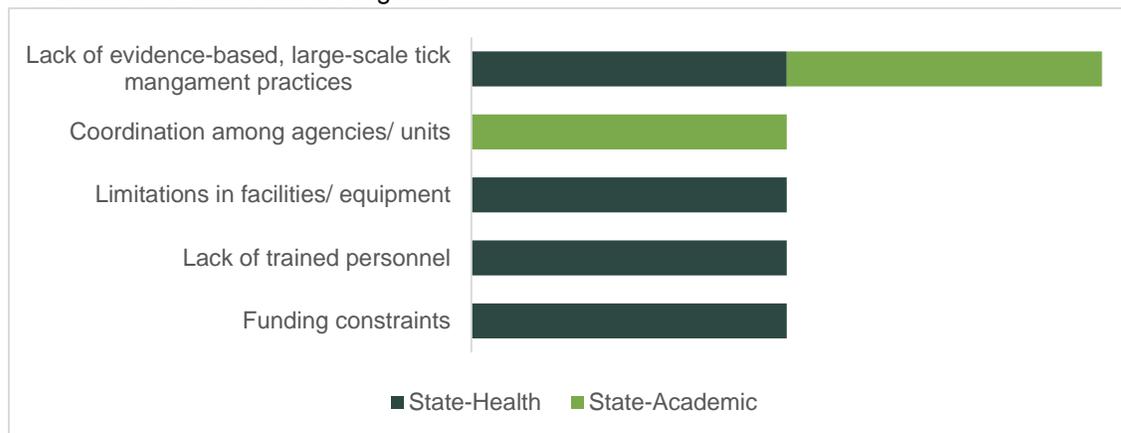
Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures ME-6a, ME-6b). Both respondents listed funding constraints as a barrier to tick surveillance programs, and listed the lack of evidence-based, large-scale tick management practices as a barrier to tick control.

Figure ME-6. Barriers to Development/Enhancement in Maine Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



Maryland

I. Respondent Demographics

Four individuals responded from organizations operating in the state of Maryland. Table MD-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: State-Health, Fed-Agriculture, and State-Ag-Coop. Two respondents were affiliated with the same organization (State-Ag-Coop); their responses will be reported jointly.

Table MD-1. Demographic Summary of Maryland Respondents

Agency Type	Jurisdiction		Level of Program Involvement			
	State	Federal	Directly Involved	Supervisory	Disease Surveillance	Other*
Agricultural	1	1	1	1	0	1
Health	1	0	0	1	1	0
Cooperative Extension	1	0	1	0	0	1
Level of Program Involvement	State	Federal				
Directly Involved	0	1				
Supervisory	1	1				
Disease Surveillance	1	0				
Other*	2	0				

* Respondents listing 'other' described their program involvement as accepting tick photographs from the public for identification and providing tick-related information to the public.

Only the State-Health respondent indicated they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction or organization. This respondent was familiar with routine active surveillance, ad hoc active surveillance, and passive surveillance programs.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

The State-Health respondent was the only participant to record data for the following section.

The State-Health respondent indicated that both state health and state agriculture agencies are involved in tick surveillance activities. Table MD-2 provides an overview of the program funding and operations. These programs also collaborate with a state academic center in this work.

Table MD-2. Overview of Tick Surveillance Programs Operating in Maryland

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Health ^a	State funding through appropriations	Passive surveillance	2011 - present
		Ad hoc active surveillance	2018 - present

^a Partners with state academic center

The current program objectives include:

- Detect the presence of ticks by species
- Monitor the geographic spread of tick species
- Monitor the abundance of ticks that are of public health concern

The State-Health respondent listed the following ticks as highly important to surveillance programs:

- *A. americanum*
- *A. maculatum*
- *D. variabilis*
- *H. longicornis*
- *I. scapularis*
- *R. sanguineus*
- Introduction of exotic species

The respondent identified no other tick species as important for surveillance.

Surveillance Program Operations

Active Surveillance Methods

No respondents provided information regarding active tick surveillance methods in the state.

Passive Surveillance Methods

Only the State-Health respondent indicated that programs in their jurisdiction/organization were directly involved in passive tick surveillance activities. Table MD-3 provides an overview of the passive surveillance methods and jurisdictions served by this program. The respondent indicated that their program receives a medium volume of tick sample submissions from the general public and public agencies, and a low volume of submissions from veterinarian offices, medical providers, citizen science projects, and research consortiums.

Table MD-3. Passive Surveillance Operations for Maryland Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Health	<ul style="list-style-type: none">• Ticks found on humans• Ticks found on pets• Ticks found on domestic livestock• Ticks found on wildlife	Entire state

Pathogen Testing

Federal-Agriculture was the only respondent to provide feedback on the testing of tick samples for pathogens within their jurisdiction. This respondent reported programs in their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in this program are displayed in Table MD-4.

Table MD-4. Tick-borne Pathogens and Samples Tested in Maryland Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
Federal-Agriculture	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. mayonii</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i>	Environmental collections Ticks from animals	State-owned lab

III. Tick Control Program Operations

Respondents were asked to answer questions related to tick control program funding and operations. The only respondent indicating that programs in their jurisdiction/organization financially support tick control efforts was Federal-Agriculture.

Tick Control Methods

Table MD-5 summarizes the tick control methods and products used by the Federal-Agriculture program. This respondent indicated that their program collaborates with a state academic center in these activities.

Table MD-5. Tick Control Methods Used in Maryland Programs

Respondent	Control Method	Products Used	How Conducted
Federal-Agriculture	Application of conventional or synthetic chemical pesticides	Permethrin	Contracted out to private company
	Application of botanical pesticides/biopesticides	<i>Metarhizium brunneum</i> / <i>anisopliae</i>	Contracted out to private company
	Treatment of host species	<ul style="list-style-type: none"> Rodent bait boxes Tickicide for deer 	Performed in-house

Resistance Monitoring

The Federal-Agriculture respondent indicated that resistance monitoring is not currently supported through their program.

IV. Program Information Dissemination

Respondents were asked to indicate how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs; only the State-Health and Federal-Agriculture respondents provided responses (Table MD-6).

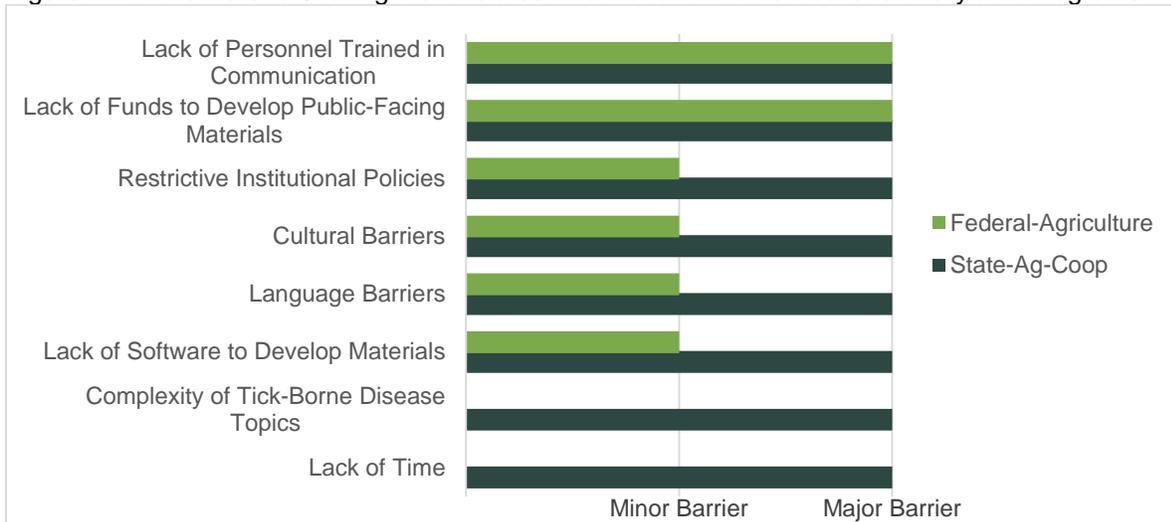
Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders. The top barriers for sharing information with the public included a lack of funds to develop public-facing materials and lack personnel trained in communication (Figure MD-1). The only respondent to provide feedback on barriers to sharing data with partners and stakeholders was State-Health. This respondent listed the lack of

minimum dataset requirements as a major barrier, and the lack of standardized protocols across agencies and the time and effort costs of preparing data for sharing as minor barriers.

Table MD-6. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Maryland

Respondent	Information Sharing Practices
State-Health	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder audiences
Federal-Agriculture	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder audiences • Data shared with academic partners for analysis

Figure MD-1. Barriers to Sharing Tick-Related Information with the Public for Maryland Programs

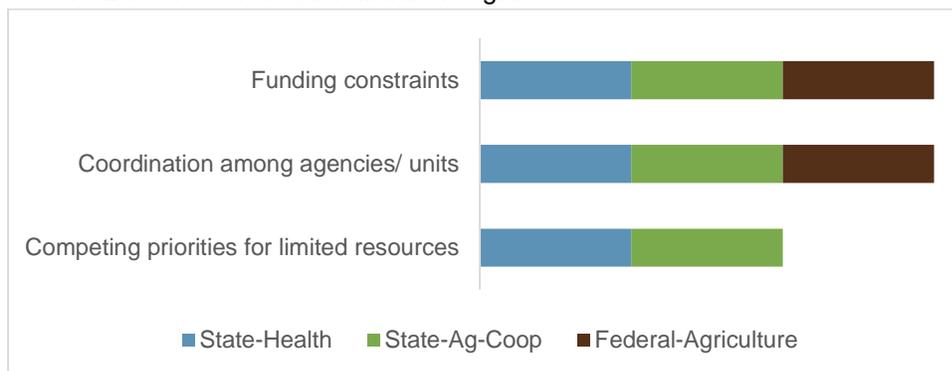


V. Barriers to Program Development and Enhancement

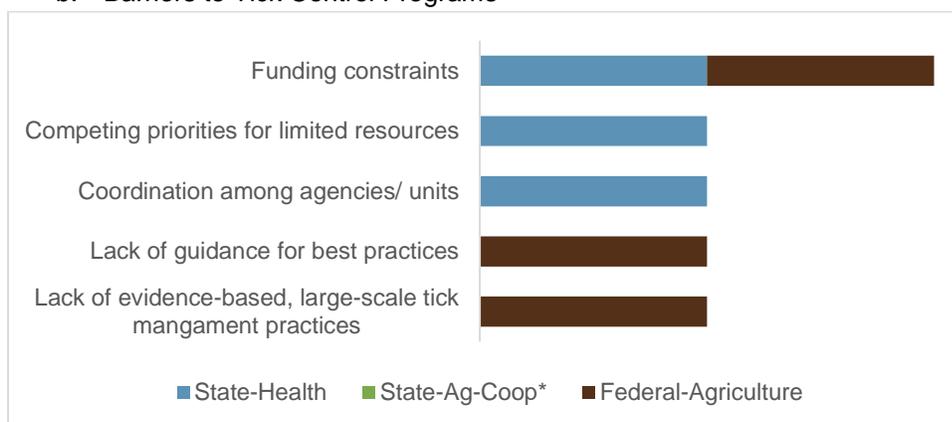
Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures MD-2a, MD-2b). All three respondents selected funding constraints and lack of trained personnel as program barriers.

Figure MD-2. Barriers to Development/Enhancement in Delaware Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



* The State-Ag-Coop respondents did not report any barriers to tick control

Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The State-Coop-Ag respondents reported that enhanced coordination among agencies and prioritization of these efforts would address barriers to both tick surveillance and tick control programs.

Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. The State-Ag-Coop respondents commented that addressing invasive plant species that benefit tick populations, such as Japanese barberry, educating the public, and addressing deer management should be priorities of these programs.

Massachusetts

I. Respondent Demographics

One individual responded from an organization operating in the state of Massachusetts. This individual worked in a state health agency, and was involved with human disease surveillance for tick-borne diseases. This respondent will be referred to as State-Health.

The State-Health respondent indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction. These included routine active surveillance, ad hoc active surveillance, and passive surveillance activities.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

The State-Health respondent indicated surveillance programs in operation in the state are funded through the mechanisms highlighted in Table MA-1 below. The State-Health respondent indicated that they collaborate with two academic institutions in the state in tick surveillance activities. These academic institutions and a county-based cooperative extension program were identified as the primary implementers of tick surveillance activities in the state.

Table MA-1. Overview of Tick Surveillance Programs Operating in Massachusetts

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Health ^a	<ul style="list-style-type: none"> Community/municipal tax-based funding Fee for service tick testing for the public Independently acquired grants from academic institution 	Passive surveillance	2006 - present
		Active surveillance	Not reported

^a Two in-state academic institutions and one county-based cooperative extension program are primary implementers of these activities

The objectives of these programs were identified as:

- Detect the presence of ticks by species
- Evaluate tick abundance by species
- Monitor the geographic spread of tick species
- Monitor the emergence of new tick species
- Detect the presence of tick-borne pathogens in ticks
- Evaluate the prevalence of tick-borne pathogens in reservoir hosts
- Assess infection rates of ticks that are of public health concern

The State-Health respondent indicated that three ticks were of high importance to these surveillance programs: *Ixodes scapularis*, *Haemaphysalis longicornis*, and the introduction of exotic species. *Amblyomma americanum* and *Dermacentor variabilis* were listed of medium importance.

Surveillance Program Operations

Active Surveillance Methods

The State-Health respondent reported that one county cooperative extension office is primarily involved in active surveillance in the state, employing the use of drag and flag cloths. The respondent was unsure of the sampling arrangement used for flagging and dragging. The target of this active surveillance is *Amblyomma americanum*. The sampling approach used by this program is to sample the same sites in the same locations each season. Different sites in different locations are also sampled in response to reports of *Amblyomma americanum* presence. Sites are usually sampled more than once each season.

Passive Surveillance Methods

The State-Health respondent indicated that academic institutions in the state operate passive surveillance programs, using ticks from animals and ticks from wildlife. These programs receive a high volume of samples from the general public. These programs serve the entire state.

Pathogen Testing

The State-Health respondent indicated that their program/jurisdiction paid for or otherwise supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table MA-2.

Table MA-2. Passive Surveillance Operations for Massachusetts Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Test
State-Health	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. mayonii</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i> Other relapsing fever spirochetes Bourbon virus Heartland virus Powassan virus	Ticks from humans Ticks from animals	Academic lab

III. Tick Control Program Operations

The State-Health respondent that indicated their program/jurisdiction financially or otherwise supports tick control efforts. The agencies involved in tick control include: local/municipal natural resources, local/municipal public works, state public works, and state conservation and recreation.

Tick Control Methods

Table MA-3 summarizes the tick control methods and products used by programs in the state.

Table MA-3. Tick Control Methods Used in Massachusetts Programs

Respondent	Control Method	Products Used	How Conducted
State-Health	<ul style="list-style-type: none"> • Host species reduction programs • Treatment of host species with pesticides • Vegetation modification 	<ul style="list-style-type: none"> • Permethrin • <i>Metarhizium brunneum/ anisopliae</i> Rodent bait boxes • 4-poster tickicide 	Joint effort across multiple programs

Resistance Monitoring

The State-Health respondent indicated that no resistance monitoring is currently supported.

IV. Program Information Dissemination

Table MA-4 summarizes how information from tick surveillance, tick pathogen testing, and/or tick control programs is generally shared. Respondents were also asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders.

A lack of time was identified as a major barrier to sharing information with the public, and the complexity of tick-borne disease topics and lack of funds to develop public-facing materials were also listed as minor barriers. The time and effort costs of preparing data for sharing, personal data protection laws, and difficulty establishing data sharing agreements were all listed as major barriers to sharing data with partners and stakeholders. No other barriers were identified to sharing program information.

Table MA-4. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Massachusetts

Respondent	Information Sharing Practices
State-Health	<ul style="list-style-type: none"> • Data made available to the public online • Information shared through public programs

V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Table MA-5).

Table MA-5. Barriers to Development/Enhancement of Programs in Massachusetts

Respondent	Barriers to Tick Surveillance Programs	Resolve Barriers to Tick Control Programs
State-Health	<ul style="list-style-type: none"> • Funding constraints • Competing priorities for limited program resources • Limitations in utility of surveillance - in a state like Massachusetts, focus would be on identification of emerging tick species or pathogens, not on tick populations/abundance 	<ul style="list-style-type: none"> • Competing priorities for limited program resources • Lack of evidence-based, large-scale tick management strategies

New Hampshire

I. Respondent Demographics

One individual responded from an organization operating in the state of New Hampshire. This respondent represented a state health agency and was involved in human disease surveillance for tick-borne diseases.

This respondent was not familiar with any tick surveillance programs ongoing in the state. No data was reported detailing any program operations for tick surveillance, tick testing, or tick control for New Hampshire.

The respondent did provide feedback on barriers to sharing information with the public, as well as barriers to the development and/or enhancement of tick surveillance and tick control programs in the state.

The lack of software to develop public-facing materials was identified as a major barrier to sharing tick-related information with the public; lack of funds to develop public-facing materials, lack of personnel trained in communication, restrictive institutional policies, lack of time, and the complexity of tick-borne disease topics were listed as additional minor barriers.

The following factors were identified as barrier to enhancing or developing both tick surveillance and tick control programs in the state:

- Funding constraints
- Lack of trained personnel
- Limitations in facilities/equipment
- Lack of access to testing labs/resources

New Jersey

I. Respondent Demographics

Ten individuals responded from organizations operating in the state of New Jersey. Table NJ-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as:

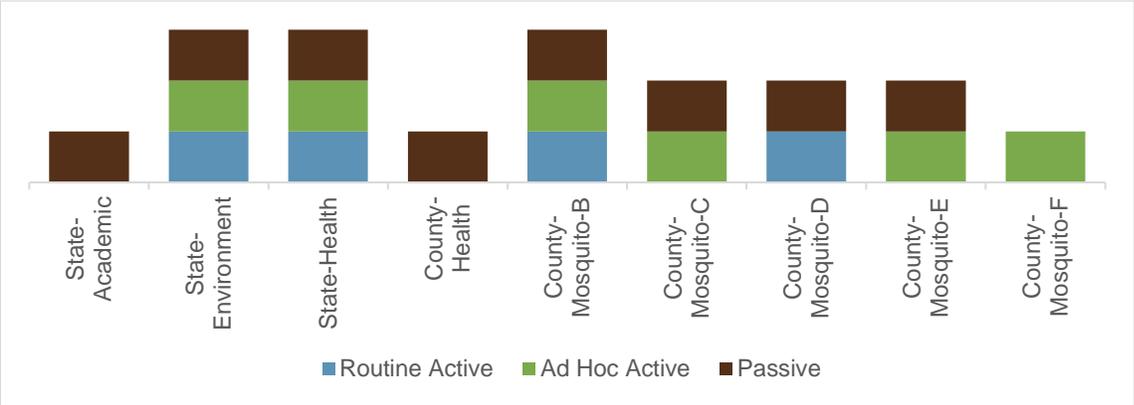
- State-Academic
- State-Environment
- State-Health
- County-Mosquito (A through F)
- County-Health

Table NJ-1. Demographic Summary of New Jersey Respondents

Agency Type	Jurisdiction			Level of Program Involvement			
	Local	County	State	Directly Involved	Supervisory	Disease Surveillance	Not Involved
Environment	0	0	1	1	0	0	0
Health	0	1	1	1	1	1	0
Public Works/ Mosquito Control	0	6	0	3	1	0	3
Academic	1	1	1	1	0	0	0
Level of Program Involvement	Local	County	State				
Directly Involved	1	5	2				
Supervisory	0	2	0				
Disease Surveillance	0	0	1				
Not Involved	0	3	0				

Several respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction or organization (Figure NJ-1).

Figure NJ-1. Familiarity with Tick Surveillance Programs among New Jersey Respondents



II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. Nine respondents identified local, county and state mosquito control; state cooperative extension, state agriculture, state environment, state health, federal agriculture, and state academic institutions.

Nine respondents indicated that tick surveillance programs were funded through the mechanisms highlighted in Table NJ-2 below. Only six respondents shared information regarding the start dates of tick surveillance programs in their jurisdiction. Six respondents also indicated that the surveillance programs in their jurisdiction had partnerships with academic centers in both New Jersey and a neighboring state.

Respondents were asked to indicate the objectives of the tick surveillance program(s) operating in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure NJ-2, Figure NJ-3). The most commonly identified program objectives were to detect the presence of ticks by species and to monitor for the emergence of new tick species. The most important tick species for the tick surveillance programs highlighted by respondents were *A. americanum*, *I. scapularis*, *D. variabilis*, *H. longicornis*, and the introduction of exotic species.

Eight respondents provided feedback on how programs in their jurisdictions approached the introduction of exotic species. Several respondents indicated that surveillance programs were initiated in response to the invasive Asian longhorned tick, and involved combinations of passive tick surveillance and active surveillance approaches. Two respondents indicated that the USDA and state agriculture departments were involved in these efforts.

Table NJ-2. Overview of Tick Surveillance Programs Operating in New Jersey

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Academic	<ul style="list-style-type: none"> State funding through appropriations Federal funding through grants/cooperative agreements 		
State-Environment ^a	<ul style="list-style-type: none"> No dedicated funding for these efforts at present, professional interest and need for more information has driven efforts to date 	<ul style="list-style-type: none"> Routine active surveillance Ad hoc active surveillance Passive surveillance 	2018 - present
State-Health ^b	<ul style="list-style-type: none"> County/municipal tax-based funding 	Routine active surveillance	2017 – present
		Passive surveillance	2006 - present
County-Health	<ul style="list-style-type: none"> County/municipal tax-based funding 	Passive surveillance	2000 - present
County-Mosquito-B ^c	<ul style="list-style-type: none"> State funding through appropriations State funding through grants County/municipal tax-based funding 		

County-Mosquito-C ^d	<ul style="list-style-type: none"> Federal funding through grants/cooperative agreements 		
County-Mosquito-D ^e	<ul style="list-style-type: none"> County/municipal tax-based funding 	Routine active surveillance	2017 - present
		Passive surveillance	2005 - present
County-Mosquito-E ^f	<ul style="list-style-type: none"> Program not specifically funded. Initial materials provided by local university and employee time paid through mosquito control. 	<ul style="list-style-type: none"> Ad hoc active surveillance Passive surveillance 	2018 - present
County-Mosquito-F ^g	<ul style="list-style-type: none"> We have no funding for tick work; hence, we only do it when a partner can fund the work. 	<ul style="list-style-type: none"> Ad hoc active surveillance 	1994 - present
^{a-f} Partners with State-Academic respondent ^g Partners with university in neighboring state			

Figure NJ-2. Current Surveillance Objectives for New Jersey Programs

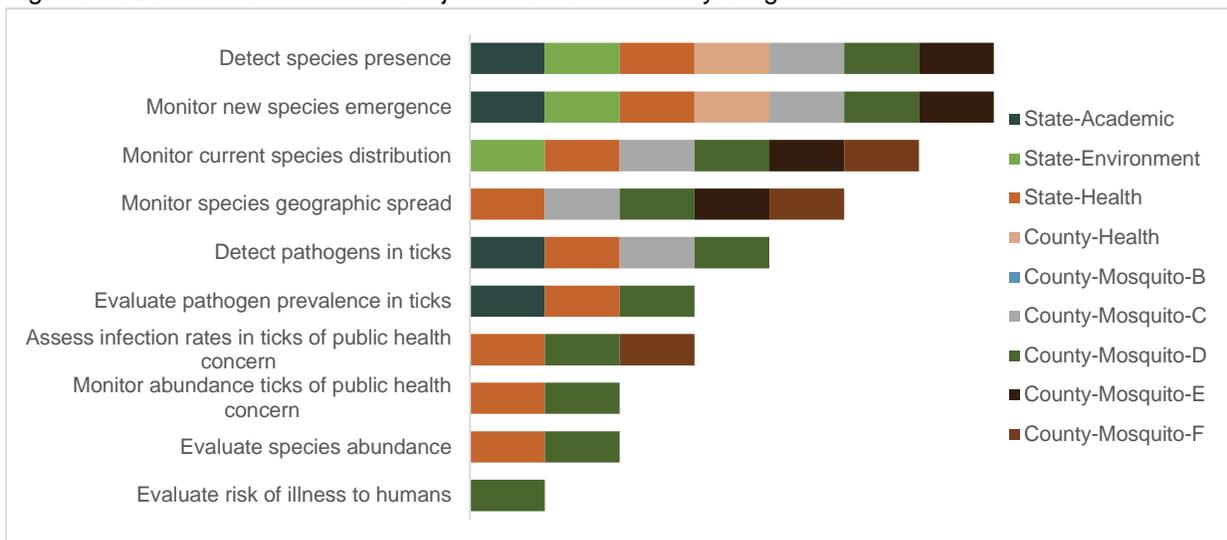
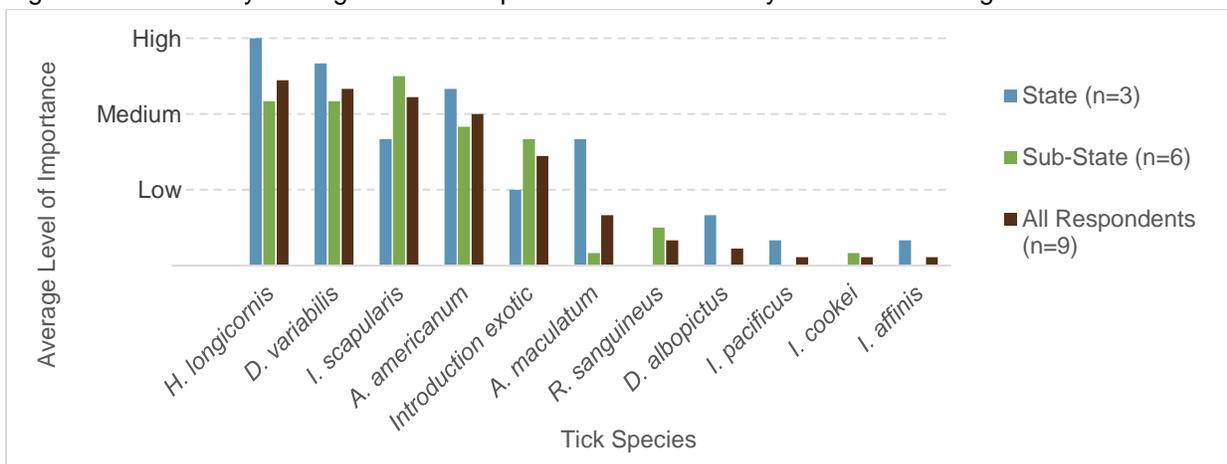


Figure NJ-3. Ticks by Average Level of Importance to New Jersey Surveillance Programs



Surveillance Program Operations

Active Surveillance Methods

Five respondents indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table NJ-3. There were a variety of sampling arrangements for these programs, with some programs sampling the same sites in the same locations each season, while others followed a random sampling approach; County-Mosquito-E respondent did not provide information on their program's sampling approach (Table NJ-4).

Table NJ-3. Active Surveillance Methods Used in New Jersey Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/Season
State-Environment	<ul style="list-style-type: none"> • Drag cloths • Active collection from host/reservoir animals • Flag cloths • CO₂-baited traps 	<ul style="list-style-type: none"> • In transect paths 	Usually more than once
County-Mosquito-C	<ul style="list-style-type: none"> • Flag cloths • CO₂-baited traps 	<ul style="list-style-type: none"> • In transect paths • Time collections 	Usually just once
County-Mosquito-D	<ul style="list-style-type: none"> • Drag cloths • Flag cloths • CO₂-baited traps 	<ul style="list-style-type: none"> • In transect paths 	Usually more than once
County-Mosquito-E	<ul style="list-style-type: none"> • Flag cloths • CO₂-baited traps 	<ul style="list-style-type: none"> • In transect paths 	Pilot project trial; 2018 first season
County-Mosquito-F	<ul style="list-style-type: none"> • Drag cloths • Flag cloths • CO₂-baited traps 	<ul style="list-style-type: none"> • In transect paths 	Based on partnership

Table NJ-4. Sampling Arrangements Used in New Jersey Active Surveillance Programs

Respondent	Sampling Arrangement/Season	How Sites Selected
State-Environment	<ul style="list-style-type: none"> • Same sites, same locations • Randomly sample different sites at different locations 	<ul style="list-style-type: none"> • Sites identified following emergence of exotic tick species • Sites selected following research project protocols
County-Mosquito-C	<ul style="list-style-type: none"> • Same sites in same locations randomly sampled 	Informed by mosquito control programs
County-Mosquito-D	<ul style="list-style-type: none"> • Same and different sites sampled in same locations 	Sites identified following historical data from previous surveillance, available habitat, ensure a county-wide distribution of sites
County-Mosquito-E	Not reported	Based on habitats and human interactions
County-Mosquito-F	<ul style="list-style-type: none"> • Sampled only once thus far 	<ul style="list-style-type: none"> • Sites selected following human disease cases • Sites selected following research project protocols

Passive Surveillance Methods

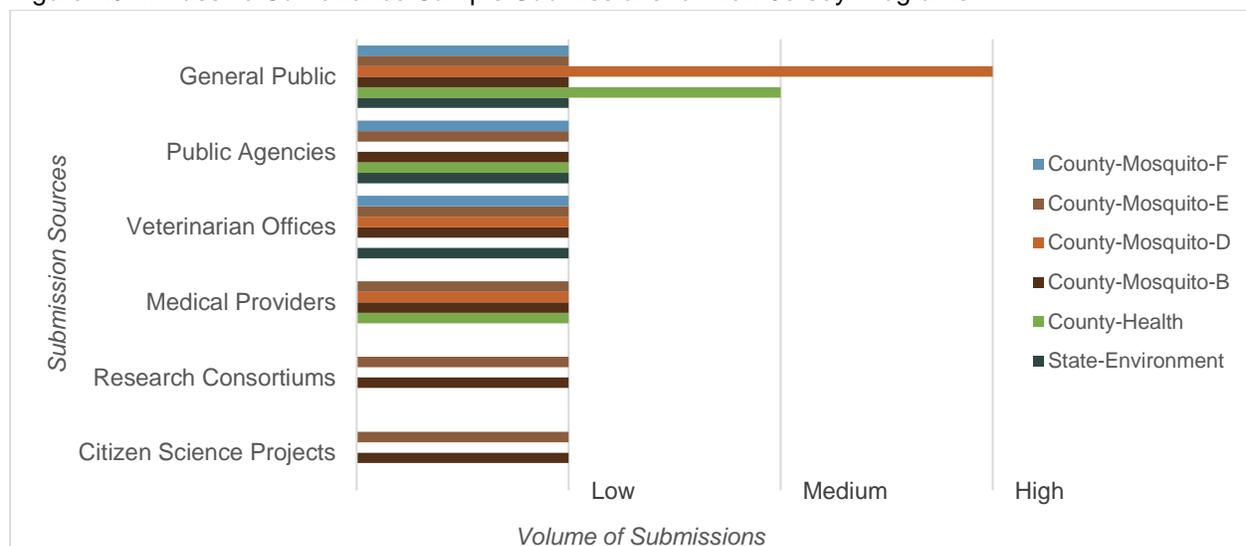
Six respondents indicated that the programs in their jurisdiction/organization were directly involved in passive tick surveillance activities. Table NJ-5 provides an overview of the passive surveillance methods and jurisdictions served by these programs, and Figure NJ-4 summarizes the sample submissions to the programs, by volume of specimens received.

Table NJ-5. Passive Surveillance Operations for New Jersey Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Environment ^a	<ul style="list-style-type: none"> • Use of domestic animals as sentinels for human disease • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock • Ticks found on wildlife • Ticks from public drop off sites* 	Entire state
County-Health	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock • Ticks found on wildlife 	Single county within state
County-Mosquito-B	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Single county within state
County-Mosquito-D	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock 	Multiple counties within state
County-Mosquito-E	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock 	Single county within state
County-Mosquito-F	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock 	Single county within state

^a The State-Environment respondent provided additional details, stating that drop off locations for the public were established at nearly all local mosquito control programs in the state, with each county having a drop off location. This was established to aid in the detection of *H. longicornis*.

Figure NJ-4. Passive Surveillance Sample Submissions for New Jersey Programs



Pathogen Testing

The State-Academic, State-Environment and County-Mosquito-D respondents stated that they could comment on pathogen testing, but only the County-Mosquito-D respondent reported that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table NJ-6.

Table NJ-6. Tick-borne Pathogens and Samples Tested in New Jersey Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Academic	<i>Rickettsia spp.</i> <i>Coxiella burnetii</i>	Environmental collections Ticks from animals	Not reported
State-Environment	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i>	Environmental collections	Academic lab CDC
	<i>B. mayonii</i> Bourbon virus Heartland virus Powassan virus Other relapsing fever spirochetes	Environmental collections	CDC
County-Mosquito-D	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. mayonii</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i>	Environmental collections	Academic lab

III. Tick Control Program Operations

The State-Environment, County-Health, and County-Mosquito-D respondents indicated they were able to comment on tick control program funding and operations, and that their jurisdiction/organization pays for or otherwise financially supports tick control activities.

The agencies identified by these respondents as involved in tick control include: county environmental, state environmental, county health, county public works, and county mosquito control.

Tick Control Methods

Table NJ-7 summarizes the tick control methods and products used by New Jersey programs. The State-Environment respondent indicated that their program partners with a private pest control company in their tick control efforts.

Table NJ-7. Tick Control Methods Used in New Jersey Programs

Respondent	Control Method	Products Used	How Conducted
State-Environment ^a	<ul style="list-style-type: none"> • Application of conventional or synthetic chemical pesticides • Small scale evaluation of several formulations 	<ul style="list-style-type: none"> • Carbaryl • <i>lambda</i>-Cyhalothrin 	Performed in-house
County-Health	<ul style="list-style-type: none"> • Application of conventional or synthetic chemical pesticides 	<ul style="list-style-type: none"> • Carbaryl • Deltamethrin • <i>lambda</i>-Cyhalothrin 	Performed in-house
County-Mosquito-D	<ul style="list-style-type: none"> • Participation in field trials and research studies of several methods and products • Research field trials of all commercial host-targeted methods • No systematic control 	<ul style="list-style-type: none"> • Suspend (Deltamethrin) • <i>Metarhizium brunneum/anisopliae</i> • Rosemary • Nookatone • Mixed essential oils • Rodent bait box • Tick tubes • 4-Poster Tickicide 	Performed in-house

^a Partners with private pest control company

Resistance Monitoring

No resistance monitoring activities were reported by any respondent.

IV. Program Information Dissemination

Six respondents provided feedback on how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table NJ-8). Information was predominantly shared with partner agencies within the state.

Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders (Figure NJ-5, Figure NJ-6). The top barriers for sharing information with the public included a lack of time and lack of funds to develop materials; the responses were similar across respondents at both state and county

jurisdiction levels. State-Academic and State-Health respondents did not provide information on barriers to sharing data with public. Top barriers for sharing program data with partners and stakeholders were time and effort costs to preparing data and lack of data sharing guidance; there were no state-level respondents to this question set.

Table NJ-8. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in New Jersey

Respondent	Information Sharing Practices
State-Environment	<ul style="list-style-type: none"> • Results shared with partner agencies within state
County-Health	<ul style="list-style-type: none"> • Information not shared
County-Mosquito-B	<ul style="list-style-type: none"> • Results shared with local health departments • Results shared with partner agencies within state • Data shared with academic partners for analysis
County-Mosquito-D	<ul style="list-style-type: none"> • Results drafted into summary reports available online • Results incorporated into maps made available online • Results drafted into summary reports sent to specific stakeholder audiences • Results drafted into educational materials to inform public/communities • Results shared with local health departments • Results shared with partner agencies within state • Results shared with partner agencies in neighboring states • Data made available to the public online • Results published in peer reviewed literature
County-Mosquito-E	<ul style="list-style-type: none"> • Results shared with partner agencies within state
County-Mosquito-F	<ul style="list-style-type: none"> • Results shared with partner agencies within state • Results shared with partner agencies in neighboring states

Figure NJ-5. Average Ranking of Barriers to Sharing Tick-Related Information with the Public for New Jersey Programs

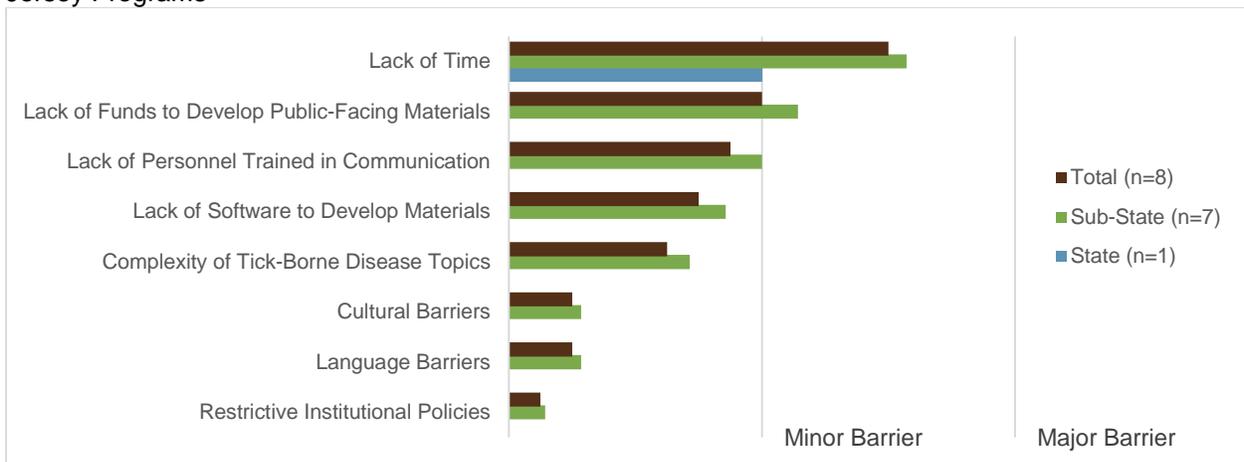
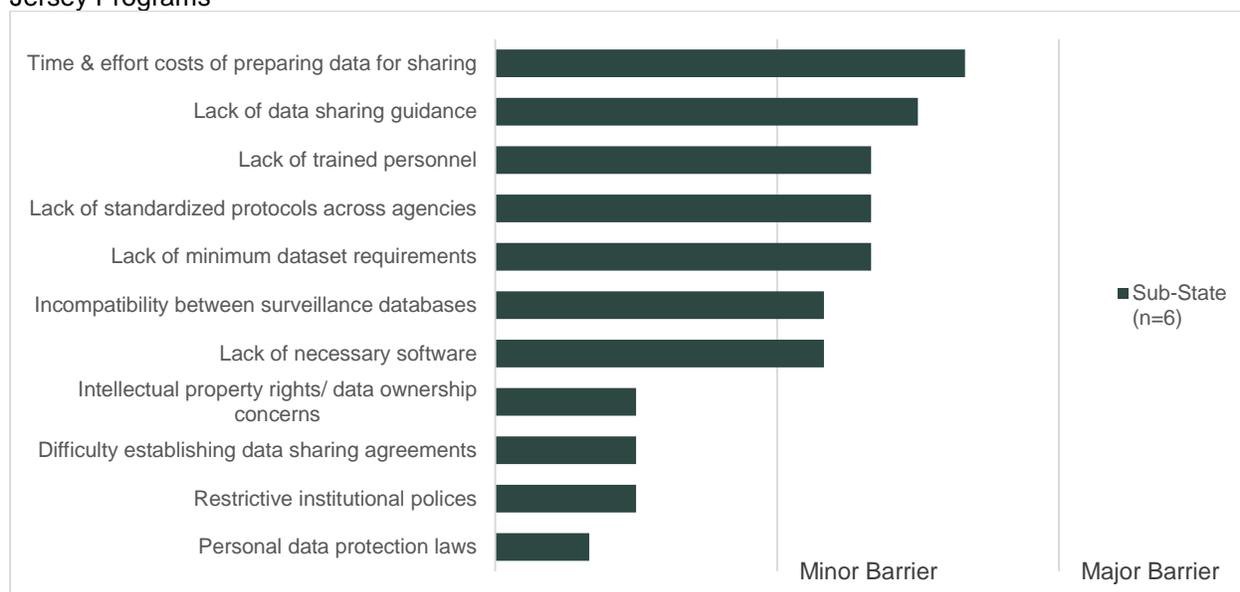


Figure NJ-6. Average Ranking of Barriers to Sharing Program Data with Partners/Stakeholders for New Jersey Programs



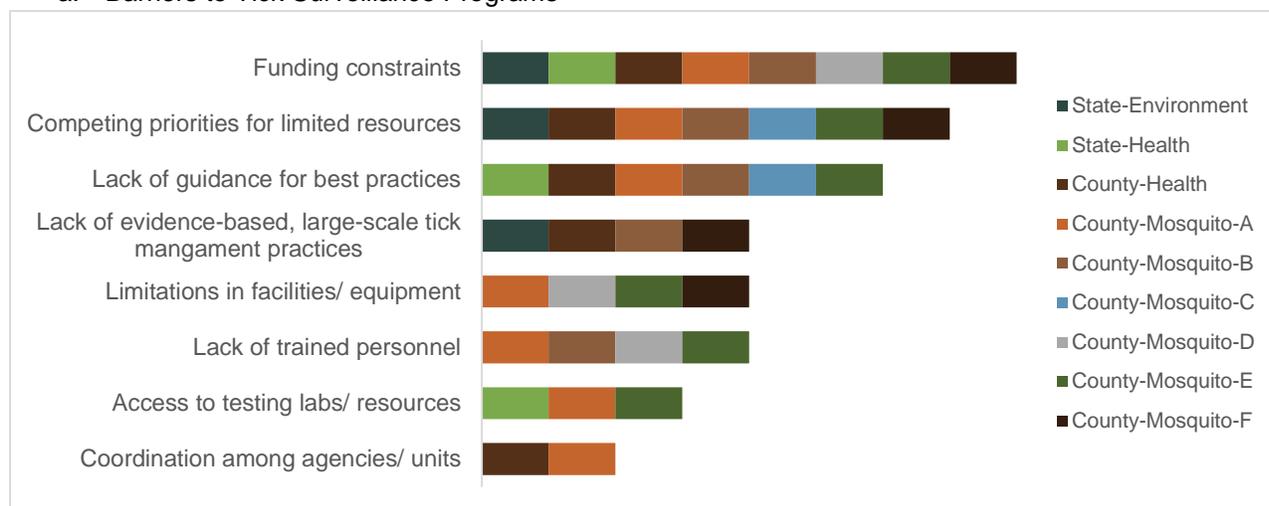
V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures NJ-7a, NJ-7b). The State-Academic respondent did not provide information for this question.

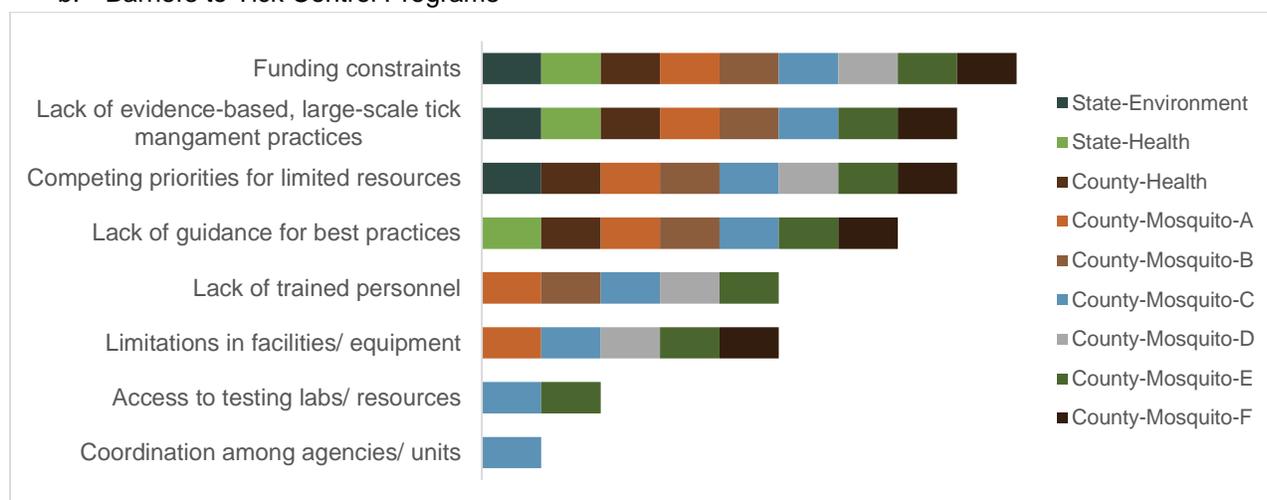
The top constraints for both tick surveillance and tick control programs were funding constraints and competing priorities for limited resources, lack of guidance for best practices, and lack of evidence-based, large-scale tick management practices. Mosquito-Control-F provided additional feedback, citing the lack of political support as a barrier to both tick surveillance and tick control programs.

Figure NJ-7. Barriers to Development/Enhancement in New Jersey Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. Table NJ-9 summarizes the responses provided.

Table NJ-9. Summary of Open-Ended Reponses on Recommendations to Address Tick Surveillance and Control Program Barriers for New Jersey Programs

THEME	NO. OF RESPONDENTS
TICK SURVEILLANCE PROGRAM BARRIERS (N=9)	
Guidance and standardization of methods	5
Expanded and sustained funding	5
Prioritization of these activities by stakeholders and policy makers	4
Increased training and/or availability of trained personnel	3
Increased coordination and communication across agencies	2
Central data reporting system	1
TICK CONTROL PROGRAM BARRIERS (N=9)	
Evaluation of methods for efficacy and cost-effectiveness	4
Expanded and sustained funding	3
Guidance and standardization of methods	3
Education and partnership with private sector	2
Increased coordination and communication across agencies	2
Prioritization of these activities by stakeholders and policy makers	1
Tick control is not within agency purview/not feasible within jurisdiction	1
Increased training and/or availability of trained personnel	1

Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. The State-Environment, State-Health, and County-Mosquito-F respondents provided feedback, which is summarized below:

- Assigning responsibility and providing adequate funding are core issues that must be resolved in order to enhance and expand tick surveillance and control activities.
- The state has a strong infrastructure of mosquito control districts that would be interested in tick surveillance if sufficient support were provided. These districts need local government body approval to become involved in these activities. Garnering support for these efforts at the local level is challenging.
- A joint military base also conducts surveillance, and may be a partner in state and county efforts moving forward.
- The only ongoing, sustained tick surveillance and pathogen testing activities are operated through one county in partnership with a state university. These activities are tax-payer funded with a strong research focus. Findings are predominantly shared via publication in peer-reviewed journals, rather than directly with county and public stakeholders.
- Any state-level tick control efforts are predominantly focused on vegetation management in public lands. If county-level activities are conducted, that information is now widely announced to partners.

New York

I. Respondent Demographics

Seven individuals responded from organizations operating in the state of New York. Table NY-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. Two individuals responded from the state health agency; their responses are reported jointly. For the remainder of this summary, these agencies will be referred to as:

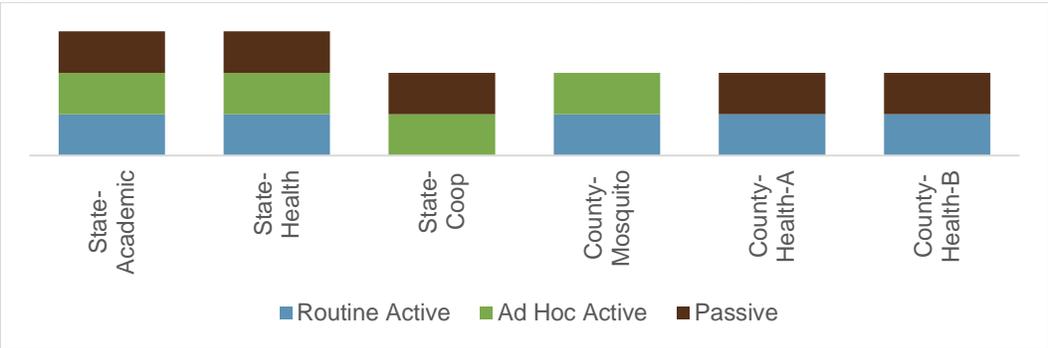
- State-Academic
- State-Health
- State-Coop
- County-Mosquito
- County-Health (A-B)
- Local-Health

Table NY-1. Demographic Summary of New York Respondents

Agency Type	Jurisdiction			Level of Program Involvement		
	Local	County	State	Directly Involved	Supervisory	Disease Surveillance
Health	1	2	2	2	3	3
Cooperative Extension	1	1	1	1	1	0
Academic	0	0	1	1	1	0
Public Works/ Mosquito Control	0	1	0	1	1	0
Level of Program Involvement	Local	County	State			
Directly Involved	1	3	4			
Supervisory	1	3	4			
Disease Surveillance	1	1	2			

Several respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction or organization (Figure NY-1). The Local-Health respondent noted that they are not involved in tick surveillance activities and did not provide responses to any of the remaining questions in the survey.

Figure NY-1. Familiarity with Tick Surveillance Programs among New York Respondents



II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. Six respondents identified local, county and state health and cooperative extension agencies; county and state mosquito control and public works agencies; and state agriculture, state laboratory, and county environment agencies as those involved in tick surveillance activities in the state.

Six respondents indicated that tick surveillance programs were funded through the mechanisms highlighted in Table NY-2 below. Two respondents also indicated that the surveillance programs in their jurisdictions had partnerships with academic institutions in the state. One respondent indicated that their program partners with a private ecological research institute in the state.

Table NY-2. Overview of Tick Surveillance Programs Operating in New York

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Academic	Fee for service testing	<ul style="list-style-type: none"> • Passive surveillance • Ad hoc active surveillance 	2014 - present
State-Health ^a	<ul style="list-style-type: none"> • State funding through appropriations • Federal funding through grants/cooperative agreements 	Routine active surveillance	2004 - present
		Passive surveillance	1989 - 2011
State-Coop ^b	County/municipal tax-based funding	<ul style="list-style-type: none"> • Passive surveillance • Ad hoc active surveillance 	2015 - present
County-Mosquito	State funding through grants	<ul style="list-style-type: none"> • Routine active surveillance • Ad hoc active surveillance 	2015 - present
County-Health-A ^c	<ul style="list-style-type: none"> • State funding through appropriations • County/municipal tax-based funding 	Routine active surveillance	2018 - present
		Ad hoc active surveillance	2015 - 2018
County-Health-B	County/municipal tax-based funding	Routine active surveillance	2014 – present
		Ad hoc active surveillance	1995 – 2013
		Passive surveillance	1995 - present

^a Partners with several in-state colleges

^b Partners with two in-state universities

^c Partners with private ecological research institute

Respondents were asked to indicate the objectives of the tick surveillance program(s) operating in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure NY-2, Figure NY-3). The most commonly identified program objectives were to detect the presence of ticks by species and to detect the presence of tick-borne pathogens in ticks. The surveillance program objectives for State-Health, County-Mosquito, and County-Health-B largely overlapped.

The most important tick species for the tick surveillance programs highlighted by respondents were *A. americanum*, *I. scapularis*, *D. variabilis*, *H. longicornis*, and the introduction of exotic species. Three respondents provided additional information regarding their approach to the introduction of exotic species; these approaches largely involved monitoring routine surveillance collections for exotic species.

Figure NY-2. Current Surveillance Objectives for New York Programs

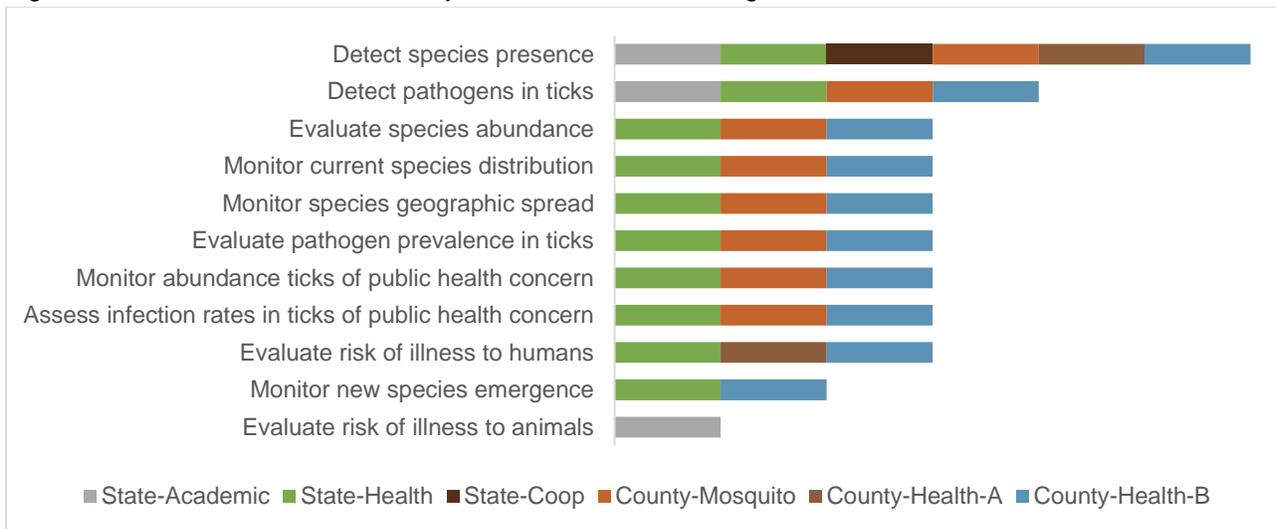
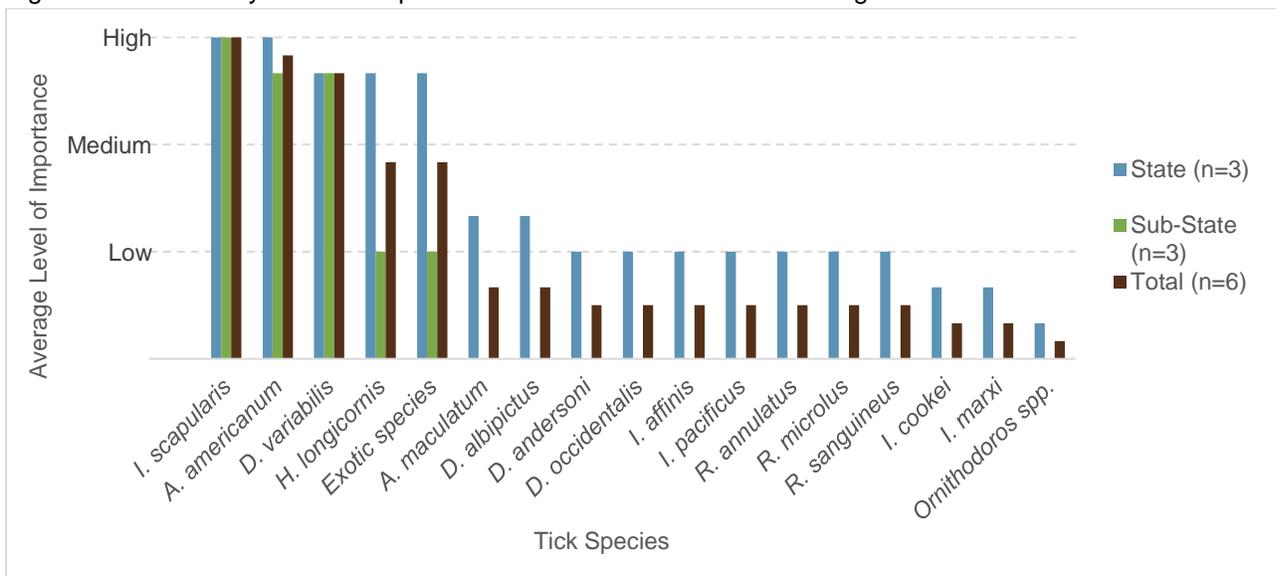


Figure NY-3. Ticks by Level of Importance to New York Surveillance Programs



Surveillance Program Operations

Active Surveillance Methods

Four respondents indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table NY-3. There were a variety of sampling arrangements for these programs, with some programs sampling the same sites in the same locations each season, while others followed a random sampling approach; the County-Mosquito-E respondent did not provide information on their program's sampling approach (Table NY-4).

Table NY-3. Active Surveillance Methods Used in New York Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Health	<ul style="list-style-type: none"> • Drag cloths • Flag cloths 	<ul style="list-style-type: none"> • In transect paths • Timed collections 	Usually more than once. Dependent on tick density and sampling effort needed to reach surveillance quotas.
State-Coop	<ul style="list-style-type: none"> • Drag cloths • Flag cloths 	<ul style="list-style-type: none"> • Within grid system • In transect paths • Timed collections 	Usually just once
County-Mosquito	<ul style="list-style-type: none"> • Drag cloths • Flag cloths • Active collection from host/reservoir animals • CO₂-baited traps 	<ul style="list-style-type: none"> • Using both grid systems and transect paths 	Bi-weekly 20-24 times per year
County-Health-B	<ul style="list-style-type: none"> • Flag cloths 	<ul style="list-style-type: none"> • In transect paths 	Usually more than once

Table NY-4. Sampling Arrangements Used in New York Active Surveillance Programs

Respondent	Sampling Arrangement/ Season	How Sites Selected
State-Health	<ul style="list-style-type: none"> • Same sites in same locations, different sites in same locations, and different sites in different locations • Sampled in a mixture of each season, every other season, and on a rotational basis across seasons • Sites also sampled in response to disease cases 	<ul style="list-style-type: none"> • Sites selected by suitable habitat, publicly-accessible lands, proximity to reported tick bites, historical data from previous surveillance • Permanent sites also evaluated for long-term use based on tick densities, with even distribution across region • Rotational sites selected based on habitat or human cases, but usually have lower tick densities or populations
State-Coop	<ul style="list-style-type: none"> • Different sites in same locations sampled in a mixture of each season and every other season 	<ul style="list-style-type: none"> • Sampling organized around community engagement, often on homeowner properties • Not a scientific sampling design
County-Mosquito	<ul style="list-style-type: none"> • Same sites in same location, different sites in same location sampled each season 	Sites selected by suitable habitat and historical data from previous surveillance

County-Health-B	<ul style="list-style-type: none"> • Same sites in same location, different sites in same location • Sampled in a mixture of each season and on a rotational basis across seasons 	Sited selected by open space/park land with risk of human exposure and no plans for future development
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Passive Surveillance Methods

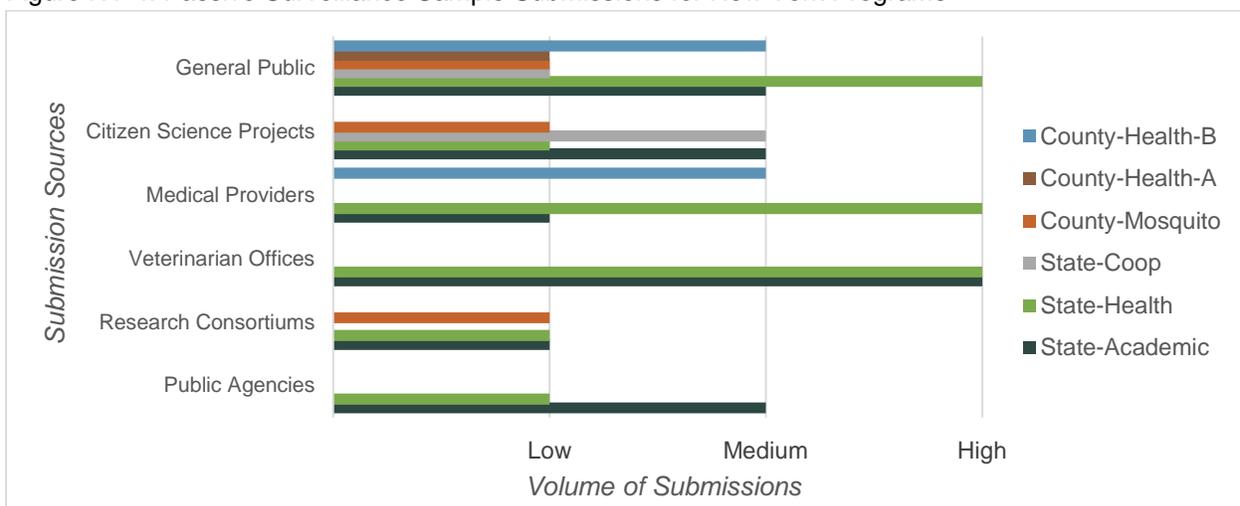
Four respondents indicated that the programs in their jurisdiction/organization were directly involved in passive tick surveillance activities; the State-Health respondent also provided information on a discontinued program. Table NY-5 provides an overview of the passive surveillance methods and jurisdictions served by these programs, and Figure NY-4 summarizes the sample submissions to the programs, by volume of specimens received.

Table NY-5. Passive Surveillance Operations for New York Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Academic	<ul style="list-style-type: none"> • Ticks found on animals • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock • Ticks found on wildlife 	Entire United States
State-Health*	<ul style="list-style-type: none"> • Ticks found on humans 	Entire state
State-Coop	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Single county within state
County-Mosquito [±]	<ul style="list-style-type: none"> • Ticks found on humans 	Single county within state
County-Health-A	<ul style="list-style-type: none"> • Ticks found on humans 	Single county within state. Do not reject samples from other places, however.
County-Health-B	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Single county within state

* The State-Health passive surveillance program was discontinued in 2011.
[±] The County-Mosquito respondent indicated they were not directly involved in this passive surveillance program.

Figure NY-4. Passive Surveillance Sample Submissions for New York Programs



Pathogen Testing

Five respondents stated that they could comment on pathogen testing, but only the State-Academic, State-Health and County-Health-B respondents reported that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table NY-6.

Table NY-6. Tick-borne Pathogens and Samples Tested in New York Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Academic	<i>A. marginale</i> <i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. mayonii</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i> <i>T. orientalis</i> Powassan virus	Environmental collections Ticks from humans Ticks from animals	Academic lab
State-Health	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>F. tularensis</i> <i>Rickettsia spp.</i> Bourbon virus Heartland virus Powassan virus	Environmental collections	State lab
State-Coop	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i>	Environmental collections	State lab
County-Health-A	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> Powassan virus	Environmental collections	State lab
County-Health-B	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i> Bourbon virus Heartland virus Powassan virus	Environmental collections	State lab

III. Tick Control Program Operations

Four respondents indicated they were able to comment on tick control program funding and operations, but only the County-Mosquito and County-Health-B respondents stated that their jurisdiction/organization pays for or otherwise financially supports tick control activities.

The agencies within the state identified by these respondents as involved in tick control include: local mosquito control, county public works, county mosquito control, state environment, state public works, and state parks and preservation agencies.

Tick Control Methods

Table NY-8 summarizes the tick control methods and products used by New York programs. The County-Health-B respondent indicated that their program partners with academic and private organizations in tick control efforts.

Table NY-8. Tick Control Methods Used in New York Programs

Respondent	Control Method	Products Used	How Conducted
State-Health	<ul style="list-style-type: none"> • Application of botanical pesticides/biopesticides • Treatment of host species • Vegetation modification 	<ul style="list-style-type: none"> • Rosemary • Rodent bait boxes • Tick tubes • 4-poster tickicide 	Joint effort of multiple programs
	<ul style="list-style-type: none"> • Host species exclusion programs 		Contracted out to private company
County-Mosquito	<ul style="list-style-type: none"> • Application of conventional or synthetic chemical pesticides • Vegetation modification 	Deltamethrin	Joint effort of multiple programs
	<ul style="list-style-type: none"> • Host species reduction programs • Host species exclusion programs • Treatment of host species 	4-poster tickicide	<ul style="list-style-type: none"> • In-house • Contracted out to private company
County-Health-B	<ul style="list-style-type: none"> • Application of conventional or synthetic chemical pesticides 	<ul style="list-style-type: none"> • Deltamethrin 	Performed in-house

Resistance Monitoring

No resistance monitoring activities were reported by any respondent. Both the County-Mosquito and County-Health-B respondents indicated that limitations in staff time, supplies, and funding impede the ability of their programs to conduct pesticide resistance monitoring for ticks.

IV. Program Information Dissemination

Six respondents provided feedback on how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table NY-9).

Table NY-9. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in New York

Respondent	Information Sharing Practices
State-Academic	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder audiences
State-Health	<ul style="list-style-type: none"> • Results drafted into summary reports available online • Results incorporated into maps made available online • Results drafted into summary reports sent to specific stakeholder audiences • Results drafted into educational materials to inform public/communities • Reported to CDC through annual reports • Results shared with local health departments • Results shared with partner agencies within state • Results shared with medical providers • Data made available to the public online • Data shared with academic partners for analysis
State-Coop	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder audiences • Results shared with local health departments • Data shared with academic partners for analysis • Results shared with participating community groups
County-Mosquito	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder audiences • Results drafted into educational materials to inform public/communities • Results shared with partner agencies within state • Results shared with partner agencies in neighboring states • Results shared with medical providers • Data shared with academic partners for analysis
County-Health-A	<ul style="list-style-type: none"> • Results shared with medical providers
County-Health-B	<ul style="list-style-type: none"> • Data made available to the public online

Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders (Figure NY-5, Figure NY-6). The top barriers for sharing information with the public included a lack of time, lack of funds to develop materials, and lack of software to develop materials, and restrictive institutional policies. The top barriers for sharing data with partners included time and effort costs of preparing data for sharing, lack of trained personnel, lack of minimum dataset requirements, and lack of necessary software. The County-Health-B respondent did not provide information on barriers to sharing information with the public or sharing data with partners.

Figure NY-5. Average Rating of Barriers to Sharing Tick-Related Information with the Public for New York Programs

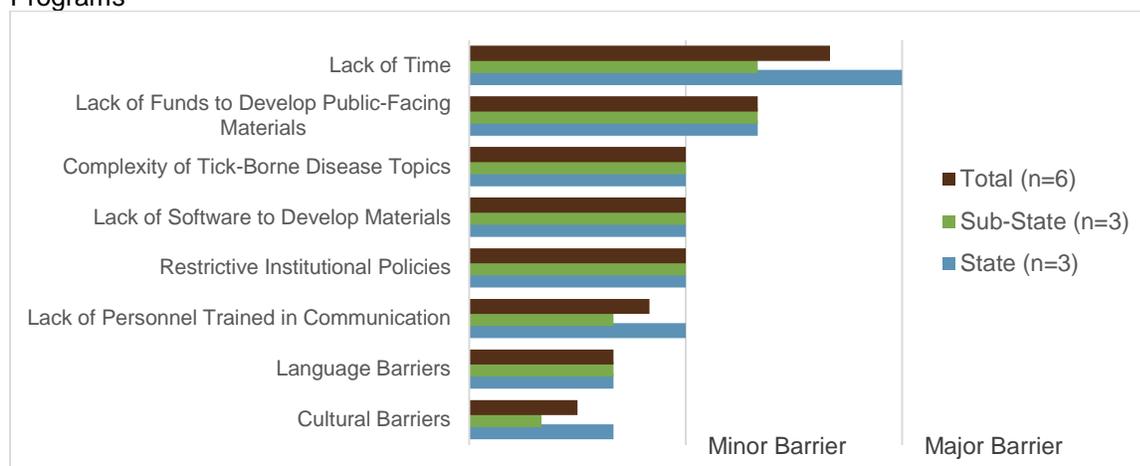
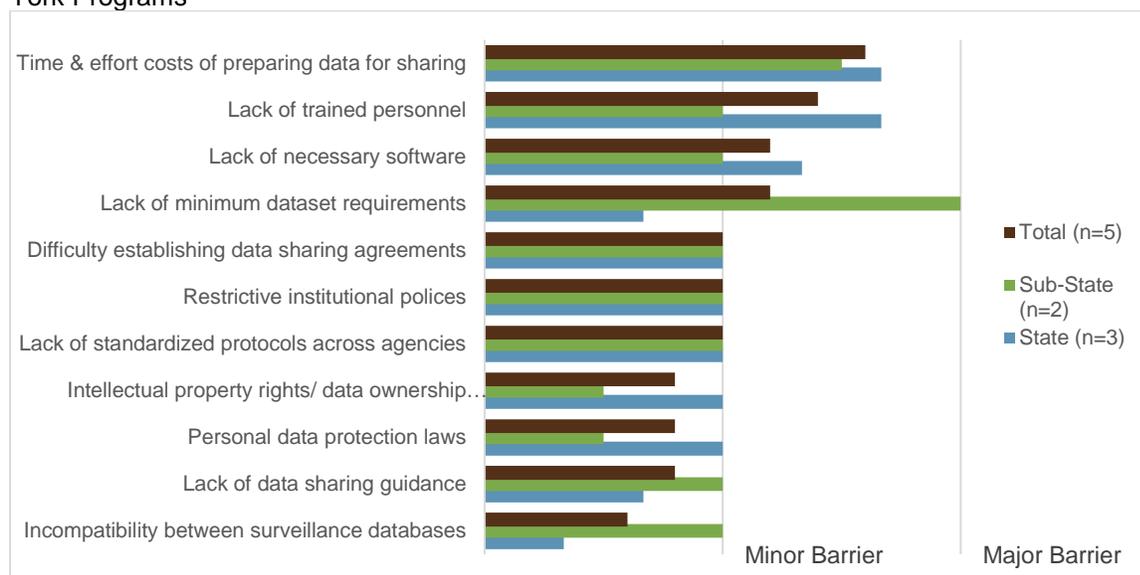


Figure NY-6. Average Rating of Barriers to Sharing Program Data with Partners/Stakeholders for New York Programs

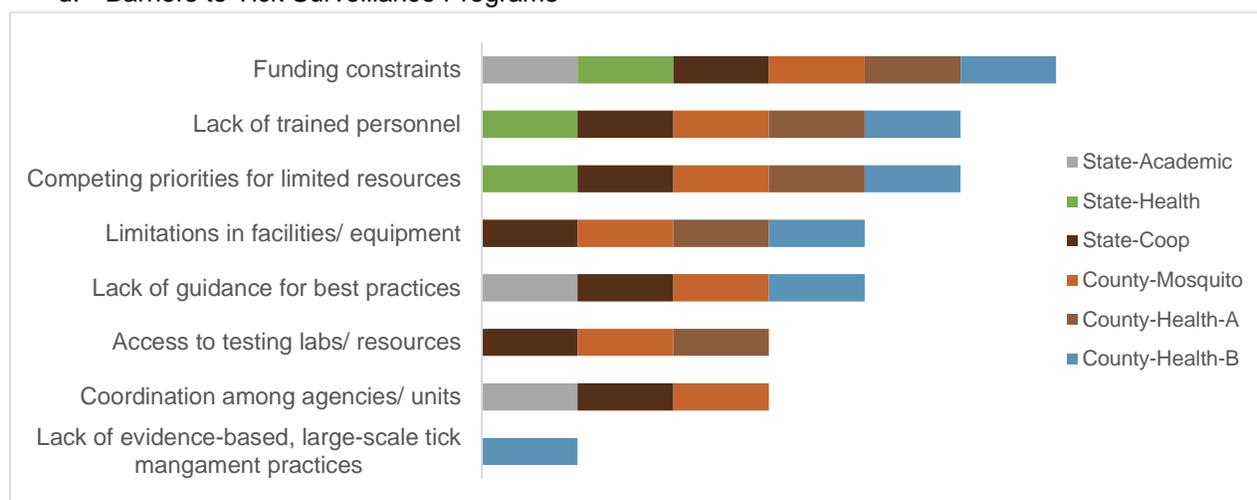


V. Barriers to Program Development and Enhancement

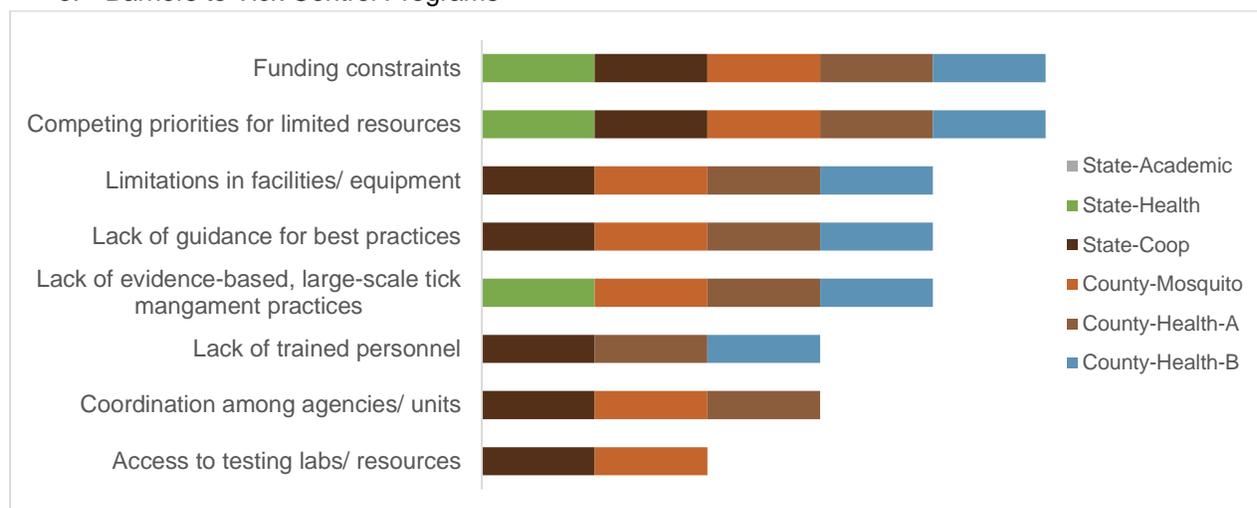
Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures NY-7a, NY-7b). The top constraints for both tick surveillance and tick control programs included funding constraints and competing priorities for limited resources.

Figure NY-7. Barriers to Development/Enhancement in New York Programs

d. Barriers to Tick Surveillance Programs



e. Barriers to Tick Control Programs



Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. Table NY-10 summarizes the responses provided. Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. Table NY-10 summarizes these open-ended responses.

Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. The State-Academic, State-Health, and County-Mosquito respondents provided feedback, which is summarized below:

- The proliferation of non-accredited labs conducting tick-borne pathogen testing is a serious concern.
- Tick control applications conducted at the county are only for specific county properties that have already attempted mitigation efforts through non-acaricide methods and continue to meet the flagging threshold for treatment.

Table NY-10. Summary of Open-Ended Responses on Recommendations to Address Tick Surveillance and Control Program Barriers for New York Programs

THEME	NO. OF RESPONDENTS
TICK SURVEILLANCE PROGRAM BARRIERS (N=6)	
Expanded and sustained funding	3
Guidance and standardization of methods	3
Increased training and/or availability of trained personnel	2
Increased coordination and communication across agencies	1
Central data reporting system	1
TICK CONTROL PROGRAM BARRIERS (N=5)	
Expanded and sustained funding	4
Evaluation of methods for efficacy and cost-effectiveness	4
Guidance and standardization of methods	1
Tick control is not within agency purview/not feasible within jurisdiction	1

Pennsylvania

I. Respondent Demographics

Five individuals responded from organizations operating in the state of Pennsylvania. Table PA-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as:

- State-Environment
- State-Health
- State-Natural Resources
- State-Academic
- County-Academic

Table PA-1. Demographic Summary of Pennsylvania Respondents

Agency Type	Jurisdiction		Level of Surveillance Program Involvement			
	County	State	Directly Involved	Supervisory	Unit Involved	Not Involved
Environment	0	1	1	1	0	0
Natural Resources	0	2	0	0	0	1
Academic	1	1	2	1	0	0
Health	0	1	1	1	1	0
Level of Program Involvement	Local	County				
Directly Involved	1	3				
Supervisory	1	2				
Unit Involved	0	1				
Not Involved	0	1				

Three respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction or organization. The State-Academic respondent was familiar with ad hoc active surveillance activities; the County-Academic respondent was familiar with active surveillance activities; and the State-Environment respondent was familiar with ad hoc active surveillance and passive surveillance activities. The State-Natural Resources and State-Health respondents noted that they were not involved in tick surveillance activities and did not provide responses to any questions related to tick surveillance.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. Three respondents identified local and state environmental, state health, and state laboratory agencies as those involved in tick surveillance activities in the state.

Three respondents indicated that tick surveillance programs were funded through the mechanisms highlighted in Table PA-2 below. Two respondents also indicated that the surveillance programs in their jurisdiction had partnerships with in-state universities. The County-Academic respondent indicated that their program also collaborates with a private health network.

Table PA-2. Overview of Tick Surveillance Programs Operating in Pennsylvania

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Environment ^a	<ul style="list-style-type: none"> • Unfunded. • Activities performed as possible within confines of mosquito surveillance. 	Ad hoc active surveillance	2011 - present
State-Academic ^b	<ul style="list-style-type: none"> • Federal funding through grants/cooperative agreements • Private university grants • Federal work study funding 	Ad hoc active surveillance	2013 - present
County-Academic ^c	<ul style="list-style-type: none"> • Private university grants • Private health network funding 	Routine active surveillance	2013 - present

^a Partners with State-Academic respondent
^b Partners with in-state university
^c Partners with private health network

Respondents were asked to indicate the objectives of the tick surveillance program(s) operating in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure PA-1, Figure PA-2). The most commonly identified program objectives were to detect the presence of ticks by species, monitor current species distribution and geographic spread, and to monitor the abundance of ticks of public health concern and evaluate the risk of illness to humans. The surveillance program objectives for these three respondents largely overlapped. The most important tick species for the tick surveillance programs highlighted by respondents were *I. scapularis*, *D. variabilis*, and *A. americanum*.

Figure PA-1. Current Surveillance Objectives for Pennsylvania Programs

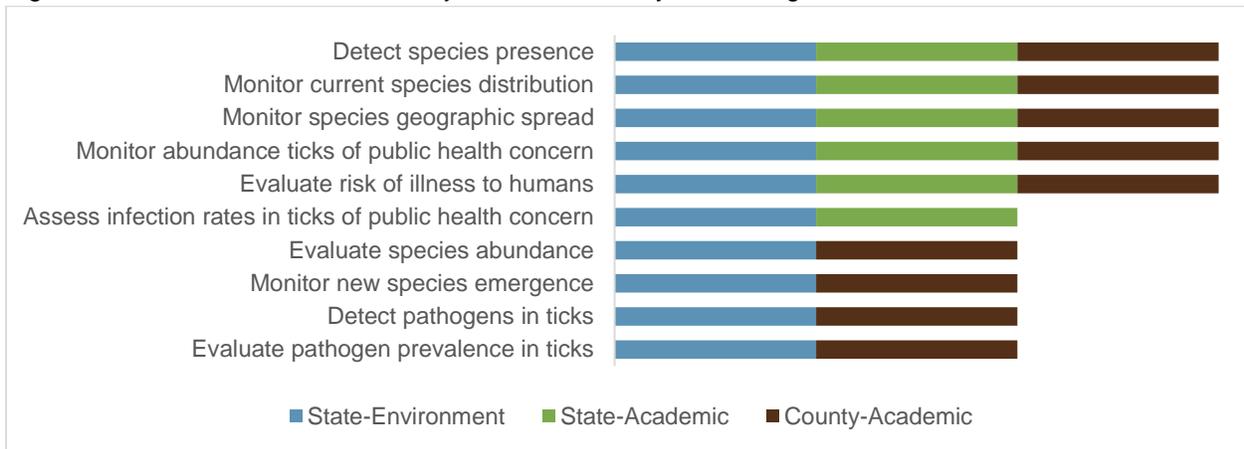
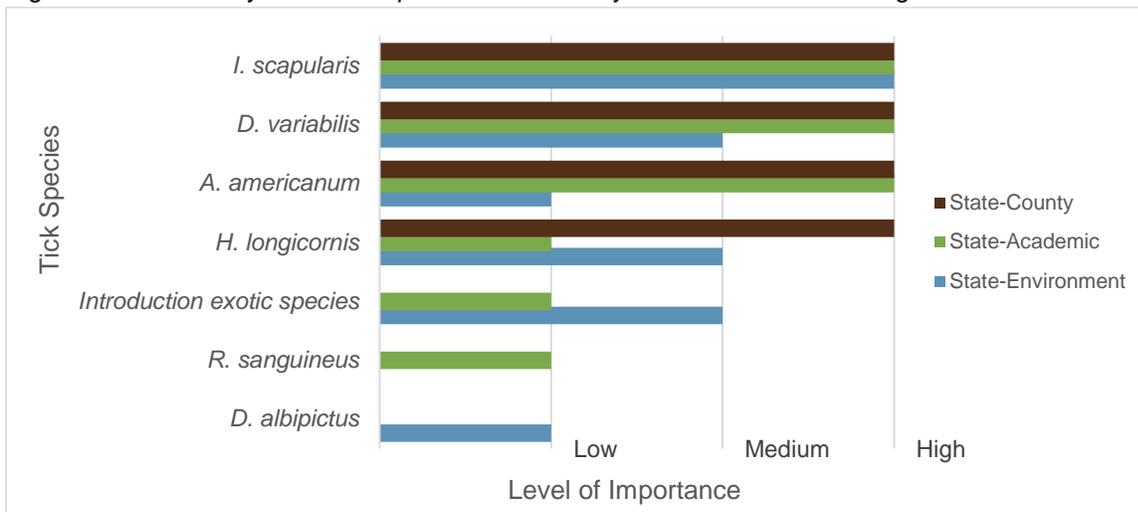


Figure PA-2. Ticks by Level of Importance to Pennsylvania Surveillance Programs



Two respondents provided additional detail on how their programs address exotic species. The County-Academic respondent indicated that their program drags for blacklegged ticks, but also looks for other species in these activities. The State-Environment respondent stated that they will perform tick drags, flags and dry ice trapping, and may potentially coordinate with the state game commission to check hunter or road-killed deer, targeting the invasive Asian longhorned tick.

Surveillance Program Operations

Active Surveillance Methods

Three respondents indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table PA-3. Additional details on the program sampling approaches can be found in Table PA-4.

Table PA-3. Active Surveillance Methods Used in Pennsylvania Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Environment	<ul style="list-style-type: none"> • Drag cloths • Flag cloths • CO₂-baited traps 	<ul style="list-style-type: none"> • In transect paths • Timed collections 	Usually just once
State-Academic	<ul style="list-style-type: none"> • Drag cloths • Flag cloths 	<ul style="list-style-type: none"> • In transect paths • Timed collections 	Usually just once
County-Academic	<ul style="list-style-type: none"> • Drag cloths 	<ul style="list-style-type: none"> • In transect paths • Timed collections • Distance of timed collections determined by GPS 	Usually just once

Table PA-4. Sampling Arrangements Used in Pennsylvania Active Surveillance Programs

Respondent	Sampling Arrangement/ Season	How Sites Selected
State-Environment	Same and different sites in same locations, as well as different sites in different locations, sampled randomly across seasons	Sites selected based on suitable habitat near ongoing work locations
State-Academic	Different sites in different locations randomly sampled across seasons	Proximity to home locations of volunteer university students
County-Academic	Different sites in different locations sampled each season	<ul style="list-style-type: none"> • Public land and preserves with target habitat sampled with permission granted for collections • Sites selected by ability to collect a minimum of 50 nymphs in 270 minutes of dragging.

Passive Surveillance Methods

No respondents provided information regarding passive tick surveillance methods in the state.

Pathogen Testing

Three respondents stated that they could comment on pathogen testing, but only the State-Environment and State-Academic respondents reported that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table PA-5.

Table PA-5. Tick-borne Pathogens and Samples Tested in Pennsylvania Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Environment	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> Powassan virus	Environmental collections	State lab
State-Academic	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i>	Environmental collections	State lab Academic lab
County-Academic	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i>	Environmental collections	Academic lab

III. Tick Control Program Operations

Only the State-Natural Resources respondent indicated they were able to comment on tick control program funding and operations. This respondent indicated that their jurisdiction/organization pays for or otherwise financially supports tick control activities. The State-Natural Resources respondent listed state health and state natural resources agencies as those involved in conducting tick control activities.

Tick Control Methods

Table PA-6 summarizes the tick control methods and products used by Pennsylvania programs. The State-Natural Resources respondent indicated that their program collaborates with an in-state university in these activities.

Table PA-6. Tick Control Methods Used in Pennsylvania Programs

Respondent	Control Method	Products Used	How Conducted
State-Natural Resources	Host species reduction programs	N/A	Joint effort of multiple programs

Resistance Monitoring

No resistance monitoring activities were reported.

IV. Program Information Dissemination

Four respondents provided feedback on how their organizations generally share information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table PA-7).

Table PA-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Pennsylvania

Respondent	Information Sharing Practices
State-Environment	<ul style="list-style-type: none"> • Results shared with partner agencies within state • Results shared with partner agencies in neighboring states • Results shared with medical providers • Results published in peer-reviewed literature
State-Natural Resources	<ul style="list-style-type: none"> • Results drafted into educational materials to inform the public/communities • Results shared with partner agencies within state • Data made available to the public online
State-Academic	<ul style="list-style-type: none"> • Results shared with partner agencies within state • Data shared with academic partners for analysis • Results published in peer-reviewed literature
County-Academic	<ul style="list-style-type: none"> • Results drafted into summary reports sent to specific stakeholder audiences • Results drafted into educational materials to inform public/communities • Results shared with medical providers • Data shared with academic partners for analysis • Results published in peer-reviewed literature

Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders (Figure PA-3, Figure PA-4). The top barriers for sharing information with the public included a lack of time and lack of funds to develop materials. The largest barrier for sharing data with partners included time and effort costs of preparing data for sharing.

Figure PA-3. Barriers to Sharing Tick-Related Information with the Public for Pennsylvania Programs

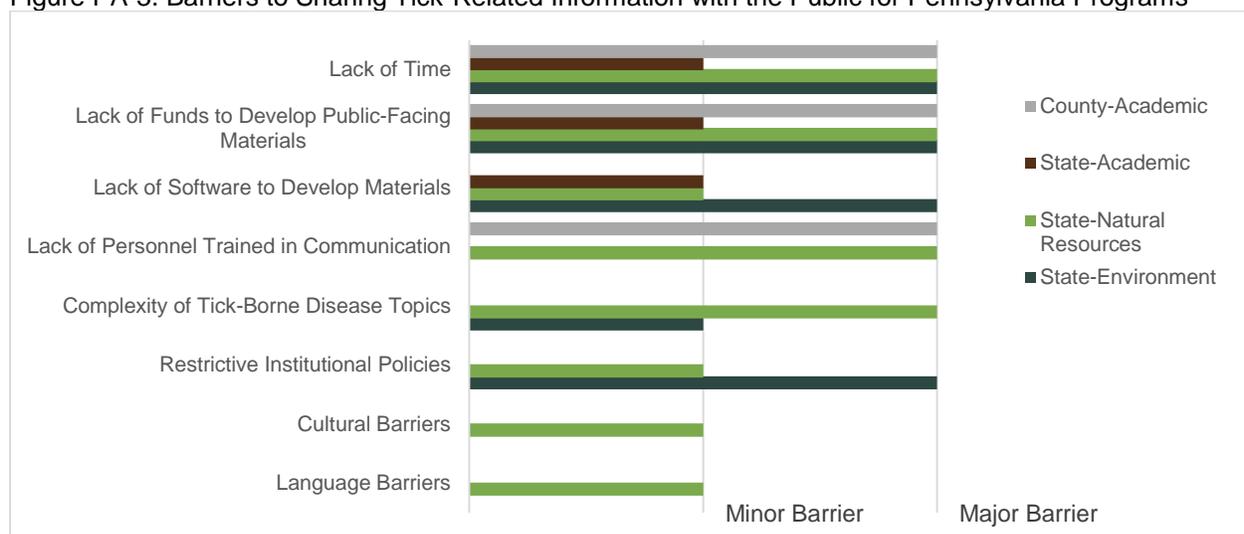
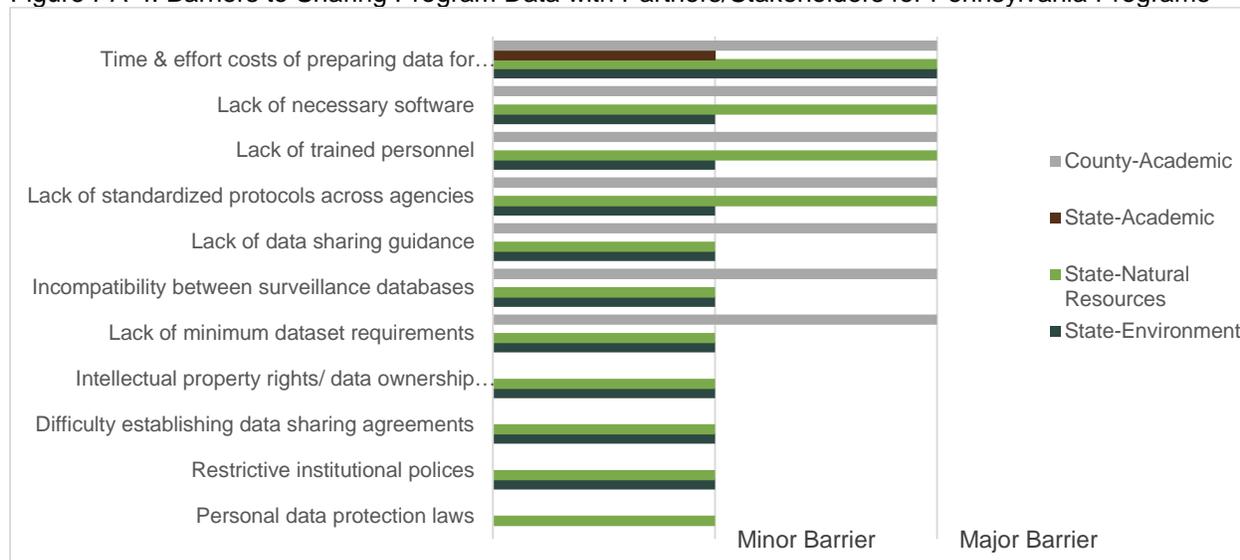


Figure PA-4. Barriers to Sharing Program Data with Partners/Stakeholders for Pennsylvania Programs



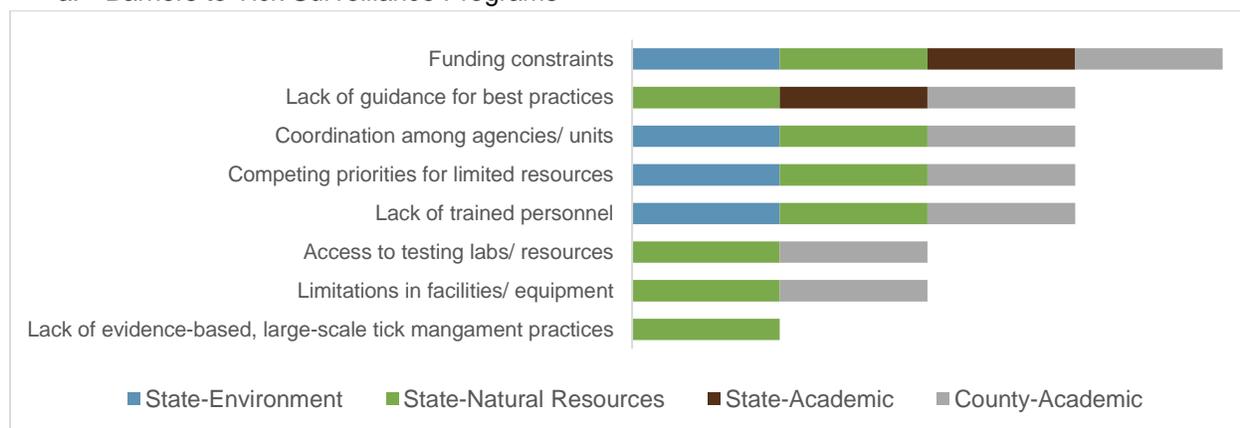
V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures PA-5a, PA-5b). The State-Academic and County-Academic respondents did not indicate any barriers to tick control programs.

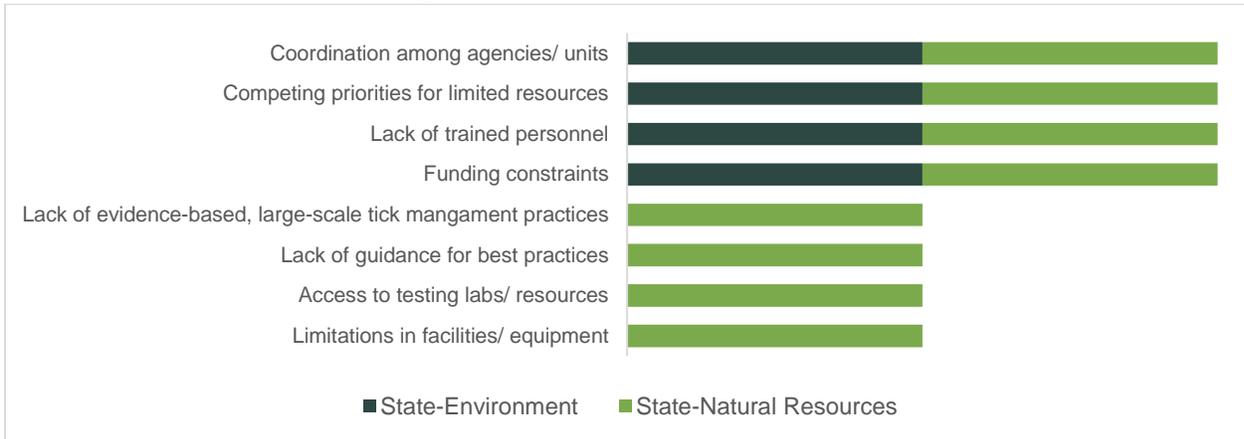
The top barriers for both tick surveillance and tick control programs included funding constraints, lack of trained personnel, and competing priorities for limited resources.

Figure PA-5. Barriers to Development/Enhancement in Pennsylvania Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. Table PA-8 summarizes the responses provided. The State-Natural Resources respondent suggested that more dedicated staff could assist with tick surveillance programs, while greater leadership from state public health agencies would enhance tick control programs. The State-Academic partner felt that the lack of state-level funding for both tick surveillance and control would need to be addressed, as well as expanding evidence-based methods for tick control.

Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. The State-Academic respondent stated that tick surveillance and control in the state is inconsistently implemented, with the majority of the work being conducted by academic centers. This respondent described an approach to work within the network of state colleges and universities to use student volunteers to conduct tick surveillance and control activities targeting *Ixodes scapularis*.

Rhode Island

I. Respondent Demographics

Two individuals responded from organizations operating in the state of Rhode Island. Table RI-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: State-Health, State-Academic.

Table RI-1. Demographic Summary of Rhode Island Respondents

Agency Type	Jurisdiction	Level of Surveillance Program Involvement			
	State	Directly Involved	Supervisory	Disease Surveillance	Not Involved
Academic	1	1	1	0	0
Cooperative Extension	1	1	1	0	0
Health	1	0	0	1	1

Only the State-Academic respondent indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction or organization. This respondent was familiar with routine active, ad hoc active, and passive surveillance activities. The State-Health respondent noted that they were not involved in tick surveillance activities and did not provide responses to any surveillance program-related questions.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The State-Academic respondent identified academic institutions as the only organizations in the state involved in tick surveillance.

The State-Academic respondent indicated that the tick surveillance programs were funded through the mechanisms highlighted in Table RI-2 below. This respondent also indicated that the active tick surveillance program was discontinued in 2014 due to a lack of funding.

Table RI-2. Overview of Tick Surveillance Programs Operating in Pennsylvania

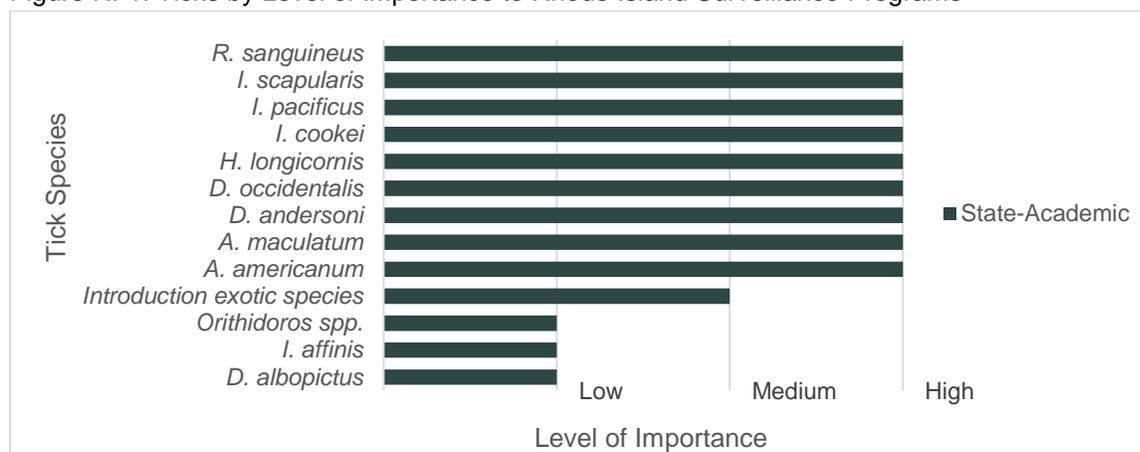
Respondent	Funding Source	Program Type(s)	Years of Operation
State-Academic	<ul style="list-style-type: none"> State funding through grants 	Routine active surveillance	1993 - 2014
		Ad hoc active surveillance	1993 - present
	<ul style="list-style-type: none"> Private donations 	Passive surveillance	2013 - present

The objectives of the tick surveillance programs described by the State-Academic respondent include:

- Detect the presence of ticks by species
- Monitor the current distribution of ticks species
- Monitor the geographic spread of tick species
- Monitor the emergence of new tick species
- Evaluate or calculate risk of tick-borne illness to humans
- Provide information and education to public

Ticks of importance to the programs detailed by the State-Academic respondent are listed by level of importance in Figure RI-1.

Figure RI-1. Ticks by Level of Importance to Rhode Island Surveillance Programs



The State-Academic respondent provided additional detail on how their program addresses exotic species, stating that these programs use the power of crowd-sourced submissions in their passive surveillance program.

Surveillance Program Operations

Active Surveillance Methods

The State-Academic respondent indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by their program are detailed in Table RI-3. The sampling approach for this program samples a mixture of the same and different sites in the same locations, as well as different sites in different locations, each season. The selection of sampling sites follow different strategies depending on the goal of the surveillance effort.

Table RI-3. Active Surveillance Methods Used in Rhode Island Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/Season
State-Academic	<ul style="list-style-type: none"> • Drag cloths • Flag cloths 	<ul style="list-style-type: none"> • Timed collections 	Usually more than once per season

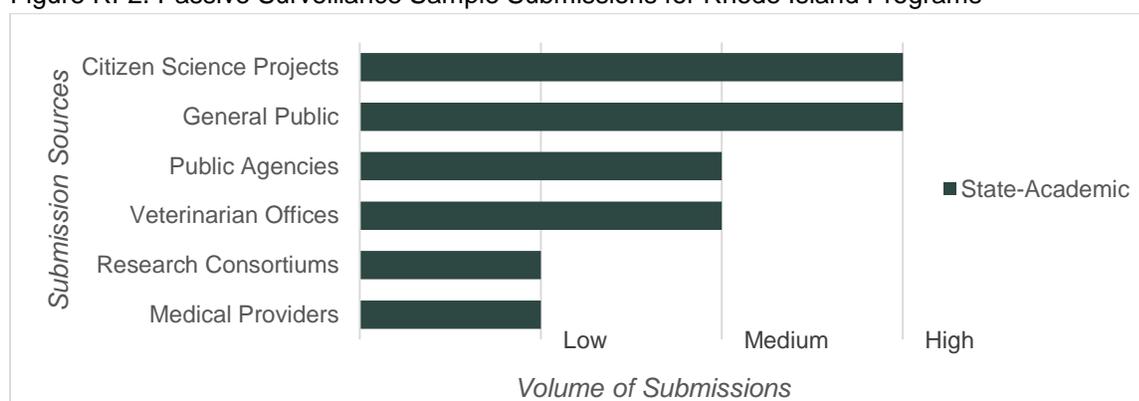
Passive Surveillance Methods

The State-Academic respondent indicated that programs in their jurisdiction/organization were directly involved in passive surveillance activities. Table RI-4 provides an overview of the passive surveillance methods and jurisdictions served by this program, and Figure RI-2 summarizes the sample submissions to the program, by volume of specimens received.

Table RI-4. Passive Surveillance Operations for Rhode Island Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Academic	<ul style="list-style-type: none"> • Use of domestic animals as sentinels for human disease • Ticks found on humans • Ticks found on pets 	National and international locations

Figure RI-2. Passive Surveillance Sample Submissions for Rhode Island Programs



Pathogen Testing

The State-Academic respondent stated that they could comment on pathogen testing, and that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table RI-5.

Table RI-5. Tick-borne Pathogens and Samples Tested in Rhode Island Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Academic	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i>	Ticks from humans	Academic lab
	Powassan virus	Environmental collections	CDC

III. Tick Control Program Operations

The State-Academic respondent indicated they were able to comment on tick control program funding and operations. This respondent indicated that their jurisdiction/organization pays for or otherwise financially supports tick control activities, and listed academic research centers as the only organizations involved in conducting tick control activities in the state.

Tick Control Methods

Table RI-6 summarizes the tick control methods and products used by Rhode Island research programs. The State-Academic respondent indicated that their program partners with a university in a neighboring state and various private pest control companies in these activities.

Table RI-6. Tick Control Methods Used in Rhode Island Programs

Respondent	Control Method	Products Used	How Conducted
State-Academic	<ul style="list-style-type: none"> • Application of conventional or synthetic chemical pesticides • Treatment of host species with pesticides 	<ul style="list-style-type: none"> • Bifenthrin • Cyfluthrin • <i>lambda</i>-Cyhalothrin • Permethrin • Pyrethrins • Rodent bait boxes • Tick tubes 	<ul style="list-style-type: none"> • In-house • Contracted out to private company • Joint effort of multiple programs

Resistance Monitoring

No resistance monitoring activities were reported.

IV. Program Information Dissemination

The State-Academic respondent provided feedback on how their organization generally shares information from their tick surveillance, tick pathogen testing, and/or tick control programs (Table RI-7), as well as barriers to sharing tick-related information with the public, and sharing tick surveillance, testing, and/or control data with partners and/or stakeholders (Table RI-8).

Table RI-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Rhode Island

Respondent	Information Sharing Practices
State-Academic	<ul style="list-style-type: none"> • Results incorporated into maps made available online • Results drafted into educational materials to inform the public/communities • Data shared with academic partners for analysis

Table RI-8. Barriers to Sharing Tick-Related Information and Data for Rhode Island Programs

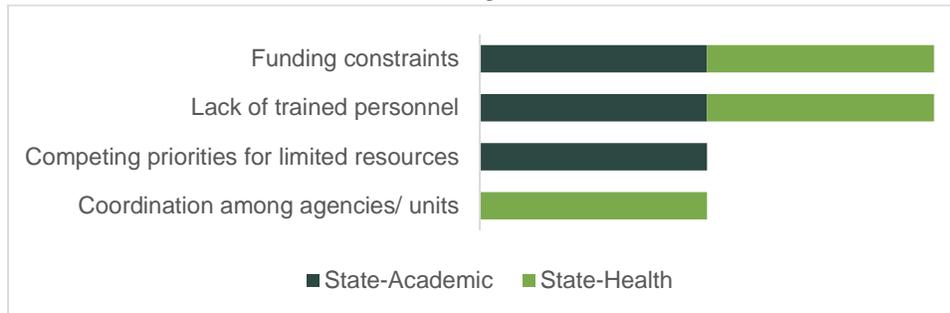
Respondent	Barriers to Public Communication	Minor	Major	
State-Academic	Lack of funds to develop public-facing materials		x	
	Lack of software to develop materials		x	
	Language barriers	x		
	Lack of time	x		
	Barriers to Sharing Program Data		Minor	Major
	Time and effort costs of preparing data for sharing			x
	Intellectual property rights/data ownership concerns			x
	Lack of trained personnel	x		
	Lack of necessary software	x		
	Incompatibility between surveillance databases	x		
	Lack of data sharing guidance	x		
	Difficulty establishing data sharing agreements	x		

V. Barriers to Program Development and Enhancement

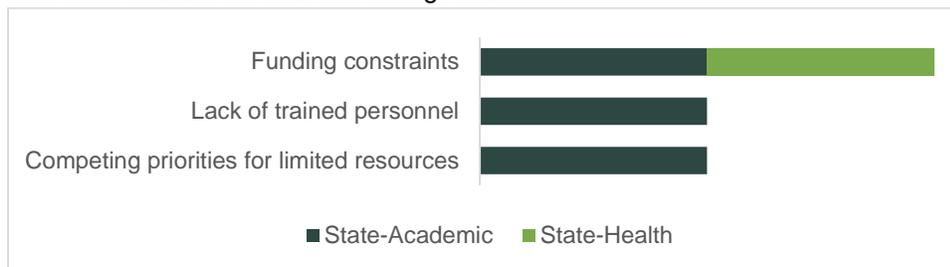
Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both (Figures RI-3a, RI-3b). The top constraints for both tick surveillance and tick control programs included funding constraints, lack of trained personnel, and competing priorities for limited resources.

Figure RI-3. Barriers to Development/Enhancement in Rhode Island Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The State-Academic respondent indicated that partnerships with regional Centers of Excellence in Vector-Borne Diseases on workforce training and funding would support tick surveillance programs, while a general increase in the availability of funding would support tick control program development.

Vermont

I. Respondent Demographics

Four individuals responded from organizations operating in the state of Vermont. Table VT-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: State-Agriculture, State-Health, Local-Academic-A, Local-Academic-B.

Table VT-1. Demographic Summary of Vermont Respondents

Agency Type	Jurisdiction		Level of Surveillance Program Involvement			
	Local	State	Directly Involved	Supervisory	Disease Surveillance	Not Involved
Academic	2	0	1	1	1	1
Agriculture	0	1	1	1	0	0
Health	0	1	1	0	1	0

The State-Agriculture, State-Health, and Local-Academic-A respondents indicated that they were able to comment on the operations of one or more tick surveillance programs ongoing in their jurisdiction or organization. All three respondents were familiar with routine active surveillance activities. The State-Health respondent was also familiar with ad hoc active surveillance activities, while the State-Agriculture respondent was also familiar with passive surveillance activities. The Local-Academic-B respondent noted that they were not involved in tick surveillance activities and did not provide responses to any surveillance program-related questions.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The State-Agriculture, State-Health, and Local-Academic-A respondents identified state agriculture and health agencies as those involved in tick surveillance. Three respondents indicated that tick surveillance programs were funded through the mechanisms highlighted in Table VT-2 below. The Local-Academic-A respondent indicated that their program collaborates with the state health agency in tick surveillance activities.

Respondents were asked to indicate the objectives of the tick surveillance program(s) operating in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure VT-1, Figure VT-2). The program objectives reported by the State-Agricultural and State-Health respondent largely overlapped. The most important tick species for the tick surveillance programs highlighted by the respondents were *Ixodes scapularis* and *Amblyomma americanum*.

Table VT-2. Overview of Tick Surveillance Programs Operating in Vermont

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Agriculture	<ul style="list-style-type: none"> State funding through appropriations Federal funding through grants/cooperative agreements 	Routine active surveillance	2015 - present
		Passive surveillance	2017 - present
State-Health	Federal funding through grants/cooperative agreements	<ul style="list-style-type: none"> Routine active surveillance Ad hoc active surveillance 	2018 - present
Local-Academic-A ^a	State funding through grants	Routine active surveillance	2014 - present

^a Partners with State-Health respondent

Figure VT-1. Current Surveillance Objectives for Vermont Programs

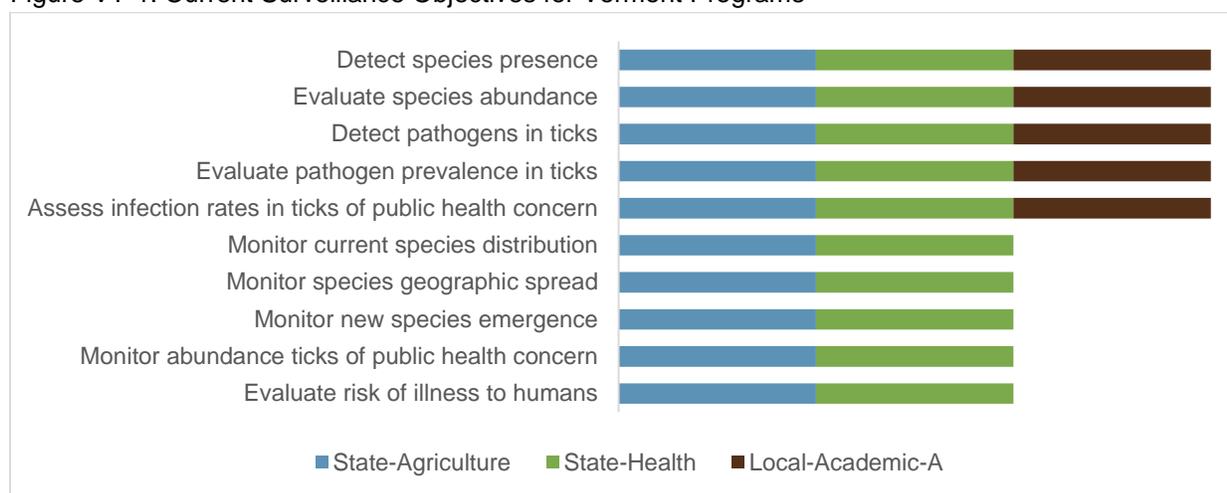
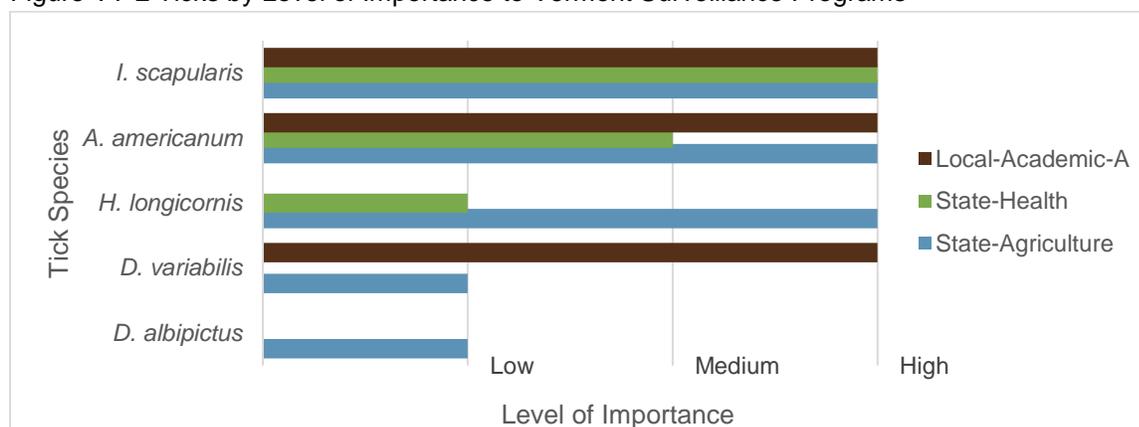


Figure VT-2 Ticks by Level of Importance to Vermont Surveillance Programs



The State-Health respondent provided additional detail on how their programs address exotic species, stating that they ask members of the public to submit possible *A. americanum* ticks to the state health department with details on where the tick was acquired; the state health department then drags the identified areas to identify *A. americanum* populations.

Surveillance Program Operations

Active Surveillance Methods

The State-Agriculture, State-Health, and Local-Academic-A respondents indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table VT-3, and details regarding sampling approaches can be found in Table VT-4.

Table VT-3. Active Surveillance Methods Used in Vermont Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Agriculture	<ul style="list-style-type: none"> • Drag cloths • Flag cloths 	Transect paths	Usually more than once per season
State-Health	<ul style="list-style-type: none"> • Drag cloths 	Transect paths	Usually more than once per season
Local-Academic-A	<ul style="list-style-type: none"> • Drag cloths 	Transect paths	Usually more than once per season

Table VT-4. Sampling Arrangements Used in Vermont Active Surveillance Programs

Respondent	Sampling Arrangement/ Season	How Sites Selected
State-Agriculture	<ul style="list-style-type: none"> • Same sites in the same locations sampled each season. • Different sites in different locations randomly sampled across seasons. 	<ul style="list-style-type: none"> • Random sites located in each town in the state, sampling 400m, to establish baseline tick and pathogen prevalence • Additional sampling sites selected from human disease cases, exposure risk, and suitable tick habitat
State-Health	<ul style="list-style-type: none"> • Same sites in the same locations sampled each season. • Different sites in different locations sampled each seasons. 	Based upon human surveillance data
Local-Academic-A	Not reported	Deciduous or mixed deciduous/coniferous forests within 20 minute drive, below 300m and for which we are able to obtain permission.

Passive Surveillance Methods

Only the State-Agriculture respondent indicated that programs in their jurisdiction/organization were directly involved in passive surveillance activities. Table VT-5 provides an overview of the passive surveillance methods and jurisdictions served by this program. The respondent indicated that their program receives a low volume of samples from citizen science projects.

Table VT-5. Passive Surveillance Operations for Vermont Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Agriculture	<ul style="list-style-type: none"> • Ticks found on humans • Ticks found on pets 	Entire state

Pathogen Testing

The State-Agriculture, State-Health, and Local-Academic-A respondents stated that they could comment on pathogen testing, with the State-Agriculture and Local-Academic-A respondents reporting that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table VT-6.

Table VT-6. Tick-borne Pathogens and Samples Tested in Vermont Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Agriculture	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> Powassan virus	Environmental collections	State lab
State-Health	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i>	Environmental collections	CDC
Local-Academic-A	<i>B. burgdorferi</i>	Environmental collections	Academic lab

III. Tick Control Program Operations

No respondents provided information regarding tick control activities in the state.

IV. Program Information Dissemination

All four respondents provided feedback on how their organization generally shares information from tick surveillance, tick pathogen testing, and/or tick control programs (Table VT-7). Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders (Figure VT-3, Figure VT-4). The top barrier for sharing information with the public was a lack of time. The largest barrier for sharing data with partners was intellectual property rights concerns.

The Local-Academic-A respondent highlighted that much of their public communication efforts are delayed by the need to first publish the information through peer-reviewed journals, but did not otherwise list any barriers to sharing information or data. The State-Agriculture respondent did not report any barriers to sharing data with partners.

Table VT-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Vermont

Respondent	Information Sharing Practices
State-Agriculture	<ul style="list-style-type: none"> • Results drafted into summary reports available online • Results incorporated into maps made available online • Results drafted into educational materials to inform the public/communities • Results shared with local health departments • Results shared with partner agencies in neighboring states • Data made available to the public online
State-Health	<ul style="list-style-type: none"> • Results drafted into summary reports available online • Results incorporated into maps made available online • Results drafted into educational materials to inform the public/communities • Reported to CDC through annual reports
Local-Academic-A	<ul style="list-style-type: none"> • Results published in peer-reviewed literature
Local-Academic-B	<ul style="list-style-type: none"> • Results drafted into educational materials to inform the public/communities • Results shared with partner agencies within state • Data shared with academic partners for analysis

Figure VT-3. Barriers to Sharing Tick-Related Information with the Public for Vermont Programs

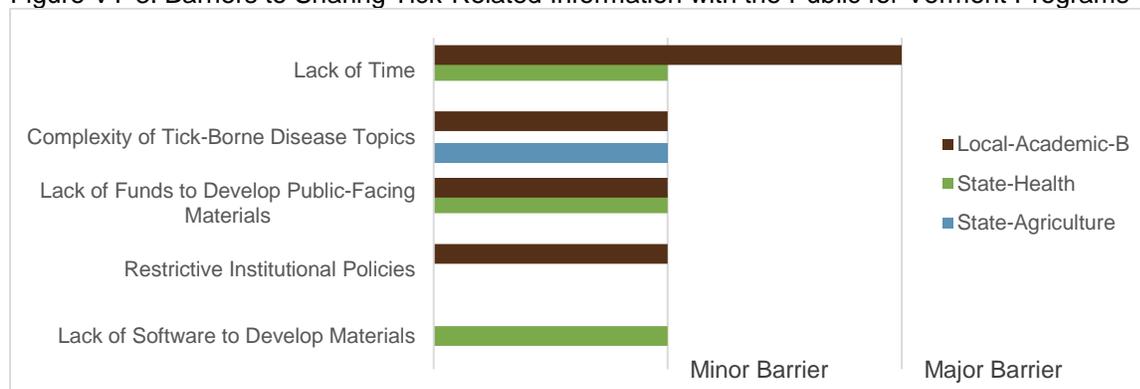
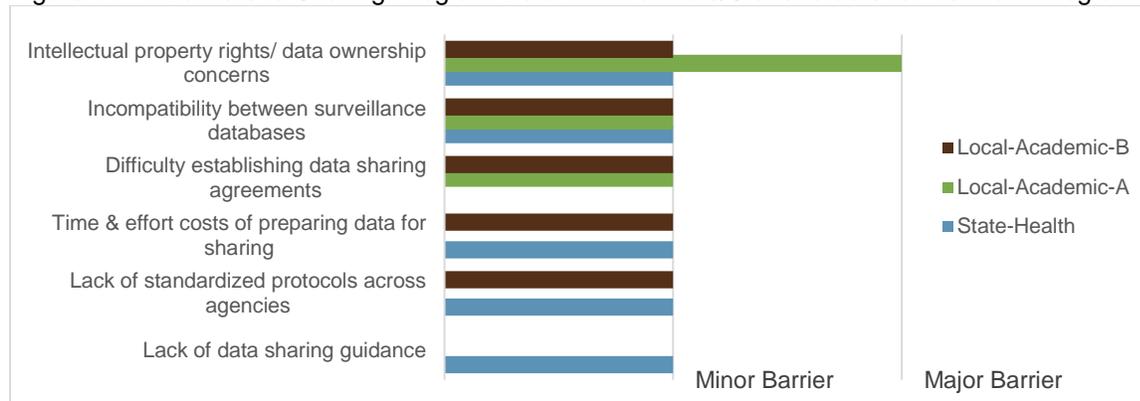


Figure VT-4. Barriers to Sharing Program Data with Partners/Stakeholders for Vermont Programs

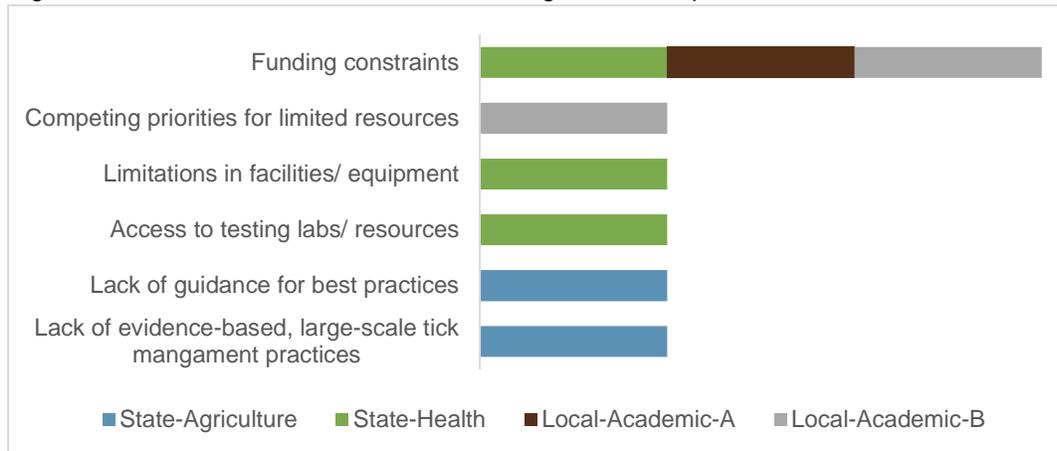


V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both. Figure VT-5 summarizes the barriers to developing or enhancing tick surveillance programs reported by respondents.

The only respondent to provide feedback on barriers for tick control programs was Local-Academic-B, listing funding limitations and competing priorities for limited resources as the two main barriers.

Figure VT-5. Barriers to Tick Surveillance Program Development/Enhancement in Vermont



Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The State-Agriculture respondent reported that a standard method or guidance for conducting active tick surveillance would be helpful for designing and implementing successful programs. The Local-Academic-A respondent indicated that the need to publish data in a peer-reviewed journal caused delays in sharing information from programs operated at academic institutions.

Virginia

I. Respondent Demographics

Three individuals responded from organizations operating in the state of Virginia. Table VA-1 below displays the jurisdictional level, agency type, and level of involvement in tick surveillance programs for each of these respondents. Respondents were able to select more than one agency type and more than one jurisdiction level, as applicable to their circumstances. For the remainder of this summary, these agencies will be referred to as: State-Health and Local-Health. Two individuals were part of the same organization (State-Health); their responses will be reported jointly. The Local-Health respondent indicated that their organization also serves local agricultural agency functions.

Table VA-1. Demographic Summary of Virginia Respondents

Agency Type	Jurisdiction		Level of Surveillance Program Involvement		
	Local	State	Directly Involved	Supervisory	Disease Surveillance
Agriculture	1	0	0	0	1
Health	1	2	2	2	3

All respondents indicated that they were able to comment on the operations of one or more tick surveillance program ongoing in their jurisdiction or organization. The State-Agriculture respondent was familiar with passive surveillance activities, and the State-Health respondent was familiar with both ad hoc active surveillance and passive surveillance activities.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The respondents identified federal agriculture; local, county, and state health; county and state mosquito control; and state university cooperative extensions and research agencies as those involved in tick surveillance in the state. The respondents indicated that tick surveillance programs were funded through the mechanisms highlighted in Table VA-2 below. The State-Health respondent indicated that their program collaborates with three universities in the state on tick surveillance activities.

Respondents were asked to indicate the objectives of the tick surveillance program(s) operating in their jurisdiction/organization, as well as the relative importance of specific tick species to that program (Figure VA-1, Figure VA-2). Both respondents reported detecting ticks by species and evaluating species abundance as program objectives. The Local-Health respondent did not provide information regarding tick species targeted by surveillance programs. The State-Health respondent listed *I. scapularis*, *A. americanum*, *H. longicornis*, and the introduction of exotic species as the main tick species targeted.

The State-Health respondent provided additional detail on how their programs address exotic species, stating that in 2018, their program has been conducting tick surveys in un-surveyed parts of the state, during which they have discovered the presence of exotic tick species (*H. longicornis*) in new counties.

Their program also actively surveyed for the presence of *H. longicornis* in places where they suspected the tick would be found.

Table VA-2. Overview of Tick Surveillance Programs Operating in Virginia

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Health ^a	<ul style="list-style-type: none"> State funding through appropriations Federal funding through grants/cooperative agreements 	Ad hoc active surveillance	2005 - present
		Passive surveillance	2000 - present
Local-Health	County/municipal tax funding	Not reported	Not reported

^a Partners with academic institutions in the state

Figure VA-1. Current Surveillance Objectives for Virginia Programs

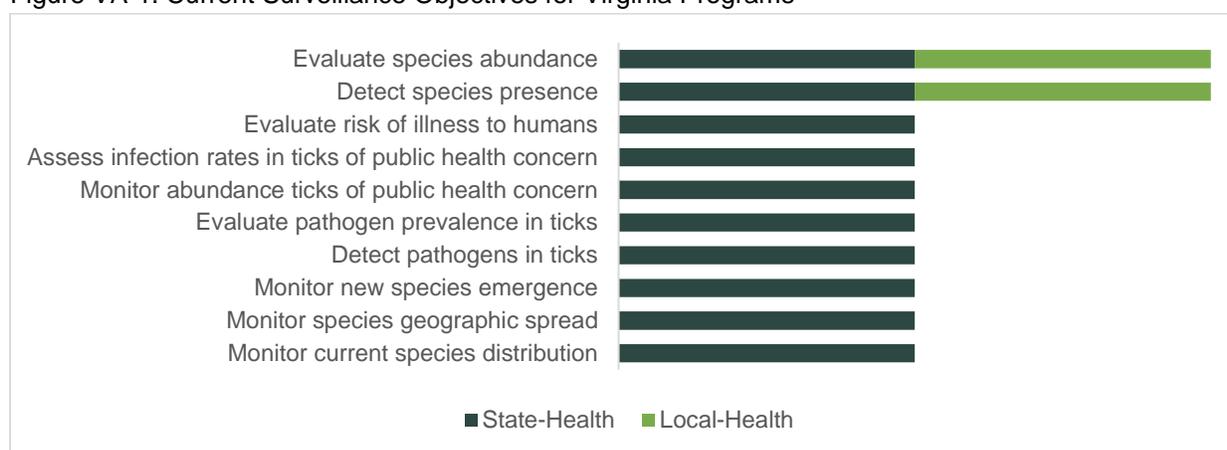
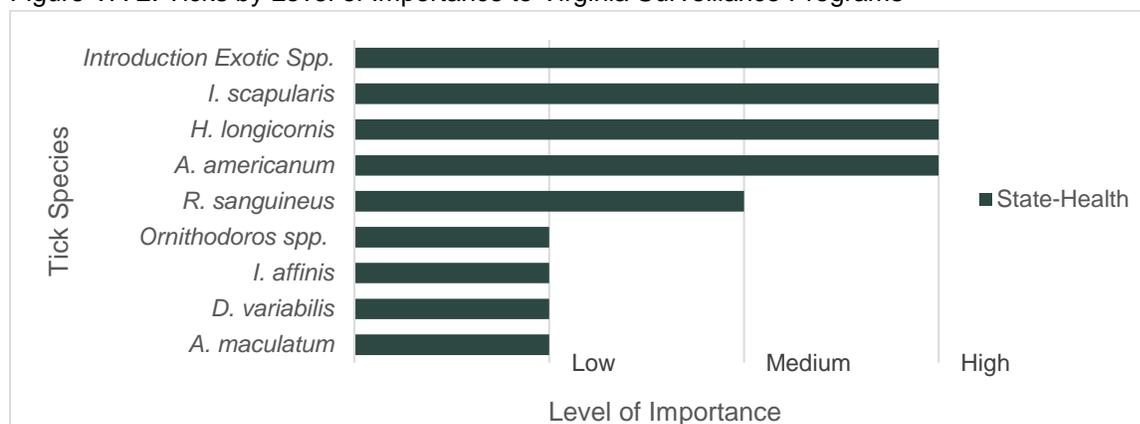


Figure VA-2. Ticks by Level of Importance to Virginia Surveillance Programs



Surveillance Program Operations

Active Surveillance Methods

Only the State-Health respondent indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by their programs are detailed in Table VA-3, and details regarding sampling approaches can be found in Table VA-4.

Table VA-3. Active Surveillance Methods Used in Virginia Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Health	<ul style="list-style-type: none"> • Drag cloths • Active collection from host animals* • Using live, caged sentinel animals* • CO₂-baited traps 	Transect paths	Usually just once

* Respondent indicated ticks were collected from animals at animal shelters/veterinary practices

Table VA-4. Sampling Arrangements Used in Virginia Active Surveillance Programs

Respondent	Sampling Arrangement/ Season	How Sites Selected
State-Agriculture	<ul style="list-style-type: none"> • Sampled randomly in response to disease cases and periodically as time and resources permit • Sites are a mixture of same and different locations each year 	Peridomestic sites prioritized due to higher human health risk and larger tick sample yields

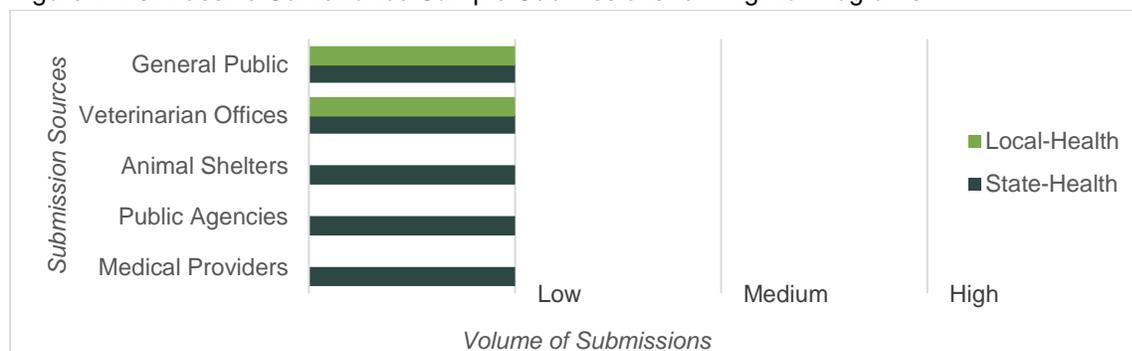
Passive Surveillance Methods

Both the State-Health and Local-Health respondents indicated that programs in their jurisdiction/organization were directly involved in passive surveillance activities. Table VA-5 provides an overview of the passive surveillance methods and jurisdictions served by these programs, and Figure VA-3 summarizes the sample submissions to the programs, by volume of specimens received.

Table VA-5. Passive Surveillance Operations for Virginia Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Health	<ul style="list-style-type: none"> • Ticks found on pets • Ticks found on domestic livestock • Ticks on animals from animal shelters/veterinarian offices 	Entire state
Local-Health	<ul style="list-style-type: none"> • Ticks found on pets 	Single county within state

Figure VA-3. Passive Surveillance Sample Submissions for Virginia Programs



Pathogen Testing

The State-Health and Local-Health respondents stated that they could comment on pathogen testing, with both respondents reporting that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table VA-6.

Table VA-6. Tick-borne Pathogens and Samples Tested in Virginia Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Health	<i>A. phagocytophilum</i> <i>B. microti</i> <i>B. burgdorferi</i> <i>B. miyamotoi</i> <i>Ehrlichia spp.</i> <i>Rickettsia spp.</i>	Environmental collections	Academic lab
	Powassan virus	Environmental collections	CDC
Local-Health	<i>B. burgdorferi</i>	<ul style="list-style-type: none"> • Ticks from humans • Ticks from animals 	State lab

III. Tick Control Program Operations

The State-Health and Local-Health respondents stated that they could comment on tick control, but none of the respondents reported that their jurisdiction/organization paid for or otherwise financially supported the tick control activities. Respondents indicated that state agricultural agencies were those involved in tick control activities in Virginia. Respondents were largely unable to comment on specific activities involved in tick control efforts in the state, but the State-Health respondent reported the following:

*“The only tick control activities I have seen in Virginia in the past decade were experimental four-poster treatments of deer with acaricide by a local health department, spraying along hiking trails in county parks by a different local health department, and spraying of cattle on a farm supported by the agriculture department after an exotic tick (*Haemaphysalis longicornis*) was discovered there.”*

IV. Program Information Dissemination

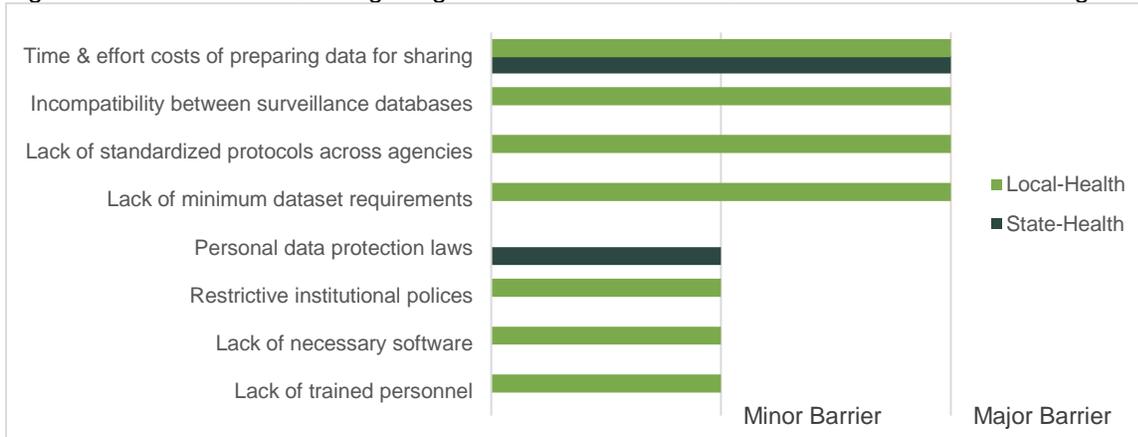
All respondents provided feedback on how their organization generally shares information from tick surveillance, tick pathogen testing, and/or tick control programs (Table VA-7). Respondents were asked to indicate barriers to sharing tick-related information with the public, as well as sharing tick surveillance, testing, and/or control data with partners and/or stakeholders.

Both the State-Health and Local-Health respondents indicated that lack of time was a major barrier, and lack of funds to develop public facing materials was a minor barrier to sharing information with the public. The Local-Health respondent reported more barriers to sharing data with partners compared to the State-Health respondent; both listed time and effort costs as a major barrier to sharing program data (Figure VA-4).

Table VA-7. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in Virginia

Respondent	Information Sharing Practices
State-Health	<ul style="list-style-type: none"> • Results incorporated into maps made available online • Results drafted into summary reports sent to specific stakeholder audiences • Results drafted into educational materials to inform the public/communities • Reported to CDC through appropriate databases • Results shared with local health departments • Results shared with partner agencies within state • Results shared with partner agencies in neighboring states • Results shared with medical providers • Data made available to the public online • Results shared with interested groups through presentations
Local-Health	<ul style="list-style-type: none"> • Results drafted into summary reports available online

Figure VA-4. Barriers to Sharing Program Data with Partners/Stakeholders for Vermont Programs



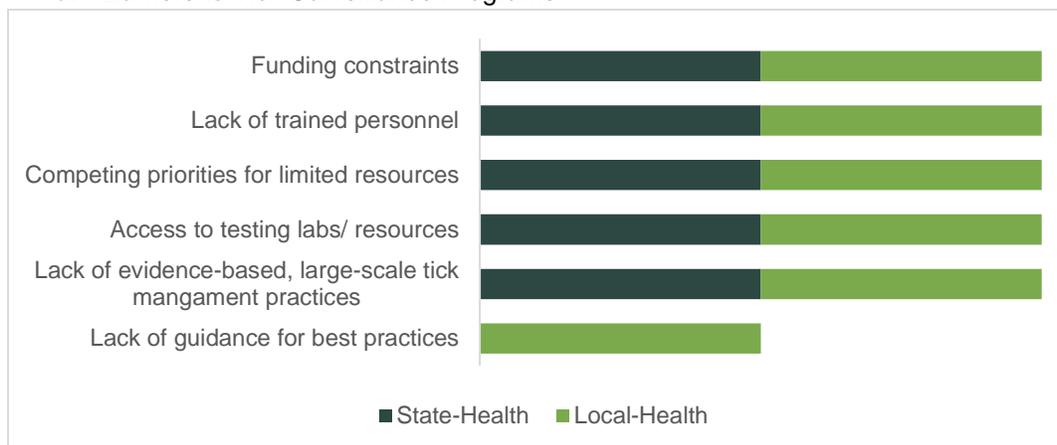
V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both. Figures VA-5a and VA-5b summarize the barriers to developing or enhancing tick surveillance and control programs reported by respondents.

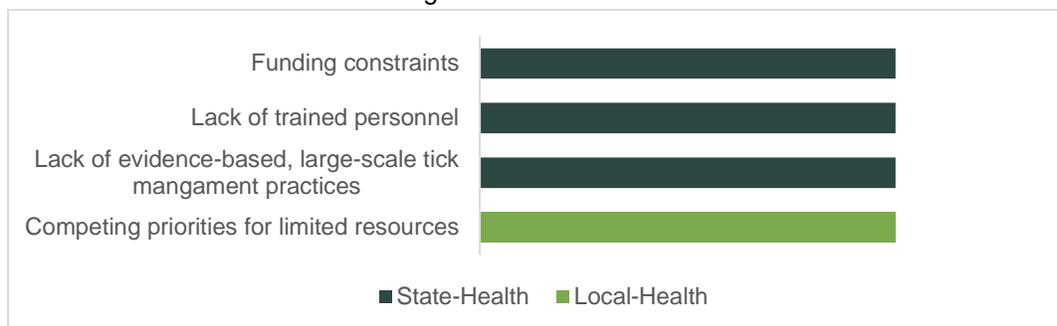
The State-Health respondent also provided additional commentary on barriers to program development and enhancement, stating that they have not had personnel dedicated to tick surveillance, leading to these activities only being conducted when time and resources become available. Additionally, they have encountered resource and funding barriers to tick-borne pathogen testing, and have no resources available for any form of control.

Figure VA-5. Barriers to Development/Enhancement in Virginia Programs

a. Barriers to Tick Surveillance Programs



b. Barriers to Tick Control Programs



Respondents were given an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The following themes were identified from both the State-Health and Local-Health responses:

- Lack of funding to support personnel, travel, and supplies is a major impediment to implementing a routine tick surveillance program; in absence of this funding, tick surveillance is only conducted on an ad hoc basis when time and funding allow.
- The lack of sustainable access to tick-borne pathogen testing inhibits the utility of tick surveillance efforts.

- Large-scale tick control is not viewed as a possibility in the state. Current methods for tick control are applicable to only small areas, and the only justification a state agency would have for local control efforts would be in response to a disease outbreak in a localized area, or to pilot test a protocol that could be expanded to cover larger areas.
- Provision of best-practices guidelines for tick surveillance and tick control are needed.

Respondents also had the opportunity to provide additional details about tick surveillance, tick-borne pathogen testing, and/or tick control in their areas that were not otherwise covered in the questionnaire. The State-Health respondent reported that:

- Tick surveillance conducted by the state health department has implemented for a variety of reasons, including determining the prevalence of tick species in various habitat/locations in the state; collecting ticks for pathogen testing as part collaborative academic research projects; or collecting ticks as part of a disease outbreak response. The state also performed tick surveillance instructional activities at local summer camps and citizen groups.
- Tick-borne pathogen testing activities have only occurred with funding windfalls to support the activity, or in partnership with academic research projects.

West Virginia

I. Respondent Demographics

One individual responded from an organization operating in the state of West Virginia. This individual worked for the state health agency, was directly involved in surveillance program activities, and served in supervisory and disease surveillance capacities. For the remainder of this summary, this respondent will be referred to as: State-Health.

The State-Health respondent indicated that they were able to comment on ad hoc active and passive surveillance activities in their organization/jurisdiction.

II. Surveillance Program Goals and Operations

Program Objectives, Partners & Funding

Respondents were asked to list the agencies or organizations within their state that implemented any form of tick surveillance. The State-Health respondent identified state agriculture, county and state health, state natural resources, and state laboratory agencies as those involved in tick surveillance in the state.

The State-Health respondent indicated that tick surveillance programs were funded through the mechanisms highlighted in Table WV-1 below. The respondent reported that their program collaborates with two universities in the state on tick surveillance activities.

Table WV-1. Overview of Tick Surveillance Programs Operating in West Virginia

Respondent	Funding Source	Program Type(s)	Years of Operation
State-Health ^a	<ul style="list-style-type: none">State funding through appropriationsFederal funding through grants/cooperative agreements	Ad hoc active surveillance	2011 - present
		Passive surveillance	2013 - present

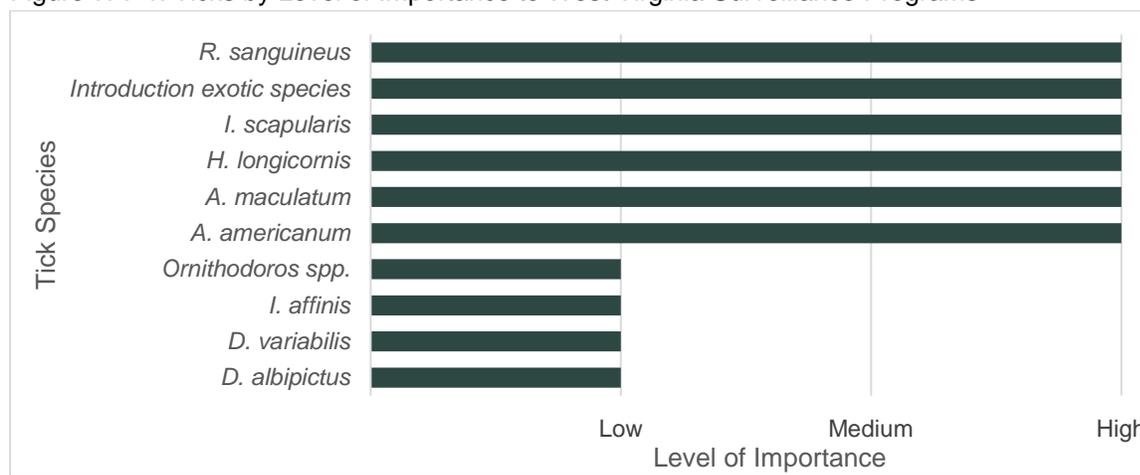
^a Partners with in-state universities

Current program objectives include:

- Detect the presence of ticks by species
- Evaluate tick abundance by species
- Monitor the current distribution of tick species
- Monitor the geographic spread of tick species
- Monitor the emergence of new tick species
- Detect the presence of tick-borne pathogens in ticks
- Evaluate the prevalence of tick-borne pathogens in ticks
- Monitor the abundance of ticks that are of public health importance
- Assess infection rates of ticks that are of public health importance
- Evaluate or calculate risk of tick-borne illness to humans
- Compare human incidence of tick-borne disease to tick-borne pathogen infection rate in ticks and sentinel animals

Ticks of importance to the programs detailed by the State-Health respondent are listed by level of importance in Figure WV-1.

Figure WV-1. Ticks by Level of Importance to West Virginia Surveillance Programs



The State-Health respondent provided additional detail on how their programs address exotic species, stating that they identify tick species submitted through their public health program; any information of exotic tick species is conveyed to local health departments, state agencies, federal agencies, and academic partners. With the recent concerns over the Asian longhorned tick, the state agriculture department visits sites of reported tick hot spots or veterinarian reports to conduct localized active surveillance.

Surveillance Program Operations

Active Surveillance Methods

The State-Health respondent indicated that programs in their jurisdiction/organization were involved in active tick surveillance activities. The active surveillance methods used by these programs are detailed in Table WV-2, and details regarding sampling approaches can be found in Table WV-3.

Table WV-2. Active Surveillance Methods Used in West Virginia Programs

Respondent	Active Surveillance Methods	Drag/Flag Sampling Arrangement	# Times Sampled/ Season
State-Health	<ul style="list-style-type: none"> • Drag cloths • Flag cloths • Active collection from host animals • CO₂-baited traps 	<ul style="list-style-type: none"> • Transect paths • Timed collections 	Usually more than once

Table WV-3. Sampling Arrangements Used in West Virginia Active Surveillance Programs

Respondent	Sampling Arrangement/ Season	How Sites Selected
State-Health	<ul style="list-style-type: none"> • Same sites in same locations sampled each season • Sites sampled randomly in response to disease cases • Sites sampled to determine presence of invasive tick species 	<ul style="list-style-type: none"> • Historical sampling records, habitat suitability, and landowner permission inform sampling sites for exotic tick species • Targeted sampling for <i>Ixodes scapularis</i> in low-incidence counties informed by habitat suitability and landowner permission • Surveillance conducted at residential locations in response to human disease cases

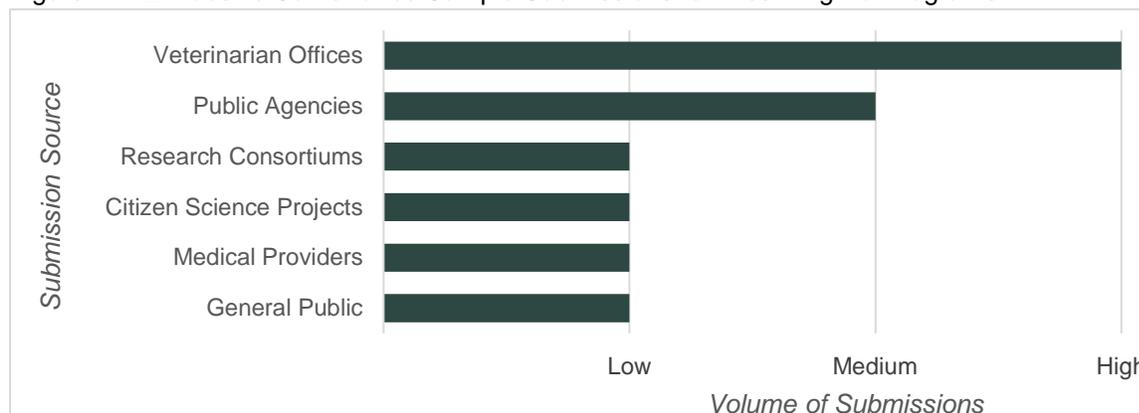
Passive Surveillance Methods

The State-Health respondent indicated that programs in their jurisdiction/organization were directly involved in passive surveillance activities. Table WV-4 provides an overview of the passive surveillance methods and jurisdictions served by these programs, and Figure WV-2 summarizes the sample submissions to the programs, by volume of specimens received.

Table WV-4. Passive Surveillance Operations for West Virginia Programs

Respondent	Surveillance Targets	Jurisdictions Served
State-Health	<ul style="list-style-type: none"> • Use of domestic animals as sentinels for human disease • Ticks found on humans • Ticks found on pets • Ticks found on domestic livestock • Ticks found on wildlife 	Entire state

Figure WV-2. Passive Surveillance Sample Submissions for West Virginia Programs



Pathogen Testing

The State-Health respondent stated that they could comment on pathogen testing, and that their jurisdiction/organization paid for or otherwise financially supported the testing of tick samples for pathogens. The samples tested and tick-borne pathogens targeted in these programs are displayed in Table WV-5.

Table WV-5. Tick-borne Pathogens and Samples Tested in West Virginia Programs

Respondent	Pathogens Tested	Samples Tested	Lab Conducting Tests
State-Health	<i>B. burgdorferi</i>	Ticks from animals	Academic lab

III. Tick Control Program Operations

The State-Health respondents stated that they could comment on tick control, and that their jurisdiction/organization paid for or otherwise financially supported the tick control activities. The respondent indicated that state agricultural agencies were those involved in tick control activities in West Virginia.

The only control activity reported was vegetation modification, completed as a joint effort of multiple programs.

Resistance Monitoring

No resistance monitoring efforts are currently supported.

IV. Program Information Dissemination

The State-Health respondent provided feedback on how their organization generally shares information from tick surveillance, tick pathogen testing, and/or tick control programs (Table WV-6), as well as barriers to sharing tick-related information with the public, and sharing tick surveillance, testing, and/or control data with partners and/or stakeholders (Table WV-7).

Table WV-6. Information Sharing Practices for Tick Surveillance, Testing, and/or Control Programs in West Virginia

Respondent	Information Sharing Practices
State-Health	<ul style="list-style-type: none"> • Results drafted into summary reports available online • Results incorporated into maps made available online • Results drafted into summary reports sent to specific stakeholder audiences • Reported to CDC through appropriate databases • Results shared with local health departments • Results shared with partner agencies within state • Results shared with partner agencies in neighboring states • Results shared with medical providers • Data made available to the public online • Data shared with academic partners for analysis • Results published in peer-reviewed literature

Figure WV-7. Barriers to Sharing Tick-Related Information and Data for West Virginia Programs

Respondent	Barriers to Public Communication	Minor	Major
State-Health	Lack of funds to develop public-facing materials		x
	Lack of software to develop materials		x
	Loss of online GIS applications due to financial costs		x
	Language barriers	x	
	Restrictive institutional policies	x	
	Lack of time	x	
	Barriers to Sharing Program Data	Minor	Major
	Lack of standardized protocols across agencies		x
	Lack of necessary software		x
	Lack of minimum data set requirements	x	
	Time and effort costs of preparing data for sharing	x	
	Lack of trained personnel	x	
	Incompatibility between surveillance databases	x	
	Lack of data sharing guidance	x	
	Restrictive institutional data sharing policies	x	
	Personal data protection laws	x	
	Difficulty establishing data sharing agreements	x	

V. Barriers to Program Development and Enhancement

Respondents were asked to indicate the most significant barriers to developing and/or enhancing tick surveillance and control programs in their jurisdiction. These questions asked respondents to indicate whether the barrier applied to tick surveillance, tick control, or both. The State-Health respondent listed the following barriers to both tick surveillance and tick control program development:

- Funding constraints
- Lack of trained personnel
- Competing priorities for limited resources
- Limitations in facilities/equipment
- Lack of guidance for best practices

The responding also identified access to testing labs/resources as a particular barrier to tick surveillance programs, and lack of evidence-based, large-scale tick management practices as a barrier to tick control programs.

Respondents were provided an opportunity to provide feedback on what activities could help resolve these tick surveillance and tick control program barriers. The State-Health respondent reported that increasing available laboratories and resources to test tick samples for human pathogens would enhance tick surveillance programs and inform health decisions for multiple audiences in the state. In addition, standardizing tick surveillance methodologies would enhance our ability to generate regional tick and tick-borne disease activity maps. The State-Health respondent also indicated that a more detailed understanding of habitat conducive to different tick species, such as invasive plant species, will improve integrated tick management strategies and implementation.

For more information, please contact:

Northeast Regional Center for Excellence in Vector-Borne Diseases

Cornell Department of Entomology

3138 Comstock Hall, Ithaca, NY 14853

Contact: nevbd@cornell.edu

Web: <http://www.neregionalvectorcenter.com>

Northeast Regional Center for Excellence in Vector-Borne Diseases

May 2019



This publication was supported by the Cooperative Agreement Number U01CK000509, funded by the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention or the Department of Health and Human Services.