Vector Surveillance and Control at the Local Level

Findings from the 2023 Vector Control Assessment

NACCHO℠

National Association of County & City Health Officials

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Acknowledgements

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Introduction

The National Association of County and City Health Officials (NACCHO), supported by a cooperative agreement from the Centers for Disease Control and Prevention (CDC), conducted a nationwide assessment of local vector control programs. The 2023 Vector Control Assessment represents the third time such an assessment has been conducted.

The initial assessment in 2017 provided a baseline understanding of local mosquito surveillance and control capacity. In 2020, NACCHO conducted the second iteration of this national assessment with an expanded questionnaire that included items related to tick surveillance and control.

The results of the 2023 Vector Control Assessment provide an opportunity to assess trends over time for both mosquito and tick surveillance and control capacity at the local level.

This report provides a summary of the results from the assessment, highlighting results that may be most relevant to public health officials and policymakers.

Large dengue outbreaks were reported throughout **South America** in 2023 and have continued into 2024. In March of 2024, **Puerto Rico** declared a dengue epidemic.

While this assessment is focused on the United States, and only includes the 50 states and D.C., the ongoing dengue epidemic highlights the need for robust vector surveillance and control programs everywhere. Malaria, chikungunya, and other mosquito-borne diseases also remain a risk globally, and future mosquito seasons may present new risks, as the Zika virus outbreak in 2015 and 2024 reports of Oropouche virus transmission have shown.

Due to the nature of vector-borne diseases, and the local environmental factors that can influence population risk, local vector control programs play a significant role in the detection and prevention of outbreaks.

Methods

The 2023 assessment was conducted online through Qualtrics© survey software. It included 28 total items. The assessment was sent to 1,588 verified programs between October and December 2023. These programs were drawn from NACCHO's database of 2,213 local vector programs. Verified programs are programs for which NACCHO has valid contact information. After the survey was distributed via Qualtrics©, routine follow-up emails were sent, and NACCHO staff directly followed up with as many programs as possible via phone and email.

A total of **474** programs responded resulting in a **response rate of approximately 30%**.

A total of **192** programs responded to all three assessments in 2017, 2020, and 2023.

One limitation of this assessment is that new programs are not identified or added to the database. In addition, this survey is unweighted, and as such, the results are only representative of the sample of programs that responded. Results from this survey cannot be interpreted as nationally representative. Data are self-reported, not independently verified, and results are not tested for statistical significance. Furthermore, some of the questions have been adjusted over time, which may have affected the results, especially when compared over time.

Response Rates

Response rates have declined over time, beginning at **57%** in 2017, and decreasing to **29%** in 2020.

In 2020, lower response rates were largely attributed to competing priorities for local health department staff as many vector control staff were also supporting COVID-19 response efforts. While the reasons for this trend persisting in 2023 are unclear, it may indicate a need for other avenues of data collection to help supplement the survey research.

Mosquito Surveillance and Control Capacity

A scoring matrix was created to prioritize and weight questions based on the necessary capacities of a comprehensive, evidence-based mosquito control program. Using the CDC framework for mosquito control capacity as guidance, five core capacities and five supplemental capacities were used to rank each organization as **fully capable**, **competent**, or **needs improvement**.

Core Capacities

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

Supplemental Capacities

6. Licensed pesticide application
7. Vector control activities other than chemical control (e.g., biological, source reduction, or water management)
8. Community outreach and education campaigns regarding mosquito-borne diseases, how they spread, and how to prevent infection
9. Regular communication with local health departments (LHDs) regarding surveillance and epidemiology
10. Outreach (e.g., communication and/or cooperation) with nearby vector control programs

Definitions

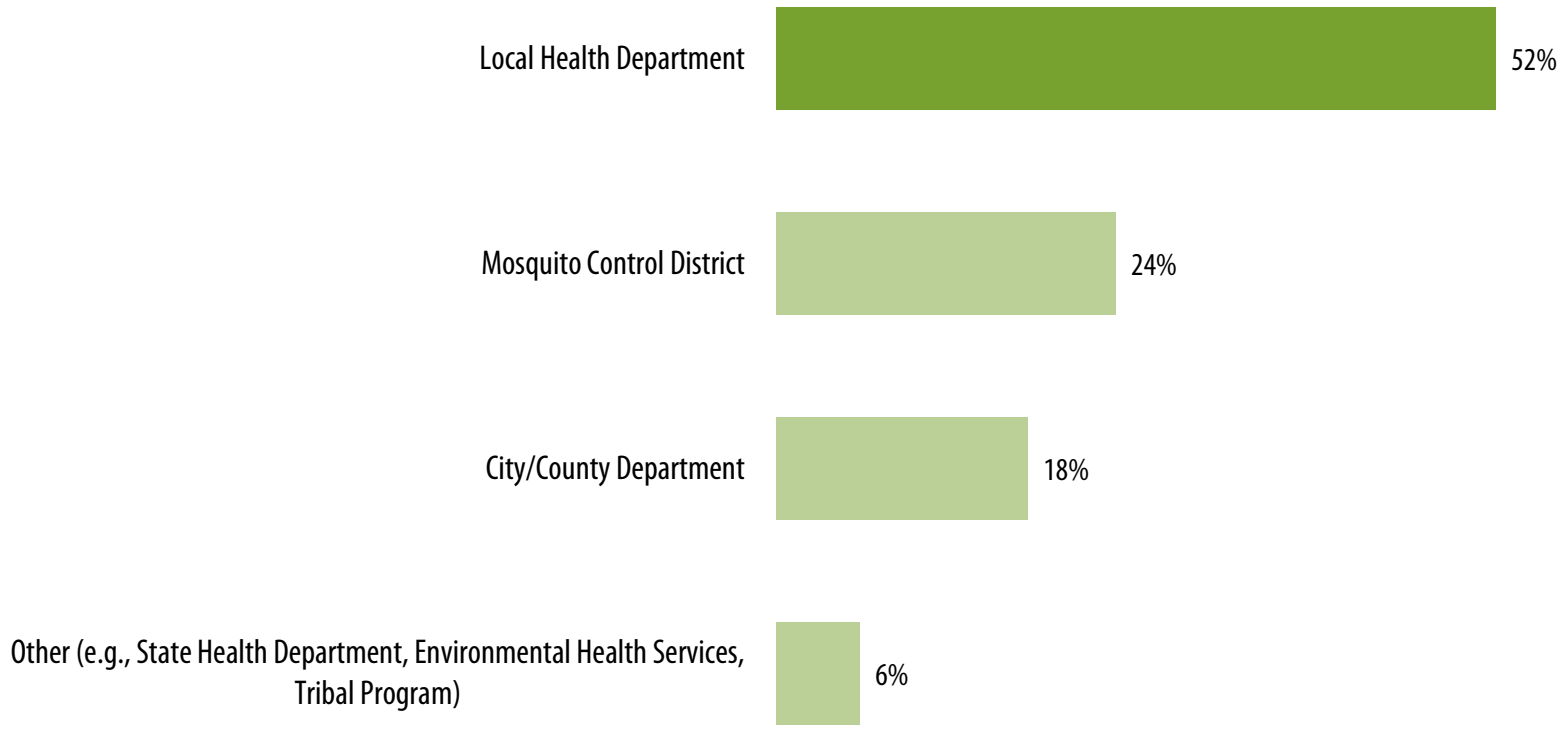
Fully Capable: Vector control organization performs all core and supplemental capacities.

Competent: Vector control organization performs all core capacities.

Needs Improvement: Vector control organization fails to perform one or more core capacities.

Mosquito Surveillance and Control Capacity

Percent of Respondents by Organization Type



n=474

Forty percent of responding programs serve small jurisdictions, with populations of less than 50,000.

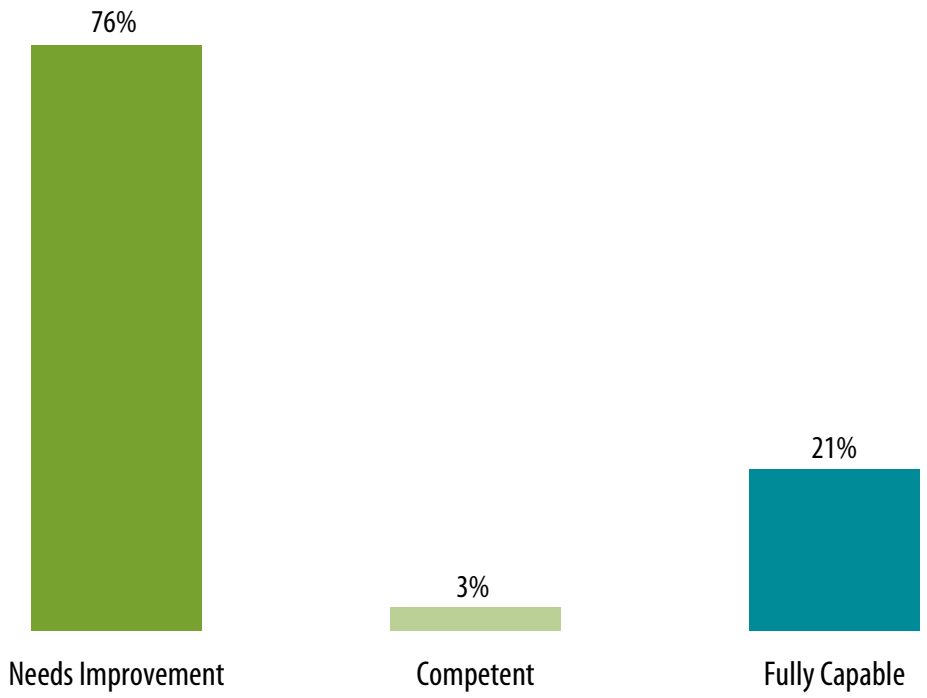
Sixty-three percent of responding programs reported dedicated funding.

Seventy-seven percent of responding programs with dedicated funding reported that their program received local funding, while **32%** reported state funding, and **8%** reported federal funding passed down through the state.

While many responding programs report receiving only local funding, some programs receive funding from more than one source.

Mosquito Surveillance and Control Capacity

Percent of Respondents' Capacity, by Category



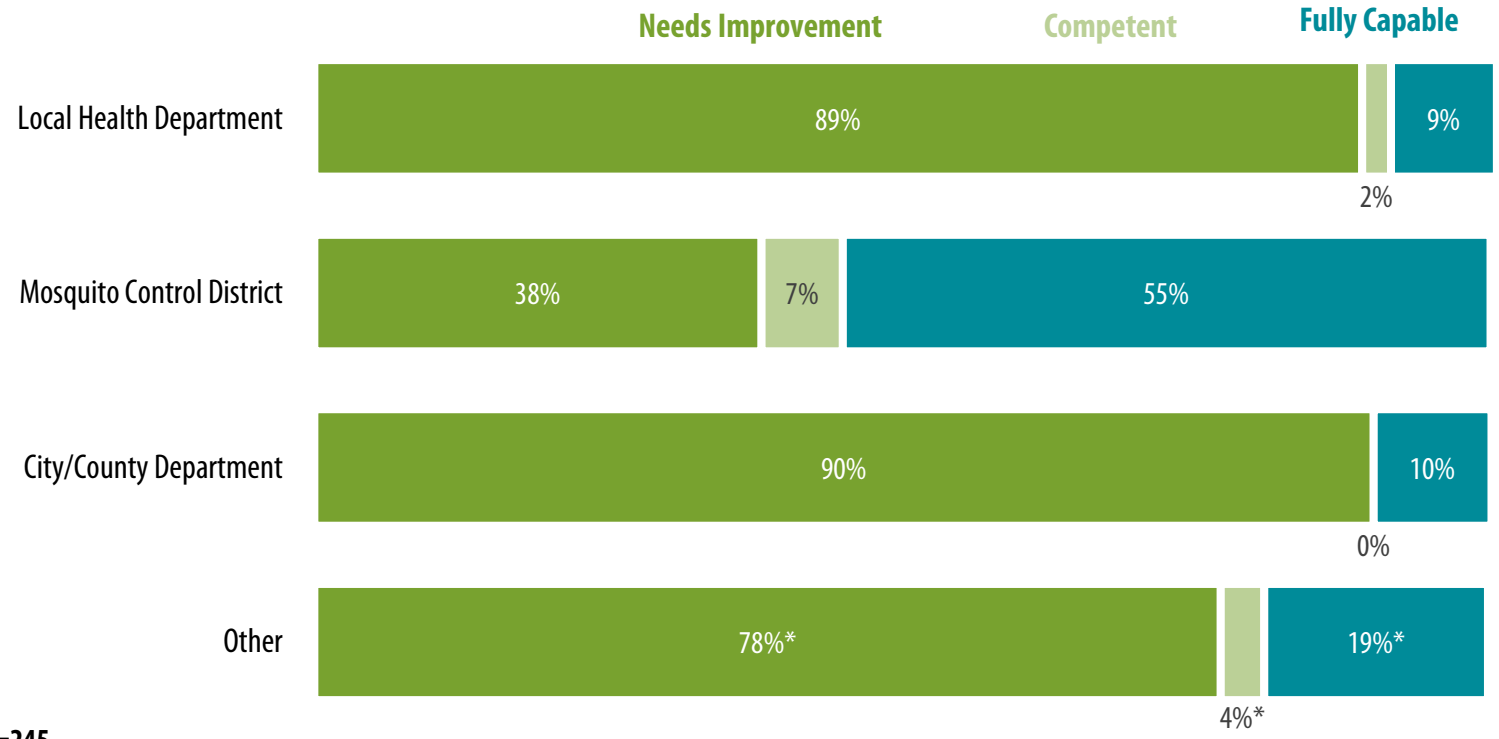
n=474

Encouragingly, **one out of five** responding programs are fully capable.

However, most responding programs fit into the Needs Improvement category.

Mosquito Surveillance and Control Capacity

Percent of Program Capacity, by Responding Organization Type



n(LHD)=245
n(MCD)=116
n(City/County)=86
n(Other)=27

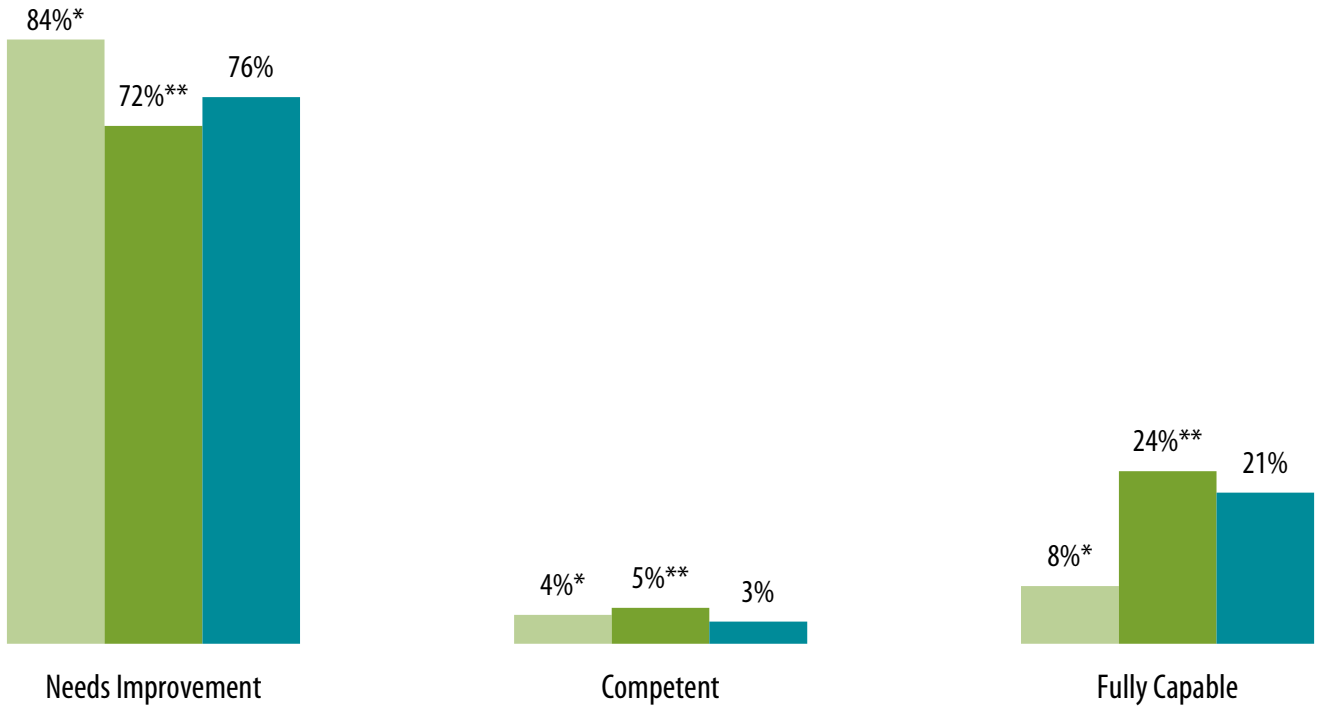
*Note: Percents may not sum to 100 due to rounding.

Mosquito control districts are more likely to be able to perform all ten capacities than other responding programs.

Mosquito control districts are special purpose districts that pool resources from different municipalities within the county. They are set up for the specific purpose of collaborating on mosquito surveillance and control activities with the ultimate goal of preventing mosquito-borne disease, decreasing nuisance bites, and protecting well-being.

Mosquito Surveillance and Control Capacity

Percent of Respondents' Program Capacity, Over Time (2017-2023)



n(2017)=1,083
n(2020)=483
n(2023)=474

2017
2020
2023

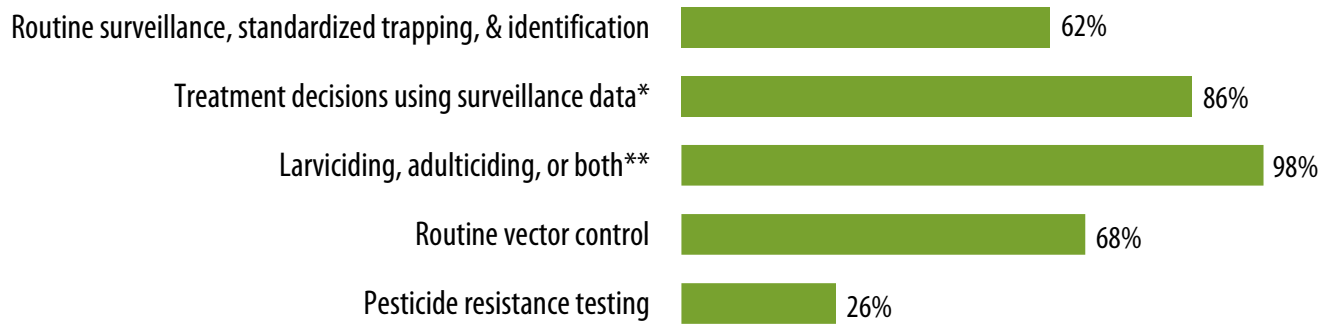
*There were 4 percent of agencies that could not be assessed in 2017.
**Note: Percents may not sum to 100 due to rounding.

While the proportion of fully capable responding programs increased notably between 2017 and 2020, there was a slight drop off between 2020 and 2023.

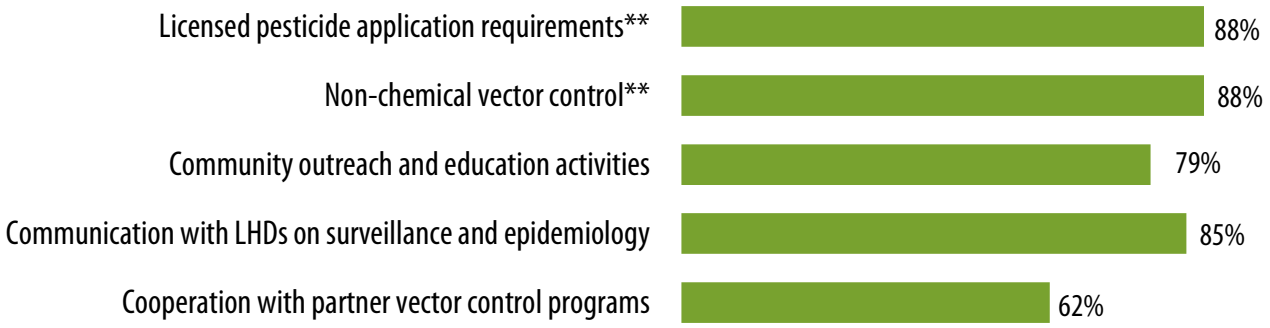
Mosquito Surveillance and Control Capacity

Percent of Responding Programs, by Individual Capacity

Core Capacities



Supplemental Capacities



n=295–474

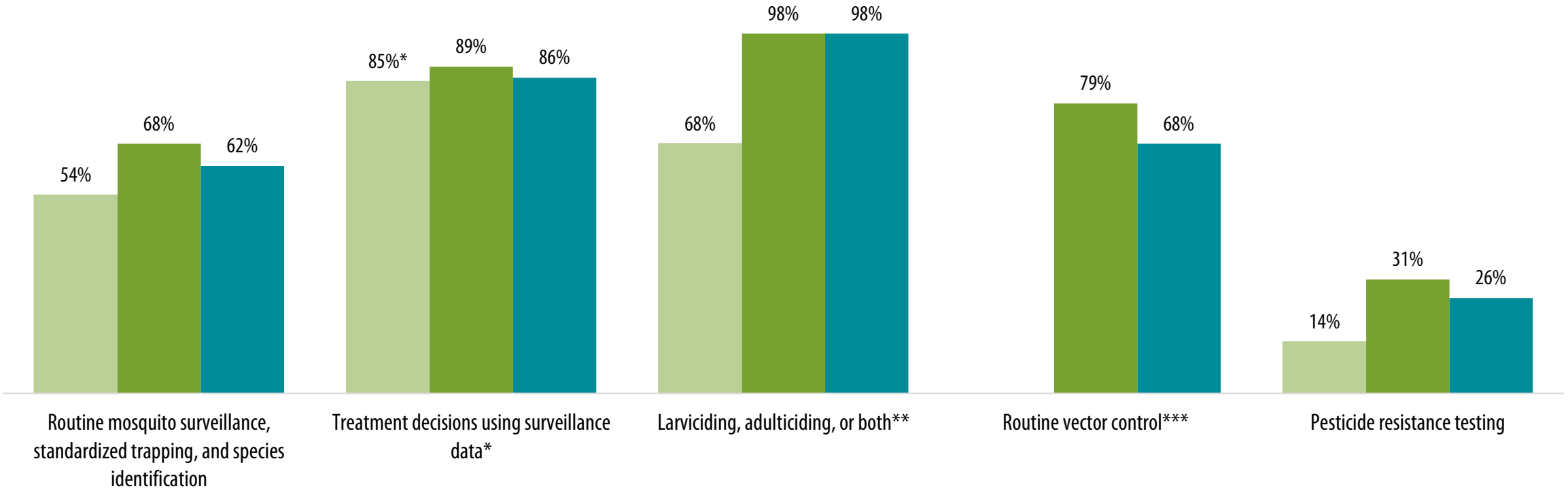
*Reflects percentage of programs that reported routine surveillance activities.
**Reflects percentage of programs that reported control activities.

Most responding programs had the capacity to perform **four out of five** core capacities and all supplemental capacities.

Only **26%** of respondents reported they had the capacity to conduct pesticide resistance testing.

Mosquito Surveillance and Control Capacity

Percent of Core Capacities Performed by Responding Programs, Over Time (2017-2023)



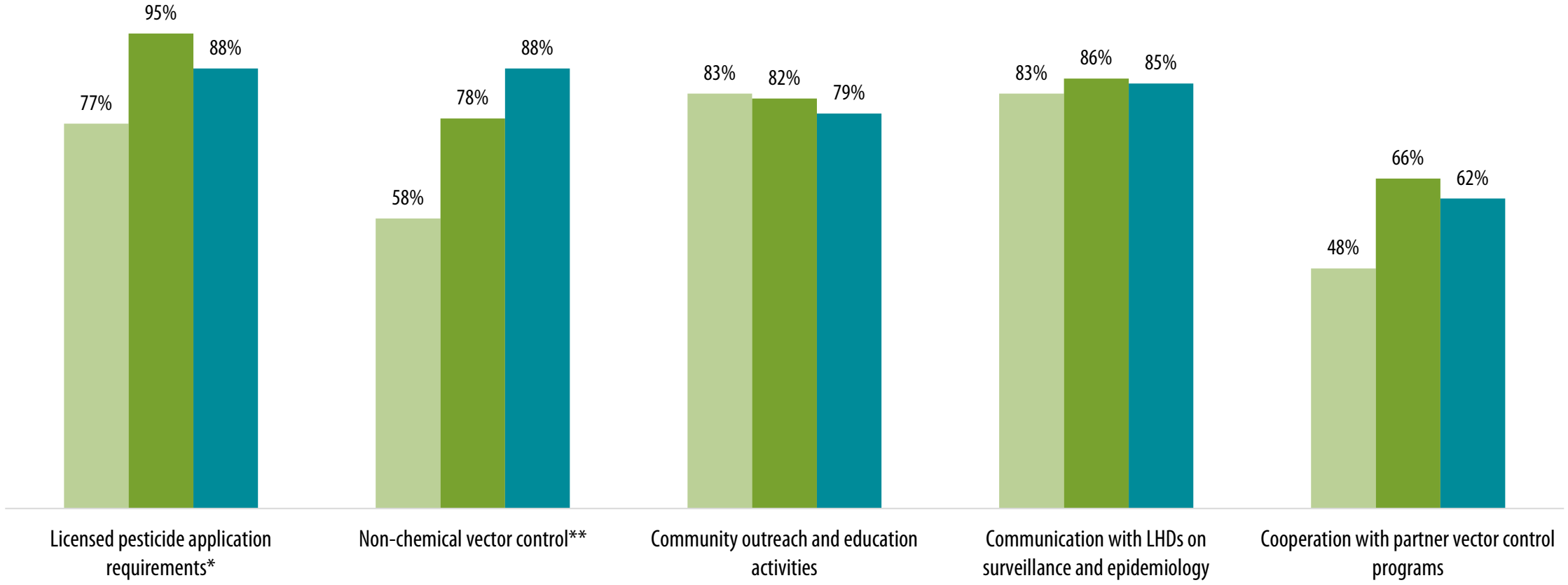
n(2017)=1,083
n(2020)=483
n(2023)=474

2017
2020
2023

*Reflects percentage of programs that reported routine surveillance activities. In 2020, the 2017 percentage was misreported as 46% and has been corrected here.
**Reflects percentage of programs that reported control activities in 2020 and 2023.
***In 2017, the assessment only asked about routine control for certain species. This item is not directly comparable to the assessments in 2020 and 2023.

Mosquito Surveillance and Control Capacity

Percent of Supplemental Capacities Performed by Responding Programs, Over Time (2017-2023)



n(2017)=1,083
n(2020)=483
n(2023)=474

*In 2017 and 2020, every respondent was asked this question; in 2023, only those reporting control activities were asked this question.
** In 2020 and 2023, the item was changed, but results remain comparable over time.

Mosquito Surveillance and Control Capacity

Capacity decreased slightly between 2020 and 2023.

Reported capacity for nearly all mosquito surveillance and control activities **dropped slightly** from 2020 to 2023, falling between **1%** and **11%**. The sole exception was non-chemical vector control capacity, which **increased from 78%** to **88%.**

Reported capacity for routine control and licensed pesticide application requirements dropped the most between 2020 and 2023, with routine control **falling from nearly 80%** in 2020 to **below 70%** in 2023, and licensed pesticide requirements **falling from 95%** in 2020 to **under 90%** in 2023.

Reported capacity for pesticide resistance testing has improved since 2017 but has dropped off slightly since 2020. This core capacity has continued to lag behind all other capacities over time. The assessment does not distinguish between in-house capacity or use of external testing services.

In 2023, a slightly larger proportion of responding programs reported mosquito control activities **(68%)** than mosquito surveillance activities **(62%)**. This same gap between reported control and surveillance activities was observed in 2020 as well, though encouragingly, the gap has narrowed since then.

Individual programs have shown improvement over time.

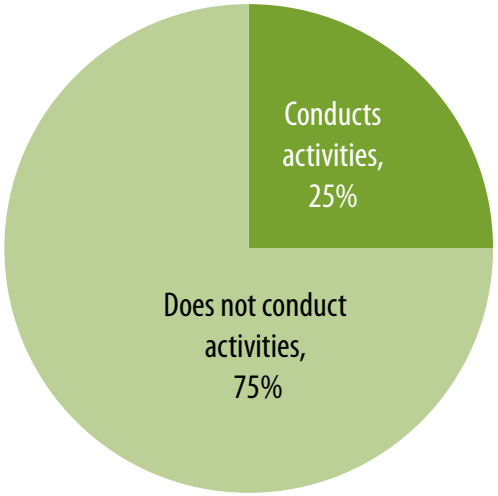
A total of **192 programs** responded to all three assessments in 2017, 2020, and 2023. While most programs that responded to all assessments began in the Needs Improvement category in 2017 and did not change status over time, of the programs that did change their capacity, most showed improvements over time. A few programs did show decreased capacity over time, the reasons for which may be worth investigating further.

Overall, most responding programs reported the capacity to conduct a range of surveillance and control activities in 2023, but notable gaps remain in routine surveillance, routine control, collaboration with partner programs, and most notably, pesticide resistance testing.

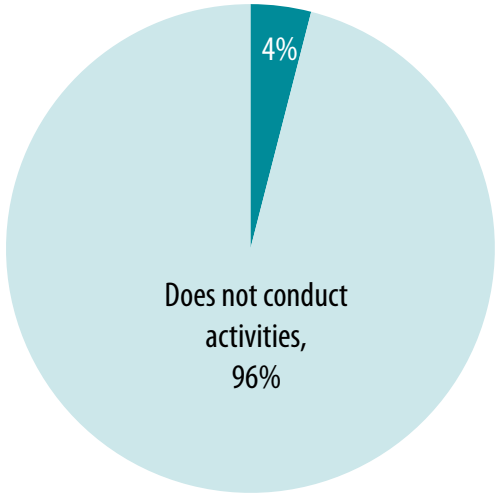
Tick Surveillance and Control Activity

Percent of Responding Programs, Tick Surveillance vs. Control Activities

Tick Surveillance Activity



Tick Control Activity



n(surveillance)=469
n(control)=467

One in four respondents reported tick surveillance activities. This is a slight increase from 2020, when approximately one in five reported any surveillance activities.

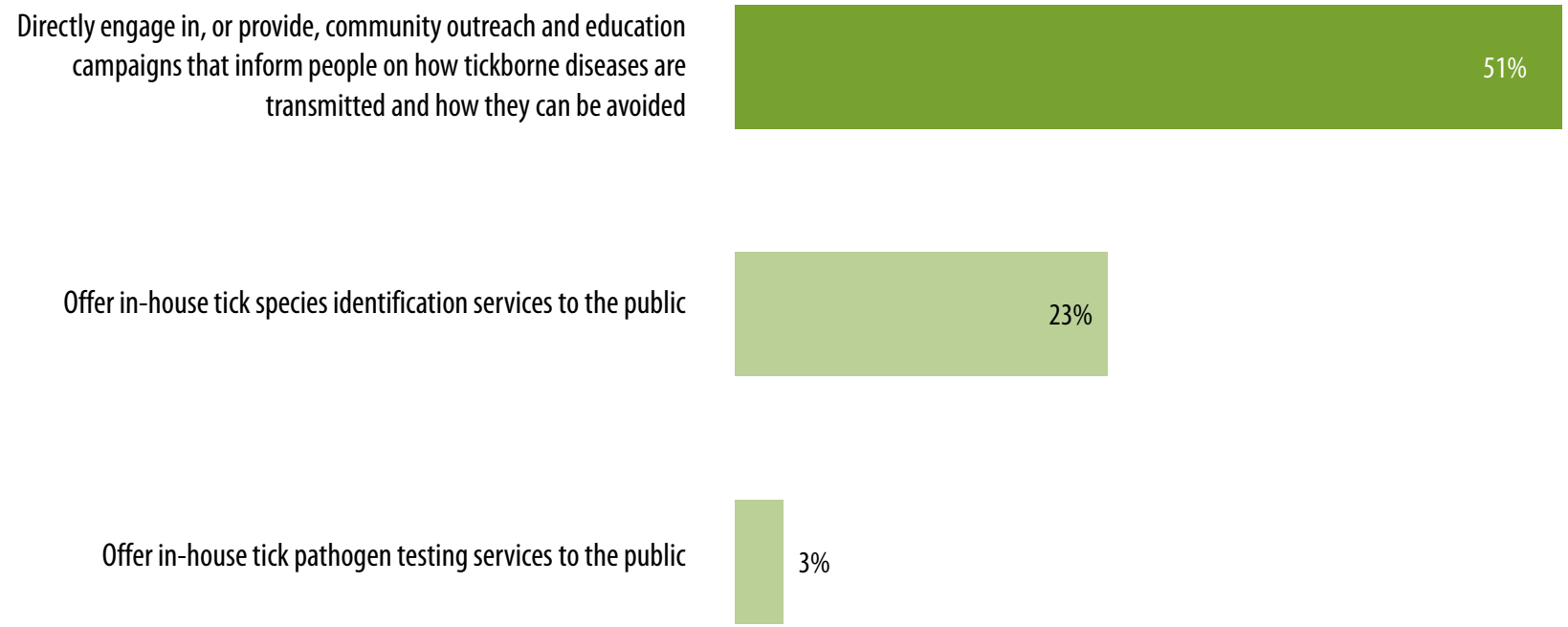
Four percent of respondents reported any tick control activities, a similar finding to 2020 when 3% of respondents reported any tick control activities.

Tick surveillance activities may include tick collection and species identification.

Tick control activities may include application of synthetic chemical acaricide to kill host-seeking ticks or vegetation management (i.e., mowing or brush removal).

Tick Surveillance and Control Activity

Percent of Responding Programs, Other Tick Activity



n=467-470

Fifty-one percent of responding programs provided community outreach and education to inform people on how tickborne diseases are transmitted and can be avoided.

This is a notable increase from 2020, when only **35%** of responding programs reported community outreach and education about tickborne diseases.

In addition, **23**% of responding programs offered in-house tick species identification to the public. Only **3%** offered in-house tick pathogen testing. No notable changes were observed between 2020 and 2023 for these activities.

Conclusions and Recommendations - Mosquitoes

Mosquito surveillance and control capacity was slightly lower in 2023 than it was in 2020. While the decreases were small and overall gains from the baseline assessment in 2017 are evident, this is still a trend in the wrong direction. Increased funding or technical assistance may be needed. In addition, more opportunities for collaboration—particularly the formation of mosquito control districts—may be needed.

The consistently large percentage of responding programs that fall into the Needs Improvement category, driven by the lack of capacity for pesticide resistance testing, also indicates a need for increased investment in this particular activity. In-house pesticide resistance testing may not be possible for all programs, however partnerships, including partnerships with academic institutions, may help fill this gap.

One finding that ran counter to the overall trend was the notable improvement in non-chemical vector control capacity. This is an encouraging finding as the 2020 report concluded that programs may benefit from additional support in building up capacity for this activity. The reasons behind this improvement may be worth exploring further. In addition, the narrowing gap between reported mosquito control as compared to surveillance demonstrates improvements in the field overall between 2020 and 2023. It should be noted that more programs are likely to be basing their treatment decisions on underlying data.

Mosquito Resources

Whether you are a local program establishing a mosquito surveillance and control program for the first time or considering building on current capacity, NACCHO's **Practical Guide to Building Local Mosquito Control Capacity** can help.

This resource educates, supports, and encourages local programs to be better prepared for future mosquito-borne disease outbreaks.

Conclusions and Recommendations - Ticks

Reported tick surveillance activities have increased slightly since 2020, mostly driven by an increase in community outreach around tickborne disease prevention. More information may be needed to identify the factors that may have led to this increase in outreach and education activities. If there are successful models for scaling up such activities, these findings may help to propel further gains in this area as one in two responding programs still report no outreach or education on tickborne illnesses.

Reported tick control continues to lag far behind tick surveillance activities. This continues to be a notable finding as there are no available vaccines to prevent tickborne illnesses in humans. Reducing the overall risk of tick bites is still the best available method of prevention when it comes to tickborne illnesses. Further research may be needed to best support tick control activities at the local level.

Finally, reported tick surveillance and control lag far behind mosquito surveillance and control at the local level. Mosquito control methods are better known, more standardized, and more widespread than available tick control methods. However, tickborne illnesses continue to affect the U.S. population at a higher rate than mosquito-borne illnesses. Further research into effective tick control methods, paired with funding and technical assistance to disseminate those findings, may help close this gap.

Tickborne Illness

Lyme disease is the most commonly reported tickborne illness. **Over 63,000 cases were reported to the CDC in 2022**, though the actual number of cases may be much higher.

While Lyme disease is treatable, some tickborne diseases, including infections from Powassan virus, have no available treatment. Preventing tick bites remains the best option—and sometimes the only option—for preventing tickborne illnesses.

CDC's National Public Health Framework to Prevent Vector-Borne Diseases has highlighted stronger surveillance systems as a priority, including at the local level.

For Further Reading

Prior Assessments (2020, 2017)

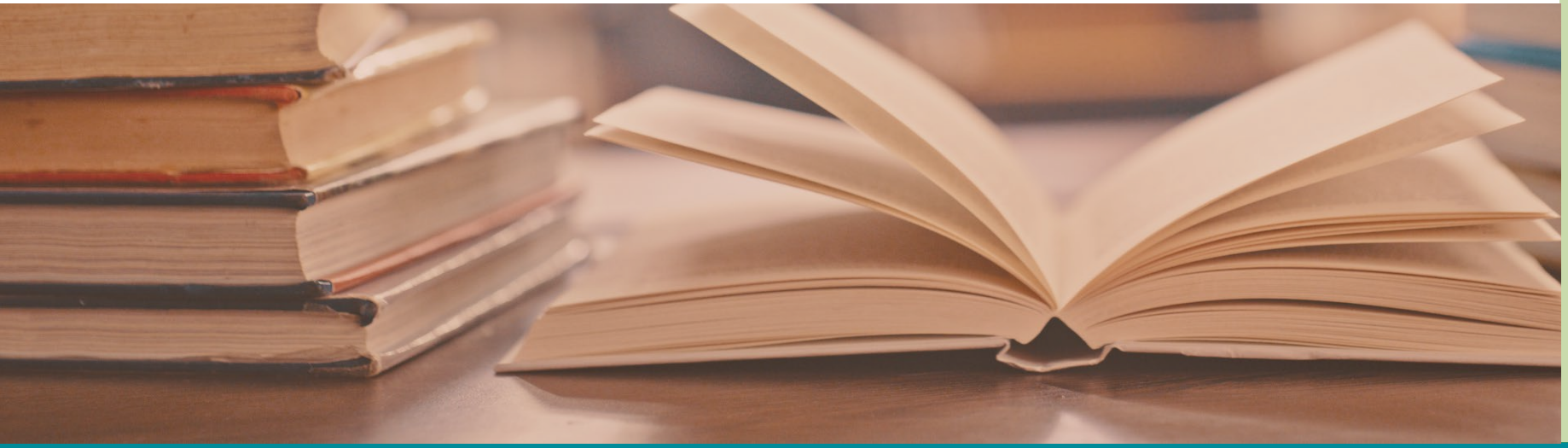
- Vector Surveillance and Control at the Local Level: Findings from the 2020 Vector Control Assessment
- Mosquito Control Capabilities in the U.S.

Additional NACCHO Resources

- A Capabilities-Based Framework for Mosquito Control Programs in the United States
- The Role of Local Environmental Health Departments in Tick-Related Activities and Services
- A Practical Guide to Building Local Mosquito Control Capacity

Additional CDC Resources

- A National Public Health Framework for the Prevention and Control of Vector-Borne Diseases in Humans Framework



Visit the NACCHO Vector Control webpage at

www.naccho.org/vector-control

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