The National Environmental Health Association (NEHA) represents more than 7,000 governmental, private, academic, and uniformed services sector environmental health professionals in the U.S., its territories, and internationally. NEHA is the profession's strongest advocate for excellence in the practice of environmental health as it delivers on its mission to build, sustain, and empower an effective environmental health workforce.

Policy Statement on Mosquito Control

Adopted: November 2021
Policy Sunset: November 2026

NEHA recognizes the association between the health of humans, animals, and the environment. NEHA advocates for federal, state, territorial, local, and tribal policies, regulations, research, and the requisite resources to enhance the abilities of environmental health professionals to reduce the risk of mosquito-borne diseases and protect public health. As such, NEHA also advocates incorporating the vector management framework outlined by the Centers for Disease Control and Prevention (CDC), American Mosquito Control Association, and World Health Organization while also integrating a One Health approach. One Health is a transdisciplinary, collaborative effort across all government levels with the goal of achieving optimal health outcomes including addressing environmental sources of current and emerging diseases and their connections between humans, animals, and the environment (Centers for Disease Control and Prevention [CDC], 2021a).

NEHA's Policy Statement

NEHA supports the following policies and actions:

- Develop model standards for mosquito management programs that align with state and federal guidelines and expand resources for those standards to include the provision of additional funding.
- Develop and implement up-to-date local and national mosquito surveillance and control training programs that also enhance the coordination among environmental health, epidemiology, entomology, and certified and licensed mosquito control professionals, as well as public and private organizations.

NEHA also endorses federal, state, territorial, local, and tribal health departments, abatement districts, and other vector control organizations to provide technical assistance, education, and related programs to accomplish the following:

- Build and sustain core capacities to execute integrated mosquito management programs designed to reduce the risk of disease to people, domestic animals, wildlife, and the environment (National Association of County and City Health Officials, 2014; Northwest

Mosquito and Vector Control Association [NWMVCA], 2017; World Health Organization [WHO], 2012).

- Support continued research in areas of mosquito repellents and genetics for mosquito control.
- Improve state, local, territorial, and tribal infrastructure and capacity to predict, prevent, and suppress mosquito-borne disease outbreaks (Association of State and Territorial Health Officials [ASTHO], 2005; WHO, 2017).
- Expand social mobilization and community empowerment by educating the public about local agency capabilities and personal preventive behaviors and practices (U.S. Environmental Protection Agency [U.S. EPA], 2021a).
- Advocate for policies that address climate change, which can contribute to distribution changes in mosquito populations and the resulting spread of mosquito-borne diseases (ASTHO, 2015a; Githeko et al., 2000; Gubler et al., 2001; Molaei et al., 2019).
- Continue to improve mosquito treatment formulations and application practices with the goal of reducing treatment failures due to insecticide resistance as well as minimizing risk to the environment and nontarget species.
- Develop policies across all government levels addressing social injustices that might contribute to a disproportionate burden of mosquito-borne or collateral disease on vulnerable populations (U.S. EPA, 2021b).
- NEHA and its members will continue to work with relevant stakeholders to further enhance the effectiveness of mosquito control programs and those that conduct them.

Analysis

Mosquitoes transmit viruses, parasites, and other pathogens such as bacteria to numerous people in the U.S. and millions globally every year. Increasing urbanization, changing land use patterns, and expanding international travel and trade bring humans and animals into more frequent contact with mosquitoes, while climate and other environmental changes also fuel their spread. As an example, West Nile virus (WNv) appeared in the U.S. in 1999 and continues to cause widespread health problems afflicting thousands of U.S. residents every year (Burakoff et al., 2018). WNv is currently active in all 48 contiguous states with 96% of counties reporting transmission in humans, mosquitoes, birds, horses, or other mammals (CDC, 2020a; WHO, 2012). The U.S. also continues to be at risk for new or introduced mosquito-borne diseases. The most recent example is the 2015–2017 Zika virus outbreak in the Southern U.S. and Puerto Rico. During that period, the virus caused serious human health issues including birth defects and other problems in pregnant individuals (CDC, 2019). Research has shown certain mosquito species in the U.S. can transmit multiple diseases such as dengue, malaria, yellow fever, chikungunya virus, WNv, Zika virus, and other encephalitic diseases, as well as a combination of these diseases.

To reduce the risk and adverse impacts of mosquito-borne illness, many state, territorial, local, and tribal health agencies have established mosquito control programs. These programs

normally consist of a combination of four basic interventions: 1) removal of mosquito habitats, 2) structural barriers, 3) control at the larval stage, and 4) control at the adult stage (U.S. EPA, 2020). Risk assessment (e.g., surveillance) is the first necessary step for any integrated pest management program. Background information on the identification (e.g., systematics and taxonomy), distribution (e.g., spatial and temporal), behavior (e.g., potential for causing damage in particular), and developmental biology of pests defines the problem and suggests strategies for its control (Beard & Strickman, 2014). Effective programs include gathering surveillance data to monitor changes in mosquito species distribution and abundance over time, as well as predict possible outbreak situations. The standard for these programs is to follow integrated vector management (IVM). IVM is defined as a synergistic, ecosystem-based strategy that focuses on long-term suppression of vectors (e.g., mosquitoes) or their ability to cause disease or damage through a combination of techniques, including biological control, trapping, habitat manipulation, and chemical control (American Mosquito Control Association, 2017; CDC, 2021b; NWMVCA, 2017; U.S. Department of Health and Human Services, 2013; van den Berg et al., 2012). In many areas, environmental health professionals are responsible for conducting these mosquito surveillance, control, and disease prevention programs.

The National Association of County and City Health Officials (2016), in collaboration with CDC, released a report evaluating vector control capacity across key jurisdictions in 2016 with a focus on core competencies. The report found that only 21% of local vector control respondents (39/190) were “fully capable” and 68% of local vector control organizations (129/190) were ranked as “needs improvement” due to minimal resistance testing. In a different study, the Council of State and Territorial Epidemiologists (2014) identified a decrease in mosquito-borne virus surveillance since 2004 where respondents indicated a 41% reduction in staff for surveillance, a 58% decrease in mosquito trapping activities, and a 68% decrease in mosquito testing due to budget cuts. In 2019, the U.S. Congress passed the much-needed SMASH (Strengthening Mosquito Abatement for Safety and Health) and Kay Hagan TICK (Ticks: Identify, Control, and Knockout) Acts to help reduce the risk of mosquito and other vectorborne diseases in the U.S. These acts awarded grants to support the establishment of Regional Centers of Excellence in Tick and Vector-Borne Diseases and funded CDC to form cooperative agreements with state, local, and tribal health departments to address mosquito control and other vectorborne diseases.

While the SMASH Act has improved the effort to control mosquitoes and reduce mosquito-borne disease risk in the U.S., there continues to be a lack of sufficient sustained and organized funding for mosquito control programs. This deficiency continues to result in state, territorial, tribal, and local jurisdictions having to develop independent funding systems to maintain effective risk-based programs. This trend has led to nationally inconsistent and socioeconomically biased programs as only some jurisdictions can implement fees and specific tax revenues to supplement state or locally allocated funding. NEHA supports the foundation of a national public health framework for the prevention and control of vectorborne diseases in humans as outlined by CDC (2020b).

Research continues to indicate the growing incidence and changing geographical distribution of mosquito-borne diseases can be partially attributed to climate change, transglobal migration, and international travel (Githeko et al., 2000; Gubler et al., 2001; WHO, 2021). These indications are particularly significant in the case of the expanding habitat of *Aedes* mosquitoes in the U.S. This expansion is likely to lead to increases in local transmission of Zika virus, dengue, chikungunya, and other diseases (Becker, 2008; CDC, 2020a; Tjaden et al., 2018). Therefore, state, territorial, local, and tribal health departments have a pressing need for consistent funding to support comprehensive IVM programs that include mosquito-borne disease surveillance, control, and public education and outreach that covers all U.S. residents.

Justification

Mosquito-borne diseases add significant healthcare, lost productivity, and income costs to the U.S. economy. It is estimated that the average cost of WNv in the U.S. is $56 million annually with human lifetime lost productivity and death at $449 million (Staples et al., 2014). It is estimated that dengue infections alone cost the global economy $8.9 billion annually (Margolis, 2016) and this disease is now endemic in the U.S. There are also new and emerging disease threats as CDC reports nine new vectorborne viruses and bacteria have arrived in the U.S. since 2004 (CDC, 2020a). The prevention of mosquito-borne diseases through vector control programs is significantly cheaper than treating disease both in real dollar amounts and in disability-adjusted life years (Kaiser Family Foundation, 2016; LaBeaud et al., 2011).

Mosquito control programs and their budgets vary widely in relation to the type of mosquito present, disease impact, and population size. For example, Lee County, Florida, had a 2020–2021 budget of $34 million for mosquito control, compared to $8 million for San Diego County, California, and $150,000 for Conway, Arizona (Lee County Mosquito Control District, 2020; SCI Consulting Group, 2020; Vector Disease Control, 2016). In addition to “boots on the ground” prevention and surveillance activities, laboratory capacity is vital in the identification and tracking of mosquito-borne diseases. Federal funding for epidemiology and laboratory capacity grants from CDC’s Division of Vector-Borne Diseases was $9.2 million in 2013, a drastic decrease from $34.7 million in 2002 (ASTHO, 2015b). Accounting for inflation (www.usinflationcalculator.com), a minimum of $51 million is currently needed to fund programs at the same level as in 2002.

The return on investment in mosquito control includes a significant reduction in medical bill costs, a gain in years lived by people in the U.S., and a decrease in deaths, all of which can lead to an increased number of days worked and a positive impact the U.S. gross domestic product. In 2020, CDC and the U.S. Environmental Protection Agency released a joint policy report in regard to vector control, documenting that diseases can pose threats to communities amid public health emergencies (e.g., COVID-19) or following natural disasters such as floods, fires, and hurricanes (Connelly et al., 2020). To mitigate vectorborne disease threats, it is critical that mosquito control and public health organizations continue to effectively conduct their surveillance and control programs to the extent that local conditions and resources will allow (Connelly et al., 2020). A reduction of these capabilities will likely result in increased rates of mosquito biting and potential mosquito-related illness.

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