Examining the U.S. Public Health Response to the Zika Virus

HEARING BEFORE THE

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TESTIMONY
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Good morning, Mr. Chairman and Members of the Subcommittee. My name is Joseph Conlon and I am a retired U.S. Navy medical entomologist serving as Technical Advisor for the American Mosquito Control Association (AMCA), a nonprofit organization of 1600 members dedicated to enhancing health and quality of life through the suppression of mosquitoes and other vectors of public health importance. I welcome this opportunity to provide a mosquito control perspective to the deliberations of this committee concerning Zika Virus and will limit my testimony to mosquito management methodologies that contribute to its control.

The introduction and spread of Zika Virus in Central and South America and the Caribbean in 2014 reawakened in the United States an appreciation of mosquitoes as vectors of diseases. I use the term "reawakened" advisedly, for mosquito-borne diseases such as malaria and yellow fever were once quite prevalent in the United States and, indeed, played a major part in shaping our nation's destiny. These diseases no longer claim victims in the United States as a matter of course largely due to the exemplary efforts of organized mosquito control agencies, in conjunction with an enlightened and effective public health infrastructure. But other mosquito-borne diseases are on the horizon and public health agencies need to be prepared to meet the challenges they present.

Progress continues in defining the transmission dynamics of Zika Virus so as to allow for its prevention and control. However, considering that it is a comparatively recent epidemiological phenomenon, there remains much to learn in order to establish and verify

baseline data. The virus is thought to be primarily transmitted from human to human by the bite of infected *Aedes aegypti* and (possibly) *Aedes albopictus* species of mosquitoes. Of these, *Aedes aegypti* has been primarily responsible for transmitting the disease due to its preference to bite humans both day and night and its predilection for biting the lower extremities. Moreover, females frequently take multiple partial bloodmeals, often from different individual humans, not only increasing the likelihood of feeding on an infectious human but also leading to single infectious females potentially feeding on and infecting multiple humans within a relatively short time period.

Aedes aegypti and *Aedes albopictus* are notoriously difficult to prevent or kill. They live inside our houses under furniture, beds and in closets; their eggs can withstand months of drying, and their young can develop in water containers as small as a bottle cap. Virtually any collection of stagnant water in containers, treeholes, leaf axils, etc. can serve as egg-laying habitat for these species. Thus, draining wet areas doesn't prevent their development around our homes and yards; predators do not consume enough to provide effective control; and repellents, while protecting individuals, just redirect the adult mosquitoes to bite somebody else.

Aedes aegypti has been found in isolated areas of California, and from Arizona, New Mexico, Texas, Louisiana, Mississippi, Alabama, Florida, Georgia and South Carolina. *Aedes albopictus* is a more cold-hardy species and its range includes those states but extends northward to Illinois and New York. Its range is thought to be defined by an average winter temperature of 50 degrees Fahrenheit.

Mosquito Control as currently practiced in the United States

The first mosquito control districts were established in NJ in 1912. California and Florida followed suit in 1915 and 1925, respectively. In the ensuing years, mosquito control districts and state agencies were established nationwide so that there are now more than 700 recognized districts within the United States along with over 1000 control entities within municipal service programs.

The integrated mosquito management methods currently employed by these organized control agencies and endorsed by the CDC and EPA are comprehensive and specifically tailored to safely counter each stage of the mosquito life cycle. Larval control through water management and source reduction, where compatible with other land management uses, is a prudent pest management alternative - as is use of the environmentally friendly EPA-approved larvicides currently available. When source elimination or larval control measures are clearly inadequate, or in the case of imminent disease, the EPA and CDC have emphasized in a published joint statement the need for considered application of adulticides by certified applicators trained in the special handling characteristics of these products.

In 2009 the AMCA published its "Best Management Practices for Integrated Mosquito Management" and promulgated it to its membership as a set of guidelines for safe, effective and efficient vector control programs. The AMCA is currently in the process of developing guidelines specifically geared toward control of *Aedes aegypti* and *Aedes albopictus*. This will emphasize urban mosquito control and the paradigm shift in control

practices from floodwater/salt marsh mosquitoes (predictable habitats) to container-inhabiting mosquitoes (unpredictable and ubiquitous in the peridomestic environment). In addition, the unique man-power, resources, and funding needed for proactive urban control will be covered. AMCA hopes to have a finalized version available as early as possible in 2016/2017 timeframe.

States thought to be particularly susceptible to Zika introduction, such as Florida California, and Texas, have excellent integrated mosquito control programs in many areas, but emergency funds to respond to a Zika outbreak are needed if timely interventions to contain outbreaks in these districts and elsewhere are to be realized. Critically, many potential ports of entry throughout the U.S. have limited or no mosquito control available and there is a pressing need for funding to establish sustainable mosquito control programs in these areas.

Components of successful mosquito-borne disease control programs as currently practiced in the United States include, but are not limited, to the following:

Prevention

Surveillance - A sustained, consistent surveillance program targets the particular vector species, mapping their larval habitats by season, and documents the need for control through larval and adult trapping regimens. It thus also monitors the effectiveness of the control program. Appropriate and timely response to surveillance data is the key to preventing human disease associated with Zika. Control activity should then be intensified in response to evidence of virus in imported cases, as deemed necessary by the local statutory authority.

Public Information and Outreach – Studies have shown that information programs, while crucial to the overall prevention/control strategy, only exert a moderate effect on modifying population behaviors related to personal protective measures. Effective programs include development of a community task force, interventions to improve access to window screening materials or repellents, and social marketing to reinforce preventive behaviors. These are critical components of any mosquito control program, but cannot, in and of themselves, replace established prevention/control methodologies.

Source Reduction - Removing breeding habitat is the most effective long-term mosquito preventative/control and includes activities as simple as the proper disposal

of used tires, paint cans and trash, in addition to the cleaning of rain gutters and bird baths, by individual property owners.

Control

Reducing the contact between the vector mosquito and humans - This is accomplished through removing, modifying or treating larval habitats; modification or removal of adult mosquito resting areas, adulticide treatments when indicated, and use of repellents. All of these interventions can be problematic regrding control of *Aedes aegypti*.

Best Management Practices (BMP) - Most larger mosquito control districts in states having potential ports of entry, such as California, Texas and Florida, usually employ a phased response based upon mosquito trapping data. Such programs consist of public education emphasizing personal protection and residential source reduction; municipal larval control to prevent repopulation of the area with competent vectors; adult mosquito control to decrease the density of infected, adult mosquitoes in the area; and continued surveillance to monitor virus activity and efficacy of control measures.

How mosquito control can be improved

- Mosquito surveillance tools for adult *Aedes aegypti* are ineffective for small populations and need to be improved and made more widely available to marginally funded programs.
- Training in the use and interpretation of survey results should be made available to both program managers and public health officials as continuing education adjuncts.
- Additional training resources and comprehensive participation in workshops and professional mosquito control conferences are key components of program upgrades.
- Faster and more efficient communications between public health laboratories and vector control programs need to be explored and implemented. The speed with which the public health sector can respond to either imported or locally-acquired cases will ultimately depend on the turnaround time between testing of suspect cases, laboratory confirmation and promulgation of surveillance results. In addition, variable interpretations of the Health Insurance Portability and Accountability Act (HIPAA) may delay release of results, further restricting timely interventions by vector control agencies. Mechanisms need to be developed that require health departments at all levels to disclose to local vector

control agencies the location of suspect cases of Zika while not violating HIPAA provisions. This will ensure more timely and targeted initiation of intervention measures that will prevent or rapidly contain outbreaks.

- Materials and training regarding pesticide resistance testing should be implemented nationwide.
- Funds should be made available to underwrite new data call-ins that might influence a pesticide registrant's decision to keep products on the market
- New chemical, genetic, and biological control methodologies and means of dispersal should be developed and field validated.
- Conventional pesticides are losing ground to resistance. New tools are in development (spatial repellents, ATSB, lethal ovitraps, intracellular biological control (*Wolbachia*), RNAi, GMO mosquitoes, and new pesticide chemical classes require more field validation prior to widespread use.
- Rapid diagnostic tests for Zika and other arboviral agents need development and deployment to mosquito control entities to provide timely notification of infected mosquitoes prior to human cases.

The Role of Federal Government

The federal government has a crucial role to play in how vector control is accomplished. Several agencies either conduct (e.g., USDA and to a lesser degree CDC) research on applied vector control topics, or fund (NIH) projects (e.g., *Wolbachia*) into novel technologies, FEMA supports large-scale vector control in declared disasters (under Stafford Act stipulations).

In addition, the Centers for Disease Control and Prevention (CDC) Division of Vector-borne Disease provides national expertise in mosquito-borne disease prevention and control in concert with members of the AMCA. They have also served as an effective conduit via the Expanded Laboratory Capacity (ELC) program for funding that can increase arboviral testing capacities at both state and local levels. To this end, we encourage Congress to authorize supplemental funding for 2016 and increased funding in FY 2017 to support vector-borne disease surveillance. Funding should be allocated through the Centers for Disease Control and Prevention's (CDC's) Division of Vector-Borne Diseases for dispersal to localities most vulnerable to disease introduction while lacking the capabilities.

The Mosquito Abatement for Public Health Act (MASH), Public Law 108-75, was passed during the first session of the 108th Congress but has not received appropriations for its implementation. This Act is a mechanism by which local governments could receive matching federal funds up to $100,000 for the establishment and/or enhancement of a mosquito abatement program through the CDC. The MASH Act authorized $100,000,000 in funds for FY 2003, but, as of this hearing, Congress has still not appropriated any funds to cover its provisions. In addition, it requires NIEHS to conduct or support research into methods to control the population of insects and vermin that transmit dangerous diseases to humans. The AMCA fully supports the MASH Act and requests action to

appropriate the funds for its full implementation to bolster long-term vector surveillance and control.

The critical challenge for the nation's public health system will be modifying the behavior of the US population to eliminate oviposition sites for these species. Vector control agencies do not possess the resources to provide the sustained service for each resident in their jurisdiction that is required to successfully control invasive *Aedes*. To accomplish that end via source reduction will entail a national effort, along the lines of the "buckle up" seat belt, Smoky the Bear, and "don't be a litterbug" campaigns of the 1960s. A sustained national program will required continued funding into the foreseeable future if the benefits from reduced introduction and spread of exotic mosquito-borne diseases are to be realized.

We further see a federal government role in maintaining our present, proven chemical tools at risk of losing their registration. In 1996 Congress unanimously approved the Food Quality Protection Act (FQPA) (PL 104-170) to modernize the regulation of pesticides and expand data requirements to demonstrate their safety to people and the environment. A key element was authorization to use federal funds when the cost of new data for public health pesticides was more than their producers could afford, putting registration at risk. Unfortunately, these essential funds have never been appropriated, and we are now losing critical public health tools because the cost to prove their safety is higher than return on investment.

Conclusion

Vector-borne diseases, whether ancient like malaria or relatively new like Zika, are an unfortunate reality, and Zika won't be the last to challenge our vector-borne disease control capabilities. There are many factors that contribute to the emergence of novel vector-borne diseases, including poverty, climate change, and global trade. They will require long-term solutions.

Mosquito control capabilities in the United States are the finest in the world, but in many cases, fall short of providing the level of protection needed to prevent outbreaks of mosquito-borne disease in all potential ports of entry. Increased tourism and trade make continual introductions of exotic diseases inevitable and resources for sustainable prevention and control programs must be made available so that future imported cases of exotic diseases beyond Zika can be contained and eliminated before their establishment and spread. Our citizenry deserves no less.

Summary

- Capacities to address mosquito-borne diseases in the U.S. are better than in the past, but require significant improvement to successfully meet the mosquito-borne disease threats such as Zika Virus surely to come our way in the future.
- Increased capacity must include capabilities to address survey control strategies applicable to the widest possible variety of vector-borne disease transmission cycles.
- The unique bionomics of *Aedes aegypti* require better surveillance and prevention/control tools and strategies over the long-term.
- The Federal role should consist of exploring and implementing funding mechanisms devoted to increasing sustainable integrated vector surveillance and control capabilities in areas with organized mosquito control and to develop startup programs in areas of potential risk.
    - The MASH act proposes just that sort of thing – providing support for developing new vector control where lacking, and enhancing capacities where they exist but are inadequate.
    - Fully fund the Food Quality Protection Act provisions to use federal funds when the cost of new data for existing public health pesticides is more than their producers can afford, putting their registration at risk.

- Increase the CDC/DVBD annual budget to levels that allow funds to be allocated directly for testing of mosquito pools conducted at the local mosquito control program level or intrastate testing collaborative below the state level.