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CDC's Public Health Approach to Control of Disease-Carrying Mosquitoes

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Testimony of Roger Nasci, Ph.D.
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Before the
Subcommittee on Water Resources and the Environment, Committee on Transportation and Infrastructure United States House of Representatives
October 10, 2002

Good morning. I am Dr. Roger Nasci, Research Entomologist with the National Center for Infectious Diseases, at the Centers for Disease Control and Prevention (CDC). It is my privilege today to speak about the public health approach to control of disease-carrying mosquitoes, including those that transmit West Nile virus. I believe that public health agencies play a critical role in ensuring the health of all the people living in the United States.

Today, I will provide 1) an update on the spread of West Nile Virus (WNV) in the United States, 2) an overview of CDC's response to WNV, and 3) an explanation of how water management strategies, as a part of mosquito habitat source reduction, play a role in controlling mosquito-borne diseases.

Mosquito-borne illnesses in the United States were largely eliminated as a health risk in the middle of the last century, although mosquitoes that can transmit malaria, dengue, and yellow fever remain. Although Americans have not regarded mosquito-borne diseases as a major domestic threat for some time, the introduction and rapid spread of WNV has changed this. CDC has played an important leadership role in rebuilding the nation's capacity to monitor and diagnose mosquito-borne viral diseases through state and local public health partners around the country, but this year's events show that more work remains to be done. The more we strengthen our nation's front-line workers, whether in the field or in the laboratory, the better prepared we are to respond to new and emerging infections, such as WNV.

Spread of West Nile Virus in the United States

WNV is a mosquito-borne virus first recognized in the West Nile district of Uganda in 1937. Since then, it has been seen in Europe, the Middle East, Africa, and as far east as India. The virus lives in a natural cycle involving birds and mosquitoes, and only incidentally is transmitted to humans and other mammals, often in outbreak situations. A closely related virus, St. Louis encephalitis (SLE) virus, acts similarly in North America. Most humans who become infected with WNV through the bite of an infected mosquito will develop a mild illness or will not become sick at all. However, in a small fraction (<1%), encephalitis (inflammation of the brain) or meningitis (infection of the membranes surrounding the brain and spinal cord) will develop; approximately 10% of these patients will die. The elderly are recognized to be at higher risk than the rest of the population for the development of severe illness following WNV infection. It is likely that persons with compromised immune systems are also at higher risk.

The human and animal epidemic of WNV encephalitis, which began in the

northeastern United States in the summer and fall of 1999, underscored the ease with which emerging infectious pathogens can be introduced into new areas. The persistence of virus activity through 2002 indicates that WNV has become established in North America. This dramatic introduction and spread across the United States of a disease not previously seen in the Western Hemisphere reinforces the need to rebuild the public health system to prevent and respond to potential future introductions of other emerging infections.

WNV was recognized in the United States in late August 1999 when an alert infectious disease clinician at the Flushing Medical Center in Queens, New York, reported to the New York City Department of Health an unusual syndrome of fever and severe muscle weakness in several elderly patients. Eventually, 62 cases of human illness with WNV were recognized in the New York City area in 1999.

Laboratory studies of the virus demonstrated it was essentially identical to a WNV strain, which had been isolated from geese in Israel in 1998, and all viruses identified in New York were indistinguishable by molecular typing techniques, indicating the outbreak resulted from a single introduction into the York City area in 1999.

This year, as you know, WNV infection has continued to expand geographically. As of October 8, 2002, surveillance in humans, birds, mosquitoes, and horses has detected WNV activity in 43 states and Washington, DC. Among humans, 2,768 cases with laboratory evidence of recent WNV infection have been reported from 34 states and Washington DC. A total of 146 human deaths have been reported. Among the 2,369 patients for whom data are available, the median age was 56 years, with age ranging from 1 month to 99 years; and 1,282 patients were male. (*For West Nile Virus update and current case count refer to <http://www.cdc.gov/ncidod/dvbid/westnile/surv&controlCaseCount03_detailed.htm>)*

It should be noted that there are periodic outbreaks of other viral diseases from the same family of viruses, which are also transmitted by mosquitoes. For example, in 1990-1991 there were 221 cases of St. Louis encephalitis (SLE) illness in Florida, with 20 deaths, and in 2001, 70 cases and 3 deaths of SLE in Louisiana. Recently, CDC has reported on the transmission of WNV through organ donations, blood transfusions and breast milk. Even so, the vast majority of WNV infections are undoubtedly related to mosquito-borne transmission.

CDC's Response to West Nile Virus
After the outbreak of WNV in 1999, a West Nile Virus Interagency Working Group was formed to facilitate information sharing and coordination of activities among federal agencies with a role in monitoring and control. CDC leads the working group, which includes representatives from the Departments of Agriculture, Commerce, Defense, and Interior, the Environmental Protection Agency, and the National Institutes of Health (NIH), who continue to monitor for WNV activity and seek ways to prevent future outbreaks, including research by NIH into the development of diagnostics, an effective vaccine and effective antiviral treatments. The working group routinely assembles for telephone conference calls and has provided several briefings to keep Congress informed of ongoing activities. CDC has also conducted weekly conference calls with our state partners to assure coordination of national surveillance, share information and discuss response.

As with many emerging infectious disease problems, addressing the WNV outbreak requires a strong partnership between public health and veterinary agencies and the public. Effective systems need to be in place to ensure: 1) effective monitoring for WNV and other mosquito-borne diseases and 2) further development of prevention and control measures, including integrated pest management, public education, optimal mosquito control measures, vaccines and antiviral therapy. Further research on the basic biology of the virus and its natural ecology is also needed.

CDC has been the lead federal agency to respond to the WNV outbreak in humans. Since fiscal year 2000, DHHS and CDC have provided more than $58 million to state

or local health departments to develop or enhance epidemiologic and laboratory capacity for WNV and other mosquito-borne diseases. In fiscal year 2002, approximately $35 million has been awarded to those public health agencies to address the continued spread of the virus.

CDC has also provided extramural funding to other federal agencies for related WNV surveillance and diagnostic activities in support of the states. A university-based cooperative agreement was initiated in fiscal year 2001 to support research on WNV pathogenesis and improved laboratory diagnosis, ecology, and prevention and control. And, in fiscal year 2002, CDC awarded funding to three universities to initiate programs to train scientists in vector-borne infectious diseases. Finally, CDC has undertaken an aggressive intramural research program in several scientific areas to address the long-term needs related to epidemic WNV.

Public education is another essential component of a comprehensive disease control strategy. Among the recommended prevention measures to reduce the risk of exposure to WNV are 1) eliminating any areas of standing water around the house, i.e., draining standing pools, cleaning gutters, and emptying bird baths; 2) minimizing outdoor activities at dawn, dusk, and in the early evening; 3) wearing long-sleeved shirts and pants when outdoors; and 4) applying insect repellent according to package directions to exposed skin and clothing.

Water Management and Mosquito Control

Control and prevention of West Nile Virus and related diseases require establishing and maintaining comprehensive, integrated mosquito management programs at the local level. Integrated management programs include surveillance for potential mosquito vectors and developing control strategies for those mosquito species. Several types of surveillance activities are required including identification of mosquito sources, the viruses carried by mosquitoes, and illnesses among animals (e.g., birds and horses) and people. A variety of techniques to reduce mosquito populations must also be considered.

One approach to controlling mosquito populations is source reduction – the removal or modification of mosquito production habitats. This is frequently accomplished through Rotational Impoundment Management or Open Marsh Water Management practices designed to modify drainage patterns to limit mosquito production, or by simply removing mosquito habitats where possible. When effective, these practices limit the use of pesticides needed to control larval or adult mosquitoes.

CDC supports the Federal Clean Water Act- related efforts to improve the quality of the nation's clean water supply by developing diversion and retention structures to remove pollutant load in storm water runoff. At the same time, CDC recognizes that the creation of these structures inadvertently increase mosquito populations of important West Nile virus vectors near communities. Prior experience indicates that over time, if not properly designed and maintained, these structures become choked with aquatic vegetation, clogged with debris, or simply malfunction, and mosquito populations increase. Obviously, the inadvertent creation of new mosquito habitat is contrary to Integrated Pest Management principles.

CDC believes that comprehensive integrated mosquito management must evaluate the threat posed by mosquito populations for all sources, including water diversion and retention ponds. Mosquito control should be considered in the design, construction and maintenance of those structures, as appropriate. Stormwater retention structures should be designed in consultation with experts in mosquito biology and control to prevent as much mosquito production as possible, and to facilitate proper functioning and maintenance in the future. CDC believes that regulations associated with stormwater retention and flood control structures should incorporate appropriate operations and maintenance provisions including considerations for routine monitoring and control of mosquito populations.

Source management practices applied to these structures may not always adequately control mosquito populations. At times additional mosquito larval control measures

will be urgently needed. It is important that Clean Water Act regulations and interpretations consider needed mosquito control activities. Public health emergencies may require integrated management practices beyond source reduction for control of mosquito larvae. Introduction of mosquito-eating fish, or biological, or chemical larval control measures may need to be applied. At such times, it will be important to evaluate barriers that inhibit needed public health interventions.

Conclusion

In conclusion, addressing the threat of emerging infectious diseases such as WNV depends on a revitalized public health system and sustained and coordinated efforts of many individuals and organizations. Preventing WNV is dependent upon establishing and maintaining effective integrated pest management control systems. As CDC carries out its plans to strengthen the nation's public health infrastructure, we will collaborate with state and local health departments, academic centers and other federal agencies, health care providers and health care networks, international organizations, and other partners. We have made substantial progress to date in enhancing the nation's capability to detect and respond to an infectious disease outbreak; however, the emergence of WNV in the United States has reminded us yet again that we must not become complacent. We must continue to strengthen the public health systems and improve linkages with health care providers and colleagues in veterinary medicine and public health. Priorities include strengthened public health laboratory capacity; increased surveillance and outbreak investigation capacity; education and training for clinical and public health professionals at the federal, state, and local levels; and communication of health information and prevention strategies to the public. A strong and flexible public health infrastructure is the best defense against any disease outbreak.

Thank you very much for your attention. I will be happy to answer your questions.

For more information about this topic contact:
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