

# COMPREHENSIVE MOSQUITO SURVEILLANCE AND CONTROL PLAN

## 2008



The City of New York  
DEPARTMENT OF HEALTH AND  
MENTAL HYGIENE

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# New York City Department of Health and Mental Hygiene

## Comprehensive Mosquito Surveillance and Control Plan 2008

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## **EXECUTIVE SUMMARY**

In 1999, New York City experienced an unprecedented outbreak of encephalitis caused by West Nile (WN) virus, a mosquito-borne virus never before detected in the Western Hemisphere. That year, 59 cases of neuroinvasive disease (encephalitis, aseptic meningitis or acute flaccid paralysis) due to WN virus occurred in the New York City metropolitan region. Since 1999, WN virus has reappeared in New York City each year during the adult mosquito season. A total of 159 human cases of WN neuroinvasive disease, including 23 deaths, have occurred among New York City residents from 1999-2007. Human cases of WN fever have also been reported (n=21), although the estimated number of undetected or unreported WN fever cases is much higher over the same time period. Over the past seven mosquito seasons, WN virus has established itself in most of the continental United States, emerging as a major public health problem, and causing large outbreaks of neuroinvasive disease since 2002. Last year WN virus was responsible for 3,623 human cases, including 124 deaths nationwide.

The Department of Health and Mental Hygiene (DOHMH) routinely analyzes surveillance and control data from previous years in order to better prepare for the upcoming mosquito-breeding season. To ensure a coordinated approach in managing mosquito-borne disease outbreaks in the City, DOHMH has worked closely with the New York State Departments of Health (NYSDOH) and Environmental Conservation (NYSDEC), the U. S. Centers for Disease Control and Prevention (CDC), and other State and Federal and local agencies such as the Mayor's Offices of Operations and Environmental Coordination, the New York City Office of Emergency Management, Departments of Environmental Protection, Parks and Recreation, Sanitation, Police, Citywide Administrative Services, Information Technology and Telecommunications and the New York City Housing Authority.

Key to DOHMH's planning efforts is a primary emphasis on prevention. DOHMH devotes considerable resources to a citywide effort to prevent mosquito breeding, while enhancing existing disease surveillance, and public and medical provider education activities. The goal of this plan is to prevent disease caused by mosquitoes through aggressive source reduction and larviciding. Should surveillance findings indicate that a substantial risk exists for WN virus transmission to humans, adult mosquito control is considered.

Surveillance data collected from 1999-2007 demonstrate that WN virus can be detected in mosquitoes weeks before there is a significant risk to human health. Therefore, routine surveillance of mosquito populations provide the City the opportunity to specifically target those neighborhoods and communities where virus is reappearing. The goal of early detection is to enhance mosquito control in high-risk areas in an attempt to interrupt the amplification of the virus before it has a significant impact on human health.

Although mosquitoes are most active in New York City from May through October, our

strong mosquito prevention, surveillance, and control efforts are year-round activities. The current Comprehensive Mosquito Surveillance and Control Plan is designed to minimize the impact of mosquito-borne diseases through citywide surveillance measures and an integrated approach to mosquito management with control practices that are commensurate with the risk posed by these diseases. The comprehensive nature of the plan ensures the efficacy of the control measures while minimizing adverse impacts to the environment and human health from these measures. The plan includes the following components:

### **Public Education and Community Outreach**

Through the media, advertising, presentations to community groups, collaboration with community boards and elected officials, and weekly posting of neighborhood level surveillance data and maps on the Department's website, the Office of Communications will increase public awareness of mosquito-borne disease risk, surveillance, prevention and control. If surveillance data indicate an increased human disease risk that requires the application of pesticides to control adult mosquitoes, accurate and timely information of these mosquito control activities will be provided. Communications will provide the public with application schedules, the type of pesticides being used and how to reduce exposure. Additionally, the public will be informed about what to do in the event of pesticide exposure.

### **Host Surveillance**

Because of the limited value of dead birds as an early warning system for West Nile Virus, DOHMH will discontinue surveillance for dead birds in 2008. Bird does not appear to be as sensitive indicator of West Nile virus activity as mosquitoes; therefore, reports of dead birds will not be solicited by the DOHMH in the future. DOHMH's Office of Vector Surveillance and Control (OVSC) in collaboration with the Office of Veterinary and Public Health Services (VPHS) will continue monitoring disease among pet birds and other domestic animals, particularly horses. Broadcast alerts will be sent at the beginning of the season to all veterinarians in New York City. Veterinarians will be requested to report any suspicious animal cases with neurological abnormalities to DOHMH. All animals with neurological symptoms will be tested for rabies before being tested for WN virus.

### **Human Surveillance and Provider Education**

A system for detecting mosquito-borne diseases among humans will include passive surveillance for suspected cases of viral encephalitis and aseptic meningitis in hospitals and laboratories. Broadcast alerts will be sent at the beginning of the season and periodically throughout the season to all hospitals in New York City. Health care providers play a critical role in the detection, prevention and clinical management of mosquito-borne diseases. The Communicable Disease Program will continue its efforts to educate New York City health care providers regarding diseases transmitted by mosquitoes, especially WN virus, and encourage reporting and testing of patients with encephalitis, aseptic meningitis, fever syndromes compatible with WN fever, and other diseases possibly caused by arboviral infection. The DOHMH Public Health Laboratory

(PHL) will test blood and cerebrospinal fluid samples submitted by health care providers for WN virus upon request. The PHL also will forward samples from hospitalized patients with encephalitis to the New York State Department of Health for additional testing for other arboviruses.

### **Mosquito Surveillance**

DOHMH's Office of Vector Surveillance and Control will monitor mosquitoes citywide by collecting larval and adult mosquitoes to determine the distribution, density and species. DOHMH will continue to test adult mosquitoes collected in New York City for WN virus at its own laboratories. With testing taking place locally, the time required to receive results showed significant reduction in the last five years. This has allowed for increased public education, more focused mosquito breeding reduction activities as well as more targeted control of larval and mosquitoes in area with increased viral activity.

### **Larval Mosquito Control**

DOHMH will reduce mosquito breeding through the aggressive elimination of standing water and the application of larvicide to sites that cannot be emptied or drained. Through a public information campaign, DOHMH will urge residents to reduce breeding sites around their homes and commercial properties and to report potential mosquito-breeding sites. DOHMH will collaborate with elected officials, other City agencies and large property owners to eliminate standing water in empty lots, tire piles and other containers. DOHMH will also aggressively enforce the health code that requires elimination of standing water from properties throughout the City. These activities will be augmented with the application of larvicide to potential breeding sites where water cannot be eliminated, including catch basins citywide. Whenever WN virus is detected in an area, DOHMH will increase public education, breeding site reduction and larviciding.

### **Adult Mosquito Control**

A timely and appropriate response to mosquito, bird, mammal and human surveillance findings is key to preventing an outbreak of human disease. DOHMH will implement a phased response to surveillance findings that will expand education, prevention and control activities in relation to the threat of an outbreak of human disease. If surveillance indicators suggest that the level of WN virus activity poses a significant threat to human health, adult mosquitoes will be controlled through the use of adulticides. Mosquito density and distribution, mosquito species, persistence of WN virus activity, weather, time of year, and the proximity to human populations will be carefully considered in determining the necessity for adult mosquito control. The accuracy, quality and efficacy of the adulticide application will be closely monitored to ensure compliance with Federal and State guidelines. If application of adulticides becomes necessary, DOHMH will provide advance notice to the public and to health care providers.

### **Surveillance of Potential Adverse Health Effects from Pesticide Exposure**

In 2001, DOHMH completed a comprehensive environmental impact study on the pesticides used for adult mosquito control. The study concluded that at the relatively low

levels at which adulticides are applied, the occurrence of adverse public health effects to the population from applying pesticides to reduce the adult mosquito population would not be considered significant when compared to the potential risk to the public health from West Nile virus or other mosquito-borne illness. However, health care professionals are informed and reminded throughout the mosquito season about potential health effects of pesticide exposure and the need to report pesticide-related illness to DOHMH and NYSDOH. DOHMH will monitor the adverse health effects associated with the application of pesticides for adult mosquito control.

### **Research and Evaluation**

DOHMH will conduct research to better understand where mosquito breeding occurs in New York City and how WN virus and other mosquito-borne viruses are maintained in our environment. Furthermore, DOHMH will continue to evaluate more specific bird, mammal and mosquito surveillance indicators that signal a threat to human health and to assess the efficacy of larval and adult mosquito control.

## INTRODUCTION

In late August 1999, the New York City Department of Health and Mental Hygiene (DOHMH) detected an unusual cluster of encephalitis cases in northern Queens. This was due to West Nile (WN) virus, a mosquito-borne virus that had not been recognized in the Western Hemisphere prior to 1999. In 1999, the outbreak resulted in 44 hospitalized cases among City residents, including 4 fatalities.

Since its introduction to New York City in 1999, WN virus has caused successive outbreaks in the United States each summer and fall, and has moved steadily westward. In 2003, WN virus caused the largest outbreak of meningoencephalitis ever recorded in the Western Hemisphere, with 9,862 cases reported overall, including 264 deaths. In New York City, the virus has also persisted and has become endemic, causing at least 159 neuroinvasive cases and 23 deaths. From 2000-2007, the number of neuroinvasive cases due to WN virus among New York City residents has ranged from 2 to 30 (median 13) per year.

In 2007, 13 cases of WN neuroinvasive disease and five cases of WN fever were detected among New York City residents, all of which were possibly or probably acquired in New York City.

There were 3,623 human cases and 124 human deaths reported in the United States in 2007, and extensive WN activity detected in the mid-West and West of the country. Please see the CDC homepage at <http://www.cdc.gov/ncidod/dvbid/westnile/index.htm> for more information.

Since 2003, universal screening of donated blood products has been conducted in New York City by the New York Blood Center, and 8 presumptively infected donors have been identified in New York City from 2003-2007. All implicated blood products were retrieved and removed from the blood supply.

The considerable and rapid spread of the virus throughout the country from 2002-2007 provides ample evidence that WN virus is permanently established in New York City and in the United States. With this establishment of WN virus throughout the City and the region having a routine, year-round Integrated Mosquito Management (IMM) program has become a necessity.

There are three probable mechanisms for WN virus overwintering within the City. The principle enzootic vector, *Culex pipiens*, overwinters in the adult stage; and it is believed that, at least, some infected mosquitoes successfully survive the winter. Alternatively, infected birds that remain in the area may harbor the virus throughout the winter months. As spring returns, the virus recrudesces within the birds and is readily passed to early season mosquitoes. A third mechanism is reintroduction of the virus into the area during the spring or early summer by infected migratory birds. Hence, a number of infected mosquitoes and/or birds are present within the City during the early spring months. At this time, the virus resumes its amplification cycle. As mosquitoes feed on birds, the virus is transmitted back and forth between the vector and the reservoir host populations

allowing an increasing number of birds and mosquitoes to become infected. If environmental conditions are optimum for transmission, the virus amplifies to a theoretical point of “spill over”. At this point in the amplification cycle, the virus bridges out of the enzootic, bird-mosquito cycle via bridge vectors. Bridge vectors are mosquito species that readily feed on humans and other mammals. It is at this point in the season, that transmission to humans occurs and when management actions are most critical.

An effective surveillance and control program should be able to detect virus during the amplification cycle prior to bridge vector involvement allowing for targeted, effective control of the mosquito population that are limited in scope. With WN virus, the presence of dead American crows, *Corvus brachyrhynchos*, has been the most sensitive indicator of viral activity in past years, though less so in recent years. Typically, infected mosquitoes signal the presence of local WN virus activity, and occur a month or more prior to human transmission. Eventually, proper surveillance will detect viral presence in the bridge vectors and finally in humans and other mammalian hosts. The goal of DOHMH’s vector surveillance program is to detect the virus in local mosquito populations before sufficient amplification of the virus can occur, so that management practices can be implemented thereby reducing the number of infected mosquitoes and simultaneously reducing the risk of human transmission.

DOHMH extends its gratitude to the following collaborators with whom it has worked closely to develop a plan that meets the specific needs of New York City: the U.S. Centers for Disease Control and Prevention (CDC); the New York State Departments of Health (NYSDOH), Environmental Conservation (NYSDEC) and Agriculture and Markets; and New York City agencies, including the Mayor’s Offices of Operations, New York City Office of Emergency Management and the Departments of Environmental Protection, Parks and Recreation, Sanitation, Police, Citywide Administrative Services, Information Technology and Telecommunications and the Housing Authority; along with other partners.

## **PUBLIC EDUCATION & COMMUNITY OUTREACH**

### **Objective**

To increase public awareness of mosquito-borne diseases and surveillance, prevention and control techniques and activities.

### **Background**

Each year, DOHMH launched a public education campaign to increase awareness of WN virus. This campaign highlighted the need for New Yorkers to take personal protective measures against mosquito bites and to eliminate mosquito breeding sites around their homes. This message was aired on television and radio and published in newspapers and magazines. DOHMH developed 22 fact sheets and made information available in 12 languages to community boards, elected officials, schools, community-based organizations, and the general public. In subsequent years, DOHMH staff has made hundreds of presentations to various community gatherings.

DOHMH promotes WN virus prevention strategies and community participation through a number of venues. In 2007, the Offices of Vector Surveillance and Control and Community Relations conducted targeted, grassroots educational outreach to senior citizens. Approximately 5,000 cans of DEET were successfully distributed to seniors this year, along with public education materials. Educators conducted 75 presentations (65 in English, and 10 in languages other than English) to senior citizens throughout the City. The Health Media and Marketing Office updated the multi-faceted informational materials for print and radio to promote personal protective measures and elimination of standing water. The Press Office made spray notifications and personal precaution announcements through the media. Materials were made widely available in hard copy and electronic form (through email and the Agency's website), in multiple languages. Information was also made available through 311 - the City's non-emergency information line.

In 2008, DOHMH will take standing water reports via the New York City's Citizen Service Center (311) and DOHMH's enhanced Web site ([nyc.gov/health](http://nyc.gov/health)). Callers can receive comprehensive information about WN virus, including updated information about adulticiding schedules by dialing 311. The Citizen Service Center provides callers with a live operator 24 hours a day, 7 days a week. DOHMH also provides information on WN virus through its web site ([nyc.gov/health/wnv](http://nyc.gov/health/wnv)) in the form of fact sheets, press releases, adulticiding schedules, and maps. This information is regularly faxed to City agencies, elected officials, community boards, the Department of Education, hospitals, nursing homes, and associations of green grocers, day camps, and community organizations. DOHMH will work with the Department for the Aging (DFTA) for distribution of West Nile virus literature and insect repellents to the senior citizens at social gatherings and formal meetings.

Adulticiding information is made available through DOHMH's web site and 311, regular

news broadcasts, scheduled advertising times on local radio, print media, and web sites of news organizations.

### **Planned Activities**

The following key messages will be communicated:

- The public will be informed about the City's comprehensive preventive strategies and activities (community education, surveillance, source reduction, larviciding, etc.) to address the threat of WN virus and to minimize the necessity of pesticide application for adult mosquito control.
- The public will be asked to help eliminate mosquito-breeding sites and to report standing water using the Citizen Service Center (311) and via DOHMH's enhanced Web site ([nyc.gov/health](http://nyc.gov/health)). The public will be advised to eliminate standing water sites (tires, buckets, and other water-holding objects) where mosquitoes can breed from their property. They will also be urged to change the water in bird baths once each week; to clean and chlorinate swimming pools or drain and cover if not in use; to prevent water from accumulating in pool covers; and to unclog gutters and down spouts.
- The Office of Communications will increase public awareness of the nature of mosquito-borne diseases and the signs and symptoms of WN virus infections (headache, high fever, muscle pain, weakness and disorientation).
- The public will be informed about the proper personal protective measures to avoid mosquito bites such as ensuring that screens fit tightly on doors and windows, wearing protective clothing (long pants, long-sleeved shirts, and socks) and appropriate use of insect repellents.
- Maps and tables showing recent WN virus activity by zip code will be posted on the NYCDOHMH website in order to provide the public with up to date information on where WN virus is present in the City. This information will be posted when the first WN virus activity is detected, and updated on a weekly basis until WN virus activity has ceased.

If the application of pesticides to control adult mosquitoes becomes necessary, the public will be informed in a timely manner to reduce direct exposure to pesticides. The public will also be given detailed information about the pesticides being used and the potential risks associated with exposure. The public will be encouraged to contact the Poison Control Hotline (212-POISONS/764-7667 or 1-800-222-1222) with any suspected pesticide-related illness or exposure.

- Fact sheets in several languages will be distributed to community-based organizations, community boards, elected officials, schools, elder care facilities, libraries, outdoor activity sites, and many other organizations City-wide.

- The Citizen Service Center (311) will be updated regularly with information pertaining to DOHMH pesticide spraying activities. Beginning in April, operators will be available 24 hours a day, 7 days a week for WN virus related inquiries and reports.
- DOHMH's web site ([nyc.gov/health](http://nyc.gov/health)) will be regularly updated and, beginning in April, the public can use web-based forms for reporting standing water.
- Regular updates will be made to elected officials and community boards, who are essential to the City's communication activities about WN virus activity. Presentations, available in multiple languages, will be offered by DOHMH staff to community boards and a wide variety of organizations. These will include information about mosquito breeding site reduction and related DOHMH activities.
- Press releases regarding all activities will be issued regularly and DOHMH will work closely with media to achieve accuracy of the WN virus coverage.
- In the event adulticiding is necessary:
  - Information will be released at least 24 hours in advance through the media, DOHMH web site and Citizen Service Center (311), and to hospital emergency departments, pertinent City agencies, elected officials, community boards, the Department of Education, nursing homes, associations of green grocers, day camps, and community organizations. Under certain conditions and with the approval of the NYSDOH, applications in green areas may take place with less than the required 24 hour notice. For these cases, the green area will be closed to the public during and a few hours after the application of adulticide.
  - Police Department escorts will accompany the applicator's trucks to announce that adulticiding is about to take place, and will urge people to go indoors to reduce exposure to pesticides.

## **HOST SURVEILLANCE**

### **Objective**

To monitor mammal and bird populations as a means of early detection of potential arthropod-borne diseases in the City

### **Background**

Arthropod-borne viruses (arboviruses) cause diseases such as WN virus infection, Eastern Equine encephalitis (EEE), St. Louis encephalitis (SLE), La Crosse (LAC) encephalitis and Powassan (POW) encephalitis. These viruses are maintained in nature in a cycle of transmission between an animal host (the reservoir) and the mosquito or tick. All of these viruses can cause human infections and have been responsible for epidemics over the past several decades. These viruses have their own specific ecologic and epidemiologic characteristics, and each has exhibited a tendency to extend geographic range and become established in new areas, which is of growing concern.

Among arboviruses, WN virus is currently endemic in New York City. Many species of birds have tested positive for WN virus, however crows and blue jays continue to be the birds most susceptible to this disease. Their local populations have significantly declined as a result of WN virus epizootics in the last nine years. Other potential WN virus reservoir host birds in New York City are grackles, house sparrows, and American robins. Of the 416 dead birds submitted by DOHMH and other organizations to NYSDEC, NYSDOH and the Wildlife Conservation Society for testing, 30 (7.21%) birds tested positive in 2007. Among the positive birds, 23% were house sparrows, 20% American crows, 13% Blue Jays, 10% American robins, 7% common Grackle, and 20% all other bird species.

There will be no dead and (sentinel) live bird surveillance conducted by the DOHMH in 2008 as they have limited use as an early warning system for human disease. Also, mammals do not appear to be sensitive to WN virus; therefore, reports of dead animals will also not be solicited by the DOHMH in 2008. In 2001, 2002, and 2005-2007 no mammals tested positive for WN virus in New York City. In 2003, one non-equine mammal and in 2004, one horse and one non-equine mammal tested positive for WN virus in New York City though it has not been concluded whether WN virus was responsible for the animal's death. DOHMH's animal surveillance efforts have been assisted by a number of partner organizations, including the New York City Department of Parks and Recreation, the New York State Department of Agriculture and Markets, the Animal Medical Center, the Staten Island Zoo, and the Wildlife Conservation Society.

DOHMH will continue to ask veterinarians and other animal specialists to monitor for unusual illness and death among birds and mammals. The DOHMH will also continue to work with and receive animal test results for WN virus (and other arboviruses) from the New York City Wild Life Society. This data may be used in setting up supplemental mosquito traps in the areas from where infected mammals and/or dead birds are recently

found.

### **Planned Activities**

- At the onset of WN virus season, DOHMH will alert veterinarians to be vigilant for neurologic illness in vertebrates and to consider the possibility of an arbovirus as an etiology. WN and other arboviral infections are reportable diseases in animals, and any laboratory or veterinarian is required to report confirmed cases in New York City animals to DOHMH.

## HUMAN SURVEILLANCE AND PROVIDER EDUCATION

### Objective

To quickly detect human illness due to mosquito-borne diseases, especially WN virus.

### Background

During 1999-2007, 159 New York City residents developed neuroinvasive disease due to WN virus. Among these cases, 23 died as a result of West Nile infection. Most of the neuroinvasive cases have occurred in older New Yorkers (median: 69 years; range 1-93). 21 cases of WN fever were also detected during this time period. The table below summarizes WN virus disease by borough.

West Nile Viral Disease, NYC, 1999-2007, by Borough

	<b>Bronx</b>	<b>Brooklyn</b>	<b>Manhattan</b>	<b>Queens</b>	<b>Staten Island</b>
<b>1999</b>	9	3	1	34	0
<b>2000</b>	0	2	1	1	10
<b>2001</b>	0	2	3	2	2
<b>2002</b>	8	2	1	13	5
<b>2003*</b>	6	8	2	11	3
<b>2004</b>	0	0	3	1	1
<b>2005</b>	3	3	1	5	2
<b>2006</b>	1	0	1	2	8
<b>2007*</b>	1	7	1	7	1
<b>Total</b>	<b>28</b>	<b>27</b>	<b>14</b>	<b>76</b>	<b>32</b>

\*Table excludes one 2003 case who was homeless and spent time in Manhattan and Queens, and a 2007 case that had unknown borough of residence

In 2007, 13 New York City residents had WN neuroinvasive disease. There were also five cases of WN fever detected in the City in 2007. All but one of the NYC cases of WN viral disease possibly or probably became infected locally.

The table below summarizes morbidity and mortality due to WN virus in New York City from 1999-2007:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Summary
<b>Cases</b>	47	14	9	29	32	5	14	12	18	<b>180</b>
<b>Syndrome</b>										
Neuroinvasive	45	14	7	28	31	2	11	8	13	<b>159</b>
WN Fever	2	0	2	1	1	3	3	4	5	<b>21</b>
<b>Median age* (yrs) (Range)</b>	71 (5-90)	62 (36-87)	51 (44-75)	72 (22-86)	67 (8-93)	34 (1-66)	61 (27-84)	65 (44-80)	75 (41-90)	<b>69 (1-93)</b>
<b># Deaths</b>	4	1	1	3	7	0	2	2	3	<b>23</b>
Median age (yrs)	80	87	51	75	72		56	57	79	<b>74</b>
Case fatality rate*	9%	7%	14%	11%	23%		18%	25%	23%	<b>14%</b>

\* Median age and case fatality rate calculated for neuroinvasive cases only

Serosurveys performed in Queens (1999) and Staten Island (2000) provided an estimate of the proportion of WN viral infections that are asymptomatic or subclinical. Accordingly, an estimated 140 subclinical WN virus infections, including 30 cases of WN fever, probably occur for every one hospitalized case. Therefore, approximately 17,490 asymptomatic infections and 4,770 cases of WN fever have likely occurred among New York City residents from 1999-2007. The vast majority of asymptomatic infections and WN fever cases go undetected and unreported in New York City, since many individuals with febrile illness may not seek medical attention and may not be tested for WN virus even if they do see a provider. Commercial testing is now available for WN virus, but many New York City providers still rely upon free testing for WN virus at the Public Health Laboratory.

As part of a surveillance and provider education program, DOHMH's Bureau of Communicable Disease offers slide presentations to health care providers. Broadcast alerts are issued via the Health Alert Network (broadcast e-mail) to all NYC hospitals, encouraging prompt reporting of suspected cases of encephalitis, aseptic meningitis and acute flaccid paralysis from July through October. Providers and laboratory personnel are also instructed on how to submit specimens for WN virus testing to the DOHMH Public Health Laboratory or the NY State Department of Health (NYSDOH) Wadsworth Laboratory through these same outreach methods.

Prior to 2006, DOHMH actively facilitated the transportation of specimens to the DOHMH Public Health Laboratory for rapid WN virus testing for all cases meeting certain criteria. Beginning in 2006, providers were encouraged to request WN testing for appropriate patients through commercial laboratories, or to arrange for shipment of specimens to the DOHMH Public Health Laboratory themselves. Under special circumstances specimen transportation and testing can be arranged by DOHMH (e.g. high suspicion for WN virus, possible transfusion or transplantation related cases, or unusual clustering of cases suggestive of an outbreak of WN virus or another cause of encephalitis).

Serologic testing for WN virus is performed at the DOHMH Public Health Laboratory (PHL). The laboratory performs tests for antibodies to WN virus. If physicians request

antibody testing for other arboviruses, such as dengue, Eastern equine encephalitis and/or St. Louis encephalitis (SLE) viruses, specimens are referred to the NYSDOH Wadsworth Laboratory or the Centers for Disease Control and Prevention (CDC) for testing. Serologic specimens which test positive for WN virus at PHL are sent for confirmation by plaque reduction neutralization testing to NYSDOH if appropriate. Cerebrospinal fluid specimens from hospitalized patients with encephalitis are also forwarded to the NYSDOH for testing by polymerase chain reaction for a panel of viruses that cause human encephalitis, if requested by the treating physician.

### **Planned Activities**

- Beginning in late June, DOHMH will remind providers to report all suspected cases of WN virus neuroinvasive disease (encephalitis, aseptic meningitis or acute flaccid paralysis), and to test all hospitalized patients, either at commercial laboratories or at the PHL, for WN virus.
- From July through October, regular broadcast updates will be sent to all City hospitals and infectious disease specialists regarding the importance of reporting suspected WN virus cases. DOHMH will provide the criteria for reporting and submission of appropriate laboratory specimens for WN virus testing.
- DOHMH will encourage providers to test appropriate suspect cases through commercial laboratories. However, the DOHMH Public Health Laboratory will continue to conduct diagnostic testing for WN virus and forward specimens for testing for other mosquito-borne viral causes of encephalitis to NYSDOH, as needed.
- DOHMH will work closely with NYSDOH and CDC to ensure that surveillance information is standardized and remains confidential.
- DOHMH will conduct health care provider education to increase knowledge about the proper detection, prevention and clinical management of mosquito-borne diseases and other types of encephalitis and meningitis. Presentations will be made at local hospitals and to specialty societies as requested. Also, DOHMH will provide educational opportunities on mosquito-borne diseases through its Continuing Medical Education and Continuing Nursing Education programs.
- The Bureau of Communicable Disease will work with other agencies to ensure that any case of West Nile infection in a person who has received or donated blood products or organs is rapidly investigated and reported so that other affected blood products or organs can be promptly identified and withdrawn before they are used.

## **MOSQUITO SURVEILLANCE**

### **Objective**

To monitor the seasonality, population dynamics and abundance of mosquito populations and detect the presence of arboviruses

### **Background**

Mosquitoes were collected weekly from mosquito traps over 72 permanent locations throughout New York City in 2007. In addition, 166 (supplementary) mosquito traps were placed at 83 locations throughout the City to enhance virus surveillance in the areas where WNV activity had been identified in mosquitoes, birds, and humans, and to study the efficacy of adulticiding in the treated areas. In 2007, a total of 117,658 adult mosquitoes were identified to species levels, of which 72,339 belonged to twenty-three species that were tested for the presence of West Nile virus infection. Six mosquito species, *Culex pipiens*, *Cx. restuans*, and *Cx. salinarius*, *Coquilettidia perturbans*, *Aedes vexans* and *Ochlerotatus trivittatus* were found infected with WN virus. Of the 5,516 mosquito pools tested, 174 tested positive for WN virus: 5 in Manhattan; 5 in Brooklyn; 32 in Staten Island; 36 in the Bronx; and 96 in Queens. *Cx. pipiens* was identified as the primary enzootic vector of WN virus from 1999-2007 based upon the number of positive pools. In fall and winter 2007, hibernating *Culex* females were collected from indoor resting sites and were kept at 24-25 °C with 14:10 (L:D) photoperiod for 20-30 days and later tested for the presence of WN virus. No WN virus was detected in these overwintering mosquitoes.

The risk of mosquito-borne disease depends on both the number of mosquitoes capable of transmitting the virus and the prevalence of the virus among these mosquitoes. Proper surveillance data on larval and adult mosquitoes is important for guiding appropriate prevention and control activities. Larval surveillance can provide information on expected adult mosquito density and can indicate areas where efforts to eliminate mosquitoes at their source (breeding sites) should be targeted. Adult mosquito surveillance and viral testing provide early predictive information about the potential for a disease outbreak.

### **Planned Activities**

- DOHMH will continue to work closely with other City agencies to collect and map information on potential mosquito-breeding habitats.
- DOHMH will determine which areas should be regularly inspected for the presence of larvae. These sites will be subjected to routine inspection to determine the presence of mosquito larvae.
- Larval habitat information will be collected and updated throughout the season.

- In the urban areas, mosquito trapping will be conducted from sewer and adjacent buildings by using light traps in response to resident complaints.
- From June to October, DOHMH will trap adult mosquitoes at more than 50 permanent sites throughout the 5 boroughs. The trapping season may be lengthened or shortened depending on the weather.
- Mosquitoes will be collected using DOHMH miniature light and gravid traps on a weekly basis. Each trap collection will be sorted by species of mosquitoes collected. Information on the location, collection data, trap type and the total number of female mosquitoes will be recorded.
- Extra trapping will be conducted to collect day biting mosquitoes using omnidirectional Fay Prince traps and mosquito magnets.
- Adult mosquito trapping will be expanded in areas where WN virus is detected in mosquitoes, birds, other animals, and humans. This will help determine extent of viral activity and delineate spray zones.
- In the event that pesticides are applied for adult mosquito control, DOHMH will set traps more frequently to evaluate the efficacy of the control measures.
- The DEP will continue to use mosquito magnet traps to survey and control adult mosquitoes at wastewater treatment plants. Additionally, DOHMH will place mosquito magnet traps to survey and control adult mosquitoes in the Rockaways Peninsula.

## **LARVAL MOSQUITO CONTROL**

### **Objective**

To reduce the abundance of adult mosquitoes through the use of Integrated Mosquito Management (IMM) practices

### **Background**

*Culex pipiens*, a primary vector of WN virus and one of the most common mosquitoes found in urban areas, breed quickly and use standing or slow-moving water containing decaying organic materials to lay their eggs. Prime breeding sites include discarded tires left outdoors, poorly maintained bird baths, clogged rain gutters, unused swimming and plastic wading pools, pots and pans with standing water, and puddles that last for a week or more. Eliminating breeding sites is the simplest and most effective way to reduce the number of mosquitoes. Every residential and commercial property owner should regularly inspect their property and buildings to determine if conditions are conducive to mosquito breeding and endeavor to eliminate those conditions. Mosquito breeding can be prevented by either eliminating the standing water (source reduction), or if that is not possible, treating the water with larvicide to prevent mosquitoes from developing.

DOHMH's public education campaign emphasizes the need for New Yorkers to eliminate mosquito-breeding sites around their homes. From April to October 2007, DOHMH received 4,896 complaints of standing water through the City's Citizen Service Center Information Line (311), on DOHMH's web site, and from elected officials and community groups. The NYC DOHMH investigated each of the complaints. Every report led to a letter being sent to the property owner regarding the need to eliminate mosquito-breeding sites and 4,651 sites were visited and checked for the presence of mosquito breeding. In order to respond to egregious conditions, the Board of Health adopted a resolution that made standing water a public health nuisance and allowed for the issuance of Notice of Violations to unresponsive property owners. In 2007, 989 Notice of Violations were issued to unresponsive landlords.

DOHMH will conduct extensive larviciding in accordance with permits issued by NYS Department of Environmental Conservation (DEC) in catch basins (street corner storm drains), sewage treatment plants, and areas of permanent standing water. DOHMH works with the New York City Department of Environmental Protection (DEP), the New York City Housing Authority, and the New York City Department of Parks and Recreation to treat catch basins and other potential breeding sites for mosquitoes, and has expanded the use of mosquito larvae-eating fish at DEP wastewater treatment plants. Approximately 140,000 catch basins across the City will be inspected and/or treated at least twice each season by hand application of larvicides. In areas that are inaccessible by ground vehicles, larvicide may be applied aerially.

The larvicides most commonly used in New York City are VectoLex (*Bacillus sphaericus*) and VectoBac [*Bacillus thuringiensis* var. *israelensis* (Bti)]. *B. sphaericus*

and Bti are naturally occurring soil bacteria that produce toxins which cause disease in mosquito larvae. In addition to these larvicides, the Department is planning to use VectoMax CG and WSP in catch basins and wetlands, respectively. These larvicides are new products based on mixtures of both *B. sphaericus* and Bti. All these microbial products (based on *B. sphaericus*, Bti or mixture of both) are considered ideal for mosquito management because of their specificity to mosquitoes and because of their lack of toxicity to humans and the natural enemies of mosquito larvae. These bacteria form asexual reproductive cells, called spores, which enable them to survive in adverse conditions. They also produce unique crystalline bodies. When eaten, the crystalline bodies dissolve in the intestine of the larvae and paralyze the cells in the gut, interfering with normal digestion and triggering the larvae to stop feeding. The spores can then invade other tissues, multiplying in the larva's blood, until the insect dies. Death typically occurs within a few hours of ingestion.

### **Planned Activities**

- Under the direction of the Mayor's Office of Operations WN virus Task Force, OVSC and other City agencies have identified areas of standing water associated with surface grading problems, road construction, clogged sewers and catch basins, obstructed waterways, etc. that are serving as mosquito-breeding habitat. These conditions will be remediated as they are identified.
- The WN virus Task Force will work to inform large-property owners and managers of the need to eliminate mosquito-breeding sites on their property or to properly treat them with larvicides.
- DOHMH will work with the New York City Department of Sanitation to prioritize and enhance the enforcement of lot cleaning and to ensure an aggressive tire disposal program. Abandoned lots are particularly conducive to mosquito breeding, and in areas where WN virus has already been detected these lots will be targeted for remediation.
- DOHMH will work with the New York City Department of Buildings to develop and implement a protocol for requiring all City's demolition and excavation contractors to larvicide when their activities result in significant sources of mosquito breeding.
- The public will be asked to help eliminate mosquito-breeding sites and to report standing water using the City's toll-free Citizen Service Center Line (311) and the DOHMH Web site ([nyc.gov/health](http://nyc.gov/health)).
- OVSC will monitor reported breeding sites; send letters to property owners asking them to address the problem; conduct on-site inspections of the more egregious conditions; make referrals to appropriate agencies for abatement; and, if necessary, issue notices of violation.
- DOHMH will use VectoLex (*Bacillus sphaericus*), VectoBac/AquaBac (*B. thuringiensis* var. *israelensis*, Bti), VectoMax (mixture of *B. sphaericus* and Bti)

and/or Altosid (methoprene) to control mosquito larvae. DOHMH will continue to explore other DEC-approved products that may increase the effectiveness of the larviciding program.

- Beginning in May, larvicides will be applied at wastewater treatment plants, parks, and other surface waters, if larval breeding is determined to exist. Applications will be made by hand, backpack or aerially via helicopter and continue to be applied as needed throughout the mosquito-breeding season.
- Beginning in June, larvicides will be applied to sewers and to more than 140,000 catch basins citywide. Applications will continue, based upon larval surveillance findings, as needed throughout the mosquito-breeding season.
- OVSC staff will intensify larval control once an infected animal is identified in the area. Targeted neighborhoods will have an expanded public outreach regarding breeding site elimination and personal protection; also community-specific media materials will be distributed.
- DOHMH will work with the Parks Department and other partners to ensure that green areas (e.g., parks, cemeteries, and golf courses) receive intensified mosquito prevention activity, especially in areas where infected mosquitoes are found.
- The DEP will continue to use larvae-eating fish at wastewater treatment plants.
- During inspections, DOHMH will provide “Mosquito Dunks” to property owners with clear written instructions on how to use the larvicide product.
- DOHMH will provide occupational safety and health training to all employees involved in mosquito surveillance and control operations. Additionally, DOHMH will require that all employees from contracted vendors be provided with similar training as well as appropriate personal protective equipment.
- For residents conserving rainwater, OVSC will recommend covering the barrels or other water holding containers with a tight-fitting lid or very fine mesh screen. Also, bacterial larvicides containing Bti can safely be placed in the barrels to control any mosquito larvae that may be developing.

## **ADULT MOSQUITO CONTROL**

### **Objective**

To reduce the abundance of WN virus infected adult mosquitoes in targeted areas through the judicious use of pesticides

### **Background**

Comprehensive vector, bird and human surveillance data collected during the last eight seasons have allowed DOHMH to develop more sensitive surveillance criteria for determining the level of WN virus activity in birds and mosquitoes that indicate a significant risk for a human disease. DOHMH will monitor this surveillance data on a citywide basis to identify areas at risk for human transmission.

The adulticides used during the last seven seasons in New York City is Sumithrin. This product is a first-generation synthetic pyrethroid that has been used for more than 30 years. Sumithrin, similar to other pyrethroids, provides a rapid knockdown of adult mosquitoes. It exhibits very low mammalian toxicity, degrades very rapidly in sunlight, provides little or no residual activity, and does not bio-accumulate in the environment. This product is applied at very small quantities per acre and is therefore referred to as ultra low volume (ULV) application. ULV-delivery techniques minimize environmental impacts while effectively managing adult mosquito populations. In addition, DOHMH adulticiding operations are monitored by city, state and federal officials to ensure compliance with all USEPA and NYSDEC requirements.

The presence of mosquito-borne viral pathogens in or near New York City will result in one or more responses or interventions by DOHMH. These interventions can range from routine continuing existing surveillance to, in worst-case scenarios, large-scale aerial application of adulticides. DOHMH will utilize its surveillance data to assess the risk of an outbreak of human disease and the need to apply pesticides in a limited and targeted area to control adult mosquitoes by considering habitat; time of year; weather conditions; the intensity of viral activity; the distribution, density, species, age and infection rate of the vector population; and the density and proximity of human populations.

The response of DOHMH will depend upon, but not be limited to: the intensity and persistence of pathogen activity, proximity of pathogen activity to human populations within the City, time of year, mosquito population density, and weather conditions. Because these conditions can vary greatly and cannot be predicted, a consultation process will be used to determine which, if any, responses are appropriate, on a case-by-case basis. The responses initiated by the DOHMH can be grouped into 3 broad categories or levels of risk:

### **Planned Activities**

#### **Level 1 – No Pathogen Detection**

DOHMH *Responses*: Surveillance and Control programs continue as outlined in the City's Mosquito Surveillance and Control Plan. Periodic reports or communications are

made to the WN virus Steering Committee providing current status of the various surveillance programs. Periodic press releases are issued providing the public with current surveillance results.

#### Level 2 – Initial or Single Pathogen Detection

Initial or a single detection of mosquito-borne viral pathogens in mosquito populations or avian populations in or near New York City will result in a move to Level 2 responses.

*DOHMH Responses:* OVSC recommendations will be communicated to the WN virus Steering Committee and the DOHMH Commissioner. Upon approval by the Commissioner, a press release will be drafted, notifying the public of the recent findings. Surveillance programs will continue with the following added activities:

- CDC Light Traps will be added to the area of concern if additional surveillance data are required.
- Larval surveillance and enhanced adult trapping will be conducted in affected areas if needed.
- Laboratory testing of mosquito pools will be given priority in bridge vector mosquito species (i.e. *Aedes* spp., *Ochlerotatus* spp., *Cx. salinarius*).
- Data from these additional traps and surveillance measures will aid in determining the extent of pathogen transmission and mosquito populations and be used to guide control measures, if applicable.

#### Level 3 – Continued or Multiple Pathogen Detections

Persistent detection of mosquito-borne pathogens or detection in bridge vector mosquitoes or in non-avian vertebrate populations in or near New York City will result in a move to Level 3 responses.

*DOHMH Responses:* OVSC recommendations will be communicated to the WN virus Steering Committee and the DOHMH Commissioner. Upon approval by the Commissioner, a press release will be drafted, notifying the public of the recent findings. Surveillance programs will continue as noted above. Control measures will be implemented.

- CDC Light Traps will be added to the area of concern if additional surveillance data are required.
- Larval surveillance and enhanced adult trapping will be conducted in affected areas if needed.
- Laboratory testing of mosquito pools will be increased in bridge vector mosquito species (i. e. *Aedes* spp., *Ochlerotatus* spp., *Cx. salinarius*).
- Control measures to be considered:
  - Application of larvicides (including aerial applications) to areas breeding

large numbers of mosquitoes

- Ground application of adulticides to immediate areas of concern
  - Aerial application of adulticides to broader areas, based upon surveillance data
  - Recommend the restriction and/or cancellation of outdoor evening activities
  - Recommend the closing of recreational areas
- Monitor the efficacy of the adulticiding activities.
  - DOHMH will comply with Local Law 37 of 2005, which sets forth requirements on pesticide use by New York City.
  - DOHMH will consider EPA and NYSDEC registered products for mosquito control that contain the following active ingredients: sumithrin, resmethrin, permethrin, dibrom, or naled. The City will continually review the available information on the health impact of pesticides. Any products used will be applied in compliance with City, State, and Federal laws and regulations.
  - The public will be notified of adulticide schedules in advance, which will allow sufficient time to take any necessary precautions to reduce pesticide exposure. (See Public Education and Community Outreach)
  - Hospitals will be notified regarding the adulticiding schedule. Information on the pesticide to be used will be provided to the public, physicians and other health care providers.
  - For quality assurance purposes, a private contractor, independent of the pesticide applicator, will provide guidance and assist with the technical elements of pesticide application so that operations are conducted according to plan and pursuant to applicable regulations.
  - Adult mosquito control will be scheduled when mosquitoes are most active and when weather conditions are conducive to successful application.
  - Information will be released 24 hours in advance of the scheduled spray event through the media, the DOHMH web site, West Nile virus Information Line, and pertinent City and community organizations.
  - DOHMH will monitor and assess control activities for any potential environmental and health effects through several measures, including pre- and post-spray environmental sampling and addressing pesticide exposure complaints received by DOHMH.

- Depending on surveillance findings and other criteria, DOHMH or its Contractor may apply targeted adulticides in response to community concerns about nuisance mosquitoes on the Rockaway Peninsula.

## **SURVEILLANCE OF POTENTIAL ADVERSE HEALTH EFFECTS FROM PESTICIDE EXPOSURE**

### **Objective**

To perform passive and syndromic surveillance to monitor for possible exposure to pesticides used to control adult mosquitoes and the potential health sequelae due to such exposure.

### **Background**

Since exposure to pesticides has the potential to cause adverse reactions, particularly among those with pesticide sensitivity or underlying health conditions, beginning in 2000, DOHMH took additional care to provide advance notification whenever adulticide applications occurred. Prior to conducting adult mosquito control activities, information on pesticides was sent to all hospital emergency departments, which included product information on pesticides, Material Safety Data Sheets, and other information relevant to identifying possible exposures to pesticides. Each year since 2000, calls to the New York City Poison Control Center (NYC PCC) were monitored during pesticide spraying and relevant exposures were forwarded to the New York State Pesticide Poisoning Registry (NYS PPR) for review and possible inclusion in the registry. In 2001, active surveillance for pesticide-related health complaints was performed. In this regard, chart review was conducted in emergency departments and physicians were randomly surveyed in the affected areas by telephone to determine if any individuals had sought care for symptoms related to possible exposure to adulticides. No cases of individuals reporting to emergency departments or seeking care from their physicians for health complaints related to adulticide exposure were found through these activities. Additional research was conducted to determine whether pesticide applications associated with West Nile Virus mosquito control were associated with negative health outcomes. As a recent publication reported, no such associations were found.<sup>1</sup>

Beginning in 2002 syndromic surveillance was adopted as a surveillance tool to identify any possible respiratory symptom related cluster in areas in which a spray action occurred. If such a cluster is identified, DOHMH conducts further review of emergency department data to investigate the possible etiology of that cluster. In addition, the Poison Control Center monitors pesticide-related calls for number and severity that are geographically and temporally associated with spray events.

### **Planned Activities**

Prior to conducting adult mosquito control activities, information on pesticides and their possible adverse health effects will be sent to all hospital emergency departments, including product information on pesticides, Material Safety Data Sheets, and other information relevant to identifying possible exposure to pesticides. Calls received by the

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<sup>1</sup> Karpati AM, Perrin MC, Matte T, Leighton J, *et al.* Pesticide Spraying for West Nile Virus Control and Emergency Department Asthma Visits in New York City, 2000. *Environ. Health Perspect.* 2004 Aug; 112(11): 1183-7.

New York City Poison Control Center (NYC PCC) will continue to be monitored during pesticide spraying for geographic and spatial associations with spray events. These data will continue to be forwarded to the NYS Pesticide Poisoning Registry for possible follow-up and inclusion in the Registry. Syndromic surveillance will also continue to be utilized to identify possible asthma clusters in the zip codes in which spraying occurs. Statistical and field investigation methods for evaluating spatial and temporal clustering are described in recent publications.<sup>2</sup> In the event that a possible respiratory symptom cluster is identified, emergency department chart review will be considered to investigate the possible etiology of that cluster at nearby hospitals.

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<sup>2</sup> See for example: Heffernan, R., F. Mostashari, D. Das, *et al.* New York City Syndromic Surveillance Systems MMWR September 24, 2004 / 53(Suppl);23-27; and Steiner-Sichel, L., J. Greenko, R. Heffernan, M. Layton, and D. Weiss. Field Investigations of Emergency Department Syndromic Surveillance Signals. New York City MMWR September 24, 2004 / 53 (Suppl.);184-189.

## **RESEARCH AND EVALUATION**

### **Objective**

To better understand the transmission and pathogenicity of mosquito-borne diseases and to assess the effectiveness of DOHMH surveillance, prevention and control methods

### **Background**

One of the most important roles for public health professionals is to assess the potential impact of a disease on a population and to devise safe and effective methods for reducing the risk of disease transmission. DOHMH, in collaboration with CDC and NYSDOH, has studied closely the risk factors for infection, morbidity and mortality from WN virus. However, many questions remain about how the virus circulates in nature.

Furthermore, some of the control methods used for managing mosquito populations, especially the application of pesticides for adult mosquitoes, are not without potential impact. However, alternative control measures lack sufficient efficacy or environmental impact data to allow their wholesale integration into the City's IMM Plan. The environmental impact statement and other research endeavors are important tools used to assess potential adverse health effects associated with pesticide exposure. Additional research is needed in this area as well as in assessing improved techniques for larval and adult mosquito control in New York City.

### **Planned Activities**

- DOHMH will continue to work closely with Federal, State, and Local partners to conduct research that will identify the most effective predictors of human illness from WN virus in New York City, including the analysis of overwintering mosquito populations and the use of predictive disease models.
- DOHMH will continue to refine the New York City-specific phased response for risk categories of mosquito-borne disease outbreaks based on the ongoing analyses of bird, mosquito, mammalian and human surveillance data.
- DOHMH will evaluate the most cost-effective methods of surveillance and control.
- DOHMH will research and evaluate the potential public health and environmental impact of the application of pesticides for adult mosquito control.
- In collaboration with CDC and NYSDOH, OVSC will publish new and relevant information about mosquito-borne disease transmission in New York City in peer-reviewed public health and medical journals.
- DOHMH will conduct research to determine the blood feeding preference of the

mosquito vectors of WN virus in NYC using molecular techniques. This information will help determine what animals are the primary hosts and focus surveillance and control activities accordingly.

- DOHMH will research and evaluate the development of resistance in mosquitoes due to the application of pesticides (microbial larvicides and adulticides).
- DOHMH will conduct an analysis to predict the risk of West Nile virus infections and the outcome of interventions in New York City using Probabilistic modeling techniques, Spatial Statistics and Geographic Information System (GIS).
- DOHMH will test hibernating mosquitoes for WN virus infection to determine their role in the overwintering of WN virus from one season to the next.
- The host seeking activity patterns of mosquitoes will be determined by using collection bottle rotator traps in various habitats such as marsh, urban areas and parks.
- Larval surveillance will be conducted before and after the control activities in the catch basins (storm drain) and natural breeding sites for determining larval control efficacy of the pesticides.

## **APPENDIX A: QUESTIONS AND ANSWERS ABOUT WEST NILE VIRUS**

### **Q: What is West Nile virus?**

**A:** West Nile virus is a mosquito-borne virus that can infect humans, birds, horses, and other mammals. In humans, infection with the virus usually causes no symptoms at all or a mild, flu-like illness. However in some cases, particularly among the elderly, it can also cause more severe neurological **diseases** such as encephalitis or aseptic meningitis. West Nile virus **initially** appeared in North America in New York City in 1999. Since then, the virus has spread across the continental United States.

### **Q: How is West Nile virus spread?**

**A:** West Nile virus is spread predominantly to humans by the bite of an infected mosquito. In 2002 other methods of human transmission were discovered. It has now been shown that West Nile virus can be transmitted to humans who receive infected organs through transplantation, or who receive transfusions of infected blood or blood products. Also, in 2002 there was one case of transmission from a pregnant woman to her fetus and one case of probable mother-to-child transmission through breast-milk. West Nile virus is **NOT** spread by person-to-person contact such as touching, kissing, or caring for someone who is infected.

### **Q: Who is most at risk for getting West Nile encephalitis after being bitten by a WN virus infected mosquito?**

**A:** **People** older than 50 years of age have the highest risk of severe disease, such as encephalitis. Immunocompromised persons are also at increased risk for WN virus disease.

### **Q: Where did the West Nile virus come from?**

**A:** Outbreaks of the West Nile virus have occurred before in Africa, Egypt, Israel, Asia, Romania, Russia and France. Prior to 1999, the West Nile virus had never been discovered in the Americas. The virus was most likely introduced by an infected bird or mosquito that was imported from a country where the virus is common.

### **Q: Can you get West Nile virus directly from birds?**

**A:** Currently, there have been no reported cases of West Nile virus being spread directly from live or dead birds to the general public. However, dead birds can carry a variety of other diseases and should never be handled with bare hands. **Use plastic backs or gloves to carefully place dead birds in double-plastic bags and then place dead birds in the outdoor trash.**

### **Q: Besides mosquitoes, can you get West Nile virus directly from other insects or ticks?**

**A:** Infected mosquitoes are the primary source of West Nile virus and caused the recent outbreaks in NYC. Although several types of ticks in Africa and Europe have been found infected with WN virus, there is no information to suggest that ticks or other

insects in this country are able to transmit West Nile virus.

**Q: What are the symptoms of West Nile virus?**

**A:** Most people who are infected with West Nile virus either have no symptoms or experience mild to moderate illness such as fever, headache and body aches before fully recovering. Some may also develop a mild rash or swollen lymph glands. In some individuals, particularly individuals over age 50, West Nile virus can cause serious disease that affects brain and spinal tissue. Severe illness may include encephalitis (inflammation of the brain), meningitis (inflammation of the membrane around the brain), and acute flaccid paralysis (a polio-like syndrome in which muscles become very weak or paralyzed). Symptoms may include: headache, high fever, stiff neck, confusion, coma, tremors, convulsions, and muscle weakness or paralysis. At its most serious West Nile virus can cause permanent neurological damage and death.

**Q: If a pregnant woman gets infected with West Nile virus, can it affect her fetus?**

**A:** In 2002 there was one case of transmission of West Nile virus from mother to fetus during pregnancy. The newborn was infected with West Nile virus at birth and had severe medical problems, including abnormalities of the brain; however, it is unknown whether these problems are due to West Nile virus or some other cause. Pregnant women should take precautions to reduce their risk for West Nile virus infection by avoiding mosquitoes, wearing protective clothing and using approved insect repellents, always following the directions on the label. (Please see the DOHMH fact sheet on Insect Repellent Use & Safety for more information on DEET). When West Nile virus transmission is occurring in an area, pregnant women who have illness with fever should see their health care provider.

**Q: How is West Nile encephalitis treated?**

**A:** There is no specific therapy. In more severe cases, intensive supportive therapy is indicated, i. e. , hospitalization, intravenous (IV) fluids and nutrition, airway management, ventilatory support (ventilator) if needed, prevention of secondary infections (pneumonia, urinary tract, etc. ) and good nursing care.

**Q: Is there a vaccine against West Nile virus?**

**A:** No, but several companies are working towards developing a vaccine.

**Q: How long does it take to get sick if bitten by an infected mosquito?**

**A:** Most people who are infected with West Nile virus have no symptoms or experience only mild illness. If illness does occur, symptoms appear within 2 to 15 days of being bitten by an infected mosquito.

**Q: What should I do if I think I have West Nile encephalitis?**

**A:** You should seek medical care as soon as possible if you develop signs of encephalitis **such as/including:** fever, muscle weakness, and confusion,

**Q: What can I do to reduce my risk of becoming infected with West Nile virus?**

**A:** From June through October, when mosquitoes are most active, take the following precautions:

- Wear protective clothing such as long pants and long-sleeved shirts.
- Avoid shaded, bushy areas where mosquitoes like to rest.
- Limit outdoor evening activity, especially at dusk and dawn when mosquitoes are most active.
- Use mosquito repellent when outdoors in areas where mosquitoes are active. Repellents containing the active ingredients DEET, picaridin, IR3535 or oil of lemon eucalyptus are approved for use by the US EPA and New York State for protection against biting mosquitoes. Extra precaution should be used when applying repellents to children and infants. Products containing oil of lemon eucalyptus should not be used on children younger than three. Always read the repellents label and follow instructions for use. Formulations containing more than 25% DEET are unnecessary and may enhance skin reactions on some people. As with all products, the user should follow the manufacturer's usage recommendations.

**Q: What can I do around my home to help reduce exposure to mosquitoes?**

**A:** Mosquitoes lay their eggs in standing or slow moving water. Also weeds, tall grass, and bushes provide an outdoor resting place for mosquitoes. Mosquitoes breeding or resting on your property can then enter homes through unscreened windows or doors, or broken screens.

- Repair or replace all screens in your home that have tears or holes.
- Eliminate any standing water that collects on your property.
  - Remove all discarded tires from your property.
  - Dispose of tin cans, plastic containers, ceramic pots, or similar water-holding containers.
  - Make sure roof gutters drain properly. Clean clogged gutters in the spring and fall.
  - Clean and chlorinate swimming pools, outdoor saunas and hot tubs. If not in use, keep empty and covered.
  - Drain water from pool covers.
  - Change the water in bird baths once a week.
  - Turn over plastic wading pools and wheelbarrows when not in use.
- Remind or help neighbors to eliminate breeding sites on their properties.

**Q: What is the City doing to address the possible return of West Nile virus?**

**A:** DOHMH, along with other City, State and Federal agencies, has developed a comprehensive plan to reduce the risk of illness due to West Nile virus. The main goal of this plan is to decrease the number of adult mosquitoes by eliminating their breeding sites wherever possible, and applying larvicides (to kill the immature larval form of the mosquito) to areas with stagnant water that cannot be drained completely. The City also will regularly test mosquitoes for West Nile virus throughout the spring and summer. If West Nile virus is found at levels that indicate a threat to human health, local applications of pesticides may be undertaken to prevent people from becoming infected.

**Q: Is the City planning to apply pesticides as was done previously?**

**A:** If West Nile virus is detected in the community, the City's initial response will be to intensify its efforts to reduce mosquito-breeding sites and increase its levels of

larviciding in those areas in which WN virus has been found. Reducing the adult mosquito population with pesticides (adulticides) approved by the US Environmental Protection Agency (EPA) will be done if necessary to prevent human illness. The decision to spray, either on the ground or by air, will be based on surveillance information and the documentation of West Nile virus activity at a level that indicates a threat to human health. Adulticiding will be concentrated in areas most at risk for disease occurrence.

**Q: What health risks are posed to people and pets from pesticides for adult mosquitoes?**

**A:** In the amounts used, risks to people and pets are relatively low. However, some people may be more sensitive to such pesticides and may want to reduce their chance of exposure by following the suggestions below. Anyone experiencing persistent or significant adverse reactions to pesticides should seek medical care or call the NYC Poison Control Center at (212) POISONS or (212) 764-7667.

**Q. Will the public be notified in advance about spraying activities?**

**A:** Residents can learn about adulticiding schedules in advance through public service announcements, the media, the City's website ([nyc.gov/health](http://nyc.gov/health)), and a telephone information line (1-877-WNV-4NYC).

**Q: If the City sprays pesticides for adult mosquitoes, what can I do during spraying to reduce the risk of exposure to pesticides?**

**A:** If spraying becomes necessary, the NYC DOHMH recommends that all individuals take the following precautions to avoid direct exposure to pesticides and reduce the reactions:

- Some individuals are sensitive to pesticides. Persons with asthma or other respiratory conditions are especially encouraged to stay inside during spraying since there is a possibility that spraying could worsen these conditions
- Air conditioners may remain on. But if you wish to reduce the possibility of exposure to pesticides, set the air conditioner vent to the closed position, or choose the recirculate function
- If you wish to minimize your exposure to pesticides, you may want to bring children's toys, outdoor equipment and clothes from outdoor areas inside during spraying
- If outdoor equipment and toys are exposed to pesticides, they may be washed with soap and water to reduce the possibility of exposure
- Wash skin and clothing exposed to pesticides with soap and water

Anyone experiencing adverse reactions to pesticides should seek medical care or call the NYC Poison Control Center at (212) POISONS or (212) 764-7667.

**Q: If I live in an area where birds or mosquitoes with West Nile virus have been reported, and a mosquito bites me, am I likely to get sick?**

**A:** No. Evidence indicates that the chance of human infection and illness resulting from West Nile virus is quite low. In addition, the greatest risk is to those over age 50. These members of the population should take the greatest care to prevent exposure to mosquito bites.

**Q: I've gotten a mosquito bite. Should I be tested for West Nile virus?**

**A:** No. Illnesses related to mosquito bites are still uncommon. However, you should see a doctor immediately if you develop symptoms such as high fever, confusion, muscle weakness, severe headaches, and stiff neck or if your eyes become sensitive to light. Patients with mild symptoms should recover completely and do not require any specific medication or laboratory testing.

**Q: Should I report dead birds to the Health Department?**

**A:** No. The Health Department will no longer take reports of dead birds to monitor for WN virus. Testing of birds for WN virus had limited value as an early warning system for the WN virus infection. If you have a dead bird on your property, please dispose of it. While there is currently no evidence that West Nile virus can be spread directly from birds to people, dead birds can carry other diseases and, therefore, should never be handled with bare hands. Use plastic bags or gloves to carefully place dead birds in double-plastic bags and then place dead birds in the outdoor trash.

**For more information about West Nile virus, call the New York City Citizen Service Center, 24 hours a day, seven days a week, by dialing 311 or check the DOHMH Website at [nyc.gov/health](http://nyc.gov/health).**

## GLOSSARY

<b>adulticide</b>	a type of pesticide used to kill adult mosquitoes
<i>Aedes sollicitans</i>	<i>See Ochlerotatus sollicitans</i>
<b>Altosid</b>	brand name of methoprene, a type of larvicide
<b>arbovirus</b>	shortened term for <b>arthropod-borne virus</b> , a virus that is carried by arthropods
<b>arthropod</b>	a group of an animal that does not have a backbone and have jointed walking appendages, such as insects, spiders and lobsters
<i>Bacillus sphaericus</i>	a bacterium; type of biological pesticide used to control mosquito larvae in water (mosquito larvae die after ingesting this bacterium)
<i>Bacillus thuringiensis</i> <b>var. israelensis (Bti)</b>	a bacterium; type of biological pesticide used to control mosquito larvae in water (mosquito larvae die after ingesting this bacterium); bacteria found in Mosquito Dunks®
<b>bridge vector</b>	an arthropod (in this case, a specific species of mosquito) that serves as a main transmission of virus between the reservoir (birds) and humans.
<b>catch basins</b>	grates seen at street corners and in other properties for water runoff
<i>Culex pipiens</i>	a species of mosquito, the primary vector for West Nile virus, commonly found in urban areas; breeds in fresh, but stagnant water, such as backyard containers and storm drains
<b>DEET</b>	DEET (chemical name, N,N-diethyl-meta-toluamide) is the active ingredient in many insect repellent products
<b>Eastern equine Encephalitis (EEE)</b>	mosquito-borne viral disease that causes inflammation of the brain; similar to West Nile
<b>encephalitis</b>	inflammation of the brain, which can be caused by numerous viruses and bacteria, including West Nile virus

<b>Environmental Impact Statement (EIS)</b>	A document that describes the impact on the environment from a proposed action (in this case, the application of pesticides to control adult mosquitoes).
<b>gravid traps</b>	mosquito traps designed to attract pregnant female mosquitoes
<b>Interactive Voice System</b>	an automated telephone system by which information can be accessed by choosing from a set of options
<b>IR3535</b>	IR3535 (3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester) is the active ingredient in many insect repellent products
<b>larvae</b>	immature mosquitoes that live in water; stage which hatches from the egg, prior to adult stage
<b>larvicide</b>	a type of pesticide used to control immature or larval mosquitoes
<b>light traps</b>	mosquito traps outfitted with a light to attract mosquitoes
<b>malathion</b>	an organophosphate pesticide used to control adult mosquitoes; active ingredient in the product Fyfanon®
<b>meningitis</b>	inflammation of the lining of the brain and spinal cord that can be caused by a virus or bacteria
<b>methoprene</b>	a type of (synthetic) insect growth regulator used to control larval mosquitoes; it prevents mosquito larvae from emerging and developing into adult mosquitoes
<b>mosquito breeding site</b>	a location where mosquitoes lay eggs, usually in stagnant water with organic material
<b>mosquito pools</b>	a group of mosquitoes of the same species, collected in given area and combined at the laboratory for testing for the presence of West Nile and related viruses
<b>naled</b>	an organophosphate pesticide used to control adult mosquitoes
<b>neurology</b>	the study of the nervous system and its disorders
<b><i>Ochlerotatus sollicitans</i></b>	species of mosquito that breeds in salt marshes
<b>outbreak</b>	an unexpected increase in frequency or distribution of a

	disease
<b>permethrin</b>	a synthetic pyrethroid pesticide used to control adult mosquitoes; active ingredient in the product Biomist®
<b>pesticide</b>	substance used to kill pests such as insects, mice and rats; an insecticide is a form of pesticide
<b>picaridin</b>	(chemical name, 1-Piperidinecarboxylic acid, 2-(2-hydroxyethyl)-1-methylpropylester) is the active ingredient in many insect repellent products
<b>piperonyl butoxide</b>	An additive to pyrethroid pesticides that improves the effectiveness of the active ingredient
<b>resmethrin</b>	a synthetic pyrethroid pesticide used to control adult mosquitoes; active ingredient in the product Scourge®
<b>salt marsh</b>	areas of vegetation in bodies of salt water that may support the breeding of certain types of mosquitoes such as <i>Ochlerotatus sollicitans</i> ; example of salt marshes is Jamaica Bay.
<b>sentinel</b>	an early warning system, in this case, for the presence of virus (e. g. , sentinel chickens)
<b>serologic</b>	of, or relating to, serum
<b>source reduction</b>	the removal or reduction of larval mosquito habitats
<b>St. Louis encephalitis (SLE)</b>	mosquito-borne viral disease that causes inflammation of the brain; very similar to West Nile virus
<b>sumithrin</b>	a synthetic pyrethroid pesticide used to control adult mosquitoes; active ingredient in the product Anvil 10+10®
<b>VectoBac</b>	brand name for the larvicide <i>Bacillus thuringiensis</i> var. <i>israelensis</i> ( <i>Bti</i> )
<b>VectoLex</b>	brand name for the larvicide <i>Bacillus sphaericus</i>
<b>VectoMax</b>	brand name for the larvicide based on mixture of <i>Bacillus sphaericus</i> and <i>B. thuringiensis</i> var. <i>israelensis</i> ( <i>Bti</i> )
<b>vector</b>	an organism (an insect in most cases) capable of carrying and transmitting a disease-causing agent from one host to another

**viral**

of, or relating to, a virus

**viral encephalitis**

inflammation of the brain caused by a virus, such as West Nile virus