Assessing Capacity for the Surveillance, Prevention, and Control of West Nile Virus Infection in State and Large City/County Health Departments

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Council of State and Territorial Epidemiologists

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EXECUTIVE SUMMARY

Beginning in 1999, Congress appropriated annual funding for West Nile Virus (WNV) surveillance and prevention activities in affected states and large cities. The funds are made available to states and large cities through the Centers for Disease Control and Prevention (CDC) Epidemiology and Laboratory Capacity (ELC) cooperative agreements for emerging infectious diseases. The Council of State and Territorial Epidemiologists (CSTE), with assistance from the Association of Public Health Laboratories (APHL) and technical input from CDC, conducted a survey in 2004-2005 of WNV surveillance and control programs in state health departments and the health departments of New York City, Los Angeles County, Chicago, Philadelphia, Houston and the District of Columbia.

The survey instrument was developed in 2004. The intent was to assess the capacity of state and large city health departments to conduct surveillance, prevention and control activities for West Nile virus infection. Using published CDC guidelines for WNV surveillance, prevention and control[1], 21 indicators were identified to measure a range of capacities related to human, equine, avian and mosquito infection and disease surveillance as well as laboratory capacity and programmatic prevention activities.

Respondents were instructed to answer questions based on program activities in calendar year 2004. Forty-nine of 50 (98%) states submitted responses to the survey as well as all six of the large city/county health departments. In addition

to the presence of human, avian, equine and mosquito WNV surveillance programs in all states and major cities, results demonstrate that these WNV surveillance and control programs are well developed. This is based on the following findings:

- Presence of a surveillance system for human disease that included outreach to relevant specialists, reporting of encephalitis and meningitis of unknown etiology, and laboratory-based testing and reporting;
- Presence of surveillance systems that include reporting of equine neurologic disease (84%), tracking dead bird sightings (57%), and collection of information about mosquito infection rates by species (80%);
- Reporting intervals from collection of human and bird specimens to laboratory confirmation to surveillance program notification were approximately one week;
- Delivery of prevention messages (100%) concerning use of DEET (N, N-diethyl-m-toluamide) and other personal protection measures via press releases (96%), public service announcements (63%), and distribution of information brochures (76%);
- Testing for human infection available in all (100%) state public health laboratories, many laboratories are also equipped to perform animal and mosquito surveillance testing; and
- Adequate access to expertise in wildlife biology (92%), and adequate access to medical entomologists within a public health agency (41%) or through

contract or other formal arrangement (49%). The number of states with access to these experts has increased since 1999.

While differences were found between the WNV surveillance and control activities of state health departments and large city/county health departments, the findings may have been a reflection of differences in agency roles, rather than agency performance.

The findings of the CSTE survey demonstrate that widespread capacity for the testing, surveillance and control of all aspects of this substantial public health threat has developed over a relatively short period of time. This can be attributed primarily to the congressionally appropriated funds and technical guidance and leadership from CDC. The establishment of this national program has also enhanced laboratory capacity, veterinarian epidemiology capacity, and surveillance for vector-borne diseases other than West Nile Virus. We attribute the development of well-functioning programs across the nation to the publication of comprehensive and specific disease control guidelines by CDC, annual scientific conferences convened by CDC, the transfer of WNV laboratory technologies from CDC to state public health laboratories, and the provision of new, supplemental funding for WNV prevention programs through established Epidemiologic and Laboratory Capacity cooperative agreements.

INTRODUCTION

Domestically-acquired human disease caused by WNV was first identified in the United States in the summer of 1999 in metropolitan New York City[1-2]. It subsequently spread southward and westward across the country[3]. By the end of 2004, human disease from WNV had been reported in all states except Alaska, Hawaii, Maine, and Washington[4-9], and WNV transmission to humans had been documented by at least five routes: mosquito bites principally from *Culex* species, blood transfusions, organ transplantation, transplacental transfer, and possibly breast-feeding[1]. From 1999-2002, there were many more reported cases of WNV encephalitis than St. Louis encephalitis, Western equine encephalitis, Eastern equine encephalitis and California serogroup viral (mainly La Crosse) encephalitis combined[10]. In 2004, WNV cases continued to be widely distributed[4], while the other domestic arboviral encephalitides listed above occur infrequently and in localized parts of the country.

WNV has now been shown to affect 162 species of birds, and unlike with St. Louis encephalitis virus, avian mortality has been a hallmark of WNV activity in the United States. Disease caused by WNV infection has been reported in 20 species of mammals, including horses and humans[1]. As a result, surveillance and disease prevention activities for WNV infection focus on human and equine disease, avian mortality and mosquito control. In 2000, CDC published guidelines for WNV surveillance, prevention and control[11]. These guidelines

were updated in 2003[1]. The primary audiences for this document were state, territorial and local health agencies throughout the nation. To assist with the implementation of the guidelines, CDC developed an electronic-based surveillance and reporting system, called ArboNET, to track WNV activity in humans, horses, other mammals, birds and mosquitoes. In addition, since 1999 CDC has convened an annual national conference concerning WNV infection to share surveillance and research data, to explore lessons learned in previous WNV seasons, and to discuss and update, as needed, national guidelines for WNV disease control.

Beginning in 1999, Congress appropriated annual funding for WNV surveillance and prevention activities in affected states, large cities and U.S. territories. In FY 2003 and FY 2004, all fifty states, six large cities and Puerto Rico received supplemental WNV surveillance and prevention cooperative agreement awards from CDC totaling $23.8 million [personal communication, Deborah Deppe, NCID/CDC]. These funds were made available to states and large cities through the existing ELC cooperative agreements for emerging infectious diseases. The purpose of the funds is to "assist state and local health departments to develop and implement effective surveillance for and [enhance] laboratory diagnosis, prevention, and control of human infections with West Nile virus (WNV) and other arboviruses that occur in the U.S." [Procurement and Grants Office, CDC: Competing continuation announcement for Epidemiology and Laboratory Capacity for Infectious Diseases; Funding Opportunity No. 04040]. Recipient

activities include developing or enhancing bird, mosquito, human and equine surveillance activities; conducting data analysis, interpretation and dissemination; establishing or enhancing capabilities to capture, identify and test mosquito vectors of WNV; establishing or enhancing capabilities for avian and vertebrate capture, identification and testing for exposure to WNV; participating in ArboNET; supporting prevention activities for WNV and other arboviruses; and enhancing laboratory capacity to identify WNV infections in humans and other animal species.

To improve epidemiologic and surveillance capacities, especially infectious disease epidemiologic capacity, there has been an increase in federal funding in the past five years to states for the purpose of preparing for and responding to terrorism, infectious disease outbreaks, and other public health threats and emergencies. This funding is in addition to ELC funding and specific WNV appropriations. One survey found that there had been a 132% overall increase in the number of epidemiology workers employed in infectious disease and terrorism preparedness between 2001 and 2003[12].

CSTE has conducted several epidemiologic capacity assessments in the past five years, including assessments of overall epidemiologic capacity (2003, 2004)[13-14, 18], food safety (2002)[15], maternal and child health (2002)[16] and chronic disease (2004)[17]. In the assessment of overall epidemiology capacity conducted in 2001/2002, 41 of 44 (93%) respondents indicated substantial to full infectious

disease epidemiology and surveillance capacity, and 28 of 41 (64%) states reported having capacity to investigate infectious disease problems or health hazards[13]. However, a survey of states' overall epidemiologic capacity in 2004 showed a decrease in the number of respondents indicating they had substantial to full epidemiology and surveillance capacity in infectious disease[18].

In 2004, CSTE began to design a cross-sectional study that was intended to assess the capacity of state and large city health departments to conduct surveillance, prevention and control activities for West Nile Virus infection. In addition, the survey was intended to determine how state and large city/county health departments were staffing and conducting WNV surveillance and prevention activities. This report presents the results of a survey administered by CSTE from December 2004 through February 2005.

METHODS

The survey instrument was developed in 2004. Twenty-one indicators were developed for a range of capacities related to human, equine, avian and mosquito infection and disease surveillance as well as laboratory capacity and programmatic prevention activities. All of the indicators were extracted from CDC Guidelines[1], and survey questions were constructed from the indicators by a team consisting of the Chairperson of the CSTE Infectious Diseases Committee, CSTE National Headquarters staff, a CSTE consultant, a representative from the Association of Public Health Laboratories, and staff from the Division of Vector-Borne Infectious Diseases (DVBID), National Center for Infectious Diseases (NCID), CDC in Fort Collins, Colorado. The draft survey instrument was reviewed by members of the CSTE Infectious Diseases Committee. There were no substantive differences between the instrument developed for states and the one for large cities.

The assessment instrument was self-administered either online or by hardcopy. The key respondent in each locale was the WNV surveillance coordinator for the state or large city health department, with assistance from the agency's laboratory director or designee and with oversight from the state or city epidemiologist. A pilot study of the survey instrument was conducted in December 2004 in five states and one large city. Comments from respondents in these agencies resulted in wording changes to several questions to improve

clarity, but no substantial changes, additions or deletions were made. The revised survey was distributed in January 2005, and the last day for submitting responses was February 7, 2005. Copies of the survey instruments are included in Appendices 2 and 3.

Respondents were instructed to answer questions based on program activities in calendar year 2004. Forty-nine of 50 (98%) states submitted responses to the survey. All six (100%) large cities/counties (New York City, Los Angeles County, Chicago, Philadelphia, Houston and the District of Columbia) that receive supplemental funding for WNV surveillance from CDC participated in this assessment.

A CSTE staff member entered data that were not submitted online. After data were entered, the same staff member checked all entries to ensure they matched those provided by the state or city health department.

Not all respondents answered all questions. The frequency and percentage for each survey question's response were calculated based on the total number of responses to that question. Percentages are rounded to the nearest integer. Tables S1 and C1 display responses divided into four job categories, and respondents were instructed to treat these as mutually exclusive categories, meaning that any given employee or contractor could only be counted in one cell in the table. There were no other questions for which the respondent was

explicitly instructed that his/her answers on a particular question precluded a specific response to another question. The phrasing of questions presented in the tables in the Results and Tables sections has, in some instances, been shortened from the exact words used in the survey instruments, which are found in Appendices 2 and 3.

Except for the data presented in Figure 9, analyses for states and large cities are presented separately. In addition to univariate frequency calculations for the 49 responding states in aggregate, responses to selected questions were examined in five different groupings (Appendix 1): (1) population quintiles using July 2004 population estimates from the U.S. Census Bureau[19]; (2) the number of human cases of WNV disease reported to CDC in 2004[4]; (3) whether, as of December 31, 2004, the maximum number of human cases reported by a state had occurred in the time period 1999-2002 ("early peak"), 2003-2004 ("late peak"), or the state had not reported any human cases[4-9]; (4) the geographic location of the state by U.S. Department of Health and Human Services region of the country[20]; and (5) the amount of the CDC WNV cooperative agreement award made in FY 2004 [personal communications: Deborah Deppe, NCID/CDC and Tracy Badsgard, DVBID/NCID/CDC]. These groupings were intended to assess whether disease activity, increased program funding, state population size, geographic location, or disease burden had an association with program capacities. CDC gave awards to some large city/county health departments

separate from state awards, and the city/county awards were not considered in determining a state's award amount and grouping (Appendix 1).

Data analysis was performed using SAS version 8, MS Excel 2003, and EpiInfo version 3.3. Analysis of variance was used to test for differences in means, and the chi square test for 2 x n contingency tables was used to test for differences in proportions.

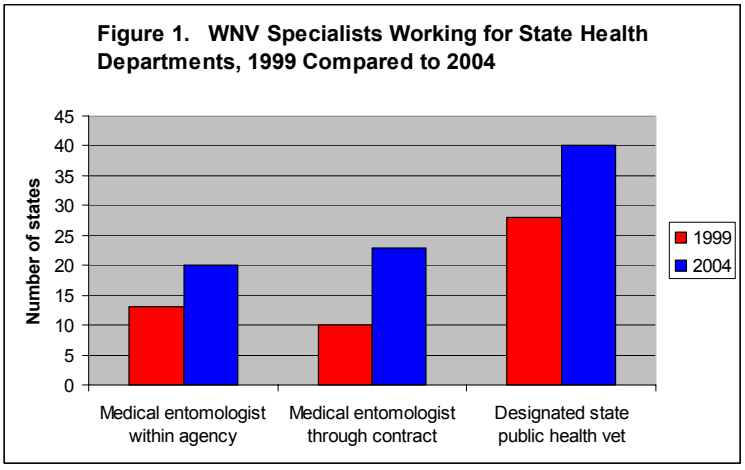
RESULTS

The text below provides summary information and highlights of data analyses displayed in the tables. The results for all questions in the survey are displayed in the Tables section of this report; the sequencing of tables, however, does not match the exact sequencing of questions in the survey. Tables S1-S16 (pages 37-45) display aggregate state health department responses to the survey, while Tables S17-S21 (pages 46-55) display tabulations of state health department data grouped in five different ways. Detailed information on groupings is presented in Appendix 1 beginning on page 64**.** Tables C1-C16 (pages 56-63) display aggregate large city/county health department responses to the survey.

Staffing in State WNV Surveillance Programs

Fifteen states (31%) reported having at least one full-time DVM, MD/DO, RN or person with other clinical degrees in the WNV surveillance program; 16 states (33%) with at least one full-time doctoral or master's-level person with a degree in epidemiology in the program; 21 states (43%) with at least one full-time doctoral or master's-level person with a degree in related sciences in the program; and 21 states (43%) with at least one full-time person performing clerical, administrative or other programmatic duties in the program (Table S1). Few states reported full-time clinical or scientific contractors working in their WNV Surveillance program. The total number of staff—full-time and part-time, employees and contractors--in each state's WNV surveillance program was not ascertained.

Table S2 shows that 92% (45/49) of state programs had adequate access to expertise in wildlife biology within their agency and that 82% (40/49) had adequate access to a designated State Public Health Veterinarian. This compares to 27 states with wildlife biology capacity and 28 states with State Public Health Veterinarians in 1999, before the national program. As shown in Figure 1 (below), a similar trend was observed for adequate access to a medical entomologist either within the public health agency—20 of 49 states (41%)—or through contract or other formal arrangement—23 of 47 states (49%). The number of states reporting such access in 1999 was 13 (within agency) and 10 (through contract), respectively.

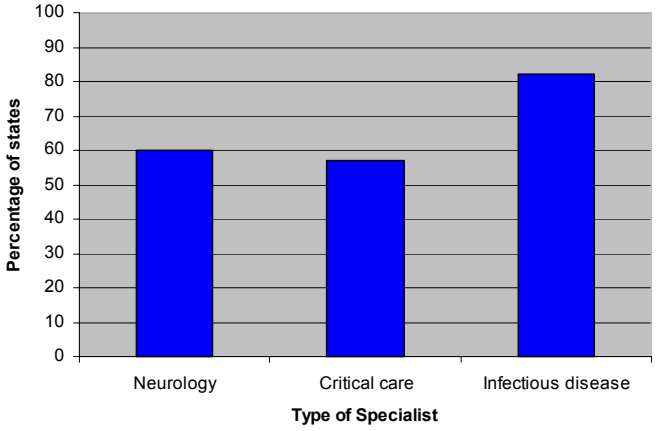


Surveillance and Prevention of Human WNV Disease by State Health Departments

Tables S3-S7 provide information on the types, methods and performance of human WNV disease surveillance and prevention activities conducted by states.

Human disease surveillance was reported to be primarily passive in 53% of states rather than primarily active (0%) or a combination of active and passive (47%, Table S3). Of three types of specialists who might diagnose and treat persons with WNV infection, 82% of programs reported contacting infectious disease specialists to encourage reporting, compared to 60% contacting neurologists and 57% contacting critical care specialists (see Figure 2 and Table S4). Sixty-three percent and 55% of states, respectively, stated that they had required reporting of hospitalized encephalitis of unknown etiology and of hospitalized meningitis of unknown etiology. Sixty-seven percent of programs reported implementing a laboratory-based surveillance system to test cerebrospinal fluid (CSF) specimens for arboviral infection (Table S4), and the median number of CSF specimens tested in the public health laboratory in 2004 was 117 (mean 310.4; range 0-2600) (Table S5).

Figure 2. Contact by State Health Departments with Medical Specialists to Encourage WNV Infection Reporting



As shown in Table S6, the median of the states' reported median intervals from collection of a human specimen to reporting positive laboratory results to the surveillance program was seven days, while the median of the median intervals

from reporting a suspect human case to the surveillance program and reporting the probable or confirmed case by the program to CDC was 16.5 days.

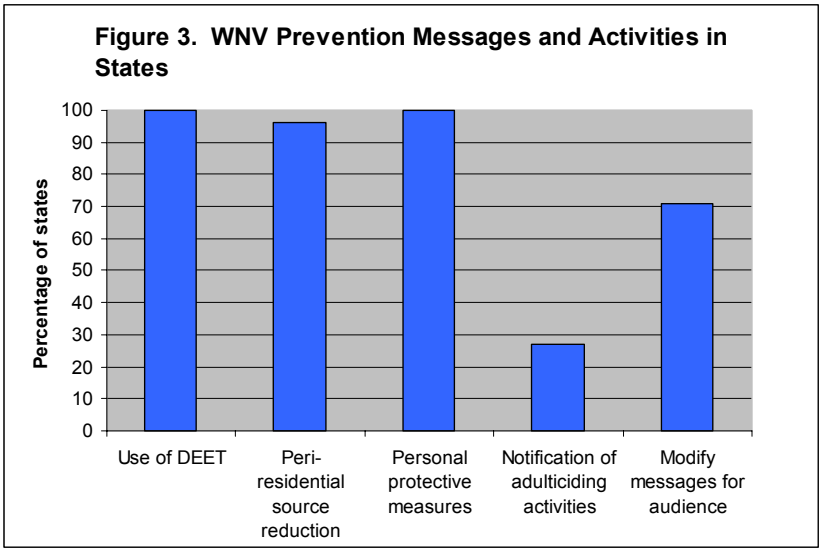
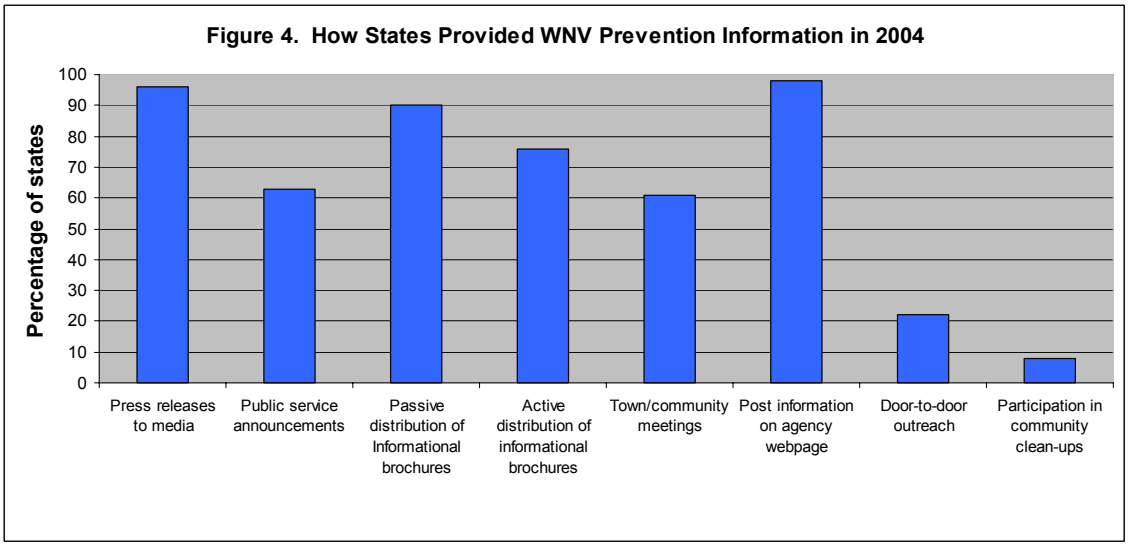


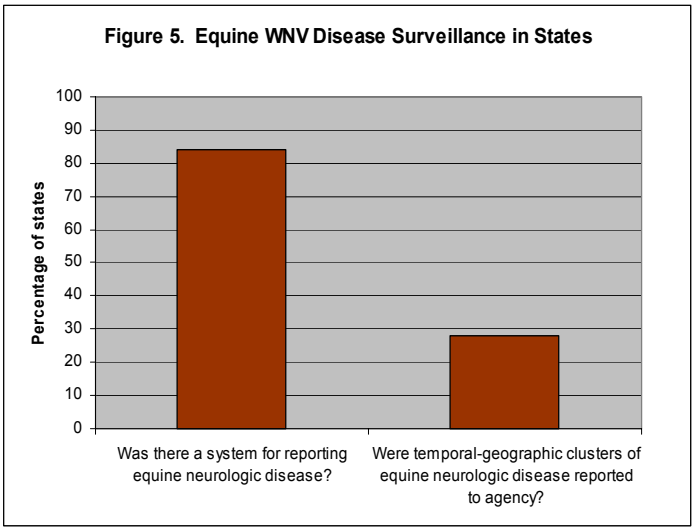
Figure 3 (above) shows that all or nearly all of state programs delivered WNV prevention messages concerning the use of DEET (N, N-diethyl-m-toluamide), peri-residential mosquito control, and other personal protective measures, whereas notification of adulticiding activities were delivered by only 27% of states (Table S7). Adulticiding activities, however, are commonly conducted by local agencies and contractors, rather than state health agencies. Figure 4 (below)



and Table S7 illustrate the various methods used by states to provide WNV prevention messages.

Surveillance for WNV Infection in Horses, Birds and Mosquitoes by State Health Departments

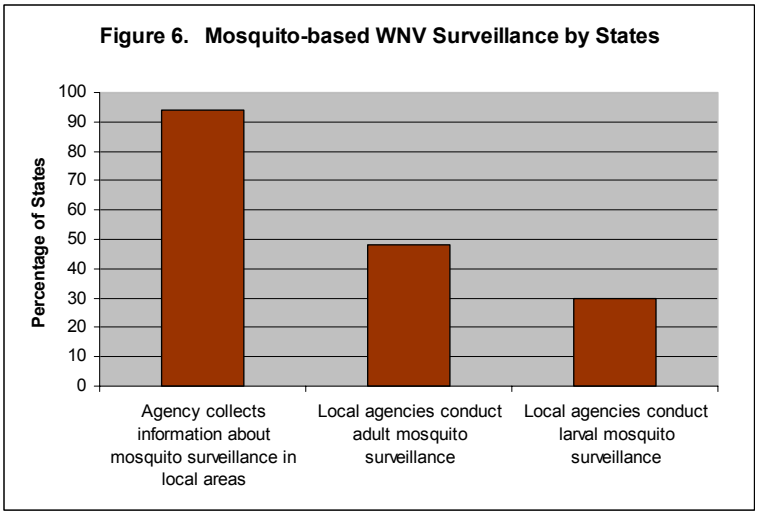
Tables S8-S12 provide information on the types and methods of non-human WNV disease surveillance conducted by states. Eighty-four percent of state WNV surveillance programs had a system for reporting cases of equine neurologic disease (Table S9 and Figure 5), and 97% reported that specimens were submitted for WNV diagnostic testing. The median number of equine specimens tested for WNV in 2004 was 12.5. Ninety percent and 77% of states reported that equine specimens were also submitted for rabies and other arboviral testing, respectively. Twenty-eight percent (n=13) of states reported that temporal-geographic clusters of equine neurologic disease were reported to the agency, and the mean of the median intervals between cluster reports and initiation of investigation was 2.3 days.



As shown in Table S10, 57% of states reported that they established a database of dead bird sightings. Of those states, 96% reported that specimens were submitted for WNV diagnostic testing. The most common elements of the database were the type of bird species (100%) and the date observed (93%).

Ninety-four percent of states reported that they collected information about mosquito surveillance in their jurisdiction; the mean of the percentage of the state's population covered by mosquito surveillance was 61.5% (Table S11). Eighty percent of states received reports from laboratories identifying the mosquito species, and 57% either calculated or received information on minimum infections rates. All other mosquito surveillance activities, such as mapping larval breeding sites and monitoring for pesticide resistance, were conducted by a relatively small percentage of states. Forty-eight percent and 30% of states reported that most local health agencies conducted adult and larval mosquito surveillance, respectively, as shown above in Figure 6.

Figure 6. Mosquito-based WNV Surveillance by States



While supplemental WNV funding enhanced almost all states' surveillance for other mosquito-borne diseases (98%), it was viewed as enhancing tick-borne disease surveillance by only 37% of states and as enhancing flea-borne disease surveillance by only 17% (Table S12).

Public Health and Clinical Laboratories: Testing and Reporting

As shown in Table S13, 87% of states reported that their public health laboratory had BSL 3 capacity. The percentage reporting animal BSL 3 capacity was considerably less (17%).

Eighty-five percent of states reported that there was commercial testing for WNV in human specimens, but less than 20% reported commercial testing for bird or mosquito specimens (Table S14). Similar trends (i.e., large differences between human specimens and bird/mosquito specimens) were observed for requirements for confirmatory testing of commercial lab-positive specimens and reporting requirements for out-of-state laboratories.

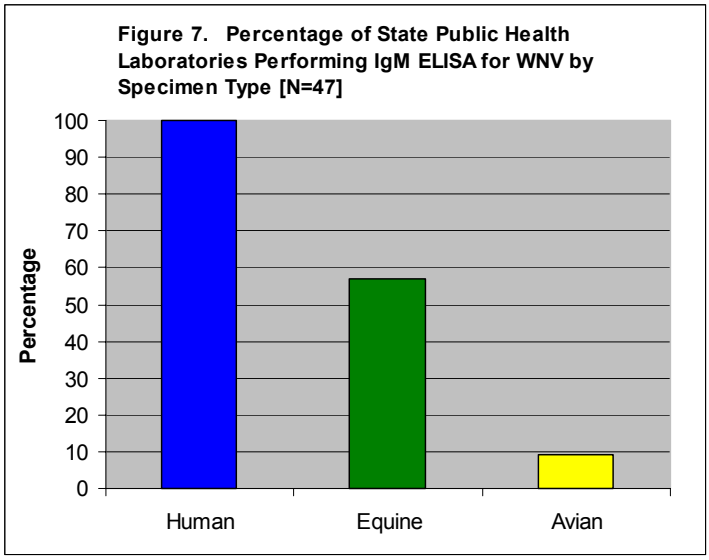


Table S15 displays the percentage of state public health laboratories performing different types of assays on different specimens. One hundred

percent of state labs performed IgM ELISA assays on human specimens (Figure 7, above), and 79% performed PCR assays on mosquito specimens. Plaque-reduction neutralization tests (PRNT)—a confirmatory assay—were performed by a minority of state labs on human (21%), equine (13%), avian (6%) or sentinel species (6%). Fourteen of 49 states (28%) reported that their laboratory uses a PRNT test. PRNT was used to confirm all positive ELISAs by seven of the 14 states (50%) and was used more selectively by the other 50% (Table S16). Twenty-three of 36 (64%) states not performing PRNT reported that confirmatory testing was performed at CDC.

Comparison of States Grouped by Size, Reported Cases, Location and Supplemental CDC Funding

Tables S17a-S21b display results of tabulations when dividing states into groups based on population size, location (either HHS regional groupings or ”early” versus ”late” states for peak incidence of reported human WNV cases), total reported human WNV cases in 2004, and amount of CDC supplemental funding awarded in FY2004. There are interesting or surprising findings in some of the cells of the tables, but few trends across groupings.

Using a cutoff for statistical significance of $p<0.05$, there were only two statistically significant differences noted:

1) In Table S21b, which displays groupings by the FY 2004 CDC WNV award amount, $p=0.0168$ for the analysis of variance of the means of the

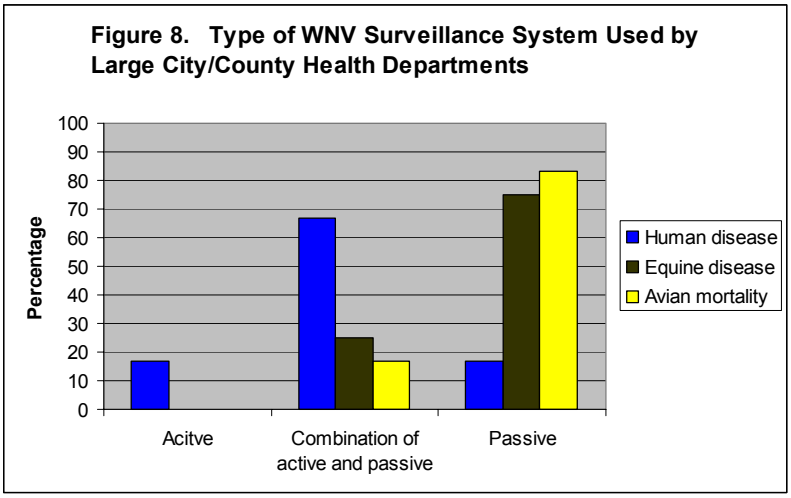
median interval between the date that a WNV-positive human specimen was collected and the date the positive laboratory were reported to the WNV surveillance program. In this analysis, the mean of the median interval for states with the greatest award amount was 8.9 days, compared to 10.1 days, 9.3 days and 10.2 days for the state groupings with smaller award amounts. A similar, although not statistically significant trend was observed in the same table for the means of the median interval between the date that a probable or confirmed human case was reported to the program and the date the case was reported on ArboNET. Also in Table S21b, the means of the total number of CSF specimens tested for WNV was greater in the higher award states compared to those with smaller amounts (p=0.0578, analysis of variance).

2) In Table S21b, the proportion of state WNV surveillance programs that had employed a full-time PhD or master's level person in a related science was significantly lower in the 19 states with the lowest award amount (10% compared to 67%, 50% and 75% in the 30 states with higher award levels, p=0.02, chi square). Similar non-statistically significant trends were found for proportion of states with full-time staff with either clinical or epidemiology degrees.

The Capacity of Large City/County Health Departments for WNV Surveillance and Disease Control

CDC awards to support WNV surveillance activities in large city/county departments were similar in amount and purpose as the funding awarded to many state health departments (Appendix 1). As a result, the findings of this survey reflect a range of capacities similar to those found in state health departments. Sixty-seven percent of the large city/counties reported that their system for human disease surveillance was a combination of active and passive surveillance, whereas most localities reported that equine and avian surveillance were primarily passive (75% and 83%, respectively) (Figure 8 and Tables C3 and C8). One hundred percent of the local health departments contacted neurologists, critical specialists and infectious disease specialists to encourage reporting, and 100% require reporting of both encephalitis and meningitis of unknown etiology (Table C4). Fifty percent implemented a laboratory-based surveillance system to test CSF specimens for arboviral infection (Table C4).

Figure 8. Type of WNV Surveillance System Used by Large City/County Health Departments



Two (33%) local health departments had a system for reporting equine neurologic disease, but in only one jurisdiction were specimens submitted for WNV diagnostic testing (Table C9). Four (67%) local health departments maintained a database of dead bird sightings (Table C10), and four (67%) collected information about mosquito surveillance (Table C11). One hundred percent of respondents reported that they conducted both adult and larval mosquito surveillance, 75% reported calculating minimum mosquito infection rates, and 83% stated they provided prevention messages notifying of adulticiding activities (Table C7). Fifty percent of the local health departments used door-to-door outreach in selected locations, and 50% reported participating in community clean-ups to get rid of mosquito breeding sites (Table C7).

Fifty percent of the local health departments reported their public health laboratory had a BSL 3 capability (Table C13). For human specimen WNV testing, 100% performed IgM ELISA assays, and 83% performed PCR assays (Table C15). One local public health laboratory reported using the PRNT for all positive ELISA assays, while three (60%) of five responding localities reported that they sent specimens to CDC for confirmatory testing (Table C16).

DISCUSSION

West Nile virus infection in the United States appears to reach a peak incidence in a particular region followed in subsequent years by much lower levels of avian mortality and human and equine disease[3-10]. CDC first published specific guidelines for the surveillance and control of WNV in 2000[11], and revised guidelines were published in 2003[1]. CSTE conducted this survey in early 2005, after the sixth season of WNV activity in North America.

Respondents were instructed to answer questions based on program activities in calendar year 2004. Forty-nine of 50 (98%) states submitted responses to the survey as well as all six of the large city/county health departments. In addition to the presence of human, avian, equine and mosquito WNV surveillance programs in all states and major cities, results demonstrate that these WNV surveillance and control programs are well developed. This is based on the following findings:

- Presence of a surveillance system for human disease that included outreach to relevant specialists, reporting of encephalitis and meningitis of unknown etiology, and laboratory-based testing and reporting;
- Presence of surveillance systems that include reporting of equine neurologic disease (84%), tracking dead bird sightings (57%), and collection of information about mosquito infection rates by species (80%);

- Reporting intervals from collection of human and bird specimens to laboratory confirmation to surveillance program notification were approximately one week;
- Delivery of prevention messages (100%) concerning use of DEET (N, N-diethyl-m-toluamide) and other personal protection measures via press releases (96%), public service announcements (63%), and distribution of information brochures (76%);
- Testing for human infection available in all (100%) state public health laboratories; many laboratories are also equipped to perform animal and mosquito surveillance testing; and
- Adequate access to expertise in wildlife biology (92%), and adequate access to medical entomologists within a public health agency (41%) or through contract or other formal arrangement (49%). The number of states with access to these experts has increased since 1999.

Individual questions were analyzed independently from other questions within the survey. Each state's response to questions was analyzed independent of the state's responses to other questions. This was because the intent was to determine the overall capacity for WNV surveillance by state health departments in the U.S. As a result, a state's response for a particular question (such as the total number of full- and part-time staff in a state's WNV program) was not summed and no attempt was made to correlate and compare responses by individual states to multiple questions (such as whether a state that had primarily

active surveillance for human disease required reporting of encephalitis of unknown etiology). Because each state was in a different stage of the evolution of the WNV epizootic/epidemic and states may reasonably choose to emphasize or develop certain capacities to meet local needs, the number of states that had all or nearly all of an arbitrary list of capacities was not calculated and no attempt was made to follow-up with a respondent to determine why a state answered a particular way.

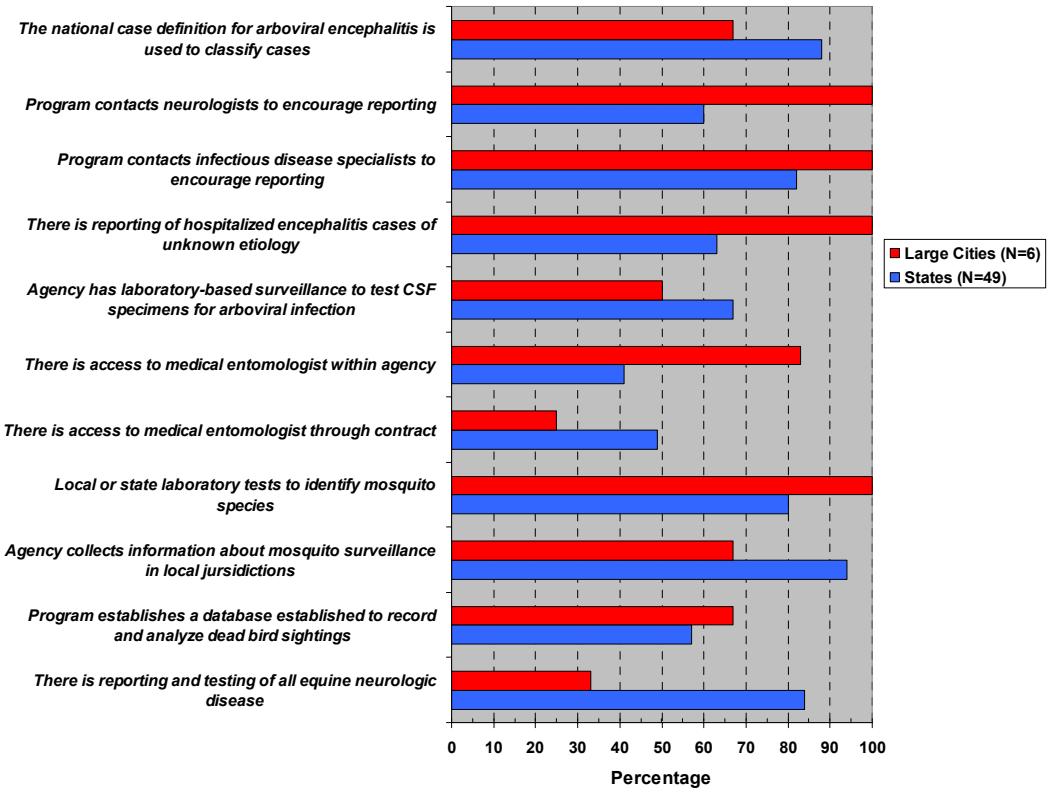
Although CDC has provided federal funding to help states develop and operate WNV surveillance and control programs, federal funding may not be the sole source of support to a state's program. Since the primary intent was to characterize the functioning of WNV surveillance and control programs, the amounts and proportions of WNV program funding from various sources were not determined.

The national program developed in response to WNV distributed its initial funding in late 1999 and included guidance to states on its purpose and use. Additionally, CDC, in consultation with state, academic and other partners, developed detailed technical guidance for all aspects of a surveillance and response program, which was provided to each state in 2000. The dramatic build-up of surveillance systems, technical expertise, laboratory capacity and the prevention effort is clearly linked by the findings of this assessment to these

increases in federal funding and the technical guidance and leadership provided by CDC.

The six large city/county health departments that were included in the survey receive supplemental funding from CDC for WNV surveillance and control. No other large city/county health departments receive such funding. Thus, the extent to which these agencies are representative of WNV surveillance activities in all city/county health departments is unclear. Nonetheless, it is interesting to compare the responses of the large city/county agencies to the state agencies. Figure 9 (below) presents a bar chart comparing the percentage of state and large city/county respondents who reported conducting selected WNV surveillance and control activities.

Figure 9. Comparison of WNV Surveillance Capacity in State and Large City/County Health Departments Based on CDC Guidelines[1]



It would be expected that WNV surveillance and control program emphases of large city/county health departments would differ from those of state health department programs because the roles and responsibilities of the two levels of public health agency are different. For example, mosquito control is primarily conducted by local agencies and contractors, and we found that local health departments more frequently conducted larval (100% vs. 30%) and adult (100% vs. 48%) mosquito surveillance than state health departments. Local health departments also more frequently provided notification of adulticiding activities

(83% vs. 27%). These differences, however, probably are a reflection of agency role, rather than agency performance.

In the analysis of survey results, states were grouped in various ways to determine if certain characteristics, such as population size, location, disease burden and CDC funding support, were correlated with WNV programmatic activities and performance. As noted above, there were only two statistically significant differences, and these appear to be consistent with the general hypothesis that program functioning is positively related to greater resources. In addition, there were a number of isolated non-statistically significant findings compatible with this general hypothesis, such as a higher mean number of CSF specimens tested for WNV in the state public health laboratory in states with a greater population. Nonetheless, when all the results for a particular grouping were reviewed, no consistent trends were found. There were small numbers of states in some of the groups, and this resulted in decreased statistical sensitivity.

Another way of interpreting the results, however, is that the absence of significant trends across groupings indicates that capacity for WNV surveillance and control has developed relatively evenly in large and small state health departments across the entire country. Furthermore, the increase in WNV surveillance capacity has helped virtually all states and large cities/counties with surveillance for other mosquito-borne diseases and assisted a number of states with surveillance for flea-borne and tick-borne diseases. There have been increases

in the total number of states with designated state public health veterinarians and with medical entomologists.

CONCLUSION and RECOMMENDATIONS

CSTE, with assistance from APHL and CDC, conducted a survey in 2004-2005 of WNV surveillance and control programs in 49 state health departments and six large city/county health departments. In addition to the specific capacity to combat WNV, states and the public health system have benefited by new viral disease laboratory capacity, and a new network of technical expertise including state public health veterinarians, wildlife biologists, entomologists, and clinical and epidemiologic leads to support surveillance for other vector-borne diseases. The development of these well-functioning programs across the nation is attributed to the publication of comprehensive and specific disease control guidelines by CDC, annual scientific conferences convened by CDC, the transfer of laboratory technologies from CDC to state public health laboratories, and the provision of new funding for WNV prevention programs through a highly effective agreement mechanism established by CDC to rebuild capacity in the U.S. to meet the challenge of emerging diseases in the 21st century.

The success, evidenced by the establishment of the national program for WNV, is based on a decade of work by CDC and states to rebuild the public health infrastructure to address newly emerging and reemerging infectious diseases.

The rapid development of an effective response to WNV capitalized on this platform for state-based response. Based on its findings, CSTE recommends sustained funding for WNV efforts with consideration for flexibility in use of existing and new WNV disease funds to address vector-borne and arboviral diseases more broadly through the emerging disease grant mechanism.

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TABLES

Tables S1 through S16 display aggregate state health department responses to the survey.

Tables S17 through S21 display state health department data grouped in five different ways. Detailed information on groupings is presented in **Appendix 1.**

Tables C1 through C16 display aggregate large city/county health department responses to the survey.

Table S1. Number and type of WNV surveillance staff in state health departments (N=49)

	# with DVM, MD/DO, RN or other clinical degrees		# with PhD, DrPH, MSPH, MPH degrees in epidemiology		# with PhD or Master's degree in related sciences		# of all other clerical, administrative, and programmatic staff	
	N	Median and range	N	Median and range	N	Median and range	N	Median and range
State health department employees								
1.0 FTE	15	1 (1-2)	16	1 (1-4)	21	2 (1-5)	21	3 (1-8)
0.50-0.99 FTE	12	1 (1-4)	10	1 (1-4)	11	1 (1-6.5)	17	2 (1-13.5)
<0.50 FTE	22	2 (1-77)	11	1 (1-7)	16	1.5 (1-12)	27	2 (1-60)
Contractors (not including county HDs)								
1.0 FTE	1	1 (N/A)	2	1 (1-1)	4	1.5 (1-2)	9	2 (1-15)
0.50-0.99 FTE	3	2 (1-4)	2	1.5 (1-2)	6	1 (1-2)	7	2 (1-9)
<0.50 FTE	5	1 (1-1)	1	2 (N/A)	10	1 (1-9)	11	4 (1-15)

Table S2. Specialists working for state health departments

Does your agency have adequate access to:	Currently (2004)		If yes, did your agency have access in 1999?	
	N	Yes (%)	N	Yes (%)
Medical entomologist within public health agency	49	20 (41)	19	13 (68)
Medical entomologists through contract or other formal arrangement	47	23 (49)	17	10 (59)
Expertise in wildlife biology within your agency	49	45 (92)	33	27 (82)
Designated state public health veterinarian within your agency	49	40 (82)	33	28 (85)

Table S3. Duration and type of human WNV surveillance in state health departments

	Number of months of surveillance		Type of Surveillance System		
			Primarily Active	Combination of Active and Passive	Primarily Passive
	N	Mean	%	%	%
Human disease	49	10.6	0	47	53

Table S4. Human WNV surveillance and reporting in states		
	N	**Yes (%)**
To encourage reporting and to suggest a high index of suspicion for arboviral encephalitis, did your agency:		
• Contact neurologists	48	29 (60)
• Contact critical care specialists	49	28 (57)
• Contact infectious disease specialists	49	40 (82)
Require reporting of:		
• hospitalized encephalitis cases of unknown etiology?	49	31 (63)
• hospitalized meningitis cases of unknown etiology?	49	27 (55)
Did your agency:		
• Implement a laboratory-based surveillance system to test CSF specimens for arboviral infection?	48	32 (67)
• Use the CDC/CSTE NPHSS case definition exclusively for neuroinvasive disease to classify cases as confirmed or probable?	49	43 (88)

Table S5. Human testing for WNV in states			
In your agency:	**N**	***Mean***	**Median and range**
Number of CSF specimens tested for WNV infection in the state public health laboratory	48	310.4	117 (0-2600)
In tests conducted by public or private laboratories in 2004, the number of patients with CSF IgM antibodies positive for:			
• *WNV* virus	46	13.5	4 (0-204)
• *SLE* virus	44	1.3	0 (0-20)

Table S6. The speed of reporting human WNV cases in states			
In 2004 what was the median interval in days:			
	N	***Mean* of median interval (days)**	***Median and range* of median interval (days)**
• Between the date that a WNV-positive *human specimen* was collected and the date that positive laboratory results were reported to the WNV surveillance program?	35	9.6	7 (2-28)
• Between the date that the case was initially reported to the WNV surveillance program and the date that the case was reported on ArboNet for cases of *human disease* that were ultimately determined to be probable/confirmed?	28	18.1	16.5 (2-45)

Table S7. WNV prevention activities in states	
(N=49)	**Yes (%)**
Which of the following WNV *prevention messages* and activities did your program use and promote in 2004?	
• Use of DEET-based repellents	49 (100)
• Peri-residential source reduction	47 (96)
• Personal protective measures	49 (100)
• Notification of adulticiding activities	13 (27)
• Modification of messages for lower literacy and non-English speaking audiences	35 (71)
Which of the following *methods* did your program use to provide WNV prevention information in 2004?	
• Press releases to electronic and printed media	47 (96)
• Public service announcements	31 (63)
• Passive distribution of informational brochures	44 (90)
• Active distribution of informational brochures	37 (76)
• Town, community, or neighborhood meetings	30 (61)
• Posting information on the home page of your agency's website	48 (98)
• Door-to-door outreach in selected locations	11 (22)
• Participation in community clean-ups	4 (8)

Table S8. Duration and type of non-human WNV surveillance in state health departments

	Number of months of surveillance		Type of Surveillance System		
			Primarily Active	Combination of Active and Passive	Primarily Passive
	N	Mean	%	%	%
Equine disease	46	9.3	0	23	77
Avian mortality	48	7.5	4	38	58
Mosquito	47	7	N/A	N/A	N/A

Table S9. Equine WNV disease surveillance in states

	Yes (%)	No (%)	Unk (%)
Did your agency have in place a system for reporting cases of equine neurologic disease to the state health department?	41 (84)	8 (16)	0 (0)
If yes, were specimens submitted for diagnostic testing for:			
• WNV	38 (97)	1 (3)	0 (0)
• other arboviruses	30 (77)	6 (15)	3 (8)
• rabies	35 (90)	2 (5)	2 (5)
How many equine specimens were tested in the public health laboratory for:			
	N	***Mean***	**Median and range**
• WNV	44	89.5	12.5 (0-1423)
• other arboviruses	39	18.6	0 (0-263)
• rabies	42	18.6	14.5 (0-80)
Temporal-geographic clusters (2 or more cases) of equine neurologic disease			
Were clusters reported to your agency?	**N**	**Yes (%)**	
	47	13 (28)	
If yes, how many clusters were reported?	**N**	***Mean***	
	11	1.7	
Did your program or any state agency investigate clusters to determine cause of illness?	**N**	**Yes (%)**	
	13	8 (62)	
Median interval in days from the date the cluster was defined and reported to your program until the investigation began?	**N**	***Mean***	
	6	2.3	

Table S10. Avian WNV disease surveillance in states			
	N	**Yes (%)**	
Did your agency establish and maintain a database of dead bird sightings?	49	28 (57)	
If yes, were specimens submitted for diagnostic testing for WNV?	28	27 (96)	
If yes, to the above, did your agency have a policy in place for determining which avian specimens and how many avian specimens to test?	27	27 (100)	
If your agency maintains a database, were the following included in the database? (N=28)			
• Caller name		22 (79)	
• Caller's telephone number		21 (75)	
• Date observed		26 (93)	
• Location geocoded to the highest feasible resolution		19 (68)	
• Bird species		28 (100)	
• Condition of the carcass		22 (79)	
	N	***Mean* of median interval (days)**	***Median and range* of median interval (days)**
In 2004 what was the median interval in days between the date that a WNV-positive *dead bird* was collected and the date that positive laboratory results on that bird were reported to the WNV surveillance program?	40	8.4	7 (1-30)

Table S11. Mosquito-based WNV surveillance in states			
	N	**Yes (%)**	**No (%)**
Does your agency collect information about mosquito surveillance in local jurisdictions or areas?	49	46 (94)	3 (6)
	N	***Mean***	**Unk (N and %)**
Approximate *percentage* of the human population that is covered by mosquito surveillance	37	61.5	6 (16)
For how many *trap-nights* were adult mosquitoes collected in 2004?	35	3573.6	14 (40)
	N	**Yes (%)**	**Unk (%)**
Does your agency:			
• Receive reports from local laboratories and/or your public health laboratory identifies the species	45	36 (80)	2 (4)
• Calculate minimum infections rates with mosquito data or receive this data	44	25 (57)	1 (2)
• Map larval breeding sites	45	8 (18)	2 (4)
• Evaluate adult mosquito control using caged mosquitoes to measure kill rates in sprayed areas	45	2 (4)	1 (2)
• Monitor for pesticide resistance	45	4 (9)	1 (2)
Do most local health agencies within your jurisdiction conduct:			
• *adult* mosquito surveillance	44	21 (48)	
• *larval* mosquito surveillance	44	13 (30)	

Table S12. Surveillance of other vector-borne diseases		
	N	**Yes (%)**
Has WNV funding enhanced your agency's capacity to conduct surveillance for other vector-borne diseases?		
• other mosquito-borne	47	46 (98)
• other tick-borne	43	16 (37)
• other flea-borne	41	7 (17)

Table S13. Laboratory biosafety capacity in states	
What is the capacity of the state public health laboratory in your jurisdiction—check all that apply (n =47)	**N (%)**
• BSL 2	21 (45)
• BSL 3	41 (87)
• Animal BSL 3	8 (17)

Table S14. Laboratory testing for WNV in states		
	N	**Yes (%)**
Was commercial testing performed in your jurisdiction for:		
• Human specimens	47	40 (85)
• Bird specimens	47	5 (11)
• Mosquito specimens	47	9 (19)
In 2004 did your agency require confirmation of commercial-lab-positive specimens by your public health laboratory or a diagnostic reference laboratory?		
• Human specimens	46	37 (80)
• Bird specimens	37	11 (30)
• Mosquito specimens	38	11 (29)
Were out-of-state laboratories required to report positive WNV tests on specimens collected within your jurisdiction?		
• Human specimens	45	35 (78)
• Bird specimens	43	11 (26)
• Mosquito specimens	43	10 (23)

Table S15. WNV assays run by state public health laboratories

N=47	IgM ELISA N (%)	IgG ELISA N (%)	PRNT N (%)	Culture N (%)	PCR N (%)	Vec Test N (%)
Human	47 (100)	34 (72)	10 (21)	9 (19)	23 (49)	
Equine	27 (57)	11 (23)	6 (13)	9 (19)	21 (45)	
Avian	4 (9)	1 (2)	3 (6)	6 (13)	36 (77)	7 (15)
Sentinel	13 (28)	4 (9)	3 (6)	2 (4)	6 (13)	
Mosquito				11 (23)	37 (79)	10 (21)

Table S16. Use of plaque-reduction neutralization tests (PRNT) by state public health laboratories

	N (%)
If your laboratory uses a PRNT test, how is it used? (check one) (N=14)	
• All positive ELISAs	7 (50)
• All early season and any unusual ELISAs throughout the season	3 (21)
• Only on equivocal ELISAs	4 (29)
If PRNT is <u>not</u> performed in your state public health laboratory, where is confirmatory testing performed? (check one) (N=36)	
• CDC	23 (64)
• At another state's public health laboratory	4 (11)
• ELISA positive are not confirmed by PRNT	9 (25)

Table S17a. Groupings by *size of state population* using population estimates for July 1, 2004, U.S. Census Bureau

	Percentage				
Number of states	N=10	N=10	N=10	N=9	N=10
Population range	8,698,879 to 35,893,799	5,509,026 to 8,541,221	2,954,451 to 5,100,958	1,317,253 to 2,902,966	506,529 to 1,299,500
Type of *human disease* surveillance:					
• primarily active	0	0	0	0	0
• combination of active and passive	50	60	30	56	40
• primarily passive	50	40	70	44	60
Specifically contact specialists:					
• neurologists	44	50	60	89	60
• critical care specialists	50	50	60	78	50
• inf. disease specialists	80	80	80	100	70
Require reporting of hospitalized cases with unknown etiology:					
• encephalitis	80	40	40	89	70
• meningitis	70	50	30	67	60
Implement lab surveillance to test CSF for arboviral infection	80	60	50	100	50
Does the state health dept. have access to a medical entomologist within the agency?	60	50	30	56	10
Use the CDC/CSTE NPHSS case definition exclusively to classify cases	80	100	80	100	80
Type of *equine disease* surveillance:					
• primarily active	0	0	0	0	0
• combination of active and passive	30	20	10	44	11
• primarily passive	70	80	90	56	89
Type of *avian mortality* surveillance:					
• primarily active	10	0	10	0	0
• combination of active and passive	30	11	60	44	40
• primarily passive	60	89	30	56	60

Table S17b. Groupings by *size of state population* using population estimates for July 1, 2004, U.S. Census Bureau

Number of states	N=10	N=10	N=10	N=9	N=10
Population range	8,698,879 to 35,893,799	5,509,026 to 8,541,221	2,954,451 to 5,100,958	1,317,253 to 2,902,966	506,529 to 1,299,500
No. and percent of states with full-time FTE with DVM, MD/DO, RN, or other clinical degrees employed in WNV surveillance program:					
	5 (50)	4 (40)	1 (10)	4 (44)	1 (10)
No. and percent of states with full-time FTE with PhD, DrPH, MSPH, or MPH degrees in epidemiology employed in WNV surveillance program:					
	5 (50)	4 (40)	2 (20)	2 (22)	3 (30)
No. and percent of states with full-time FTE with PhD or Master's degrees in related sciences employed in WNV surveillance program:					
	6 (60)	7 (70)	3 (30)	3 (33)	2 (20)
	Mean (standard deviation)				
Median interval in days between: • **the date that WNV-positive dead bird was collected *and*** • **the date that positive lab results were reported to the WNV surveillance program**	7.0 (4.2)	10.1 (6.8)	6.0 (3.4)	7.0 (3.4)	12.3 (11.3)
Median interval in days between: • **the date that WNV-positive human specimen was collected *and*** • **the date that positive lab results were reported to the WNV surveillance program**	15.6 (7.8)	10.8 (5.3)	10.1 (5.3)	5.4 (2.9)	4.2 (1.3)
Median interval in days between: • **the date that a probable/confirmed human case was reported to the WNV surveillance program *and*** • **the date the case was reported on ArboNET**	30.5 (10.8)	23.0 (10.8)	16.0 (12.2)	6.0 (5.4)	14.2 (14.9)
Total number of CSF specimens tested for WNV infection in the state public health laboratory	614.6 (539.1)	239.9 (179.2)	280.2 (642.5)	384.0 (839.3)	71.1 (79.9)

Table S18a. Groupings by *number of WNV cases reported in calendar year 2004*				
	Percentage			
Number of states	N=6	N=12	N=11	N=20
Number of reported cases in 2004	88-771 cases	20-57 cases	10-19 cases	0-9 cases
Type of *human disease* surveillance:				
• primarily active	0	0	0	0
• combination of active and passive	67	42	36	50
• primarily passive	33	58	64	50
Specifically contact specialists:				
• neurologists	40	83	45	60
• critical care specialists	67	83	36	50
• inf. disease specialists	83	100	73	75
Require reporting of hospitalized cases with unknown etiology:				
• encephalitis	50	50	64	75
• meningitis	67	33	82	50
Implement lab surveillance to test CSF for arboviral infection	50	75	73	63
Use the CDC/CSTE NPHSS case definition exclusively to classify cases	67	92	82	95
Does the state health dept. have access to a medical entomologist within the agency?	83	33	45	30
Did your program use and promote notification of adulticiding activities?	17	33	45	15
Type of *equine disease* surveillance:				
• primarily active	0	0	0	0
• combination of active and passive	33	8	27	26
• primarily passive	67	92	73	74
Type of *avian mortality* surveillance:				
• primarily active	0	0	10	5
• combination of active and passive	50	42	30	35
• primarily passive	50	58	60	60
Did your agency establish and maintain a database of dead bird sightings?	67	42	55	65

Table S18b. Groupings by *number of WNV cases reported in calendar year 2004*				
	Mean (std deviation)			
Number of states	N=6	N=12	N=11	N=20
Number of reported cases in 2004	88-771 cases	20-57 cases	10-19 cases	0-9 cases
No. and percent of states with full-time FTE with DVM, MD/DO, RN, or other clinical degrees employed in the WNV surveillance program:				
	3 (50)	5 (41)	3 (27)	4 (20)
No. and percent of states with full-time FTE with PhD, DrPH, MSPH, or MPH degrees in epidemiology employed in the WNV surveillance program:				
	4 (67)	2 (16)	3 (27)	7 (35)
No. and percent with full-time FTE with PhD or Master's degrees in related sciences employed in the WNV surveillance program:				
	2 (33)	6 (50)	6 (54)	7 (35)
	Mean (standard deviation)			
Median interval in days between: **• the date that WNV-positive dead bird was collected and** **• the date that positive lab results were reported to the WNV surveillance program**	5.8 (3.8)	9.2 (6.2)	9.6 (6.0)	8.0 (7.7)
Median interval in days between: **• the date that WNV-positive human specimen was collected and** **• the date that positive lab results were reported to the WNV surveillance program**	6.6 (2.9)	6.2 (2.7)	13.4 (6.5)	9.6 (7.3)
Median interval in days between: **• the date that a probable/confirmed human case was reported to the WNV surveillance program and** **• the date the case was reported on ArboNET**	9.3 (7.8)	16.3 (11.5)	28.1 (14.4)	14.6 (10.5)
Total number of CSF specimens tested for WNV infection in the state public health laboratory	703.8 (854.3)	571.4 (813.8)	255.7 (231.5)	85.5 (91.2)

Table S19a. Groupings by *peak time period of reported cases*

	Percentage		
Number of states	N=34	N=12	N=3
Peak time period of reported cases	1999 to 2002	2003 to 2004	Cumulative case count=0 as of 12/31/04
Type of *human disease* surveillance:			
• primarily active	0	0	0
• combination of active and passive	44	58	33
• primarily passive	56	42	67
Specifically contact specialists:			
• neurologists	59	64	67
• critical care specialists	56	67	33
• inf. disease specialists	79	92	67
Require reporting of hospitalized cases with unknown etiology:			
• encephalitis	62	67	67
• meningitis	53	67	33
Implement lab surveillance to test CSF for arboviral infection	70	58	67
Does the state health dept. have access to a medical entomologist within the agency?	44	42	0
Use the CDC/CSTE NPHSS case definition exclusively to classify cases	91	75	100
Type of *equine disease* surveillance:			
• primarily active	0	0	0
• combination of active and passive	21	33	0
• primarily passive	79	67	100
Type of *avian mortality* surveillance:			
• primarily active	6	0	0
• combination of active and passive	35	45	33
• primarily passive	59	55	67

Table S19b. Groupings by *peak time period of reported cases*

	Mean (std deviation)		
Number of states	N=34	N=12	N=3
Peak time period of reported cases	1999 to 2002	2003 to 2004	Cumulative case count=0 as of 12/31/04
No. and percent of states with full-time FTE with DVM, MD/DO, RN, or other clinical degrees employed by WNV surveillance program:			
	10 (29)	4 (33)	1 (33)
No. and percent of states with full-time FTE with PhD, DrPH, MSPH, or MPH degrees in epidemiology employed by WNV surveillance program:			
	10 (29)	5 (41)	1 (33)
No. and percent of states with full-time FTE with PhD or Master's degrees in related sciences employed by WNV surveillance program:			
	15 (44)	6 (50)	0 (0)
	Mean (standard deviation)		
Median interval in days between: • **the date that WNV-positive dead bird was collected and** • **the date that positive lab results were reported to the WNV surveillance program**	7.6 (5.3)	11.5 (10.4)	7.0 (N/A)
Median interval in days between: • **the date that WNV-positive human specimen was collected and** • **the date that positive lab results were reported to the WNV surveillance program**	10.9 (7.0)	6.8 (3.0)	7.0 (N/A)
Median interval in days between: • **the date that a probable/confirmed human case was reported to the WNV surveillance program and** • **the date the case was reported on ArboNET**	19.6 (13.4)	12.9 (11.3)	30.0 (N/A)
Total number of CSF specimens tested for WNV infection in the state public health laboratory	280.4 (467.4)	485.5 (753.9)	8.3 (10.4)

Table S20a. Groupings by *U.S. Department of Health and Human Services (HHS) Regions*

	Percentage				
Number of states	N=13	N=10	N=13	N=6	N=7
HHS Regions	*Northeast*: Regions I, II, III	*Midwest*: Regions V, VII	*Southeast and South central:* Regions IV, VI	*Rocky Mountains*: Region VIII	*West and Northwest*: Regions IX, X
Type of *human disease* surveillance:					
• primarily active	0	0	0	0	0
• combination of active and passive	69	40	38	17	57
• primarily passive	31	60	62	83	43
Specifically contact specialists:					
• neurologists	62	40	83	67	43
• critical care specialists	46	60	77	67	29
• inf. disease specialists	69	90	85	100	71
Require reporting of hospitalized cases with unknown etiology:					
• encephalitis	92	50	38	67	71
• meningitis	62	60	31	67	71
Implement lab surveillance to test CSF for arboviral infection	62	80	62	40	86
Does the state health dept. have access to a medical entomologist within the agency?	31	50	62	0	43
Use the CDC/CSTE NPHSS case definition exclusively to classify cases	100	100	85	67	71
Type of *equine disease* surveillance:					
• primarily active	0	0	0	0	0
• combination of active and passive	38	10	23	17	17
• primarily passive	62	90	77	83	83
Type of *avian mortality* surveillance:					
• primarily active	0	10	0	0	14
• combination of active and passive	50	30	23	67	29
• primarily passive	50	60	77	33	57

Table S20b. Groupings by *U.S. Department of Health and Human Services (HHS) Regions*

	Mean (std deviation)				
Number of states	N=13	N=10	N=13	N=6	N=7
HHS Regions	*Northeast*: Regions I, II, III	*Midwest*: Regions V, VII	*Southeast and South central:* Regions IV, VI	*Rocky Mountains*: Region VIII	*West and Northwest*: Regions IX, X
No. and percent of states with full-time FTE with DVM, MD/DO, RN, or other clinical degrees employed by WNV surveillance program:					
	4 (30)	4 (40)	4 (30)	0 (0)	3 (42)
No. and percent of states with full-time FTE with PhD, DrPH, MSPH, or MPH degrees in epidemiology employed by WNV surveillance program:					
	5 (38)	2 (20)	4 (30)	2 (33)	3 (42)
No. and percent of states with full-time FTE with PhD or Master's degrees in related sciences employed by WNV surveillance program:					
	6 (46)	6(60)	5 (38)	2 (33)	2 (28)
	Mean (standard deviation)				
Median interval in days between: • **the date that WNV-positive dead bird was collected *and*** • **the date that positive lab results were reported to the WNV surveillance program**	7.3 (5.9)	10.2 (4.5)	6.5 (4.8)	13.0 (13.4)	6.5 (2.6)
Median interval in days between: • **the date that WNV-positive human specimen was collected *and*** • **the date that positive lab results were reported to the WNV surveillance program**	10.5 (7.8)	11.7 (7.5)	9.7 (6.1)	5.1 (1.4)	10.0 (5.3)
Median interval in days between: • **the date that a probable/confirmed human case was reported to the WNV surveillance program *and*** • **the date the case was reported on ArboNET**	18.6 (10.9)	25.7 (15.0)	15.9 (12.1)	11.0 (12.1)	17.0 (14.1)
Total number of CSF specimens tested for WNV infection in the state public health laboratory	199.8 (198.2)	610.6 (876.2)	358.8 (597.6)	73.5 (86.8)	206.9 (338.7)

Table S21a. Groupings by *FY2004 CDC WNV cooperative agreement award amounts*

	Percentage			
Number of states	N=6	N=12	N=19	N=12
Range of FY2004 CDC WNV award	≥$800,000	$400,001 to $799,999	$300,000 to $400,000	<$300,000
Type of *human disease* surveillance:				
• primarily active	0	0	0	0
• combination of active and passive	83	42	37	50
• primarily passive	17	58	63	50
Specifically contact specialists:				
• neurologists	40	58	68	58
• critical care specialists	50	75	53	50
• inf. disease specialists	83	83	84	75
Require reporting of hospitalized cases with unknown etiology:				
• encephalitis	67	50	58	83
• meningitis	83	33	58	58
Implement lab surveillance to test CSF for arboviral infection	67	58	67	75
Does the state health dept. have access to a medical entomologist within the agency?	83	33	37	33
Use the CDC/CSTE NPHSS case definition exclusively to classify cases	83	100	79	92
Did your program use and promote notification of adulticiding activities?	0	58	26	8
Type of *equine disease* surveillance:				
• primarily active	0	0	0	0
• combination of active and passive	50	17	16	27
• primarily passive	50	83	84	73
Type of *avian mortality* surveillance:				
• primarily active	0	8	0	8
• combination of active and passive	67	33	33	33
• primarily passive	33	58	67	58
Did your agency establish and maintain a database of dead bird sightings?	83	58	42	67

Table S21b. Groupings by *FY2004 CDC WNV cooperative agreement award amounts*

	Mean (std deviation)			
Number of states	N=6	N=12	N=19	N=12
Range of FY2004 CDC WNV award	≥$800,000	$400,001 to $799,999	$300,000 to $400,000	<$300,000
No. and percent of states with full-time FTE with DVM, MD/DO, RN, or other clinical degrees employed by WNV surveillance program:				
	2 (33)	5 (41)	6 (32)	2 (17)
No. and percent of states with full-time FTE with PhD, DrPH, MSPH, or MPH degrees in epidemiology employed by WNV surveillance program:				
	2 (33)	4 (33)	7 (37)	3 (25)
No. and percent of states with full-time FTE with PhD or Master's degrees in related sciences employed by WNV surveillance program:				
	4 (67)	6 (50)	9 (47)	2 (17)
	Mean (standard deviation)			
Median interval in days between: **• the date that WNV-positive dead bird was collected and** **• the date that positive lab results were reported to the WNV surveillance program**	9.0 (5.8)	5.7 (2.5)	11.0 (8.3)	6.7 (5.7)
Median interval in days between: **• the date that WNV-positive human specimen was collected and** **• the date that positive lab results were reported to the WNV surveillance program**	8.9 (2.4)	10.1 (6.1)	9.3 (7.1)	10.2 (7.3)
Median interval in days between: **• the date that a probable/confirmed human case was reported to the WNV surveillance program and** **• the date the case was reported on ArboNET**	11.0 (11.3)	25.8 (8.5)	17.1 (14.0)	13.8 (13.6)
Total number of CSF specimens tested for WNV infection in the state public health laboratory	914.0 (989.6)	391.3 (505.1)	261.7 (474.4)	55.2 (54.2)

Table C1. Number and type of WNV surveillance staff in large city/county health departments (N=6)

	# with DVM, MD/DO, RN or other clinical degrees		# with PhD, DrPH, MSPH, MPH degrees in epidemiology		# with PhD or Master's degree in related sciences		# of all other clerical, administrative, and programmatic staff	
	N	Median and range	N	Median and range	N	Median and range	N	Median and range
City/County health department employees								
1.0 FTE	1	1 (N/A)	3	1 (1-1)	5	2 (1-4)	3	2 (1-8)
0.50-0.99 FTE	2	0.75 (0.5-1)	3	1 (1-1.5)	1	0.5 (N/A)	2	0.75 (0.5-1)
<0.50 FTE	3	1 (1-1)	1	9 (N/A)	0	N/A	2	13 (12-14)

Table C2. Specialists working for large city/county health departments

Does your agency have adequate access to:	Currently (2004)		If yes, did your agency have access in 1999?	
	N	Yes (%)	N	Yes (%)
Medical entomologist within public health agency	6	5 (83)	4	1 (25)
Medical entomologists through contract or other formal arrangement	4	1 (25)	1	1 (100)
Expertise in wildlife biology within your agency	6	4 (67)	4	4 (100)
Designated public health veterinarian within your agency	6	4 (67)	4	4 (100)

Table C3. Duration and type of human WNV surveillance in large city/county health departments

	Number of months of surveillance		Type of Surveillance System		
			Primarily Active	Combination of Active and Passive	Primarily Passive
	N	Mean	%	%	%
Human disease	6	10.8	17	67	17

Table C4. WNV surveillance and reporting in large cities/counties		
	N	**Yes (%)**
To encourage reporting and to suggest a high index of suspicion for arboviral encephalitis, did your agency:		
• Contact neurologists	6	6 (100)
• Contact critical care specialists	6	6 (100)
• Contact infectious disease specialists	6	6 (100)
Require reporting of:		
• hospitalized encephalitis cases of unknown etiology?	6	6 (100)
• hospitalized meningitis cases of unknown etiology?	6	6 (100)
Did your agency:		
• Implement a laboratory-based surveillance system to test CSF specimens for arboviral infection?	6	3 (50)
• Use the CDC/CSTE NPHSS case definition exclusively for neuroinvasive disease to classify cases as confirmed or probable?	6	4 (67)

Table C5. Human testing for WNV in large cities/counties			
In your agency:	**N**	***Mean***	**Median and range**
Number of CSF specimens tested for WNV infection in the city public health laboratory	4	393	367.5 (1-836)
In tests conducted by public or private laboratories in 2004, the number of patients with CSF IgM antibodies positive for:			
• *WNV* virus	6	16.5	5.5 (1-57)
• *SLE* virus	4	0	0 (0-0)

Table C6. The speed of reporting human WNV cases in large cities/counties			
In 2004 what was the median interval in days:			
	N	***Mean* of median interval (days)**	***Median and range* of median interval (days)**
• Between the date that a WNV-positive *human specimen* was collected and the date that positive laboratory results were reported to the WNV surveillance program?	6	6.7	5.5 (3-14)
• Between the date that the case was initially reported to the WNV surveillance program and the date that the case was reported on ArboNet for cases of *human disease* that were ultimately determined to be probable/confirmed?	2	15	15 (14-16)

Table C7. WNV prevention activities in large cities/counties	
(N=6)	**Yes (%)**
Which of the following WNV *prevention messages* and activities did your program use and promote in 2004?	
• Use of DEET-based repellents	6 (100)
• Peri-residential source reduction	6 (100)
• Personal protective measures	6 (100)
• Notification of adulticiding activities	5 (83)
• Modification of messages for lower literacy and non-English speaking audiences	5 (83)
Which of the following *methods* did your program use to provide WNV prevention information in 2004?	
• Press releases to electronic and printed media	6 (100)
• Public service announcements	4 (67)
• Passive distribution of informational brochures	5 (83)
• Active distribution of informational brochures	6 (100)
• Town, community, or neighborhood meetings	6 (100)
• Posting information on the home page of your agency's website	6 (100)
• Door-to-door outreach in selected locations	3 (50)
• Participation in community clean-ups	3 (50)

Table C8. Duration and type of non-human WNV surveillance in large city/county health departments

	Number of months of surveillance		Type of Surveillance System		
			Primarily Active	Combination of Active and Passive	Primarily Passive
	N	Mean	%	%	%
Equine disease	3	6.3	0	25	75
Avian mortality	6	8.2	0	17	83
Mosquito	5	9.8	N/A	N/A	N/A

Table C9. Equine WNV disease surveillance in large cities/counties

	Yes (%)	No (%)	Unk (%)
Did your agency have in place a system for reporting cases of equine neurologic disease to the city health department? (n=6)	2 (33)	4 (67%)	0 (0)
If yes, were specimens submitted for diagnostic testing for:			
• WNV	1 (50)	1 (50)	0 (0)
• other arboviruses	0 (0)	2 (100)	0 (0)
• rabies	0 (0)	2 (100)	0 (0)
How many equine specimens were tested in the city public health laboratory for:			
	N	***Mean***	***Median* and range**
• WNV	3	0	0 (0)
• other arboviruses	3	0	0 (0)
• rabies	3	0	0 (0)
Temporal-geographic clusters (2 or more cases) of equine neurologic disease			
Were clusters reported to your agency?	**N**	**Yes (%)**	
	4	0 (0)	

Table C10. Avian WNV disease surveillance in large cities/counties			
	N	**Yes (%)**	
Did your agency establish and maintain a database of dead bird sightings?	6	4 (67)	
If yes, were specimens submitted for diagnostic testing for WNV?	4	4 (100)	
If yes, to the above, did your agency have a policy in place for determining which avian specimens and how many avian specimens to test?	4	4 (100)	
If your agency maintains a database, were the following included in the database?			
• Caller name	4	3 (75)	
• Caller's telephone number	4	3 (75)	
• Date observed	4	4 (100)	
• Location geocoded to the highest feasible resolution	4	4 (100)	
• Bird species	4	4 (100)	
• Condition of the carcass	4	4 (100)	
	N	***Mean* of median interval (days)**	***Median and range* of median interval (days)**
In 2004 what was the median interval in days between the date that a WNV-positive *dead bird* was collected and the date that positive laboratory results on that bird were reported to the WNV surveillance program?	5	15	14 (7-30)

Table C11. Mosquito-based WNV surveillance in large cities/counties			
	N	**Yes (%)**	**No (%)**
Does your agency collect information about mosquito surveillance?	6	4 (67)	2 (33)
	N	***Mean***	**Unk (N and %)**
Approximate *percentage* of the human population that is covered by mosquito surveillance	3	100	0 (0)
For how many *trap-nights* were adult mosquitoes collected in 2004?	3	4632.3	0 (0)
	N	**Yes (%)**	**Unk (%)**
Does your agency:			
• Receive reports from local laboratories and/or your public health laboratory identifies the species	4	4 (100)	0 (0)
• Calculate minimum infections rates with mosquito data or receive this data	4	3 (75)	0 (0)
• Map larval breeding sites	4	4 (100)	0 (0)
• Evaluate adult mosquito control using caged mosquitoes to measure kill rates in sprayed areas	4	1 (25)	0 (0)
• Monitor for pesticide resistance	4	0 (0)	0 (0)
Does your agency or any other agency within your jurisdiction conduct:			
• *adult* mosquito surveillance	4	4 (100)	0 (0)
• *larval* mosquito surveillance	4	4 (100)	0 (0)

Table C12. Large cities/counties surveillance of other vector-borne diseases		
(N=6)	**N**	**Yes (%)**
Has WNV funding enhanced your agency's capacity to conduct surveillance for other vector-borne diseases?		
• other mosquito-borne	6	6 (100)
• other tick-borne	6	1 (17)
• other flea-borne	6	1 (17)

Table C13. Laboratory biosafety capacity in large cities/counties	
What is the capacity of the public health laboratory in your jurisdiction—check all that apply (n=6)	**N (%)**
• BSL 2	3 (50)
• BSL 3	3 (50)
• Animal BSL 3	0 (0)

Table C14. Laboratory testing for WNV in large cities/counties		
	N	**Yes (%)**
Was commercial testing performed in your jurisdiction for:		
• Human specimens	6	6 (100)
• Bird specimens	6	1 (17)
• Mosquito specimens	6	1 (17)
In 2004 did your agency require confirmation of commercial-lab-positive specimens by your public health laboratory or a diagnostic reference laboratory?		
• Human specimens	6	5 (83)
• Bird specimens	4	1 (25)
• Mosquito specimens	4	0 (0)
Were out-of-state laboratories required to report positive WNV tests on specimens collected within your jurisdiction?		
• Human specimens	5	5 (100)
• Bird specimens	2	0 (0)
• Mosquito specimens	3	1 (33)

Table C15. WNV assays run by the city/county public health laboratory or a laboratory contracted by the agency						
N=6	**IgM ELISA**	**IgG ELISA**	**PRNT**	**Culture**	**PCR**	**Vec Test**
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Human	6 (100)	4 (67)	1 (17)	2 (33)	5 (83)	
Equine	2 (33)	0 (0)	0 (0)	1 (17)	1 (17)	
Avian	0 (0)	0 (0)	0 (0)	0 (0)	3 (50)	2 (33)
Sentinel	1 (17)	0 (0)	0 (0)	0 (0)	0 (0)	
Mosquito				0 (0)	3 (50)	0 (0)

Table C16. Use of plaque-reduction neutralization tests (PRNT) by city/county public health laboratories	
	N (%)
If your laboratory uses a PRNT test, how is it used? (check one) (N=2*)	
• All positive ELISAs	1 (50)
• All early season and any unusual ELISAs throughout the season	1 (50)
• Only on equivocal ELISAs	0 (0)
If PRNT is <u>not</u> performed in your agency's public health laboratory, where is confirmatory testing performed? (check one) (N=5*)	
• CDC	3 (60)
• At state public health laboratory	2 (40)
• At another state's public health laboratory	0 (0)
• ELISA positive are not confirmed by PRNT	0 (0)

* One city answered both questions above

Appendix 1: Detailed information on state subgroupings

I. Quintile groupings by size of state population using population estimates for July 1, 2004, U.S. Census Bureau [available from URL: http://www.census.gov/popest/states/NST-ann-est.html] (listed in descending order)

8,698,879 to 35,893,799

California, Texas, New York, Florida, Illinois, Pennsylvania, Ohio, Michigan, Georgia, New Jersey

5,509,026 to 8,541,221

North Carolina, Virginia, Massachusetts, Indiana, Washington, Tennessee, Missouri, Arizona, Maryland, Wisconsin

2,954,451 to 5,100,958

Minnesota, Colorado, Alabama, Louisiana, South Carolina, Kentucky, Oregon, Oklahoma, Connecticut, Iowa

1,317,253 to 2,902,966

Mississippi, Arkansas, Kansas, Utah, Nevada, New Mexico, West Virginia, Nebraska, Idaho, Maine

506,529 to 1,299,500

New Hampshire, Hawaii, Rhode Island, Montana, Delaware, South Dakota, Alaska, North Dakota, Vermont, Wyoming

July 1, 2003 population estimates for large city/counties:

Los Angeles County = 9,871,506; New York City = 8,085,742; Chicago = 2,869,121; Houston = 2,009,690; Philadelphia = 1,479,339; District of Columbia = 563,384

II. State groupings by number of WNV cases reported to CDC in calendar year 2004 [available from URL: http://www.cdc.gov.ncidod/dvbid/westnile/surv&controlCaseCount04_detailed.htm] (listed alphabetically within grouping)

88-771 cases

California, Arizona, Colorado, Texas, Louisiana, New Mexico

20-57 cases

Illinois, South Dakota, Mississippi, Nebraska, Nevada, Kansas, Florida, Missouri, Minnesota, Arkansas, Iowa, North Dakota, Oklahoma

10-19 cases

Georgia, Maryland, Michigan, Alabama, Pennsylvania, Tennessee, Indiana, Wisconsin, Ohio, Wyoming, New York

0-9 cases

Kentucky, Montana, Virginia, Oregon, Idaho, North Carolina, Connecticut, New Jersey, South Carolina, Alaska, Delaware, Hawaii, Maine, Massachusetts, New Hampshire, Rhode Island, Utah, Vermont, Washington, West Virginia

III. State groupings by peak (i.e., year of greatest number of reported cases 1999-2004) time period of reported cases [see References 4-9]
(listed alphabetically within grouping)

2003-2004

Arizona, California, Colorado, Maryland, Nebraska, New Mexico, North Dakota, Montana, Pennsylvania, Texas, South Dakota, Wyoming

1999-2002

Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nevada, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Virginia, West Virginia, Wisconsin

No cases reported to CDC as of 12/31/04

Alaska, Hawaii, Washington

IV. State groupings by U.S. Department of Health and Human Services (HHS) Regions
[available from URL: http://www.hhs.gov/about/regions]
(listed alphabetically within region)

Region

I	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
II	New Jersey, New York
III	Delaware, Maryland, Pennsylvania, Virginia, West Virginia
IV	Alabama, Florida Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
V	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
VI	Arkansas, Louisiana, New Mexico, Oklahoma, Texas
VII	Iowa, Kansas, Missouri, Nebraska
VIII	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
IX	California, Arizona, Hawaii, Nevada
X	Alaska, Idaho, Oregon, Washington

Grouping

Northeast = I, II, III
Midwest = V, VII
Southeast and South central = IV, VI

Rocky Mountains = VIII
West and Northwest = IX, X

V. State and Large City/County groupings by amount of FY2004 CDC WNV Grant Award

Note: separate awards to large cities are not included in the total for the state. (states listed alphabetically within grouping)

STATES:

Greater than or equal to $800,000

Arizona, California, Colorado, Nebraska, New York, Texas

$400,001 to $799,999

Alabama, Arkansas, Florida, Illinois, Iowa, Missouri, Minnesota, New Jersey, Ohio, Pennsylvania, South Dakota, Virginia

$300,000 to $400,000

Connecticut, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Mississippi, Montana, New Mexico, North Carolina, North Dakota, Oklahoma, Tennessee, Utah, Wisconsin, Wyoming

Less than $300,000

Alaska, Delaware, Hawaii, Idaho, Maine, Nevada, New Hampshire, Oregon, Rhode Island, South Carolina, Vermont, Washington, West Virginia

CITIES:

Greater than or equal to $800,000

None

$400,001 to $799,999

New York City

$300,000 to $400,000

Houston

Less than $300,000

Chicago, District of Columbia, Los Angeles County, Philadelphia

Appendix 2: Survey instrument for state health departments

Characterization of a State Health Department WNV Surveillance Program

•Please respond for activities, data, and cases that occurred in calendar year 2004.

•Definitions: ***"Your jurisdiction" = your state***
"Your agency" = the state health dept, not county HDs
"Your program" = the state health dept. WNV or communicable disease program
"WNV Surveillance program" = the program within your agency, not county HDs

State:_____

Name of respondent:_____

Title/Position of respondent:_____

Date:_____

1. Indicate below the number of WNV surveillance staff—both epidemiology and laboratory— from all funding sources based on highest professional degree. These are mutually exclusive categories so place each staff person in only one column:

State health dept. employees	# with DVM, MD/DO, RN or other clinical degrees	# with PhD, DrPH, MSPH, MPH degrees in epidemiology	# with PhD or Masters degree in related sciences	# of all other clerical, administrative, and programmatic staff
1.0 FTE				
0.50-0.99 FTE				
<0.50 FTE				
Contractors (not including county HDs)				
1.0 FTE				
0.50-0.99 FTE				
<0.50 FTE				

2. Does the state health department have adequate access to medical entomologist(s)
►*within the public health agency* ___Yes ____No

-If yes, did your agency also have this access in 1999? ___ Yes ____No

►*through contract or other formal arrangement with a local college or university*? ___Yes ____No

-If yes, did your agency also have this access in 1999?
___ Yes ____No

3. Does the state health department have adequate access to expertise in wildlife biology *within a state agency*? ___Yes ____No

-If yes, did your agency also have this access in 1999? ___ Yes ____No

4. Does the state health department have a designated state public health veterinarian *within your agency*? ___Yes ____No

-If yes, did your agency also have this position in 1999? ___ Yes ____No

5. a. Please complete the following table concerning the duration of surveillance during the year:

Type of Surveillance	***Year round? If not, indicate # of months of surveillance***
Human disease	
Equine disease	
Avian mortality	
Mosquito	

b. What type of surveillance is used in your jurisdiction for (check most applicable box):

Type of Surveillance	**Primarily active**	**Combination of active and passive**	**Primarily passive**
Human disease			
Equine disease			
Avian mortality			

6. **For ***human*** West Nile ***neuroinvasive*** disease surveillance in 2004**:

a. Did your agency specifically contact by telephone, fax, special mailing, or health alert any of the following specialists to encourage reporting and to suggest a high index of suspicion for arboviral encephalitis?

Neurologists _____Yes _____No
Critical care specialists _____Yes _____No
Infectious disease specialists _____Yes _____No

b. Did your agency require reporting of:
-hospitalized encephalitis cases of unknown etiology?
_____Yes _____No
-hospitalized meningitis cases of unknown etiology?
_____Yes _____No

c. Did your agency implement a laboratory-based surveillance system to report CSF specimens positive for arboviral infection?
_____Yes _____No

7. What was the total number of CSF specimens tested for WNV infection in the state public health laboratory? _____

8. What was the number of patients with CSF IgM antibodies positive for WNV or SLE virus in tests conducted by public or private laboratories?
_____(+) for WNV
_____(+) for SLE

9. Did your program use the CDC/CSTE National Public Health Surveillance System (NPHSS) case definition for neuroinvasive disease to classify cases as confirmed or probable *or* did you use another case definition in your jurisdiction?
_____ CDC/CSTE NPHSS case definition used exclusively
_____A modified case definition specific to your jurisdiction

10. **For ***equine*** West Nile disease surveillance in 2004**:

a. Did your agency have a system in place for reporting cases of equine neurologic disease to the state health dept. from veterinarians, veterinary diagnostic labs or other agency labs?
_____Yes _____No _____Unk

b. If yes, were specimens submitted for diagnostic testing for:
-WNV? _____Yes _____No _____Unk
-other arboviruses? _____Yes _____No _____Unk
-rabies? _____Yes _____No _____Unk

c. How many *equine* specimens were tested in the public health laboratory for:
-WNV? _____
-other arboviruses? _____
-rabies? _____

d. Were temporal-geographic clusters (2 or more cases) of equine neurologic disease reported to your agency?
_Yes _____No

e. If yes, how many clusters were reported? _____

f. If yes to (d), did your program or any state agency investigate the clusters to determine the cause of the illness? _____Yes _____No

g. If yes to (d), what was the median interval in days from the date the cluster was defined as such and reported to your program (or another program within your agency or another state agency) until the investigation began (same day=0 days; next day=1 day, etc.) _____

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11. **For ***avian*** West Nile Virus infection surveillance in 2004**:

a. Did your agency establish and maintain a database of dead bird sightings? ____Yes _____No

b. If yes, were specimens submitted for diagnostic testing for WNV?
_____Yes _____No

c. If yes to (b), did your agency have a policy in place for determining which avian specimens and how many avian specimens to test?
_____ Yes _____ No

d. If yes to (a), which of the following data were included in your agency's database? (check all that apply)

_____Caller name
_____Caller's telephone number
_____Date observed
_____Location geocoded to the highest feasible resolution
_____Bird species
_____Condition of the carcass (good condition=unscavenged without obvious decomposition or maggot infestation)

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12. **For *mosquito-based* West Nile Virus surveillance in 2004**:

a. Does your agency collect information about mosquito surveillance in local jurisdictions or areas? _____ Yes _____ No

*If **no** to question 12a, please skip to question 13.*

b. Approximately what percentage of the human population in your jurisdiction is covered by mosquito surveillance?

_____% _____don't know

c. Do most local health agencies within your jurisdiction conduct
-adult mosquito surveillance? _____ Yes _____ No
-larval mosquito surveillance? _____ Yes _____ No

d. For how many trap-nights were adult mosquitoes collected in 2004? (e.g., 3 traps in one night = 3 trap-nights)

_____ # trap-nights _____ don't know

e. Concerning mosquito speciation when testing for WNV, does your agency either receive reports from local laboratories and/or does your public health laboratory identify the species?

_____Yes _____No _____ don't know

f. Does your agency either calculate minimum infection rates with your mosquito data or receive such data?

_____Yes _____No _____ don't know

g. Does your agency map larval breeding sites?

_____Yes _____No _____ don't know

h. Does your agency evaluate adult mosquito control using caged mosquitoes to measure kill rates in sprayed areas?

_____Yes _____No _____ don't know

i. Does your agency monitor for pesticide resistance?
_____Yes _____No _____ don't know

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13. Which of the following **WNV *prevention*** messages and activities did your program use and promote in 2004? (check all that apply)
_____ the use of DEET-based repellents
_____ peri-residential source reduction
_____ personal protective measures
_____ notification of adulticiding activities
_____ modification of messages for lower literacy and non-English speaking audiences

14. Which of the methods did your program use to provide WNV ***prevention*** information in 2004? (check all that apply)
_____ press releases to electronic and printed media
_____ public service announcements
_____ passive distribution of informational brochures
_____ active distribution of informational brochures
_____ town, community, or neighborhood meetings
_____ posting information on the home page of your agency's website
_____ door-to-door outreach in selected locations
_____ participation in community clean-ups

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15. Has WNV funding enhanced your agency's capacity to conduct surveillance for other vector-borne diseases?
- other mosquito-borne _____Yes _____No
- other tick-borne _____Yes _____No
- other flea-borne _____Yes _____No

16. In 2004 what was the median interval in days between the date that a WNV-positive *dead bird* was collected and the date that positive laboratory results on that bird were reported to the WNV surveillance program?
_____days

17. In 2004 what was the median interval in days between the date that a WNV-positive *human specimen* was collected and the date that positive laboratory results were reported to the WNV surveillance program?
_____days

18. In 2004 for cases of *human disease* that were ultimately determined to be probable/confirmed, what was the median interval in days between the date

of onset of the case and the date that the case was reported on ArboNET?
_____days

19. What is the capacity of the ***state public health laboratory*** in your jurisdiction (check all that applies)?

    _____BSL 2
    _____BSL 3
    _____Animal BSL 3

20. Was commercial testing performed in your jurisdiction in 2004 for:
    -human specimens _____ Yes _____ No
    -bird specimens _____ Yes _____ No
    -mosquito specimens _____ Yes _____ No

21. In 2004 in order to count a case as confirmed or probable, did your agency require confirmation of commercial-lab-positive specimens by your public health laboratory or a diagnostic reference laboratory?
    -human specimens _____ Yes _____ No
    -bird specimens _____ Yes _____ No
    -mosquito specimens _____ Yes _____ No

22. Were out-of-state laboratories required to report positive WNV tests on specimens collected within your jurisdiction?
    -human specimens _____ Yes _____ No
    -bird specimens _____ Yes _____ No
    -mosquito specimens _____ Yes _____ No

23. Please complete the following table concerning testing by the *state public health laboratory* or a laboratory contracted by the state health dept. in your jurisdiction:

Source	Check box if the lab did this test for a particular source					
	IgM ELISA	IgG ELISA	PRNT	Culture	PCR	Vec Test
Human						
Equine						
Avian						
Sentinel						
Mosquito						

24. If your laboratory uses a PRNT test, how is it used ? (check one)
    _____all positive ELISAs
    _____early season and any unusual ELISAs throughout the season
    _____only on equivocal ELISAs

25. If PRNT is <u>not</u> performed in your state public health laboratory, where is confirmatory testing performed? (check one)
    _____at CDC
    _____at another state's public health laboratory
    _____ELISA positives are not confirmed by PRNT

Appendix 3: Survey instrument for large city/county health departments

Characterization of a Big City Health Department WNV Surveillance Program

•Please respond for activities, data, and cases that occurred in calendar year 2004.

•Definitions: ***"Your jurisdiction" = your city (or county, as applicable)***
"Your agency" = the city health dept, not the state HD
"Your program" = the city WNV or communicable disease program
"WNV Surveillance program"= the program within your agency

City:_____

Name of respondent:_____

Title/Position of respondent:_____

Email of respondent:_____

Date:_____

1. Indicate below the number of WNV surveillance staff—both epidemiology and laboratory—from all funding sources based on highest professional degree. These are mutually exclusive categories so place each staff person in only one column:

Health dept. employees	# with DVM, MD/DO, RN or other clinical degrees	# with PhD, DrPH, MSPH, MPH degrees in epidemiology	# with PhD or Masters degree in related sciences	# of all other clerical, administrative, and programmatic staff
1.0 FTE				
0.50-0.99 FTE				
<0.50 FTE				
Contractors				
1.0 FTE				
0.50-0.99 FTE				
<0.50 FTE				

2. Does the city health department have adequate access to medical entomologist(s)
►*within the public health agency* ___Yes ____No

-If yes, did your agency also have this access in 1999? ___ Yes ____No

►*through contract or other formal arrangement with a local college or university*? ___Yes ____No

-If yes, did your agency also have this access in 1999?
___ Yes ____No

3. Does the city health department have adequate access to expertise in wildlife biology *within a city agency*? ___Yes ____No

-If yes, did your agency also have this access in 1999? ___ Yes ____No

4. Does the city health department have a designated public health veterinarian *within your agency*? ___Yes ____No

-If yes, did your agency also have this position in 1999? ___ Yes ____No

5. a. Please complete the following table concerning the duration of surveillance during the year:

Type of Surveillance	**Indicate number of months of surveillance. If surveillance is year round, please indicate 12 months**
Human disease	
Equine disease	
Avian mortality	
Mosquito	

b. What type of surveillance is used in your jurisdiction for (check most applicable box):

Type of Surveillance	**Primarily active**	**Combination of active and passive**	**Primarily passive**
Human disease			
Equine disease			
Avian mortality			

6. **For *human* West Nile *neuroinvasive* disease surveillance in 2004**:

a. Did your agency specifically contact by telephone, fax, special mailing, or health alert any of the following specialists to encourage reporting and to suggest a high index of suspicion for arboviral encephalitis?

Neurologists _____Yes _____No
Critical care specialists _____Yes _____No
Infectious disease specialists _____Yes _____No

b. Did your agency require reporting of:
-hospitalized encephalitis cases of unknown etiology?
_____Yes _____No
-hospitalized meningitis cases of unknown etiology?
_____Yes _____No

c. Did your agency implement a laboratory-based surveillance system to report CSF specimens for arboviral infection? _____Yes _____No

7. What was the total number of CSF specimens tested for WNV infection in the city public health laboratory? _____ _____N/A

8. What was the number of patients with CSF IgM antibodies positive for WNV or SLE virus in tests conducted by public or private laboratories in your jurisdiction?
_____(+) for WNV _____(+) for SLE

9. Did your program use the CDC/CSTE National Public Health Surveillance System (NPHSS) case definition for neuroinvasive disease to classify cases as confirmed or probable *or* did you use another case definition in your jurisdiction?
_____ CDC/CSTE NPHSS case definition used exclusively
_____A modified case definition specific to your jurisdiction

10. **For *equine* West Nile disease surveillance in 2004**:

a. Did your agency have a system in place for reporting cases of equine neurologic disease to the city health dept. from veterinarians, veterinary diagnostic labs or other agency labs?
_____Yes _____No _____Unk

b. If yes, were specimens submitted for diagnostic testing for:
-WNV? _____Yes _____No _____Unk
-other arboviruses? _____Yes _____No _____Unk
-rabies? _____Yes _____No _____Unk

c. How many *equine* specimens were tested in the city public health laboratory for:
-WNV? _____
-other arboviruses? _____
-rabies? _____

d. Were temporal-geographic clusters (2 or more cases) of equine neurologic disease reported to your agency?
_Yes _____No

e. If yes, how many clusters were reported? _____

f. If yes to (d), did your program or any city agency investigate the clusters to determine the cause of the illness? _____Yes _____No

g. If yes to (d), what was the median interval in days from the date the cluster was defined as such and reported to your program (or another program within your agency or another city agency) until the investigation began (same day=0 days; next day=1 day, etc.) _____

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11. **For ***avian*** West Nile Virus infection surveillance in 2004**:

a. Did your agency establish and maintain a database of dead bird sightings? ____Yes _____No

b. If yes, were specimens submitted for diagnostic testing for WNV?
_____Yes _____No

c. If yes to (b), did your agency have a policy in place for determining which avian specimens and how many avian specimens to test?
_____ Yes _____ No

d. If yes to (a), which of the following data were included in your agency's database? (check all that apply)
_____Caller name
_____Caller's telephone number
_____Date observed
_____Location geocoded to the highest feasible resolution

_____Bird species
_____Condition of the carcass (good condition=unscavenged without obvious decomposition or maggot infestation)

12. **For *mosquito-based* West Nile Virus surveillance in 2004**:

a. Does your agency collect information for mosquito surveillance?
_____Yes _____ No

*If **no** to question 12a, please skip to question 13.*

c. Approximately what percentage of the human population in your jurisdiction is covered by mosquito surveillance?
_____% _____don't know

c. Does your agency or any other agency within your jurisdiction conduct:
-adult mosquito surveillance? _____ Yes _____ No
-larval mosquito surveillance? _____ Yes _____ No

d. For how many trap-nights were adult mosquitoes collected in 2004? (e.g., 3 traps in one night = 3 trap-nights)
_____ # trap-nights _____ don't know

e. Concerning mosquito speciation when testing for WNV, does your agency either receive reports from local laboratories and/or does your public health laboratory identify the species?
_____Yes _____No _____ don't know

f. Does your agency either calculate minimum infection rates with your mosquito data or receive such data?
_____Yes _____No _____ don't know

g. Does your agency map larval breeding sites?
_____Yes _____No _____ don't know

h. Does your agency evaluate adult mosquito control using caged mosquitoes to measure kill rates in sprayed areas?
_____Yes _____No _____ don't know

i. Does your agency monitor for pesticide resistance?
_____Yes _____No _____ don't know

13. Which of the following **WNV *prevention*** messages and activities did your program use and promote in 2004? (check all that apply)
    _____ the use of DEET-based repellents
    _____ peri-residential source reduction
    _____ personal protective measures
    _____ notification of adulticiding activities
    _____ modification of messages for lower literacy and non-English speaking audiences

14. Which of the methods did your program use to provide WNV ***prevention*** information in 2004? (check all that apply)
    _____ press releases to electronic and printed media
    _____ public service announcements
    _____ passive distribution of informational brochures
    _____ active distribution of informational brochures
    _____ town, community, or neighborhood meetings
    _____ posting information on the home page of your agency's website
    _____ door-to-door outreach in selected locations
    _____ participation in community clean-ups

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15. Has WNV funding enhanced your agency's capacity to conduct surveillance for other vector-borne diseases?
    - other mosquito-borne _____Yes _____No
    - other tick-borne _____Yes _____No
    - other flea-borne _____Yes _____No

16. In 2004 what was the median interval in days between the date that a WNV-positive *dead bird* was collected and the date that positive laboratory results on that bird were reported to the WNV surveillance program?
    _____days

17. In 2004 what was the median interval in days between the date that a WNV-positive *human specimen* was collected and the date that positive laboratory results were reported to the WNV surveillance program?
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18. In 2004 for cases of *human disease* that were ultimately determined to be probable/confirmed, what was the median interval in days between the date of onset of the case and the date that the case was reported on ArboNET?
    _____days

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19. What is the capacity of the ***public health laboratory*** in your jurisdiction (check all that applies)?

_____BSL 2
_____BSL 3
_____Animal BSL 3

20. Was commercial testing performed in your jurisdiction in 2004 for:
-human specimens _____ Yes _____ No
-bird specimens _____ Yes _____ No
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21. In 2004 did your agency require confirmation of commercial-lab-positive specimens by your public health laboratory or a diagnostic reference laboratory?
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-mosquito specimens _____ Yes _____ No

22. Were out-of-state laboratories required to report positive WNV tests on specimens collected within your jurisdiction?
-human specimens _____ Yes _____ No
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23. If applicable, please complete the following table concerning testing by the *public health laboratory* or a laboratory contracted by your agency:

Source	Check box if the lab did this test for a particular source					
	IgM ELISA	IgG ELISA	PRNT	Culture	PCR	Vec Test
Human						
Equine						
Avian						
Sentinel						
Mosquito						

24. If applicable and if your laboratory uses a PRNT test, how is it used ? (check one)
_____all positive ELISAs
_____all early season and any unusual ELISAs throughout the season bird specimens
_____only on equivocal ELISAs

25. If PRNT is not performed in your agency's public health laboratory, where is confirmatory testing performed? (check one)
    _____at CDC
    _____at the state public health laboratory
    _____at another state's public health laboratory
    _____ELISA positives are not confirmed by PRNT

Thank you for completing this assessment.

We would appreciate any feedback you may have regarding this assessment below:

_____
_____
_____
_____
_____
_____

If you have any questions, please contact Jennifer Lemmings (jlemmings@cste.org) at 770-458-3811.