ISSUE REPORT

Trust for America's Health

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Source: Health Canada's West Nile virus Web site, Health Canada, http://www.west-nilevirus.gc.ca. © Her Majesty the Queen in Right of Canada, represented by the Minister of Health (2003).

WEST NILE VIRUS:
2004 Expected to Be Most Severe Year Yet

In five years since its first U.S. discovery in New York City in 1999, West Nile virus (WNV) has become a permanent part of the U.S. health landscape. The 2003 WNV season was the most severe ever. Nearly 10,000 people contracted the disease, which emerges each spring and peaks in the summer and early fall. 2003 WNV activity was concentrated in the Midwestern, Plains, and Rocky Mountain states, though human cases were diagnosed in 45 states and the District of Columbia.[1]

The Centers for Disease Control and Prevention (CDC) predicts that the 2004 West Nile season will be especially hazardous, with case counts expected to exceed 2003's total. Health officials also project that, for the first time, WNV will have a significant impact on the West Coast in 2004. The disease, which is spread to humans by infected mosquitoes, has moved westward in the U.S. with each successive season.

Early indications show that these projections are on-target – this year's first confirmed human cases have mostly emerged in the Plains states and far Western United States, in residents of Arizona, California, Nebraska, New Mexico, South Dakota, and Wyoming, in addition to two cases in Florida[2] In California, WNV has been discovered in Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties as of June 24.[3]

Now that WNV has established a strong foothold in the U.S., public health measures should reflect the changing nature of the disease and its potential impacts.

WNV raises the following public health concerns:

- How to protect people most at-risk to develop symptoms and complications from the virus, particularly those with compromised immune systems, including: the elderly, cancer patients undergoing chemotherapy, and people with HIV.
  - Additionally, though investigations are preliminary at this time, there is concern that there may be a possible link between WNV and birth defects. In 2002, a pregnant woman contracted West Nile virus and later gave birth to a child with several birth defects, who also tested positive for WNV.[4]

TRUST FOR AMERICA'S HEALTH IS A NON-PROFIT, NON-PARTISAN ORGANIZATION DEDICATED TO SAVING LIVES BY PROTECTING THE HEALTH OF EVERY COMMUNITY AND WORKING TO MAKE DISEASE PREVENTION A NATIONAL PRIORITY.

JULY 2004

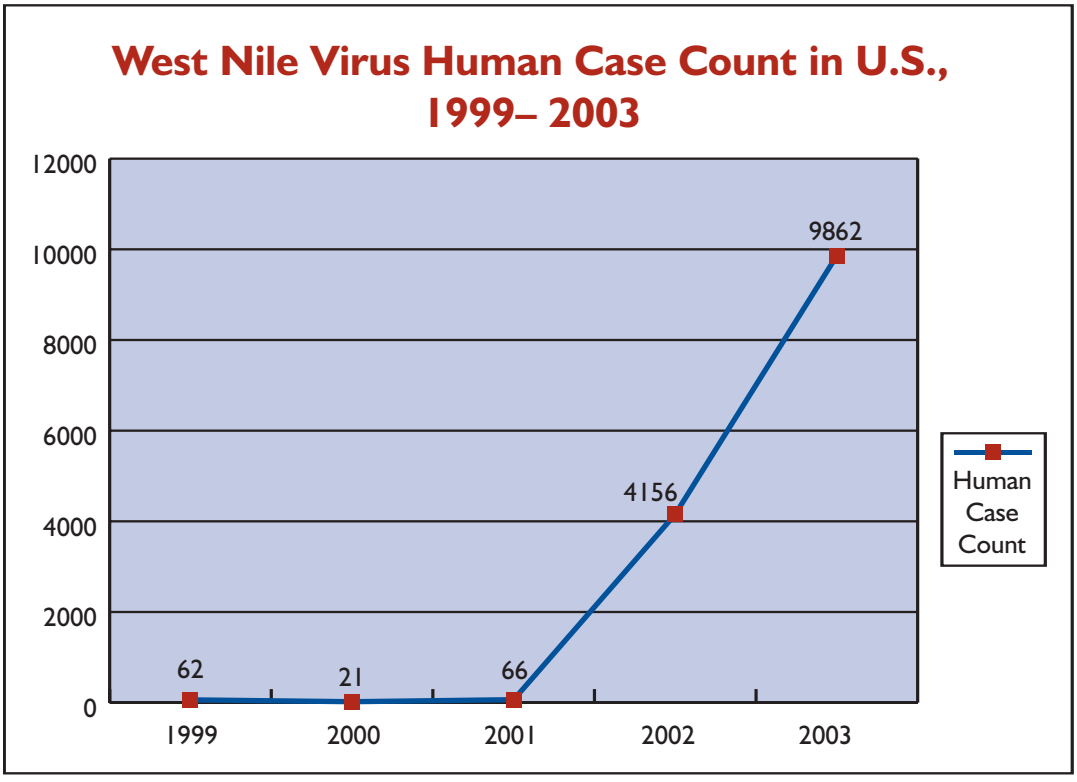
PREVENTING EPIDEMICS. PROTECTING PEOPLE.

- How to help communities evaluate the health risks or benefits of mosquito-reduction strategies, including spraying of chemicals that may raise other health concerns.
- How to diminish the hazard WNV poses to nationwide blood banks. In 2003, six cases of WNV were attributed to blood-bank transmission, following 23 cases in 2002.[5] During the height of the 2003 WNV season, 2.5 million blood donations were screened for WNV, leading to the removal of over 800 infected donations.[6]

In this white paper, Trust for America's Health (TFAH) will review the history and impact of West Nile virus, assess current control and prevention strategies, and offer recommendations to improve our national readiness against WNV and other emerging diseases.

Tracing WNV's Spread, 1999-2003

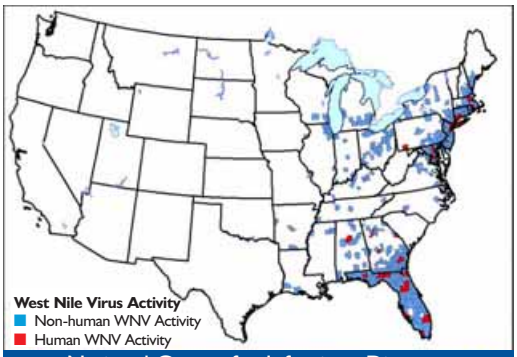
In five short years, West Nile virus has evolved from an isolated municipal event into a full-blown national epidemic. The projected West Coast emergence, combined with the continued prevalence in the rest of the country, makes the 2004 season an especially dangerous prospect.



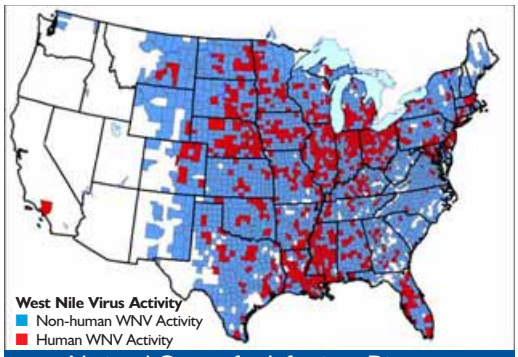
As the following images from CDC demonstrate, WNV has moved steadily westward with each season.[7]

National Center for Infectious Diseases
WEST NILE VIRUS ACTIVITY
Cumulative results for 1999 calendar year

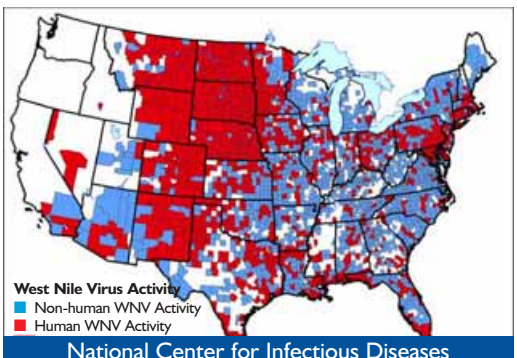
National Center for Infectious Diseases
WEST NILE VIRUS ACTIVITY
Cumulative results for 2000 calendar year



National Center for Infectious Diseases
WEST NILE VIRUS ACTIVITY
Cumulative results for 2001 calendar year



National Center for Infectious Diseases
WEST NILE VIRUS ACTIVITY
Cumulative results for 2002 calendar year



National Center for Infectious Diseases
WEST NILE VIRUS ACTIVITY
Cumulative results for 2003 calendar year

States and Counties Reporting WNV Activity, United States, 1999-2003*

Year	# States	# Counties	Date Range
1999	4	28	9 Aug – 15 Nov
2000	12**	145	6 Feb – 17 Nov
2001	27**	359	8 Apr – 26 Dec
2002	44**	2,531	3 Jan – 19 Dec
2003	46**	2,289	1 Jan – 12 Dec

* Reported to ArboNET as of 1/20/2004
** Plus D.C.

"West Nile is now well established in America. Unpredictability is the only thing predictable about new infectious diseases. The quick emergence and spread of West Nile is a reminder that we must proactively plan for the unexpected."

– Louis W. Sullivan,
Former Secretary of the U.S. Department of Health and Human Services

History of West Nile Virus

West Nile virus (WNV), first identified in Uganda in 1937, infects humans, birds, and horses. WNV is a type of virus that causes encephalitis, or inflammation of the brain. The virus has been confirmed in Africa, western Asia, the Middle East, the Mediterranean region of Europe and, since 1999, the U.S.

In people, most infections produce no symptoms, or mild to moderate symptoms. An estimated 20 percent of people infected will develop West Nile fever. Symptoms may include headache, fever, and body aches, often with skin rash and swollen lymph glands. More severe infections may be marked by high fever, neck stiffness, muscle weakness, stupor, disorientation, convulsions, paralysis, coma, and, rarely, death. The elderly, the very young, and individuals with weakened immune systems are most likely to develop West Nile fever.

WNV exists through a transmission cycle involving mosquitoes and birds. Mosquitoes become infected with the virus when they feed on infected birds, which carry the virus in their blood. Infected mosquitoes can then transmit WNV to humans and animals through biting. Testing for the virus in humans involves collection of blood and cerebrospinal fluid to determine the presence of antibodies to the virus. The incubation period is generally five to 15 days from the time a mosquito carrying WNV infects an individual.

There is no specific therapy for treating WNV. In more severe cases, intensive supportive therapy may be necessary such as hospitalization, intravenous (IV) fluids, airway management, respiratory support (ventilator), and prevention of secondary infections (pneumonia). Currently, no vaccine to prevent WNV in humans is available, although clinical trials for such a vaccine are underway. A vaccine for horses is available.

CALIFORNIA'S VULNERABILITY

Beyond the previously noted westward migration of WNV, California is projected for a severe West Nile season in 2004 due to several factors: the state has a prevalence of agricultural areas with well-irrigated fields and a predominance of polluted urban waterways, both breeding grounds for multiple types of WNV-carrying mosquitoes. Additionally, California's population density ensures high volume interactions with mosquitoes. In preparation for the onset of WNV, state health officials, working in concert with CDC, have been engaged in several preventative health measures focused on mosquito-population control and public education.[8] However, a recent report by the RAND Corporation found California's public health agencies are not uniformly prepared to respond to disease outbreaks and other important challenges – a dangerous development in a state certain to be impacted heavily by WNV.[9]

"We certainly have all the ingredients here in California for a major outbreak that involves two or three different species of mosquitoes, where a lot of states may have just had to worry about one"[10]

–Dr. John Edman, Director of University of California Davis Center for Vectorborne Diseases

Emergence of WNV

In August 1999, wild birds, especially crows, began dying in significant numbers in New York. Several residents of New York City contracted encephalitis and, a month later, horses on Long Island were showing signs of illness.

Originally, a public health laboratory and the CDC identified the human cases as St. Louis encephalitis (SLE), the most common mosquito-borne disease in the U.S. The dead birds, rarely killed by SLE, were not believed connected to the human cases. Dr. Ian Lipkin, currently at the Columbia University's Mailman School of Public Health, was the first scientist to publish a paper identifying the disease as West Nile virus.

Two weeks later, CDC changed its diagnosis to WNV. The two seemingly distinct animal and human cases were indeed related. WNV is in the same family as SLE. The U.S. public health community was shocked at the discovery of WNV, previously found only in Africa, the Middle East, and Europe. The outbreak ended in the fall of 1999, but not before 62 people developed severe encephalitis, including 59 requiring hospitalization, and seven who died.[11]

The lack of coordination between the animal and public health communities resulted in a series of setbacks in identifying the true cause of the outbreak. This slowed the disease containment and public education efforts in the important early stages when time can mean the difference between containing an outbreak and the exponential spreading of the illness.

COLORADO'S WNV EPIDEMIC

In 2003, Colorado had more reported cases of WNV and related deaths from the virus than any other state. Colorado reported 2,947 cases, compared to Nebraska's 1,942, the state with the second highest number of cases. Sixty-one Colorado residents died after being infected. Over 20 percent of Colorado's cases developed into "neuroinvasive diseases," serious illnesses that affect the nervous system such as WN encephalitis and WN meningitis. These diseases cause inflammation in the brain (encephalitis) and of the membrane surrounding the brain and the spinal cord (meningitis), and can be fatal.

State budget cuts made the fight against WNV difficult in some parts of Colorado like Larimer County – one of the areas hardest hit by the virus. In 2002, the Larimer County Department of Health and Environment received $100,000 in federal public health preparedness money, but lost $700,000 due to state cuts. This budget reduction forced the county to reduce staff and cut a range of services. In the summer of 2003, this weakened agency faced a monumental challenge: more than 500 county residents were infected with West Nile Virus. Lack of resources delayed the county's ability to fight back.[12]

Public Health Response to West Nile Virus

- Interagency Collaboration and Cooperation
- Tracking and Surveillance Systems
- Laboratories and Testing Capacities

Interagency Collaboration and Cooperation

After the 1999 WNV outbreak, CDC created a West Nile Interagency Working Group, which facilitates information sharing and coordination of activities among the range of agencies that have some connection to disease and wildlife control.

In 2000, CDC began publishing guidelines for surveillance, protection, and control of WNV with input from a variety of scientists and public health professionals, including virologists, epidemiologists, laboratory personnel, wildlife biologists, and state and local health and agriculture officials. The CDC also developed tests for use at state laboratories to diagnose WNV in humans, and provided training on how to use them.

AGENCIES AND ORGANIZATIONS INVOLVED IN RESPONDING TO WEST NILE VIRUS

U.S. Department of Health and Human Services (HHS)

- CDC is in charge of disease outbreak investigations, tracking, and diagnosis efforts, including management of the Interagency Working Group.
- CDC operates ArboNET, the electronic surveillance system for tracking mosquito-borne infections.
- Food and Drug Administration (FDA) protects against the risk of contaminating the nation's blood supply.
- National Institutes of Health (NIH) engages in research and testing of the virus and develops related treatments.

U.S. Department of Agriculture

- Tracks WNV's impact on U.S. livestock and poultry.
- Conducts research to develop methods for surveillance, monitoring, prevention, and control among animal populations.

U.S. Department of Commerce

- Conducts research on the impact of climate patterns on mosquito populations and helps develop plans for mosquito control.

U.S. Department of Defense

- Conducts research and testing initiatives to prepare and treat the military and public.
- Tests the impact on the Armed Service Blood Program.

Environmental Protection Agency

- Researches and tracks the impact of pesticides used in prevention efforts.

U.S. Department of the Interior

- Assists states with diagnosis of wildlife infections.
- Oversees control and prevention measures in National Park land.

State and local public health, agriculture, environmental protection, and wildlife agencies also work to control WNV.

Tracking and Surveillance Systems

West Nile tracking is performed through CDC's "ArboNET," an electronic surveillance system that monitors WNV and other mosquito-borne illnesses. The tracking system facilitates information-sharing between CDC and numerous state and local public health agencies across the U.S.

Disease surveillance is a vital tool in helping public health officials to understand how to control and prevent disease. ArboNET allows states to track crows and other wildlife impacted by WNV, in addition to humans. Wildlife provide a key indicator for tracking the spread of the disease and demonstrating the crucial and valuable need to connect human and animal health efforts.

The isolated nature of ArboNET, however, means that key linkages to other disease patterns and contributing health, behavioral, and environmental factors, which are all invaluable to effective disease prevention, are not being made. Currently, there is not a nationwide health tracking network that coordinates the monitoring of diseases and connects them to possible related factors. This type of information would help researchers gain a better understanding about which portions of the population are most at-risk, and learn more about the causes and ways to control diseases.

RIFT VALLEY FEVER. THE NEXT WEST NILE?

Like West Nile virus, Rift Valley fever is a mosquito-borne disease native to Africa that is beginning to spread beyond the continent. Since 2000, cases of Rift Valley fever have been diagnosed in Yemen and Saudi Arabia, where approximately 100 persons died.[13]

The transmission cycle is similar to West Nile virus, through infected mosquitoes or through contact with infected animals (usually livestock). Past Rift Valley outbreaks in Africa have shown that the disease can result in deadly hemorrhaging fevers and brain inflammations in a small number of humans.[14] Though death rates have varied widely in past human outbreaks, health officials worry that Rift Valley fever would have a significantly higher mortality rate than West Nile virus.[15] The presence of American servicepersons in the Middle East, in addition to the increasingly interconnected globe, makes common sense mosquito bite prevention against Rift Valley a logical precaution.

"If we get Rift Valley fever in the United States, it would make West Nile look like a hiccup"

-Dr. Corrie Brown, Member of U.S. Secretary of Agriculture's Advisory Committee for Animal and Poultry Diseases in Associated Press article.[16]

"West Nile virus can be seen as a harbinger of things to come. If we better prepared our public health system with the trained workforce, technology, and contingency planning and flexibility it needs, we will do a better job of protecting the public from the next deadly disease we encounter."

– Allan Rosenfield, MD,
Dean of the Mailman School of Public Health at Columbia University.

Laboratories and Testing Capacity

Laboratory testing is needed before a case can officially be classified as WNV. Lab tests most often measure antibodies to WNV in the blood of potential infected individuals.[17]

Most state labs are now self-sufficient in testing for WNV using the IgM antibody test. In the past, CDC tested every positive sample in its national labs for confirmation, but now CDC acts in an advisory capacity and is prepared to offer testing and clinical assistance when called upon by laboratories.[18] Re-testing of initial positives occurs when the patient may have been exposed to closely related viruses like SLE or to confirm results from an insufficient sample size.[19]

Increasingly, state labs contract with private laboratories to handle the volume of testing, using procedures modeled after CDC testing protocols.[20] The Association of Public Health Laboratories (APHL), state health departments, FDA, and CDC monitor commercial testing procedures to ensure suitable standards of accuracy.[21]

To prepare for the 2003 season, CDC's Fort Collins, CO manufacturing laboratory provided all states with testing solutions, specifically the reagents, to ensure cost-effective, high quality, and comparable results. However, the virus moved more rapidly and virulently than anticipated, eventually overwhelming lab capacity and reagent supply. This failure to prepare for "surge capacity" violated the fundamental rule of planning for worst-case contingencies when dealing with new and emerging infectious diseases.

For 2004, CDC has contracted with Focus Technologies, a Virginia-based firm, to provide private-sector assistance in order to avoid the planning failures of the previous year. However, the 2003 reagent shortage illustrates a larger problem: the continued emphasis on reactive shortcuts instead of a true investment in proactive solutions. By institutionalizing flexibility, backup plans, and a wider-range of public-private partnerships, CDC and the public health system in general will be sure to avoid the persistent pitfalls of reactive planning, as illustrated by the control and containment approach to West Nile.

PUBLIC HEALTH LABORATORIES OVERVIEW

Public health laboratories consist of a loose network of federal, state and local laboratories that work in undefined collaboration with private clinical laboratories. They are responsible for a range of emergency response, disease surveillance, and specialized testing procedures.[22]

CDC rests atop the loose network of public health laboratories. CDC's lab is the only civilian laboratory in the country with comprehensive capacity to test for the presence of toxic chemicals in the human body.[23] Below the CDC, each of the 50 states (and the five territories) has a state public health laboratory (SPHL).

State laboratories are not uniform in their capabilities, functions, or resources.[24] Each state lab was created and operates independently under its state-defined charter and, consequently, varies widely from location to location. Many labs lack the capacity to continually monitor infectious agents or prepare for chemical or biological terrorism and face inadequate staffing and equipment concerns.[25]

Trust for America's Health Recommendations

West Nile virus is now an unfortunate national reality. The focus of public health efforts should be shifted in acknowledgement of the disease's permanence.

The long-term impact of mass mosquito spraying on the human population-at-large is still relatively unclear and needs much more examination. Additionally, the initial need for massive information gathering and research centered on the testing of infected bird species should be moderated in favor of preventative education and control measures centered on common sense and self-protection. Specifically, emphasis should be placed on:

- **Education.** Preventative measures, such as CDC's ongoing "Fight the Bite!" campaign are essential to effective control of WNV. Awareness and education initiatives, such as eliminating stagnant water around your home and wearing insect repellent, are the most cost-effective and efficient means of controlling the impact of WNV. *(See sidebar for CDC Individual Recommendations).*

  CDC has done an admirable job in communicating common-sense prevention strategies through Web sites, multilingual public service announcements, and informational materials targeted to public health professionals, media representatives, and the general public.

  However, CDC and HHS could do more to educate the most vulnerable populations: very young children, the elderly, and people with weakened immune systems. CDC should work with medical organizations such as the American Academy of Pediatrics, the American Medical Association, and the American Nurses Association to encourage health professionals to alert vulnerable patients to the importance of taking precautions against WNV infection.

  In addition, CDC should work with the American College of Obstetricians and Gynecologists and other health care practitioners to raise awareness about WNV among pregnant women. While the effect of WNV infections during pregnancy is not fully understood, one case reported case in 2002 suggests that intrauterine transmission of WNV in certain instances might affect the newborn adversely.[26] CDC has issued advice to pregnant women who live in areas with WNV-infected mosquitoes (See box).

- **Contingency Plans for Individual Blood Donation Testing in Areas with High Rates of WNV Infection.** In July 2003, blood collection centers began testing the blood supply for WNV using a sophisticated method called nucleic acid technology (NAT). This testing method detects minute amounts of the genetic material of the virus in a person's blood. After a person is infected with WNV, relatively high levels of the virus remain in their blood for an average of 6.5 days.[27] During this timeframe, an individual who donates blood could transmit the infection to a recipient.

Currently, blood centers have tested "minipools" of blood, a batch of 6 to 16 donations. If the test finds no virus present, then it is used. However, if the minipool tests positive, the blood of each individual donor in the pool is then tested. Given that there are 2.5 million blood donations a year, it is not feasible to test all individual donors due to expense, and because there would be too few trained laboratory personnel to conduct the tests.

However, all blood centers should have contingency plans in place for conducting individual donor testing using NAT. In cases of transfusion-associated transmission of WNV in 2003, the two WNV-contaminated blood donations that led to the transmission had screened negative during initial minipool testing. When the donations comprising the minipools were tested individually during a retrospective examination, these two donations contained very low levels of WNV. **Blood Centers should have contingency plans to test individual donations in areas that might be experiencing a high number of WNV infections.** Individual donation testing is being put into place at selected blood banks in Kansas, Nebraska, North Dakota, Oklahoma, and South Dakota for 2004.

WNV AND PREGNANCY [28]

The potential health risks of West Nile transmission from mother to fetus during pregnancy is not fully understood. While research is being conducted, officials recommend the following preventative options:

Common Sense Measures During Pregnancy: Pregnant women who live in areas with WNV-infected mosquitoes should apply insect repellent to skin and clothes when exposed to mosquitoes and wear clothing that will help protect against mosquito bites. In addition, whenever possible, pregnant women should avoid being outdoors during peak mosquito-feeding times (i.e., usually dawn and dusk).

Evaluation of Infants Born to Mothers Infected with WNV During Pregnancy: When an infant is born to a mother who was known or suspected to have WNV infection during pregnancy, clinical evaluation is recommended. Infants should undergo a physical examination and evaluation for neurological damage or abnormalities.

Information From CDC "Fight the Bite!" Web site

HOW INDIVIDUALS CAN REDUCE THEIR RISK (According to the CDC)

Learn About Mosquito Control

- Apply insect repellent
- Be aware of peak mosquito hours – dusk to dawn

Mosquito-Proof Your Home

- Drain standing water
- Install or repair screens

Help Your Community

- Report dead birds to local authorities
- Mosquito control programs (Information line: 1-800-858-7378)

General Public Health System Improvements

The public health system's response to WNV offers insight into readiness to fight any emerging infectious disease. As late as the 2003 WNV season, public health officials and policymakers were reactive and shortsighted in control and command planning against the spread of WNV – elements that do not bode well for the next emerging infectious disease.

In addition to these recommendations, combating West Nile virus, as well as other health threats ranging from food-borne illness to bioterrorism to chronic disease, requires a strong public health infrastructure. The following recommendations aim to modernize public health by improving disease surveillance, laboratory capacity, and developing a more cohesive national system capable of responding to the myriad of 21st century health threats.

- **Implementing a Coordinated Disease Surveillance System Must be a Priority.** CDC launched the National Electronic Disease Surveillance System (NEDSS) in 2000 to integrate numerous surveillance and reporting systems for diseases such as hepatitis, vaccine-preventable illness, and tuberculosis in an effort to simplify disease reporting across different jurisdictions and communications systems. Unfortunately, over 40 states and the District of Columbia have yet to adopt a NEDSS-compatible system, largely due to piecemeal funding at the federal level. CDC appropriations for the system totaled $28 million in FY 2004, much less than the $50 million public health officials have recommended.[29]

  However, even with greater funding, NEDSS represents a stopgap solution masking a deeper problem. The lack of a 21st century, integrated disease tracking network hinders our ability to meet pressing health threats ranging from WNV to bioterrorism. The volume of information gathered and cross-referenced across regional systems would be a cornerstone for rapid control and prevention strategies and timely and coordinated responses.[30] NEDSS is a step in the right direction, but not enough. A real investment to overhaul and develop a nationwide health tracking system is estimated at $275 million.

- **Improved Laboratory Facilities:** A 2003 TFAH report concluded that our nation's laboratories are unprepared to meet their responsibilities as front-line defenders in our battles against the range of health threats we face.[31] A committed investment is needed to ensure that laboratories at the federal, state, and local levels are better prepared for their crucial detection and response capabilities. Specifically, TFAH recommends:

  - Federal and state public health laboratory capabilities need to be modernized, including upgrading facilities and equipment and bolstering the workforce. This is essential if public health laboratories are to have the capability to respond to all health hazards, including the ability to test for antibodies as well as man made biological agents, such as ricin or cyanide. The recommended investment it will take to achieve this is $200 million in funding.

  - CDC should retain and expand its Emerging Infectious Disease Capacity Program to ensure that states have the ability to respond flexibly and rapidly to an outbreak and are able to develop contingency strategic planning for emerging and spreading infectious diseases.

"We need to plan for the unpredictable in order to meet the numerous potential challenges of the next deadly infectious disease – which is sure to emerge before we anticipate."

– Katherine Kelly,
President-Elect,
Association of Public Health Laboratories (APHL)

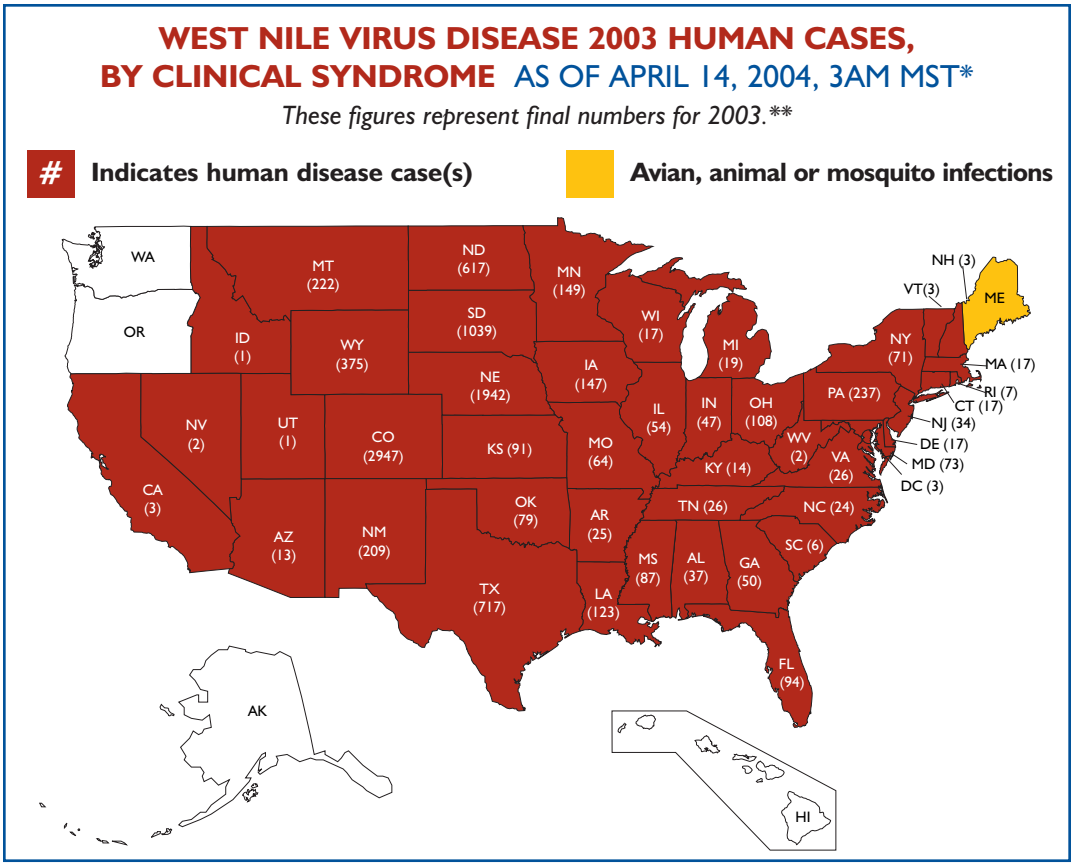
■ **Summit on Public Health Readiness:** Whether responding to West Nile virus or a bioterrorism attack, the current effort to improve the nation's ability to respond to the range of public health emergencies faces a significant organizational challenge. Whatever the threat, the response is largely dependent on the functioning of a patchwork of state and local public health agencies, whose funding sources, bureaucratic structure, and responsibilities can vary significantly from state to state and even county to county. It is clear that the U.S. needs a **more cohesive, national public health system.** Towards that aim, the President, in consultation with Congress and public health experts, should convene a **White House summit** that will develop a concrete vision for the future of the American public health system and the resources needed to make it a reality. The summit would consider how the country can best build a robust, integrated public health infrastructure.

Appendix:

DATA FROM CDC'S ARBONET

WEST NILE VIRUS DISEASE 2003 HUMAN CASES, BY CLINICAL SYNDROME AS OF APRIL 14, 2004, 3AM MST*

*These figures represent final numbers for 2003.***



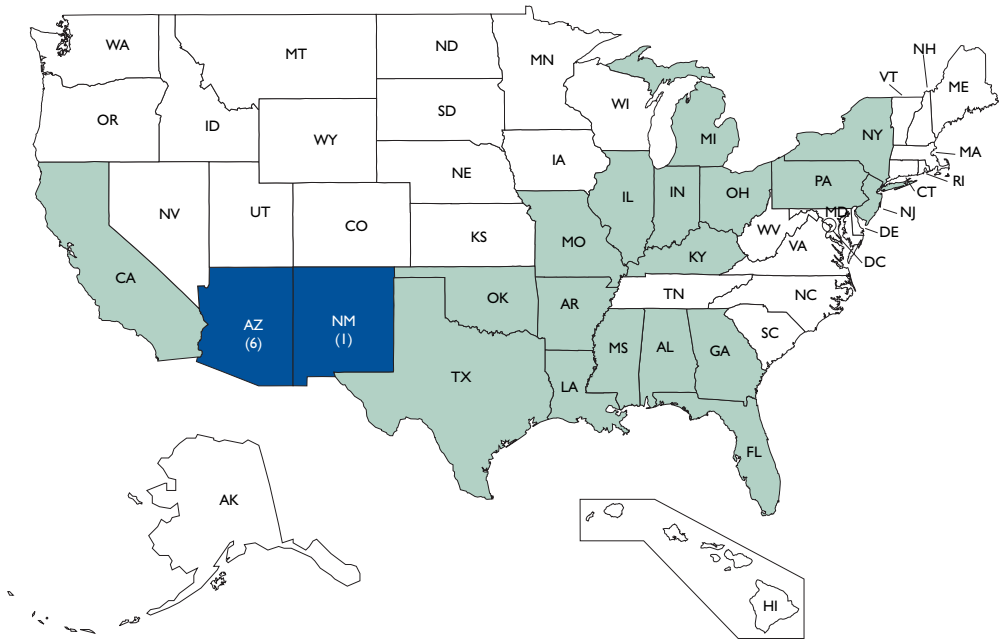
*Currently, WNV maps are updated regularly to reflect surveillance reports released by state and local health departments to the CDC Arbonet system for public distribution. Map shows the distribution of avian, animal, or mosquito infection occurring during 2003 with number of human cases if any, by state. If West Nile virus infection is reported to CDC Arbonet in any area of a state, that entire state is shaded accordingly.

2004 WEST NILE VIRUS ACTIVITY IN THE UNITED STATES

(reported to CDC as of June 8, 2004*)

**Indicates human disease case(s)**

Avian, animal or mosquito infections



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Data table:

Indicates avian or animal infection reported to CDC ArboNET for public distribution as of June 8, 2004 from the following states: Alabama, Arizona, Arkansas, California, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Michigan, Mississippi, Missouri, New Jersey, New York, Ohio, Oklahoma, Pennsylvania and Texas.

Human cases have been reported in Arizona and New Mexico.

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Endnotes

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