

West Nile Virus in Maricopa County Background, Surveillance and Plan of Action.



Maricopa County

ABSTRACT

West Nile Virus (WNV) made a dramatic intercontinental jump to North America in 1999. Exact reasons for its abrupt appearance in NYC are unknown. WNV is now recognized as the most widespread disease of its genre and has rapidly spread across the U.S., involving all but 4 states. During the 2002 season more than 4000 illnesses and 274 deaths were attributed to WNV. Evidence now exists implicating WNV in lactational, intrauterine and organ recipient transmissions as well as the viruses potential to infect the U.S. blood supply.

WNV is permanently established as a significant pathogen in the U.S. prompting research exploring new treatments, diagnostic tests and vaccines. Research is ongoing regarding the mystery of the virus's emergence in North America and it's rapid spread across the continent.

Arizona is one of 4 states without endemic WNV activity, although the virus has been identified in the border states of New Mexico and Colorado. A single human case in California has also been reported without the expected concomitant bird or mosquito viral activity. In 2002 Maricopa County dead bird, sentinel flock, mosquito pool, human and equine surveillance plans have been enhanced in anticipation of the emergence of WNV in our region. Continuing to draw from the experiences of other jurisdictions, Maricopa County WNV prevention efforts will focus on early identification of WNV activity in birds and mosquitoes resulting in utilization of measures to reduce mosquito breeding habitats, aggressive public education campaigns and graded enhancement of human and equine surveillance.

Although these efforts cannot entirely prevent WNV illness the goal is to thwart the viral amplification cycles that result in increased risk to humans and domestic animals. This goal can only be reached through comprehensive and adequately funded preparation and the well-coordinated efforts of all stakeholders in both the public and private sectors.

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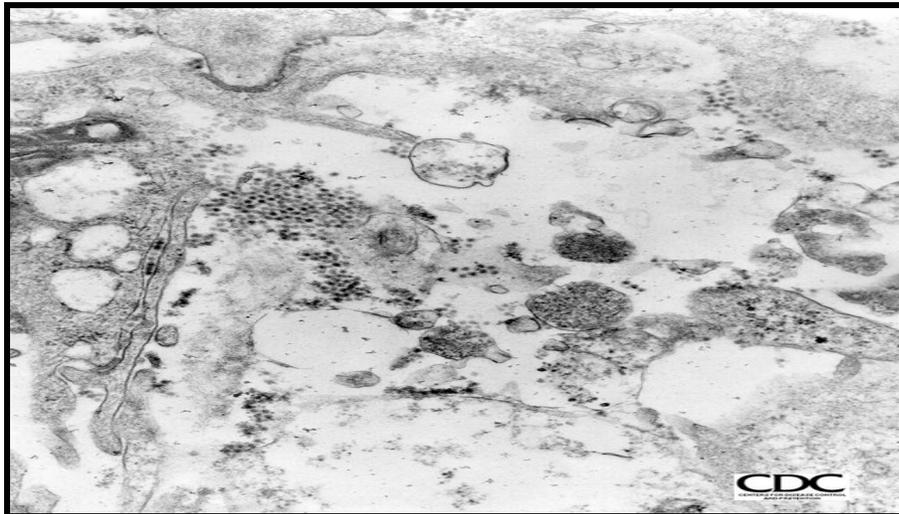
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I. GENERAL BACKGROUND/HISTORY

West Nile Virus (WNV) is one of the group of arboviruses (arthropod-borne) known to cause meningitis and encephalitis in humans, such as Western Equine Encephalitis (WEE) and St. Louis Encephalitis (SLE) viruses. Other familiar arboviruses cause Yellow fever, Denge fever and LaCrosse encephalitis.

WNV belongs to the Flaviviridae family, the genus Flavivirus Japanese encephalitis antigenic complex. This includes the Alfuy, Cacipacore, Japanese encephalitis, Koutango, Kunjin, Murray Valley encephalitis, St. Louis encephalitis, Rocio, Stratford, Usutu, West Nile, and Yaounde viruses (2).

First isolated from the blood of a woman with a febrile illness in the province of West Nile, Uganda in 1937, WNV has been a common cause of both animal and human disease in Africa, the Middle East, Europe and western Asia. Small outbreaks have occurred in Israel (1999 and 2000), Algeria (1994), Romania (1996 and 1997), the Czech Republic (1997), the Democratic Republic of the Congo (1998), Russia (1999) and the United States (1999-2002) (1). WNV is now recognized as the most widespread virus of its genre in the world.



Electron micrograph of WNV in brain tissue of a crow

Illustration 1

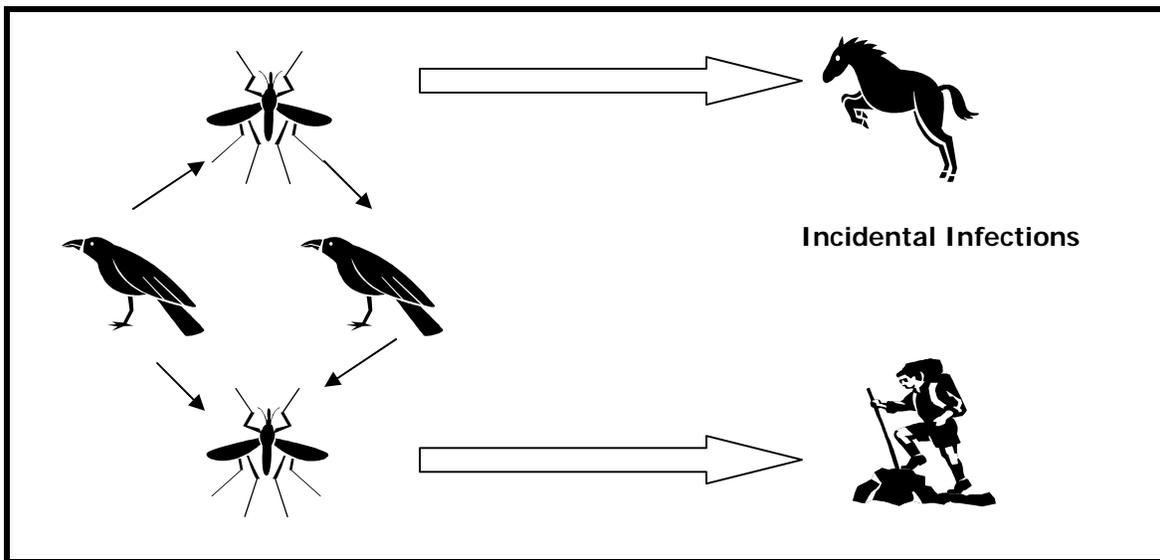
(<http://www.cdc.gov/ncidod/dvbid/westnile/virus.htm>)

Life Cycle of WNV

The principal vector for WNV and other arboviruses are bird-feeding mosquitoes. Infected mosquitoes carry viral particles in their salivary glands and infect susceptible bird species during a blood meal. Although mosquitoes of the genus Culex are the primary vectors in the life cycle, WNV has been isolated from over 43 other mosquito species (3, 4).

Wild birds are the key reservoir hosts for WNV, which has been isolated from over 160 avian species both wild and domestic. Although most infected birds are asymptomatic, crows and jays are more likely to become ill or die, often presenting the first clues to the presence of WNV in communities. Birds can remain highly viremic for 4-5 days successfully sustaining and amplifying the life cycle of the virus in endemic areas (3, 4).

Humans, equines and other mammals are considered incidental or “dead end” hosts of WNV; these species become infected but do not contribute to the viral life cycle. There is however, a theoretical risk of transmission to another hosts by way of vector mosquito bites, albeit not yet well documented. WNV has been isolated from a wide variety of domestic, zoo and farm species (3, 4). For a list of these species, see appendix A.



Life Cycle of WNV

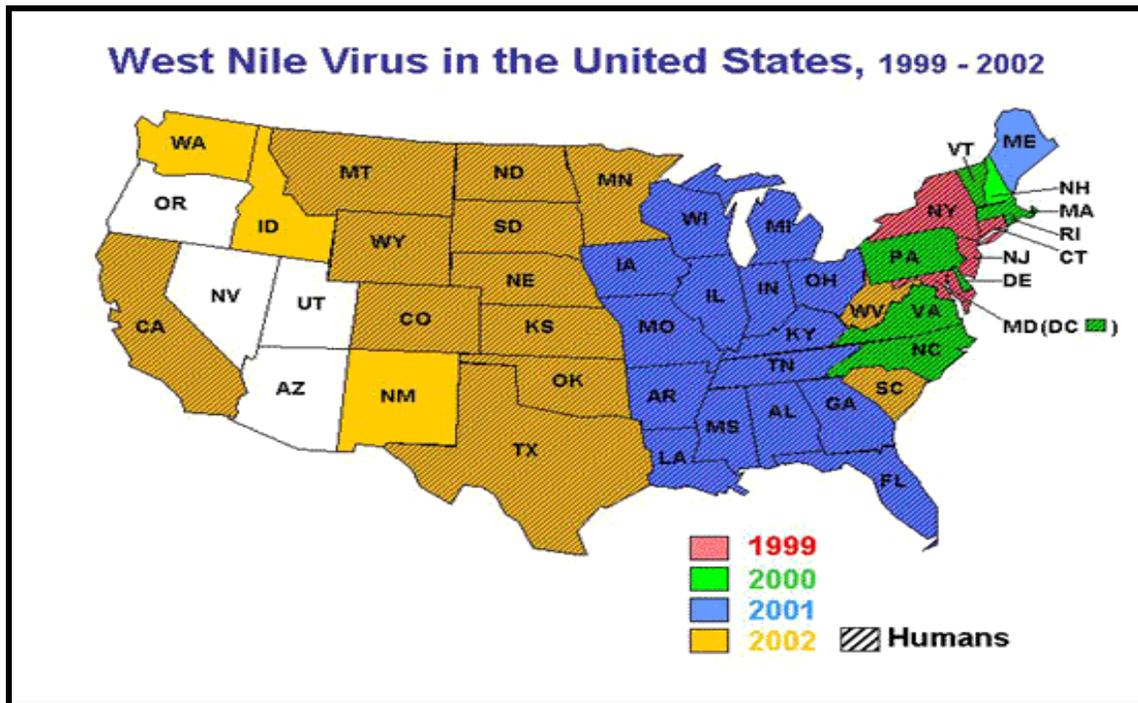
Illustration 2

WNV Arrival in the U.S.

During the summer of 1999, WNV was identified in North America for the first time in a total of four U.S. states. The outbreak in New York City resulted in 62 human cases and 7 deaths.

It is still unknown how WNV was introduced to North America. Its appearance in an area of frequent travel, international trade and bird migration routes suggests the natural or trade-related importation of exotic animals and plants from overseas as a probable answer (4). Examination of the DNA sequence of the virus isolated from both humans and animals in NYC in 1999 revealed a near 100% match with virus isolated from Israel in 1998 (6, 7).

The mechanism of WNV's spread through the U.S presents another challenge for scientists. The virus had spread to 12 states and the District of Columbia by the year 2000. By 2001 it had been isolated in animals or humans in 15 additional states and, by 2003, WNV activity was reported in a total of 44 states and the District of Columbia. In 2002 the virus appeared in Pacific coast states before it appeared in Southwestern states (2), (See Table 1 and Map 1).



Map 1

(<http://www.cdc.gov/ncidod/dvbid/westnile/surv&control.htm#map1>)

Year	1999	2000	2001	2002* (as of 1/20/03)
Cases	62	21	66	3989
Fatalities	7	2	9	259

WNV Annual Case Count

Table 1

Several hypotheses have been formulated regarding this rapid transcontinental expansion of WNV endemic areas in the U.S.: "over-wintering" of infected mosquitoes, that is, the ability to survive adverse climatic conditions and remain viable until the next season; the persistence of WNV in chronically infected endemic vertebrate hosts such as birds or frogs; persistence of the virus in the hibernating female of the *Culex* species, thus infecting her progeny transovarially; and the reintroduction of the virus seasonally by chronically infected migratory birds from tropical or subtropical endemic areas (5).

Clinical Aspects of WNV

Most human WNV infections result in mild or even absent symptoms after an incubation period of 3-15 days. Serosurveys performed in NYC confirmed that approximately 20% of those infected developed mild disease and less than 1% suffered from severe disease (1,4).

West Nile Fever

Well documented for many years in Europe, West Nile Fever is a case of mild WNV disease in humans, characterized by a 3-15 day incubation followed by abrupt onset of flu-like symptoms such as fever, myalgia, arthralgia, pharyngitis, adenopathy, headache, rash, nausea, vomiting and malaise (5). West Nile fever typically resolves spontaneously after only a few days and does not appear to cause any long-term health effects.

West Nile Meningitis/Encephalitis

Severe WNV disease, West Nile meningitis or encephalitis, is characterized by fever, severe cephalgia and mental status changes. Unique to WNV meningitis and encephalitis are the commonly reported patterns of severe muscle weakness and spastic or flaccid paralysis, which are unusual in other viral nervous system infections (6). Although rare, the most serious manifestation of WN virus infection is fatal encephalitis.

Historical Data: NYC Experience

During the WNV outbreak in 1999 in NYC the most common symptoms among hospitalized patients were fever (90%), weakness (56%), nausea/vomiting (53/51%), headache (47%) and mental status changes (46%) (1).

Age appeared to be the most important risk factor for severe disease; data revealed that the attack rate for severe neurologic disease was 10 times higher for those 50-59 years old and 43 times higher for those 80 years old and above when compared to persons aged 0-19. The median age for hospitalized patients during the outbreak was 71 years (range 5-90) and the relative risk for death for patients age 75 and over was 8.5 (1, 4) when compared to the younger age group (0-19).

A one-year follow up of hospitalized patients affected in the 1999 outbreak revealed significant residual symptomatology: fatigue (67%), memory loss (50%), difficulty ambulating (49%), muscle weakness (44%), and depression (38%) were reported (4).

2002 WNV Outbreak in the U.S. – New Findings

The 2002 outbreak in the U.S. is the largest documented WNV epidemic in the world to date. Several case reports from 2002 have contributed evidence of previously undocumented or poorly understood modes of viral transmission. The new information has prompted reevaluation of practices and procedures at the individual as well as the community level.

WNV transmission from organ transplant

In August 2002, 4 organs from a single donor in Georgia were linked to 3 cases of encephalitis (one fatal) and one case of mild febrile illness in the recipients. Three of the four organ recipients tested positive for WNV. It is not known how the donor (who was said to have been healthy before a fatal accident) contracted the disease but health officials are investigating the blood products he received during trauma resuscitation as a potential source of infection with WNV (8).

WNV transmission from blood transfusion

The Centers for Disease Control and Prevention (CDC), Food and Drug Administration (FDA), with state and local health officials are investigating 33 cases from 17 states of WNV illness associated with receiving blood products within 30 days of the onset of symptoms. So far, there is evidence indicating WNV infection as a result of the transfusion in six of those cases. In each of the six, either the donor or retention segments from the blood transfusion (tubing and needles used during the transfusion procedure) tested positive for WNV. Additionally, in each case the donor was reported as having had an illness clinically compatible with WNV (9). The FDA has revised blood bank guidelines, adding protections to exclude donors with symptoms compatible with WNV infection as well as measures to quarantine blood products already in the system from donors who become ill after donation. The FDA and other agencies are evaluating a direct rapid screening method for WNV and have proposed allowing the use of such a test under the "Investigational New Drug" application process during the summer of 2003. The new method will enable blood banks to rapidly screen for WNV just as they routinely check for diseases such as HIV, syphilis and hepatitis (10).

WNV transmission from nursing mother to infant

In September 2002, a 40-year-old Michigan woman delivered a healthy infant but required two transfusions after the delivery. The patient was readmitted 12 days later with symptoms of meningitis, her CSF was WNV positive; she was treated, recovered and was discharged. The nursing infant, who is healthy and reportedly had no mosquito exposure, has tested WNV positive. A sample of the breast milk was also positive for WNV and a viral culture is pending. Of note, the mother received blood from the same donor who also gave a transfusion of platelets to a liver transplant patient who subsequently died of WNV encephalitis. The CDC has not issued any change in breast-feeding recommendations as a result of this case (11).

Intrauterine Transmission

In August 2002, a pregnant New York woman was hospitalized for fever, headache, rash and weakness in the legs. In October, she tested WNV positive and went on to deliver an infant of 38-weeks gestation suffering severe cerebral abnormalities. The infants' blood and CSF tested WNV positive; placental and umbilical tissues also tested WNV positive confirming an apparent intrauterine infection. The CDC has stressed that these findings do not prove a causal relationship between the WNV infection and the fetal abnormalities, however they acknowledge that intrauterine infections associated with Japanese encephalitis and Dengue fever have resulted in fetal infections and spontaneous abortions have been documented in the literature. Precautions for pregnant women to avoid mosquito exposures have been emphasized. In addition, a voluntary registry has been established by the CDC to monitor the birth outcomes of pregnant women with WNV illness (12).

Laboratory Acquired Infections

Two laboratory-acquired cases of WNV have been documented this year. Although this is not a new experience in WNV research there is concern that as far more laboratories will be participating in procedures involving WNV infected tissues such exposures will increase. In one case a laboratory employee lacerated his thumb with a scalpel performing a necropsy on a dead bird subsequently found to be WNV infected. Four days later he began to exhibit typical symptoms from which he recovered without hospitalization. In the other case a research laboratory employee suffered a needle stick while harvesting WNV infected mouse brains. Three days later he began to have symptoms. Of interests in this case the patient had a history of Dengue fever and had received both yellow fever and Japanese encephalitis vaccines. Despite the presence of these presumptively protective Flavivirus antibodies he still contracted WNV illness although the episode was considered mild and the patient recovered completely (13).

The Subcommittee on Arbovirus Laboratory Safety of the American Committee on Arthropod-Borne Viruses recommends biosafety level 3 (BSL) containment for handling WNV specimens. BSL-2 facilities, by modifying procedures, can also achieve acceptable safety standards in order to continue to provide essential clinical services. CDC officials have recommended continued training and prompt reporting. A baseline serum and medical follow-up will be required for all potential laboratory exposures. (13)

II. WNV SURVEILLANCE IN MARICOPA COUNTY

In anticipation of the westward spread of the West Nile Virus in 2002 surveillance efforts to detect the illness in Maricopa County have been increased during the peak mosquito season of May through November.

In endemic areas veterinary surveillance, particularly in avian species, has proven to be a reliable early indicator for WNV activity both temporally and geographically (14). As a result the Arizona Department of Health Services' Vector-borne and Zoonotic Disease Program, the Arizona Veterinary Diagnostic Laboratory and Maricopa County public health officials have collaborated to enhance dead bird, sentinel chicken flock, mosquito pool and equine testing for WNV.

Mosquito Pools

The Arizona State Health Laboratory (ASHL) has tested over 750 mosquito pools in 2002 from locations throughout the state. While no WNV positives occurred 31 samples tested positive for WEE or SLE.

Sentinel Chicken Flocks

Four chicken flocks have been established and strategically spread across the county. Although the virus does not affect chickens their serum will indicate antibodies if bitten by WNV infected mosquitoes in the area. Over 1500 chicken blood samples from across the state were tested during the surveillance season at the ASHL. None tested positive for WNV although the chicken flocks did confirm the presence of WEE and SLE in the county.

Dead Bird Submissions

Dead birds from a variety of genres have been collected from areas across the state. At the beginning of the season information was given to the community regarding the proper submission of dead birds and their importance in WNV surveillance. The University of Arizona's Veterinary Diagnostic Laboratory performed approximately 200 dead bird necropsies, none were WNV positive.

Equine

Local veterinarians have been alerted to consider WNV in horses presenting with CNS abnormalities such as ataxia, weakness of the limbs, recumbency and muscle fasciculation. Approximately 50 equine serum samples have been tested state wide; one horse residing in Maricopa County at the time of diagnosis tested WNV positive, however investigation revealed the virus was contracted in another state. Two other WNV-positive horses were identified in Arizona counties (Cochise and Pima); these cases were also determined to have out of state transmission.

Human Surveillance

The epidemiology division has employed a set of criteria to enhance surveillance and assure appropriate testing of cases of viral neurologic disease for WNV during the peak mosquito season. The criteria were designed to closely reflect the WNV experience of endemic areas of the U.S. in terms of demographics and symptomatology. Cases meeting the following criteria were investigated and tested for WNV:

- ✓ ALL encephalitis cases
- ✓ Adults (>35) with aseptic meningitis
- ANY** age aseptic meningitis with one or more of the following:
 - ✓ Altered mentation
 - ✓ Seizure
 - ✓ Profound muscle weakness
 - ✓ Flaccid paralysis
 - ✓ Spastic paralysis

Details of the results of human surveillance in Maricopa County can be found in Appendix B. Two Maricopa County meningitis/encephalitis patients tested positive for WNV at the ASHL; the results were confirmed by CDC laboratories. Two other human cases of WNV illness were reported in Arizona (Pima). In all four cases the investigation revealed the virus was contracted out of state.

Appendix C denotes the approximate costs of enhanced surveillance in 2002.

**III. PLAN OF ACTION FOR WNV IN MARICOPA COUNTY, 2003:
SURVEILLANCE/CONTROL**

Human Surveillance Plan

Resources

Maricopa County epidemiology has prepared a proposal for reestablishing enhanced surveillance for WNV in spring of 2003. (See Appendix D: Epidemiology/Surveillance Plan for West Nile Virus 2003, 12/12/02). Additional resources requested for the 2003 season include a nurse investigator and 2 administrative assistants. Responsibilities will include community outreach, active surveillance at Maricopa County hospitals, operating hotline numbers, collection of laboratory samples, home and hospital interviews/visits and phlebotomies. A formal process will be followed to track the costs incurred to include salaries, travel and equipment.

Risk Assessment and Staged Response

The Level of Risk definitions and expected responses can be found in Table 2. Two stages of enhanced human surveillance will be guided by the Level of Risk indicated from results of enhanced mosquito and bird surveillance.

RISK LEVEL	DEFINITION	RESPONSE
I	Mosquito Season —no arbovirus detected	Business as usual: continue surveillance & education.
II	Virus Detected - mosquitoes &/or birds	<ul style="list-style-type: none"> •Activate active case surveillance in affected areas •Step-up prevention education •Step-up surveillance - affected & adjacent areas
III	Equine Cases -but still local/focal WNV	<ul style="list-style-type: none"> •Intensify prevention education efforts •Expand active human case surveillance •Increase MD outreach, add sentinel hospitals
IV	Human Cases and/or Widespread WNV	

Risk Assessment and Staged Epidemiologic Response

(Reproduced from Risk Assessment and Staged Response from Arizona Department of Health Services' Vector-borne and Zoonotic Disease Program)

Table 2

Two Stages of Enhanced Human Surveillance

-“Enhanced Passive Surveillance” will begin at the start of the mosquito season (Risk Level I conditions) and will involve promoting prompt reporting of viral encephalitis and select cases of meningitis by healthcare institutions and providers. Routine contact with hospital ICP's and laboratories will continue. Public education regarding mosquito reduction and avoidance will begin.

-“Active Surveillance” will begin with the announcement of Risk Level II conditions. Active surveillance will involve regular formal contact with healthcare institutions and providers, weekly e-mail and fax updates, broadcast fax emergency announcements, and on-site interviews and sample procurement as needed. Suspect case investigation criteria will be expanded. Public education messages will be enhanced to include WNV specific information, prevention messages and to publicized hotline numbers. Hotline phones will be engaged to answer public inquiries and

provide provider consultations. All efforts will be staged with careful consideration of risk assessment and available resources.

The testing/investigation criteria will be amended as follows to reflect recent experiences in endemic areas:

- ✓ All cases of viral **encephalitis**
- ✓ Hospitalized cases of **aseptic/viral meningitis** and:
 - >Age 30
 - Altered mentation
 - Profound muscle weakness
 - Neuropathic symptoms;
 - Flaccid paralysis
 - Spastic paralysis
 - Guillain-Barre Syndrome
 - Seizure

The age criteria will be heavily dependent upon testing resources (lab capacity, availability of reagents) and risk level assessment and will be reevaluated regularly. Cases with travel/mosquito bite history, organ or blood transfusion recipients with compatible symptoms will be evaluated on an individual basis.

IV. THE FUTURE

Vaccine

Human vaccines for WNV are being developed. Drug maker Acambis and National Institutes of Health (NIH) researchers are working with an experimental vaccine for WNV using both an experimental dengue virus and the existing Yellow Fever vaccines as the foundation for the new drug by substituting WNV specific surface proteins for the existing viral particles. Both vaccines have been extensively tested on animals with promising results. The Acambis drug is moving forward with Phase I Trials and an investigational new drug (IND) application will be filed with the Food and Drug Administration. Clinical trials will likely begin in 2003 (15)

Disease Ecology

Researchers in the U.S. along with our neighbors in Canada and Mexico are investigating the mysterious emergence of WNV in North America and the patterns of the virus's persistence in the continent by trying to gain a more detailed understanding of the avian and mosquito species involved in the life cycle and how they are affected by climactic and geographical issues (15).

Treatment and Diagnosis

NIH funded institutions have screened over 300 antiviral and immunotherapeutic drugs for treatment of WNV. Of these, 12 have shown in vitro activity against the virus warranting animal testing.

Several small biotechnology companies are attempting to develop new, commercially available diagnostic assays for WNV. A new rapid diagnostic test will likely become available in late 2003 (15).

V. CONCLUSIONS

The year 2002 marked the largest WNV outbreak to date in the world as the virus rapidly spread across the U.S. The epidemic has cost hundreds of lives and millions of dollars, impacting those directly affected as well as the community at large. The magnitude of the spread of the WNV was unexpected and as a result health officials in many jurisdictions have struggled to limit its human impact.

Maricopa County has been spared the burden of widespread WNV-illness thus far, however the area is home to a viable mosquito population, many species of migratory birds and a large human populace with a propensity for outdoor activities making arrival of the virus inevitable and advanced preparations invaluable.

Maricopa County has the luxury of applying the lessons learned from WNV endemic regions in the past four years and must plan accordingly. If we are to interrupt the amplification cycle of WNV **before** significant human impact it will be important to invest heavily in preventive measures such as early public awareness messages regarding mosquito control and dead-bird submissions, rapid and accurate bird necropsies and concomitant mosquito pool and sentinel flock testing. Once local viral activity has been confirmed preplanned strategies for larvicidal applications, equine vaccinations and reemphasizing measures for mosquito avoidance should be immediately implemented for the appropriate geographical region.

Prior to the identification of WNV activity in Maricopa County enhanced human surveillance must already be in progress with sufficient resources to generate comprehensive case investigations and assure assessment and testing of all potential WNV cases in the jurisdiction.

As with most significant public health issues the cooperation of many local, state, and federal agencies will be required as well as that of the medical community, and the lay public.

APPENDIX A
SPECIES AFFECTED BY WEST NILE VIRUS
 (Reproduced from the National Wildlife Health Center:
http://www.nwhc.usgs.gov/research/west_nile/wnvaffected.html)

Birds	Family Ciconiidae Saddle-billed Storkac-Ephippiorhynchos senegalensis
Order Anseriformes Family Anatidae Wood Duck-Aix sponsa Eurasian Wigeonac-Anas penelope Mallard-Anas platyrhynchos Bronze-winged Duck (Spectacled Duck)c-Anas specularis Domestic Gooseac-Anser chinensis Canvasback-Aythya valisineria Canada Goose-Branta Canadensis Barnacle Gooseac-Branta leucopsis Emperor Goosec-Chen canagica Greater Magellan Goose (Andean Goose)ac-Chloephagapicta leucoptera Abyssinian Blue-winged Gooseac-Cyanochen cyanopterus Tundra Swan-Cygnus columbianus Trumpeter Swanac-Cygnus Cygnus buccinator Mute Swan-Cygnus olor Rosy-billed Duckac-Netta peposaca	Marabou Storkac-Leptopilos crumeniferus Lesser Adjutant Storkac-Leptoptilos javanicus
Order Apodiformes Family Apodidae Chimney Swift-Chaetura pelagica	Family Laridae Inca Ternac-Larosterna inca
Family Trochilidae Ruby-throated Hummingbird-Archilochus colubris	Family Phoenicopteridae Chilean Flamingoc-Phoenicopterus chilensis
Order Caprimulgiformes Family Caprimulgidae Common Nighthawk-Chordeiles minor	Family Threskiornithidae Scarlet Ibisac-Eudocimus ruber Waldrappac-Geronticus eremita
Order Casuariiformes Family Dromaiidae Emuc-Dromaius novaehollandiae	Order Columbiformes Family Columbidae White-crowned Pigeon-Columba leucocephala Rock Dove (Feral Pigeon)-Columba livia Mauritius Pink Pigeonac-Columba mayeri Common Ground-Dove-Columbina passerina Eurasian Collared-Dove-Streptopelia decaocto White-winged Dove-Zenaida asiatica Mourning Dove-Zenaida macroura Luzon Pigeon (Bleeding Heart Pigeon)ac-Gallucolumba luzonica
Order Charadriiformes Family Charadriidae Ruddy Turnstone-Arenaria interpres Killdeer-Charadrius vociferus	Order Coraciiformes Family Alcedinidae Belted Kingfisher-Ceryle alcyon
Family Laridae Herring Gull-Larus argentatus Laughing Gull-Larus atricilla Ring-billed Gull-Larus delawarensis Great Black-backed Gull-Larus marinus Black Skimmer-Rhynchops niger Grey Gullac-Larus modestus	Order Cuculiformes Family Cuculidae Yellow-billed Cuckoo-Coccyzus americanus
Order Ciconiiformes Family Ardeidae Yellow-crowned Night-heron-Nyctanassa violacea Black-crowned Night-heron-Nycticorax nycticorax Great Blue Heron-Ardea herodias Green Heron-Butorides virescens Least Bittern-Ixobrychus exilis	Order Falconiformes Family Accipitridae Cooper's Hawk-Accipiter cooperii Northern Goshawk-Accipiter gentilis Sharp-shinned Hawk-Accipiter striatus Golden Eagle-Aquila chrysaetos Red-tailed Hawk-Buteo jamaicensis Rough-legged Hawk-Buteo lagopus Red-shouldered Hawk-Buteo lineatus Broad-winged Hawk-Buteo platypterus Swainson's Hawk-Buteo swainsoni Swallow-tailed Kite-Elanoides forficatus Bald Eagle-Haliaeetus leucocephalus Mississippi Kite-Ictinia mississippiensis Osprey-Pandion haliaetus Harris' Hawk-Parabuteo unicinctus
Family Cathartidae Turkey Vulture-Cathartes aura Black Vulture-Coragyps atratus King Vultureac-Sarcorampus papa	Family Falconidae Merlin-Falco columbarius Prairie Falcon-Falco mexicanus American Kestrel-Falco sparverius
	Order Galliformes Family Numididae Crested Guinea-fowlac-Guttera pucherani

Family Odontophoridae
Northern Bobwhite-Colinus virginianus

Family Phasianidae
Chukarac-Alectoris chukar
Ruffed Grouse-Bonasa umbellus
Domestic Chicken (Red Junglefowl)-Gallus gallus
Green Junglefowl-Gallus varius
Impeyan (Himalayan) Pheasant (Monal)-Lophophorus impeyanus
Bulwer's Wattle Pheasant-Lophura bulweri
Turkey (domestic and wild)-Meleagris gallopavo
Ring-necked Pheasant-Phasianus colchicus
Mount Peacock-Pheasant-Polypetron inopinatum
Crested Partridge-Rollulus roulroul
Blyth's Tragopan-Tragopan blythii
Argus Pheasant (unspecified)-ac-various

Order Gaviformes
Family Caprimulgidae
Common Loon-Gavia immer

Order Gruiformes
Family Accipitridae
Black-necked Crane-Grus nigricollis

Family Gruidae
Demoiselle Crane-Anthropoides virgo
West African Crowned Crane-Balearica pavonina pavonina
Wattle Crane-Bucconasus carunculatus
Whooping Crane-Grus americana
Mississippi Sandhill Crane-Grus canadensis pulla
Red-crowned Crane-Grus japonensis
Siberian Crane-Grus leucogeranus
Hooded Crane-Grus monacha
White-naped Crane-Grus vipio

Family Rallidae
Virginia Rail-Rallus limicola

Order Musophagiformes
Family Musophagidae
Lady Ross' Turaco (Plantain-Eater)-Musophaga rossae

Order Passeriformes
Family Bombycillidae
Cedar Waxwing-Bombycilla cedrorum

Family Cardinalidae
Northern Cardinal-Cardinalis cardinalis
Blue Grosbeak-Guiraca caerulea
Dickcissel-Spiza americana

Family Corvidae
Western Scrub-Jay-Aphelocoma californica
American Crow-Corvus brachyrhynchos
Common Raven-Corvus corax
Fish Crow-Corvus ossifragus
Blue Jay-Cyanocitta cristata
Steller's Jay-Cyanocitta stelleri
Black-billed Magpie-Pica hudsonia

Family Emberizidae
Song Sparrow-Melospiza melodia
Savannah Sparrow-Passerulus sandwichensis
Fox Sparrow-Passerella iliaca
Eastern Towhee-Pipilo erythrophthalmus
Field Sparrow-Spizella pusilla

Family Estrildidae
Zebra Finch-Taeniophygia guttata

Family Fringillidae
American Goldfinch-Carduelis tristis
House Finch-Carpodacus mexicanus
Purple Finch-Carpodacus purpureus
Evening Grosbeak-Coccothraustes vespertinus
European Goldfinch-Carduelis carduelis

Family Hirundinidae
Barn Swallow-Hirundo rustica
Purple Martin-Progne subis

Family Icteridae
Red-winged Blackbird-Agelaius phoeniceus
Rusty Blackbird-Euphagus carolinus
Brewer's Blackbird-Euphagus cyanocephalus
Baltimore Oriole-Icterus galbula
Brown-headed Cowbird-Molothrus ater
Boat-tailed Grackle-Quiscalus major
Great-tailed Grackle-Quiscalus mexicanus
Common Grackle-Quiscalus quiscula

Family Laniidae
Loggerhead Shrike-Lanius ludovicianus

Family Mimidae
Gray Catbird-Dumetella carolinensis
Northern Mockingbird-Mimus polyglottos
Brown Thrasher-Toxostoma rufum

Family Paridae
Tufted Titmouse-Baeolophus bicolor
Varied Tit-Parus varius
Black-capped Chickadee-Poecile atricapilla
Carolina Chickadee-Poecile carolinensis

Family Parulidae
Black-throated Blue Warbler-Dendroica caerulescens
Yellow-rumped Warbler-Dendroica coronata
Yellow Warbler-Dendroica petechia
Blackpoll Warbler-Dendroica striata
Common Yellowthroat-Geothlypis trichas
Kentucky Warbler-Oporornis formosus
Northern Parula-Parula americana
Ovenbird-Seiurus aurocapillus
Northern Waterthrush-Seiurus noveboracensis
Nashville Warbler-Vermivora ruficapilla
Canada Warbler-Wilsonia canadensis
Hooded Warbler-Wilsonia citrina

Family Passeridae
House Sparrow-Passer domesticus

Family Sylviidae
White-crested Laughingthrush-Garrulax leucolophus

Family Sittidae
White-breasted Nuthatch-Sitta carolinensis

Family Sturnidae
European Starling-Sturnus vulgaris

Family Troglodytidae
Carolina Wren-Thryothorus ludovicianus
Winter Wren-Troglodytes troglodytes

Family Turdidae
Veery-Catharus fuscescens
Hermit Thrush-Catharus guttatus
Gray-cheeked Thrush-Catharus minimus
Swainson's Thrush-Catharus ustulatus
Wood Thrush-Hylocichla mustelina
Eastern Bluebird-Sialia sialis
American Robin-Turdus migratorius

Family Tyrannidae
Traill's Flycatcher-Empidonax traillii/alnorum
Eastern Phoebe-Sayornis phoebe
Scissor-tailed Flycatcher-Tyrannus forficatus
Eastern Kingbird-Tyrannus tyrannus

Family Vireonidae
Black-whiskered Vireo-Vireo altiloquus
Warbling Vireo-Vireo gilvus

Order Pelecaniformes
Family Pelecanidae
American White Pelican-Pelecanus erythrorhynchos
Brown Pelican-Pelecanus occidentalis

Family Phalacrocoracidae
Double-crested Cormorant-Phalacrocorax auritus
Guanay Cormorant-Phalacrocorax bougainvillei

Order Piciformes
Family Picidae
Red-headed Woodpecker-Melanerpes erythrocephalus
Downy Woodpecker-Picoides pubescens
Yellow-bellied Sapsucker-Sphyrapicus varius

Order Podicipediformes
Family Podicipedidae
Pied-billed Grebe-Podilymbus podiceps

Order Psittaciformes
Family Cacatuidae
Cockatoo (unspecified)-Cacatua spp.
Cockatiel-Nymphicus hollandicus

Family Psittacidae
Red-crowned Parrot-Amazona viridigenalis
Macaw (unspecified)-Ara spp.
Budgerigar-Melopsittacus undulatus
Lorikeet spp.-Trichoglossus spp.

Order Sphenisciformes
Family Spheniscidae
Black-footed (Jackass) Penguin-Spheniscus demersus
Magellan Penguin-Spheniscus humboldti

Order Strigiformes
Family Strigidae
Northern Saw-whet Owl-Aegolius acadicus
Short-eared Owl-Asio flammeus
Verreaux's Eagle Owl (Milky Eagle Owl)-Bubo lacteus
Great Horned Owl-Bubo virginianus
Snowy Owl-Nyctea scandiaca
Eastern Screech Owl-Otus asio
Tawny Owl-Strix aluco
Barred Owl-Strix varia

Family Tytonidae
Barn Owl-Tyto alba

Order Struthioniformes
Family Struthionidae
Ostrich-Struthio camelis

Mammals

Order Artiodactyla
Family Bovidae
Domestic Cattle-Bos taurus
Mountain Goat-Oreamnos americanus
Domestic (Suffolk) Sheep-Ovis aries

Family Camelidae
Llama-Lama glama
Alpaca (Suri)-Lama pacos

Family Cervidae
White-tailed Deer-Odocoileus virginianus
Reindeer-Rangifer tarandus

Family Suidae
Babirusa-Babirusa babyrousa

Order Carnivora
Family Canidae
Domestic Dog-Canis familiaris
Timber Wolf-Canis lupus

Family Felidae
Domestic Cat (feral)-Felis catus

Family Mustelidae
Striped Skunk-Mephitis mephitis

Family Phocidae
Harbor Seal-Phoca vitulina

Family Procyonidae
Red Panda-Ailurus fulgens fulgens

Family Ursidae
Black Bear-Ursus americanus

Order Chiroptera
Family Vespertilionidae
Big Brown Bat-Eptesicus fuscus
Little Brown Bat-Myotis lucifugus

Order Lagomorpha
Family Leporidae
Domestic Rabbit-Oryctolagus cuniculus

Order Perissodactyla
Family Equidae
Domestic Horse-Equus equus przewalski caballus
Donkey-Equus asinus
Mule-

Family Rhinocerotidae
Great Indian Rhinoceros-Rhinoceros unicornis

Order Primata
Family Cercopithecidae
Barbary Macaque-Macaca sylvanus

Family Lemuridae
Ring-tailed Lemur-Lemur catta

Order Proboscidea
Family Elephantidae
Indian (Asian) Elephant-Elephas maximus indicus

Order Rodentia
Family Sciuridae
Gray Squirrel-Sciurus carolinensis
Fox Squirrel-Sciurus niger
Eastern Chipmunk-Tamias striatus

Reptiles

Order Crocodylia
Family Alligatoridae
American Alligator-Alligator mississippiensis

Order Squamata
Family Varanidae
Crocodile Monitor-Varanus salvadorii

**APPENDIX B
RESULTS OF HUMAN SURVEILLANCE FOR WNV IN MARICOPA COUNTY, 2002**

Maricopa County has experienced a slow but steady increase in the rate of viral meningitis/encephalitis cases reported in the past 4 years as shown in Chart 1. Of the 200 cases reported during the mosquito season 2002 21 are not considered in the data as they were ruled out (8), duplicate (4), or out of jurisdiction (9).

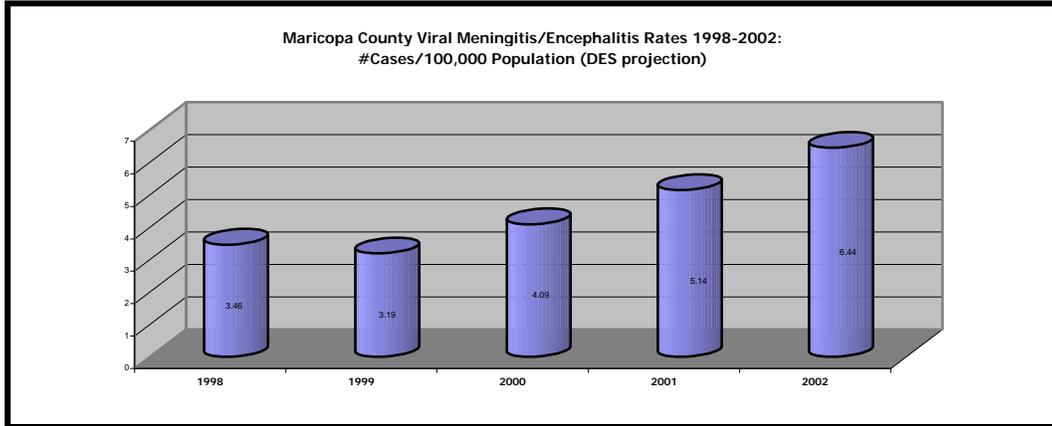


Chart 1

Chart 2 represents the remaining 179 cases by the month report was received. Date of symptom onset (which would more clearly illustrate the seasonal peak of disease) was not used in this report due to the fact that onset data were missing in more than one third of the reports. The average lag time between symptom onset to date received in cases with available data was 14.2 days (range 1-38 days).

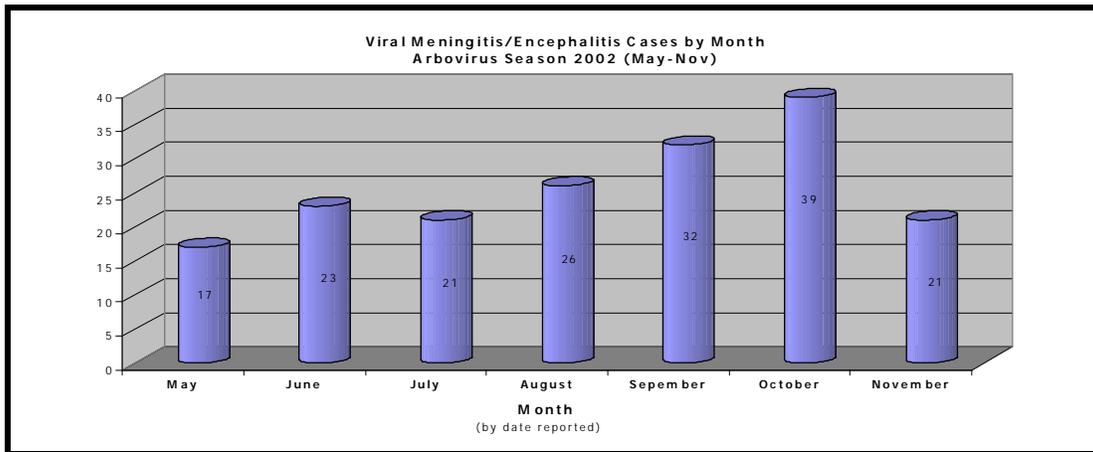


Chart 2

Of the 179 cases of viral CNS disease reported during the period of enhanced surveillance 50 met age criteria for WNV investigation. The Charts 3 -5 illustrate the general demographics of this group including age, sex race and location.

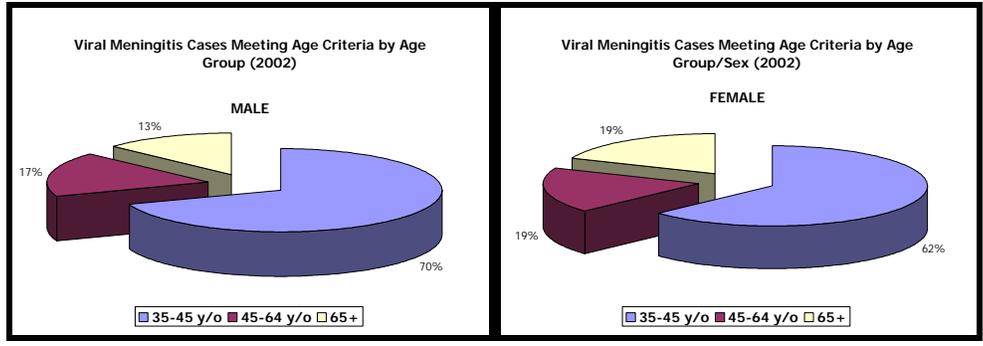


Chart 3

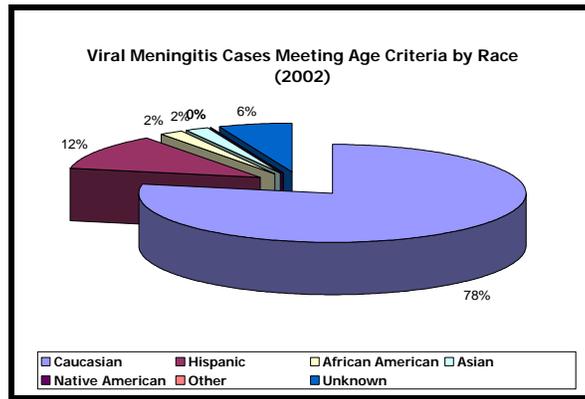
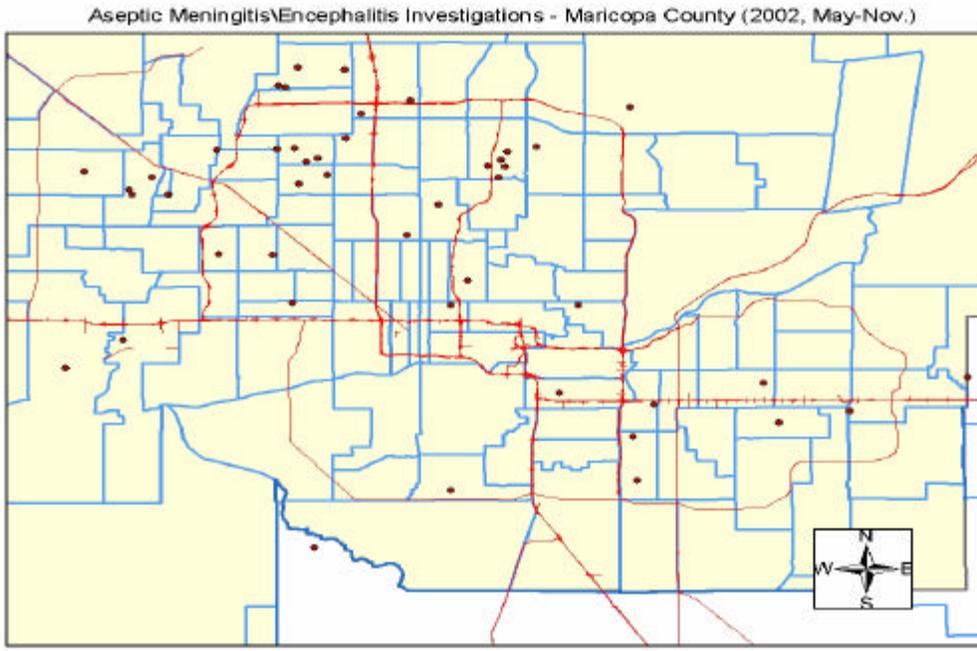


Chart 4



Map 2

Results of Enhanced Human Surveillance

In addition to the 50 cases meeting age criteria 7 more investigations were initiated for cases reported as aseptic meningitis exhibiting paresthesias (3), numbness (2) or altered mentation (2).

In August, as the national case count grew beyond all expectations and media coverage of the WNV epidemic intensified many private physicians began requesting WNV testing of the ASHL. As a result county epidemiologists were required to triage all request for testing using the established criteria prior to the specimen delivery to the lab. As some requests were for non-hospitalized patients with strictly upper respiratory symptoms, headache alone or history of travel to a WNV endemic area without symptoms, any request not meeting criteria was referred to a commercial laboratory for testing. More than 50 such consultations resulted in 21 samples to the ASHL, 15 to commercial labs.

Table 2 shows the degree of symptomatology of the 57 cases investigated in Maricopa County for 2002. These data reveal significant differences in symptom breakdown from cases of WNV disease in NYC (see Historical Data: NYC Experience).

Symptom	% With symptom
Headache	54
Gi	34
Fever	32
Photophobia	18
Weakness	16
Altered mentation	16
Neck pain/stiffness	14
Arthralgia/Myalgia	8
Seizure	6
Other	16

Symptomatology of Viral Meningitis/Encephalitis Cases investigated 2002

Table 3

Of the 57 viral meningitis/encephalitis case investigations carried out this summer in Maricopa County 2 patients tested positive for WNV IgM. In the first case a woman with a travel/mosquito bite history in Ohio approximately 10 days prior to the onset of headache, fever, nausea, vomiting and stiff neck was admitted to a local hospital in August. The second patient gave history of having spent the summer in Indiana; 4 days after returning to her winter home in Arizona she began to experience headache, neck pain and extreme fatigue. The WNV serology, which was initially done at a commercial lab, was confirmed by the ASHL.

APPENDIX C
COSTS OF ENHANCED SURVEILLANCE FOR WNV IN MARICOPA COUNTY, 2002

At the start of the enhanced surveillance period no measures were taken to account for the expenses of the effort as its magnitude was unexpected and underestimated. Listed below are the cost per epidemiologist involved during the surveillance period by hourly pay rate factoring in indirect and personnel costs (indirect: \$ 0.157, personnel: \$1.161).

ACTIVITY	TOTAL COST (\$)
MC lab draws	
Epi person/hours:	
Planning	
Triage/ Consults	
Investigating	
Correspondence/Mailings	
Reports	
Aggregate	
Epidemiologist	662.02
Epidemiologist	1560.01
Epidemiologist	17,713.35
Total	19,935.38

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APPENDIX D

MARICOPA COUNTY DEPARTMENT OF PUBLIC HEALTH EPIDEMIOLOGY/SURVEILLANCE PLAN FOR WEST NILE VIRUS 2003

Prepared by Mare Schumacher
Updated 12/17/02

Background and Current Enhanced Surveillance Efforts

In the U.S. as of December 11, 2002, there have been 3829 cases of human West Nile Virus (WNV) illness, resulting in 225 deaths. WNV activity has been documented in 42 states including the Arizona border states of Colorado, California (human case) and New Mexico (veterinary samples). In Arizona, 4 human (Pima-2, Maricopa-2) and 3 equine (Pima-1, Cochise-1, Maricopa-1) WNV positive cases have been identified. All of these cases had exposures outside of Arizona. Predictions are for Maricopa County to see it's first cases of endemic WNV during the spring/summer of 2003.

Increased efforts to detect WNV illness in Maricopa County were instituted last summer. Human surveillance for WNV in Maricopa County was expanded during the mosquito season (May thru October). In addition to routine testing for all encephalitis cases, samples for selected cases of aseptic meningitis were submitted to the State laboratory by MCDPH and other county health departments. This practice will continue into 2003.

Last year, surveillance of animals susceptible to WNV was also enhanced. The MCDPH, the Arizona Department of Health Services' Vector-borne and Zoonotic Disease Program, the Arizona Veterinary Diagnostic Laboratory, and Maricopa County Vector Control collaborated to enhance dead bird, sentinel chicken flock, mosquito pool and equine testing for WNV.

Enhanced Surveillance Efforts for 2003

Because WNV illness is transmitted by mosquitoes, enhanced surveillance will need to begin again in April of 2003 and surveillance can be expected to continue into December 2003. During this period, the MCDPH surveillance team (epidemiology staff and community health nursing surveillance staff) will need to conduct investigations of all suspect WNV cases. Due to the media interest in WNV, the team expects a greater number of suspect cases in 2003, in addition to the expected actual cases. Surveillance and investigations will include the following activities:

Arbovirus testing for:

- All viral encephalitis cases (routine)
- Selected viral meningitis cases:
 - >35 y/o
 - altered mentation
 - seizure
 - profound muscle weakness
 - flaccid paralysis
 - spastic paralysis

Testing will be performed at the AZ State Health Laboratory at the request of MCDPH.

Telephone triage:

- Contact hospitalized cases (ICP's providers)

- Interview outpatient cases and get information on specimens (providers, labs)
- Communicate with community members with questions

Site visits:

- Review medical records for hospitalized cases
- Interview hospitalized/convalescing patients
- Collect convalescent specimens and/or lab results

Data management:

- Collect case information
- Complete data entry
- Analyze data
- Clean and maintain database
- Produce reports

Community outreach:

- Distribute initial fact sheet to providers/Infection Control Practitioners (see Attachment A)
- Provide pamphlets
- Provide regular updates to reinforce protocols and disseminate new info (see Attachment B)
- In addition to MCDPH efforts, public service announcements are currently being negotiated by ADHS with Cox Communication

Resources Needed for Epidemiology for Summer 2003 West Nile Virus Enhanced Surveillance and Outbreak Response

When the disease arrives in Arizona, the surveillance team will need to investigate every suspect case of WNV and field questions and concerns from the public. With even as few as one suspect case per day, the surveillance investigation workload will increase significantly as each case requires a full interview of the patient, communication with labs, hospitals and the patient's medical provider, in addition to follow-up interviews, site visits and blood draws.

In order to meet the demand that the introduction of WNV into Arizona will produce, the Epidemiology and Community Health Nursing staff request \$99,057.37 in additional funds.

Requested funds would cover 1 surveillance nurse and 1 administrative assistant to help the existing staff handle the increased number and types of activities needed. All positions would be hired on a full-time basis for 35 weeks of the year (to cover the mosquito season). The administrative Assistant would be hired from a temporary service at the rate of \$14.30 per hour. Hiring a partial-year surveillance nurse may be more difficult. The MCDPH typically hires temporary nursing help from a nurse pool at \$30-35 per hour. However, the WNV surveillance nurse will need to have analytical and research skills in addition to basic nursing skills. The estimated cost per hour for a temporary surveillance nurse is \$52.00 per hour (including an additional \$6/hour for research skills). Job descriptions for each of the positions are provided below.

Surveillance Nurse

The WNV surveillance nurse would be responsible for all parts of a WNV investigation, including:

- Completing diagnostic telephone interviews of all suspect cases to determine if probable cases
- Conducting medical and personal interviews of probable cases
- Securing blood samples (through a blood draw) for probable cases
- Telephone triage with medical providers and hospitals to get lab results
- Following up with suspect and probable cases for changes in conditions, new lab tests, etc.

MCDPH expects to pay more for a qualified surveillance nurse than for a pool nurse. A qualified surveillance nurse has not only medical knowledge, but research skills as well.

Administrative Assistant/Data Entry Clerk

Administrative assistants will provide administrative support to the surveillance nurse and the epidemiologists. This will include:

- Data entry of completed lab results, questionnaires, and other forms
- Setting up appointments and communication with patients
- Typing, copying communication items for hospitals
- Picking-up or delivering of interviews, lab results or other items from hospitals, patients' homes, or labs

Total Costs

As shown in the table below, the total cost for one administrative assistant, one surveillance nurse, computer/software, travel, and pamphlets is \$99,057.37.

	Cost per hour/unit	Number of hours/units	Total Cost
Surveillance nurse	\$52.00	1400	\$72,800.00
Administrative assistant	\$14.30	1400	\$20,020.00
Computer	\$2,197.00	2	\$4,394.00
Software (Access)	\$400.00	2	\$800.00
Travel	.345 per mile	1575 miles	\$543.37
Pamphlets	.50 per pamphlet	1000 pamphlets	\$500.00
Total Request			\$99,057.37

Note: Computers will be needed for administrative assistants to enter data. The surveillance nurse will use the division's laptop, when needed.

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**Maricopa County Department of Public Health
Division of Epidemiology/BDPR
Contact Numbers (all 602 area code)**

Vjollca Berisha	Senior Epidemiologist	506-6802
Garrett Booth	Epidemiologist	506-1027
John Carlson	Senior Epidemiologist	506-6829
Alisa Diggs-Gooding	Epidemiologist	506-6811
Andrew Edmonds	Data Analyst	506-3252
Joesette Frausto	Administrative Assistant	506-6439
Jeanette Gibbon	Epidemiologist	506-6801
Ron Klein	Disease Surveillance Sup	506-6722
Ashraf Lasee	Epidemiologist	506-3062
Chris Mahon	Program Admin, CHN	506-6771
Yanita Moore	Data Entry Clerk	506-6805
Liva Nohre	Senior Epidemiologist	506-6826
Lawrence Sands	Director, BDPR	506-6821
Sarah Santana	Director, Epidemiology	506-6952
Mare Schumacher	Deputy Director, Epi	506-3078
Heather Wanatowicz	Administrative Supervisor	506-6825
Gary West	Statistical Programmer	506-6830

To report communicable diseases, unusual health occurrences, and public health emergencies (all 602 area codes unless otherwise noted)

	Business hours M-F 7-5	After hours
Bite reports	506-7387	506-2752
Communicable diseases	506-6868 or 506-6767	480-303-1100
Death certificates, funeral homes, human remains	506-6805	450-9982 or 420-2839
HIV (reports)	506-6426 or 506-6871	Not available
Public health emergencies	339-8749	480-303-1100
Rabies	506-7387	506-3334
STDs (other than HIV)	506-6364 or 506-6147	Not available
TB	372-6661	480-303-1100