

# West Nile Virus - Update

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**W**est Nile virus (WNV) will have reached across the North American continent on the wings of birds and arrived on the West Coast if a probable case of infection in a Los Angeles area resident, who had no travel history to an infected area, is confirmed. That would leave only 6 states, of the lower 48, free of documented locally transmitted WNV (Arizona, Idaho, Nevada, Oregon, Utah and Washington) although the virus has been introduced all of them except Nevada via infected humans or horses returning from other parts of the country where WNV is active.

As of the 10<sup>th</sup> of September, the Centers for Disease Control and Prevention (CDC) had reported 1,086 human WNV illnesses from the District of Columbia and 31 states (75 in Missouri, 0 in Kansas), with 45 fatalities (1 in Missouri).

CDC also reported that for 935 WNV cases, 522 had meningo-encephalitis symptoms, 147 had fever, and the clinical presentation of the remaining 266 was not known. While the median age of cases was 53 y (9 m - 99 y), it was 79 y (48-99 y) for fatalities. For both cases and fatalities, there was a higher proportion of males, 52% and 60%, respectively.

Nationally, through the 10<sup>th</sup> of September, 6,748 WNV infected birds had been identified, as were 1,508 horses and 1 feline. Also, 2,567 WNV positive mosquito pools had been reported.

WNV first arrived in Missouri in the late summer of 2001 in the St Louis area. At the end of June 2002, a WNV positive crow was found in St Louis City, the 1<sup>st</sup> WNV bird of the year. This discovery then triggered a continuing string of reports of WNV infected humans, birds, horses, and mosquitoes across the state. In July, the dead bird surveillance program operated by the Kansas City Health Department began to record small increases each week in the total number of dead birds being reported. By the end of July, WNV positive birds were being found in the City (a crow on 7/25 and

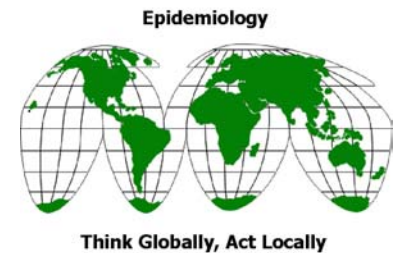
a blue jay on 7/30). Another 2 crows and 2 blue jays were positive during August. At about the same time, WNV began being reported from horses and birds in Platte, Clay, Jackson, Cass, Leavenworth, Wyandotte, and Johnson counties in the metropolitan area. As of the 11<sup>th</sup> of September, 3 probable human cases of WNV have been detected among Kansas City, MO, residents; all survived.

By mid-August, the Kansas City Health Department made an emergency purchase of mosquito larvicide for use in standing water on public lands within the City. Staff from the Water Services and Public Works departments handled the placement of the larvicide. The City Council approved the use of \$100,000 from the Health Levy fund to prepare the City for next year's WNV season. Because the effectiveness of the larvicide is about 150 days, and given the time of the year, it is not anticipated that further larviciding will be necessary in 2002.

The Kansas City Zoo, which earlier in the year had vaccinated selected animals against WNV, experienced some bird deaths in its collection and among free-flying birds. While laboratory tests are still pending, it is suspected that WNV was the cause. Therefore, further steps have been taken to protect various species.

During August, the Health Department responded to 218 requests for information on WNV from the news media and a large number of inquiries from citizens. In early September, the Health Department was notified by the Missouri Department of Health & Senior Services (MDHSS) that it would receive \$37,000 in supplemental WNV funding from CDC for educational efforts in the community.

Elsewhere in the America's WNV was making its appearance. As of the 9<sup>th</sup> of September, the virus had been found in four Canadian provinces (Quebec, Ontario, Manitoba, Saskatchewan), with confirmed human cases in Ontario. Meanwhile, confirmed human cases of WNV had been reported from Mexico, in persons returning from areas of the US where the virus was active. Meanwhile, serologic testing of birds collected in 2001 in the Yucatan area of Mexico suggests that WNV may be present in the country. Authorities in El Salvador have sent specimens to CDC to determine whether an 11 y old boy from the eastern



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portion of the country had died of WNV (ProMED 9/9/02). Last year, WNV caused illness in Cayman Islands, so the appearance of WNV in Central and/or South America would not be unexpected given bird migratory patterns.

Meanwhile, CDC is investigating whether WNV can be transmitted via blood transfusions. Four cases of WNV in persons (3 with encephalitis, one of whom died; 1 with a febrile illness) who received organ transplants from the same donor led to an investigation of the donor. The donor had received multiple blood transfusions just days prior to being killed in a motor vehicle crash. Thus, CDC was investigating whether the donor had been naturally infected or infected via transfusion. Subsequently, another possible transfusion case has come to light and is under investigation by the Mississippi Health Department (ProMED 9/9/02).

At same time that WNV in birds was being recognized in Kansas City, the Health Department received a report of California encephalitis virus (CE), another mosquito-transmitted virus, infection in an 11 y girl. Based on travel history, the infection would have to had been acquired in the metropolitan area. Her illness, coupled with the serologic testing done, classifies this case as probable under CDC's case definition. CE causes clinical illness in <1% of children infected. This CE infection represented the 1<sup>st</sup> time in >25 y that any locally acquired arbovirus infection in humans had been reported in Kansas City. If it were not for the physician's concern about WNV, the girl would not have been tested for arboviral infections. Medical practice in the community, rather than absence of arboviruses, may have masked other infections in the past.

**The Kansas City Health Department will be offering its 4-day *Principles of Epidemiology* course on the 21<sup>st</sup>-24<sup>th</sup> of October 2002. The course will be held at the Health Department and is free. Enrollment is limited to 15 individuals. If you are interested in attending, please contact:**

**Mary Dellinger at 816-513-6355**

## **Dog Heartworm Infections in Humans**

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Subsequent to the recognition of WNV in Kansas City, both the news media and the public began to make inquiries about other possible infections transmitted by mosquitoes. Among these inquiries, the most common concerned possible human infection with the dog heartworm, *Dirofilaria immitis*. And, as strange as that may initially seem, actually it was a very good question.

*D immitis* is derived from the Latin words, *diro* and *filum*, meaning "evil thread." Dogs, cats, foxes, raccoons, and other mammals are natural hosts, with the mosquito (any of 60 species in 6 genera) as the vector-intermediate host. Humans are dead-end hosts for this nematode.

In dogs, the sexually mature adult female worms reside in the right ventricle of the heart and shed thousands of microfilariae into the bloodstream daily. When a mosquito bites the infected dog, it takes up microfilariae as part of the blood meal. Over the next 10-16 days, the microfilaria develop into the infective stage which is then transmitted to a host, including humans, at the next blood meal. In a

permissive host, the larvae reside and mature in the subcutaneous tissues and along muscle sheaths for several months. They migrate to the right ventricle of the heart where the nematode fully matures. Maturation takes 6-7 months, resulting in a worm that is 1-2 mm in diameter and 25-30 cm in length. And, the cycle repeats itself.

Humans are a dead-end host since the larvae cannot develop into adults. However, the larvae do migrate to the right ventricle of the heart. There they die and embolize into the pulmonary artery. In the lungs, the dead larvae lodge in small pulmonary branches and release antigens. These antigens lead to endarteritis, with subsequent pulmonary infarction of a size larger than expected. The resulting condition can be asymptomatic (~56%-62% of cases) or symptomatic. The most common symptoms are cough, chest pain, hemoptysis, and wheezing. The condition usually is discovered serendipitously on routine chest radiograph and is seen as well circumscribed, non-calcified, peripheral coin lesions or nodules without clear predilection for any particular lobe (Chest 119:1250, 2001). Since 1941, nearly 120 human pulmonary cases of dirofilariasis have been reported in the US (South Med J 92:276, 1999).

Non-pulmonary dirofilariasis in humans also occurs, although reported cases in the US have been few (<12). Lesion locations have included the orbit, testicle, subcutaneous tissues, urinary bladder, portacaval shunt, and peritoneal cavity (South Med J 93:1009, 2000). In at least one case, the

nodule necessitated an orchiectomy (Am J Trop Med Hyg 64:317, 2001).

Serologic detection of human antibodies to dirofilariasis has been reported (9% in Spain; 50% in Columbia). However, the tests employed had poor sensitivity and specificity, raising questions as to the validity of these findings.

The first recorded case of human infection with *Dirofilaila* involved a boy from Rio De Janeiro, Brazil, in 1897 (J Thorac Cardiovasc Surg 74:403, 1977), while the first report in the

## Potpourri

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The clinical syndrome of acute encephalitis is associated with a number of infectious, post-infectious, and non-infectious causes. Although >100 different infectious pathogens and several toxins have been identified as causative agents of encephalitis, in most cases, no pathogen can be detected. Given the concern about WNV, just how common is the diagnosis of encephalitis?

To answer this question, CDC analyzed the National Hospital Discharge Survey data for 1988-1997 (Clin Infect Dis 35:175, 2002). On the average, there were nearly 19,000 hospitalizations, 230,000 bed days, and 1,400 deaths annually from encephalitis. For 59.5% of the cases, the etiologic agent was unknown or not recorded. Among known agents 38.2% were "viral" and 34.1% were other infectious agents. The most common individual diagnoses were herpetic and toxoplasmic encephalitides — each associated with 2,100 hospitalizations/y. HIV infections were listed among discharge diagnoses for 15.6% of hospitalizations. Rates of encephalitis were highest for children <1 y and persons ≥65 y. The etiology of encephalitis was unknown for person ≥65 y significantly more often than it was for younger persons. The average cost of an encephalitis-associated hospitalization for 1997 was \$28,151 which projected to annual hospitalization cost to the nation of \$650 million.

During 2000 (the most recent year for which data is available), CDC received reports of 1,402 cases of malaria with 6 deaths among persons residing in the US or its territories (MMWR 51:SS-5:9, 2002). This was a decrease of 9% from 1999. Only 4 individuals acquired their infection in the US itself; 2 were congenital and 2 were related to medical procedures. Therefore, the discovery of 2 cases of locally acquired malaria in Virginia residents this year has raised concerns (ProMED 9/27/02). A 15 y old boy and a 19 y old woman who live about a mile about from each other have the disease and neither has traveled abroad. The cases reside about 7 miles from Dulles Airport, but local authorities have ruled out calling the cases "airport malaria" since

US was from a female cadaver in New Orleans in 1941 (Am J Trop Med Hyg 1:239, 1952). Human pulmonary dirofilariasis has been recognized worldwide including the European Union (Parasitol Today 15:386, 1999), Australia (Eur J Cardiothrac Surg 16:475, 1999), Korea (Yonsei Med J 41:285, 2000), Japan (Int J Zoonoses 7:107, 1980), and Central and South America (Parasite 9:193 & 195, 2002). It probably occurs anywhere infected dogs (or other animals) and the intermediate mosquito vectors co-exist with humans.

*Anopheles* mosquitoes that might arrive on an international flight have a very short flight range themselves (<1 mile). However, that would not preclude the mosquitoes from being transported from the airport in a car or other vehicle. "Airport malaria" is not that uncommon as demonstrated by an investigation of a case near London's Heathrow Airport (New Scientist 8/31/02). It is caused by infected mosquitoes evading the fumigation of international flights and safely arriving at the airport of destination. In the US, for most cases of locally acquired malaria no source of transmission is identified.

Kansas City recorded an average of 1.7 cases of malaria/y over the past 10 y, with none being acquired locally. Historically, the 1901 Report of the Missouri State Board of Health contained status reports of 13 counties still considered malarious, including Cass and Clay. Ten of the counties were in the northern and northwestern parts of the state. During the 1920s and 1930s, the case rate for malaria in Kansas City residents was 0.3/100,000 population. After 1940, the disease was seldom recorded in extant Health Department records until 1980.

As an aside, a new genetic analysis of *Plasmodium falciparum* conducted by the National Institute of Allergy and Infectious Diseases suggests that this malaria parasite is 100,000-180,000 y old (Nature 418:323, 2002). This is considerably older than the 12,000 y suggested by prior genetic studies. If correct, the new data indicates that *P falciparum* is quite ancient and diverse, a finding that is important for the development of therapies and vaccines against this protozoan.

Vaccination of incoming college freshmen against *Neisseria meningitidis*, although strongly encouraged, is mandated by only 14 states: Arkansas, California, Connecticut, Delaware, Florida, Illinois, Indiana, Maryland, Michigan, New Jersey, Pennsylvania, South Carolina, Texas, and Virginia.

Acetaminophen is used for vanquishing pain, but a new use for this pharmaceutical product has emerged — as a control agent for the brown tree snake, *Boiga irregularis*, (Environ Sci Tech 36:3827, 2002). Snakes that ingest prey containing acetaminophen tablets die within 3 days whether or not they regurgitate the prey. Therefore, the US

Department of Agriculture is permitting its use against brown tree snakes on Guam. This mildly venomous reptile was introduced to the island in the 1940s and has mushroomed to population levels of 13,000-26,000/mi<sup>2</sup>. Growing to more than 6 ft, these snakes have caused

significant loss of wildlife and domestic animals, and many local electrical blackouts while prowling on overhead power lines. No other animals on Guam appear to be affected by the drug. Think about it next time you have a headache.

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Cat litter, as a commercial product, was first marketed <50 y ago by the late Ed Lowe. It has since evolved into a \$700 million market serving the US's 72 million felines. The latest innovation is "flushable" kitty litter, however, that product may be contributing to the spread of *Toxoplasma gondii* and adversely affecting the Southern sea otter off California's coast (Int J Parasitol 32:997, 2002). Cats are the definitive host for the parasite which is passed in the feces. Otter populations have been plagued by a mysterious brain disease in recent years. Researchers found *T gondii* in the

brains of 60% of dead sea otters and 40% of the sick ones and believe it is responsible for the encephalitic disease. Otters living in coastal waters where there is a high water flow from streams or rivers or storm drains are three times as likely to have *T gondii*. Investigations are underway to determine if the otters are acquiring *T gondii* from their main sources of food, the filter feeding mollusks such as oysters and clams. Studies in Chesapeake Bay, on the East Coast, have revealed high levels of protozoal parasites such as *Cryptosporidium*, *Giardia*, and *Cyclospora* in these types of mollusks.



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