



Colorado Department
of Public Health
and Environment

House Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs

West Nile Virus: The Colorado Experience

Written Testimony for October 6, 2004 Hearing

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Since its introduction into New York City in 1999, West Nile virus (WNV) has marched unimpeded across the continent. Its anticipated arrival in Colorado occurred in August 2002. This was rapidly detected by the comprehensive surveillance system Colorado had in place to monitor mosquito-borne virus activity across the host range including birds, mosquito vectors, mammalian hosts and humans. By the end of the 2002 mosquito season, surveillance had demonstrated that WNV had spread throughout the state. The stage was set for the subsequent 2003 Colorado epidemic that resulted in 2947 reported human cases and 63 deaths.

The Colorado Department of Public Health and Environment (CDPHE) in cooperation with local health departments has conducted surveillance for mosquito-borne arboviruses (Western equine encephalitis (WEE) and St. Louis encephalitis (SLE)) since 1988. With the assistance of federal WNV grants through the Centers for Disease Control and Prevention (CDC), this surveillance program was upgraded and expanded to include testing for WNV. It is important to note that without this infusion of funding, the continuation of Colorado's existing encephalitis surveillance program was in doubt. The existing program was using 15-20 year-old salvaged hospital lab equipment and its shoe-string budget would not permit expansion or upgrading. Federal funding permitted laboratory equipment to be upgraded and automated procedures developed to allow the lab to add WNV testing, increase accuracy and process more samples in less time without adding additional staff. A local health department lab was certified to conduct human testing to provide surge capacity for high volume human testing at the state lab. Six regional local health department labs were upgraded to facilitate rapid screening of dead birds and mosquito pools at the local level.

By the summer of 2002, a comprehensive surveillance system was in place to monitor for mosquito-borne viruses and the arrival of WNV. Communicable disease surveillance systems are absolutely necessary for detecting and responding to communicable disease outbreaks, emerging infectious diseases or a bioterrorism event. The Colorado WNV surveillance program tracked the spread of the epidemic across the state, identified areas of high transmission risk to help direct mosquito control activities and provided surveillance updates, maps and human case data to local health departments, mosquito control districts, and the public on a real-time basis. Animal and human surveillance data were compiled from 10 instate laboratories, and several private commercial labs, and provided in daily summary reports to local health departments, the media and the public. Updates were posted on the CDPHE website daily at:

<<http://www.cdphe.state.co.us/dc/zoonosis/wnv/wnvhom.html>>.

In addition to enhancements of the surveillance program and laboratory capacity, Colorado prepared for West Nile virus by training local health department, city and county staff in mosquito surveillance and control, encouraging the expansion of local mosquito control programs and developing WNV prevention activities. The state mosquito-borne virus response plan was updated to provide recommendations for response activities to local agencies based on surveillance findings. A training workshop was developed on mosquito biology, identification and control with an emphasis on hands-on training to identify samples of mosquito larvae and adults. Information on WNV was provided to thousands of professionals in Colorado including presentations at several large physician conferences, the Colorado Veterinary Medical Association, Colorado Environmental Health Association and Colorado Animal Control Officers Association conventions. Physician guidance on the recognition and diagnosis of WNV infection was sent to all hospitals, infectious disease physicians and many medical providers via Colorado's Health Alert Network (HAN) system. Town meetings were held throughout the state to discuss WNV, local mosquito control efforts, and personal prevention strategies people can use to protect themselves.

Prevention efforts revolved around the "Fight the Bite Colorado" educational campaign that emphasized personal responsibility in preventing infection. Education centered around the four Ds: Dawn/Dusk (when mosquito that transmit the virus are feeding), Dress (use of protective clothing), DEET (use insect repellents containing DEET) and Drain (eliminating standing water around the home). These steps were promoted for citizens to use in preventing mosquito bites and mosquito breeding on private property. This educational effort included community presentations, a public, toll-free telephone hotline, website <www.FightTheBiteColorado.com>, pamphlets, posters, wallet cards and other educational materials emphasizing the 4 Ds message. During the 2003 epidemic, the website had over 500,000 hits, the hotline responded to over 12,000 calls and pamphlets (250,000), posters (20,000) and wallet cards (500,000) were distributed by agencies and organizations around the state.

The surveillance and public education systems were in place by the start of the 2003 WNV transmission season. In Colorado, the mosquito season runs from May through late September. WNV arrived late in the 2002 season, and although it caused a large disease outbreak in horses and spread throughout the state, only 14 human cases were reported. In retrospect, areas with the most WNV animal activity in 2002 were the hardest hit the following year.

A common question in 2003 was why was Colorado hit so hard? First, it is important to note that several surrounding states were hit just as hard. Nebraska, South Dakota and Wyoming all had human case rates that exceeded Colorado's rate. However, Colorado's significantly larger population produced higher total numbers, and CDPHE's ability to update case numbers daily gave the impression that Colorado was affected more than its neighbors. The other point to note is that states count human WNV cases differently. In prior years, most states only counted cases of neuroinvasive diseases (i.e. meningitis or encephalitis) but not the less severe WNV fever. Colorado, in accordance with CDC guidelines, made a conscious effort to investigate and report all patients who were diagnosed with an illness from WNV.

There were several factors that resulted in the WNV epidemic of 2003. First, is the second year phenomenon, a theory that the virus arrives late the first season, becomes established in the area and has the entire second season to amplify to high levels in the bird-mosquito-bird cycle due to a lack of immunity in the local bird population. This pattern was observed in 2002 (Illinois/Ohio/Michigan/Louisiana/Mississippi), 2003 (Colorado, Nebraska, South Dakota, Wyoming) and in 2004 (Arizona, southern California). The second, and probably primary factor for Colorado, was ideal weather conditions for mosquito production. Mosquito populations were at record levels in 2003, exceeding levels from the past 10-15 years, even in areas with established mosquito control programs. Third, the western U.S. is home to a species of mosquito, *Culex tarsalis*, that is the most highly efficient

transmitter of WNV found to date. Finally, in the semi-arid climate of Colorado, nuisance mosquitoes are not a major problem and nuisance mosquito control is not routinely conducted as in other areas of the country. Thus, mosquito control infrastructure is not well developed or extensive, if it exists at all, in many areas of the state.

The 2003 epidemic “began” on June 4 with the collection of the first WNV positive dead bird. Over the next 6 weeks, surveillance showed increasing numbers of positive birds and mosquitoes in eastern Colorado especially along the Arkansas and South Platte River drainages and in the northeastern counties. WNV outbreaks are explosive and progress rapidly. By mid-July, large numbers of birds, mosquitoes and horses were testing positive daily. Although no human cases had yet been confirmed, the surveillance data showed that an epidemic was imminent. The first human case was reported July 21 and reported cases rapidly escalated during subsequent weeks. Due to unusually warm fall weather, mosquito activity continued into October, 2-3 weeks past the normal end of the season. A total of 2947 human cases were reported, including 234 cases of encephalitis, 388 cases of meningitis and 2325 cases of WNV fever. At one county hospital, 10% of all admissions from July – September were patients with WNV. Ultimately, 63 Coloradoans died. Uncounted and not fully appreciated are the patients who have experienced prolonged recoveries or suffered permanent paralysis or brain damage.

Recommendations had been made, in anticipation of WNV arrival, to counties, cities and other local jurisdictions to implement integrated mosquito control programs with a focus on eliminating breeding sites and conducting larval control. Adult mosquito control (spraying), was recommended when surveillance data indicated a human outbreak was imminent. While some jurisdictions enhanced existing control programs or implemented mosquito control, many others did not. Reasons for not implementing mosquito control varied, but generally held to four themes: tight budgets with many competing community needs, uncertainty as to the impact of WNV and the benefit of mosquito control, vocal opposition to mosquito control with the potential of lawsuits from segments of the community, and the belief that if people took personal precautions, such as repellent use, mosquito control was unnecessary.

The concern over lawsuits was a topic of discussion at many meetings. It was observed that many communities in other states had been sued for initiating emergency mosquito control activities in response to WNV outbreaks. Although most of these lawsuits were successfully defeated, the defense effort and cost for communities was considerable. In addition, there was concern that a 2001 federal court ruling (Headwaters, Inc. vs Talent) could be a possible avenue to file a lawsuit against a mosquito control district. Although the irrigation district was in compliance with all EPA Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) regulations regarding herbicide use, they were successfully sued under separate EPA Clean Water Act regulations for failure to have a National Pollution Discharge Elimination System (NPDES) permit. It is widely believed this ruling could be broadened and used against mosquito control districts if pesticide spray could potentially drift into water. Many local officials felt this put them in a no-win situation if they implemented mosquito control in their communities.

By early 2003, WNV had been in the country for only four years and our knowledge of what this virus would do was very limited. Although there were large outbreaks in the Midwest in 2002, relatively few human cases had been documented in the previous three years (1999-2001). There was no experience with WNV in the western U.S. Thus, in July 2003, given the lack of experience with this virus and tight budgets, it was difficult to convince local officials that emergency funding for mosquito control, especially highly controversial spraying, was warranted based on a few hundred dead birds. But the lessons of 2003 did not go unheeded. In 2004, when surveillance detected a potential epidemic developing in a western Colorado county, local health and elected officials quickly initiated mosquito spraying and significantly reduced the risk of WNV transmission and human cases in their communities.

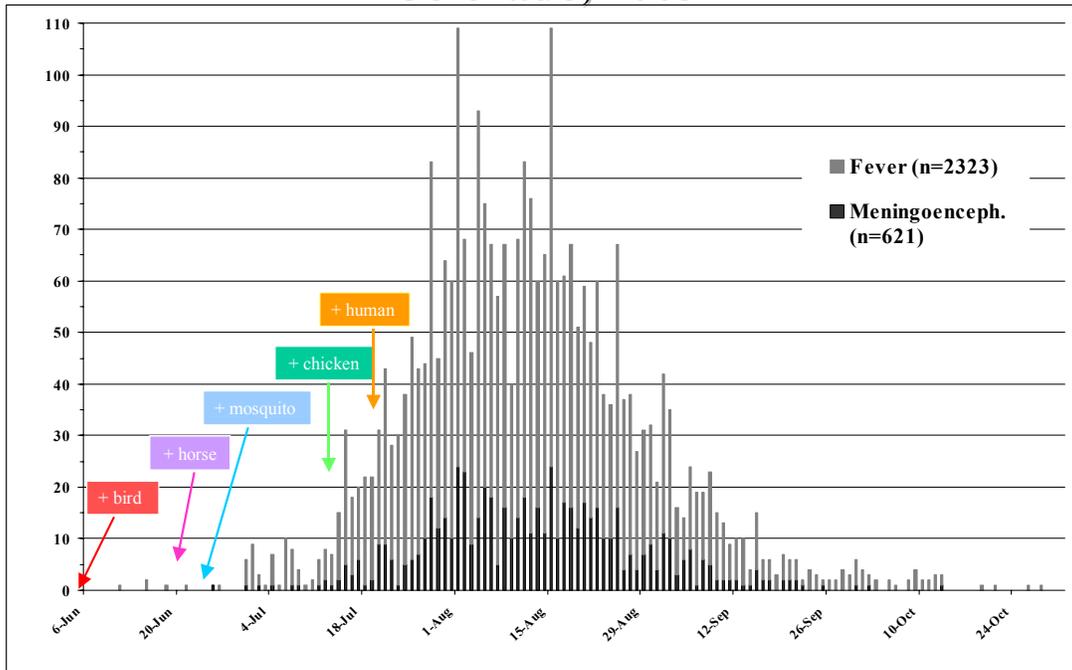
Congress could take several steps to assist state and local agencies in addressing mosquito-borne disease problems and removing barriers to local mosquito control efforts. Foremost, would be modifying contradictory EPA regulations and incorporating all pertinent pesticide regulations under one law. Secondly, the Mosquito Abatement for Safety Health (MASH) Act, passed and signed into law 2 years ago, has never had an appropriation. The MASH Act was designed to provide matching funds to local agencies to develop mosquito control programs. Funding this program would provide communities with start-up funds to initiate mosquito control programs that would then be maintained by local funds. Finally, the funding provided by CDC for WNV surveillance and prevention efforts was critical to the state's preparedness and response to the epidemic. Continued financial support of basic public health infrastructure at the national, state and local level is imperative.

The Colorado experience with WNV during the past three years has been learning opportunity for Colorado and scientists across the country. A collaborative effort of local, state and federal health officials, tracked of the 2003 epidemic. Over 2600 of the 2947 reported patients with WNV were rapidly interviewed, providing data that has expanded our understanding of WNV infections. For example, it became apparent that WNV fever for many people was a severe, prolonged illness with duration averaging 23 days. This finding was in contrast to the "mild, flu-like illness" message that had been previously promoted. Numerous studies have been initiated with CDC (long-term neurological sequelae, blood transfusion transmission and effectiveness of blood bank screening tests, effect of WNV infection in pregnancy, hospitalization outcome, impact of mosquito control on transmission), University of Colorado Health Sciences Center (cerebral spinal fluid parameters, cause of deaths, risk of complications in immunosuppressed patients) and state/local health departments (illness duration, clinical description of WNV fever, high incidence of rash, reasons for non-repellent use). These studies increase our understanding of the impact of WNV infection in the United States and facilitate improved prevention efforts, such as addressing reasons that citizens don't use repellents for personal protection.

Colorado continues to adapt its surveillance and prevention efforts, as it is clear that WNV will be a continuing problem. The Colorado experience demonstrated that effective tracking of a large communicable disease outbreak can be accomplished, experience that can be applied to future emerging infections outbreaks, pandemic flu or a bioterrorism attack. Such a response however, cannot be turned on and off as needed. It requires continued commitment to fund and maintain viable public health infrastructure in this country. As the recent outbreaks of WNV and monkeypox have demonstrated, and with the continuing threat of a bioterrorist attack, a strong public health system remains vital for the health and security of U.S. citizens.



Onset Dates of Human West Nile Virus Cases, Colorado, 2003



Human Epidemiological Curve (cases by onset date) in relation to the first positive surveillance specimen

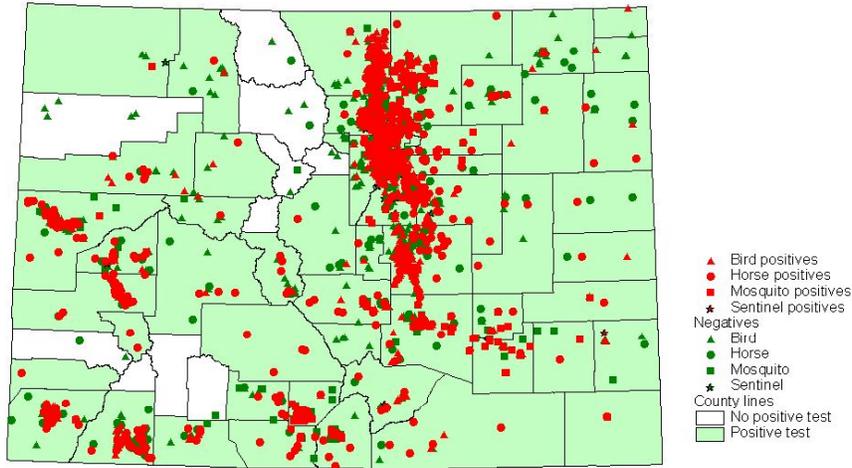
Comparison of WNV Surveillance Testing by Year, Colorado 2002-04

	2002	2003	2004*
Birds	138/889 (15%)	766/1575 (49%)	50/340 (15%)
Horses	380/810 (47%)	604/1100 (55%)	25/180 (14%)
Mosquitoes	15/362 (4%)	639/2703 (24%)	160/3558 (4%)
Human Cases	14	2947	227

* Provisional data as of 9/10/2004

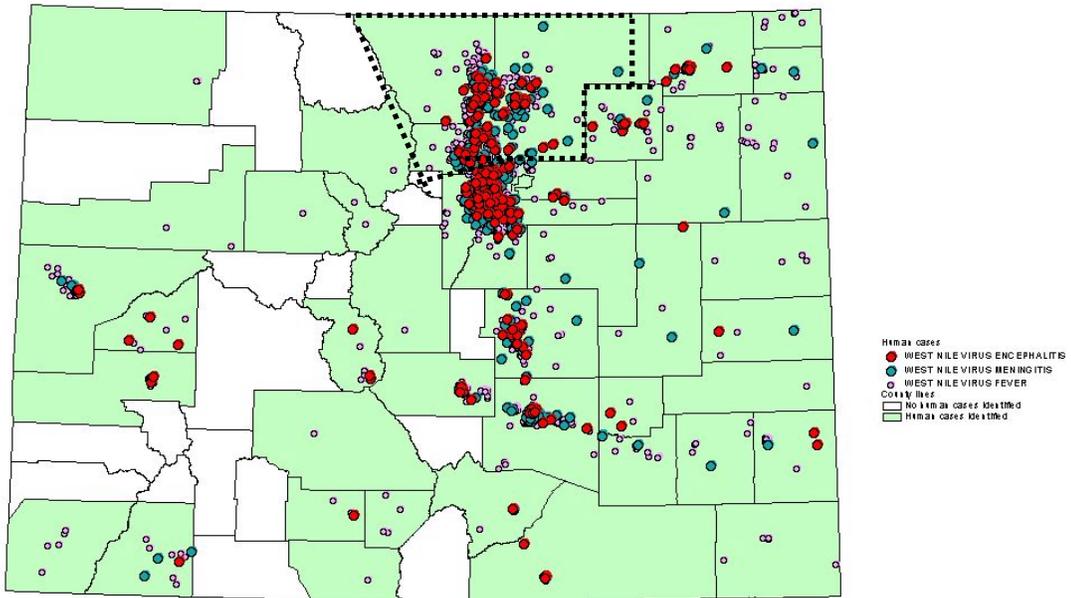
**Number of specimens positive for WNV/ total number of specimens tested
(% Positive)**

Colorado West Nile Virus Surveillance Updated October 15, 2003



Distribution on WNV surveillance testing in 2003. On average animal surveillance specimens were positive in an area 2-3 weeks prior to the first human cases. Shaded counties had a positive specimen.

Colorado West Nile Virus Human Cases Updated January 29, 2004

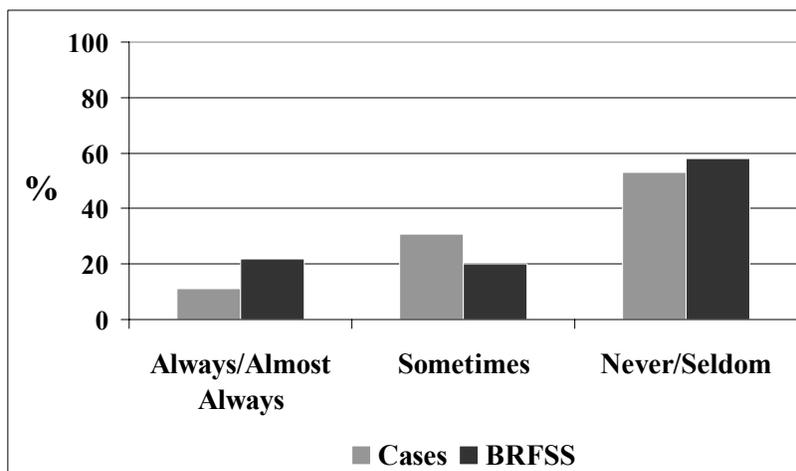


N = 2,944

Geographic distribution of Colorado Human WNV cases in 2003

Three counties in the highlighted (.....) area accounted for 46% of the total cases (dots are several layers deep).

Reported Repellent Use



Comparison of reported repellent use from 2003 WNV patient interviews (n=2601) and participants in Behavioral Risk Factor Surveillance System (BRFSS) survey conducted Nov/Dec, 2003 (n=600)

Reasons Why People Didn't Wear DEET Repellents

10. Not sure why I didn't use repellent
9. Too lazy/ didn't have time
8. Used other methods to avoid mosquito bites
7. Smells bad
6. (tie) Didn't have repellent / Mosquitoes don't bite me
5. Don't go outside
4. Concerned about health effects of DEET
3. Forgot
2. Don't see mosquitoes where I live
1. Not worried/ not at risk (36% gave this answer)

Results from the Behavioral Risk Factor Surveillance System survey conducted Nov/Dec, 2003