West Nile virus

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ß See related articles pages 1399, 1427 and 1455

Background: Since its arrival in North America in 1999, West Nile virus (WNV) has spread rapidly across the United States and into Canada. First detected in birds and mosquitoes in Ontario in 2001,[1] by the end of 2002 viral activity had been documented in Nova Scotia, Quebec, Ontario, Manitoba and Saskatchewan.[2] In the same year, cases of human infection were reported in Ontario and Quebec.[2]

WNV is a member of the Flaviviridae family, which includes the viruses responsible for Japanese encephalitis, dengue, St. Louis encephalitis and yellow fever. WNV infects over 150 species of birds as well as mammals such as squirrels, dogs, wolves, horses and mountain goats.[3] The Corvidae family of birds, which includes crows, blue and grey jays, ravens and magpies, are particularly susceptible to illness and death from WNV.[4] For this reason, sightings of dead crows have been used in Canada as a marker for WNV activity, and the testing of dead crows for WNV continues to be a fundamental part of an enhanced passive surveillance system.

Different types of mosquitoes are responsible for risk of disease in humans: "amplification" mosquitoes (e.g., *Culex pipiens* and *Culex restuans*), "bridging" species (e.g., *Coquillettidia perturbans*) and human biters (e.g., *Aedes vexans*). The first type feeds on birds and transmits the virus to other birds; this activity creates a large reservoir of WNV infection that starts to build in early spring. The second type of mosquito feeds on both birds and humans and is responsible for transmitting WVN to humans.[5] Twenty-eight public health units in Ontario conducted mosquito surveillance for the presence of WNV in 2002.[6] The most common species were *C. pipiens* and *C. restuans*, *A. vexans* and *C. perturbans*; however, field investigations found enough variation between adjacent health units to warrant local surveillance (Dr. Fiona Hunter, Brock University, St. Catharines, Ont.: personal communication, 2003). WNV-positive mosquitoes were identified in 19 Ontario health unit jurisdictions in 2002.[7]

Although mosquito transmission remains the most significant vehicle for human disease, WNV can also be spread through blood or organ donation,[8] pregnancy,[9] lactation,[10] needlestick injury and exposure to infected laboratory specimens.[11] In an update on WVN, the Canadian Blood Services stated that 2 cases of transmission are "almost certainly transfusion-related" and that another 2 are currently under investigation.[12]

WNV incubates for 3 to 14 days in humans; data from New York City indicate that only 20% of infected people have a febrile illness.[13] Clinical features range from fever accompanied by malaise, headache, myalgia, rash, lymphadenopathy, eye pain, anorexia and vomiting lasting for 3 to 6 days, to severe meningo-encephalitis. Severe muscle weakness and flaccid paralysis have been experienced by several patients admitted to hospital in the United States.[14] In addition, patients with neurological disease are experiencing long-term disability.[14] WNV should be considered in all patients with unexplained encephalitis and meningitis.[14]

Clinical management: Treatment of WNV illness remains supportive. For severe cases, intensive care and transfer to appropriate facilities is recommend-

Canapress

ed. West Nile encephalitis is typical of arboviral encephalitides, with a nonspecific prodrome leading to a deterioration in mental status, profound flaccid paralysis in some cases and coma in 15% of cases.[13,15]

Prevention and control: Prevention of WNV transmission to humans relies on the elimination of mosquito breeding sites and the use of personal protection. The experience in New York City, first with the eradication of malaria and then with the reduction of human WNV disease, demonstrates the role for habitat reduction through improved drainage and the necessity of municipal bylaws to prevent standing water.[16] These strategies require cooperation between public health, public works and conservation area officials and elected representatives.

Public education aimed at reducing the risk of mosquito bites has been conducted in Ontario, through the media, Internet, boards of education and pub-

Revised SARS case definition

The CDC surveillance case definition of severe acute respiratory syndrome (SARS) was revised Apr. 30 to include laboratory criteria for evidence of infection with the SARS-associated coronavirus (SARS-CoV). See *eCMAJ* SARS Web page for details (www.cmaj.ca/misc/sars.shtml).

lic health units. Reducing the number of breeding sites and using personal protection are key components of education campaigns. Recent surveys of residents in Ontario's Halton region, conducted June to October in 2001 and 2002, showed a significant increase in the proportion of residents who had taken measures to eliminate standing water on their property in 2002 compared with 2001 (63% v. 26%); however, less than 8% had consistently used an insect repellent containing DEET during outdoor activities (Rapid Risk Factor Surveillance System, Ontario: unpublished data, extracted Feb 2003).

Given the limitations of habitat reduction and public education to promote personal protection, control measures including the use of larvicides and adulticides to reduce mosquito populations have been used in the North American response to WNV. The key to any mosquito control program is good surveillance. Public health units in Ontario have relied on dead crow sightings, the testing of standing water for the presence of mosquito larvae and the trapping of adult mosquitoes for WNV testing to inform control efforts. Although evidence from randomized controlled trials is lacking, results from well-established mosquito control programs in Illinois and Louisiana have shown reductions in mosquito populations.[17,18]

Larvicides, often in granular, pellet or teabag formulations, are used in the spring and early summer to reduce the number of emerging mosquitoes. They are placed in catch basins and standing water sites that are close enough to human populations to pose a risk (see news article, page 1455[19]). (For larvicides approved for use in Canada, search the Pest Management Regulatory Agency's electronic database [www.eddenet.ca/b.asp; click on "ELSE label search" and enter "larvicide" in search box] or contact the agency by telephone [800 267-6315] or email [pmra_infoserv@hc-sc.gc.ca]). Each province regulates the sale, use, transportation, storage and disposal of federally regulated pesticides under its own provincial legislation. Two of the most common products used in North America as larvicides are biological agents (e.g., *Bacillus thuringiensis* var *israelensis* [commonly referred to as Bti] and *Bacillus sphaericus* [not yet available in Canada]) and growth regulators (e.g., methoprene).

Adulticides, used to kill adult mosquitoes and applied from ultra-low-volume equipment mounted on aircraft or trucks, are considered a final measure when other efforts have failed to reduce mosquito numbers, when human cases of mosquito-borne disease are increasing or when human health is at risk despite the use of larvicides and other environmental controls (Geoff Cutten, Insecticide National Steering Committee Team (INSECT) Subcommittee, Health Canada: personal communication, 2003). To date, most of the experience with WNV mosquito control has involved the use of resmethrin, a synthetic pyrethoid, and malathion, a rapidly degrading organophosphate.[20] Experience with malathion for medfly eradication in California has shown no human health effects.[21] However, malathion is highly toxic to insects, including bees, and to fish and aquatic invertebrates.[22]

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