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1. West Nile Virus and Symptoms

What is West Nile virus? What are the symptoms of infection?

West Nile virus (WNV) is a disease that is spread by infected mosquitoes. The virus causes infection in humans, birds and animals. Most people (about 80 percent) have no symptoms when they are infected. About 20 percent will experience a fever, muscle aches, headache, swollen lymph nodes and rash, lasting a few days. Some (less than 1 percent) go on to develop a serious illness involving neck stiffness, muscle weakness, stupor, disorientation, convulsions, coma, paralysis, or even death. These latter symptoms are due to an inflammation of the brain (encephalitis) or inflammation of the covering over the brain (meningitis). Symptoms of severe disease may last for weeks, and some neurological impairment can be permanent. In Canada, the West Nile virus is active from May until the end of October. It peaks in late August to early September.

How is West Nile infection confirmed?

If a doctor suspects West Nile virus infection on the basis of symptoms, two blood samples will be taken about 2 to 3 weeks apart and sent to a laboratory for testing. If antibodies to West Nile virus are found in the first sample, and the level of antibodies increases by at least 4 times in the second sample, the person is considered a “probable” case of WNV. Blood is then sent to the lab for further testing. In the past, the only Canadian laboratory that could do this testing was the National Microbiology Laboratory in Winnipeg. In May 2003, Ontario’s Health Minister announced that resources at the provincial laboratory in Toronto would be increased so that Ontario testing could be done locally. This should shorten the time it takes for Ontarians to get test results from weeks or months to about 3 days.

What is the incubation period for disease caused by West Nile virus?

The usual incubation period, or time between infection and symptoms, is 3 to 15 days.

Where does West Nile virus come from?

West Nile virus was first identified in the West Nile region of Uganda in 1937. It has since been found in various parts of Africa, Asia and Europe. It only appeared in North America in 1999, surfacing first in New York City. It first appeared in Canada in 2001 when infected birds were found in Ontario.

Who (and what) gets West Nile virus? Who’s most at risk?

Humans, birds and horses seem to be most at risk of being infected with West Nile virus. Among humans, those at highest risk of developing more severe symptoms are those over 40 to 50 years of age and those with underlying or chronic diseases, such as diabetes, cancer, heart disease, or weak immune systems. Among birds, crows, ravens, jays and magpies appear most susceptible.

Is there a cure or vaccine for West Nile virus?

No. Scientists have never developed a true “cure” for any viral disease. They usually fight a viral disease by developing a vaccine to make people immune to that disease. That’s how other viral diseases like smallpox, measles, and polio have been conquered.

There is currently no approved human vaccine for West Nile virus, but several laboratories are working to develop one. Clinical trials with a prototype vaccine began on humans in Kansas in November 2003. A commercial human vaccine is not expected to be available for about 3 years.

2. Transmission of West Nile Virus

How is West Nile virus (WNV) transmitted?

The usual cycle for the West Nile virus is from mosquitoes to birds to mosquitoes to birds, etc. When an infected mosquito bites a bird, the virus in its salivary glands passes into the bird. The virus lives in the bird host for quite some time. If another uninfected mosquito then feeds on the blood of the infected bird, the mosquito acquires the virus, which it then can pass on to the next bird it bites. However, if an infected mosquito bites a different host, such as a person or a horse, the person or horse can become infected. But in this situation, the virus does not appear to circulate in the host's blood long enough, or in great enough numbers, to infect other mosquitoes that bite later. Thus, people and horses are considered "dead ends" or accidental hosts for the virus.

Do all mosquitoes carry West Nile virus?

No. Even in areas where West Nile virus is circulating, only a small percentage of mosquitoes is infected. The percentage of infected mosquitoes is higher in the late summer and early fall (August to October).

Can I catch West Nile virus from touching an infected bird or horse or by being around another infected person?

No. There is no evidence for person-to-person spread through casual or close contact. Similarly, there is no evidence for spread from infected animals or birds to people. Nevertheless, dead animals may carry many different germs and parasites, so you should always avoid touching dead birds or animals. Hunters should handle game birds with gloves, avoid contact with blood and cook game thoroughly before eating it.

Can I get West Nile virus from a blood transfusion or through exposure to blood in my job?

Yes. Although the risk is low, West Nile virus does appear to be a blood-borne pathogen. In the U.S., WNV has been transmitted through blood transfusions and organ transplants. Health care workers can acquire West Nile virus through a needle-stick with a contaminated needle, just as with human immunodeficiency virus (HIV) or hepatitis B.

Since July 2003, Canadian Blood Services (CBS) and Héma-Québec have been testing all donated blood in Canada for WNV.

Can a pregnant or nursing woman pass West Nile virus on to her baby?

Yes. There have been several cases where pregnant women became infected with West Nile virus and then passed the virus on to their unborn babies. There has also been one case in which an infected nursing mother passed the virus on to her baby through breast milk. Therefore, it is especially important for pregnant or nursing women to avoid being bitten by mosquitoes. (See section 5, Prevention.)

If I squash an infected mosquito on my arm before it bites me, can the virus on my skin infect me?

No. The West Nile Virus is susceptible to sunlight and drying, and thus does not survive long on the skin of a person, especially if the area is washed with soap and water. (Wash the area gently, however, to avoid abrading the skin and giving the virus a way into your body.)

3. West Nile Virus in Birds and Animals

What do dead birds have to do with West Nile virus?

Mosquitoes that bite birds appear in Ontario earlier in the year than those that bite humans. As a result, infection in birds tends to happen about 2 to 6 weeks before infection in humans. WNV infects about 135 different species of birds, but most do not become ill or die. However, a mosquito that bites such a bird can pick up the virus and pass it on to the next bird, animal or person it bites. Fortunately (for us) certain birds—crows, ravens, jays and magpies— seem to be extremely sensitive to West Nile virus, and have a high death rate. This makes them useful as sentinels or indicator species for WNV, giving us an early warning of the prevalence of the virus and its whereabouts.

What should I do if I find a dead bird?

Ontario accepts only dead crows, blue jays and ravens for testing. If you find a dead bird during mosquito season, call your local health unit (A list can be found at: http://www.health.gov.on.ca/english/public/contact/phu/phuloc_mn.html). Do not handle the bird with your bare hands. If you need to move the bird, do so with a tool like a shovel or wear gloves, and put the dead bird in a plastic bag. Then wash your hands. Note the exact location the bird was found, or fill out the West Nile Virus Surveillance form which you can download from: http://wildlife1.usask.ca/en/west_nile_virus/surveillance_forms/ON_surveillance_form.pdf. Not all dead birds will be collected by Public Health, depending on the capacity of the labs in your area and the number of birds reported. If health unit officials do not want to collect the bird you have reported, they will give you instructions for its disposal.

I've heard that there's a vaccine against West Nile virus that is used on horses. Is this true?

Yes. There is a vaccine for horses that is fully licensed in Canada. It's a killed virus vaccine that requires 2 doses, 3 to 6 weeks apart, given 2 months before mosquito season. An annual booster is also recommended. Protection is not complete until about 8 weeks after the second dose. In Ontario about 30 percent of horses die or are euthanized when infected with West Nile virus.

Can my cat or dog get West Nile virus?

Yes. Many animals, including cats, dogs, rabbits, skunks, chipmunks, bats and squirrels can be infected with West Nile virus. However, because the virus does not survive well in these animals, the risk to them is low. Like humans and horses, these types of animals are regarded as “dead-ends” for West Nile virus. In other words, the virus is not transmitted further through them. There is no vaccine licensed for use in animals other than horses.

4. Occurrence of West Nile Virus

Where is West Nile virus found in Canada?

Humans: Since 2001, human cases of WNV have been reported in all provinces except Newfoundland and British Columbia. No human cases have been found in any of the territories.

Birds: Since 2001, infected dead crows have been reported in 7 provinces: Alberta, Saskatchewan, Manitoba, Ontario, Québec, New Brunswick and Nova Scotia.

Horses: Since 2001, infected horses have been reported in 6 provinces: Alberta, Saskatchewan, Manitoba, Ontario, Québec and Nova Scotia.

How many WNV cases have there been in Ontario? In Canada? How many people have died?

The tables below list data for 2002 to 2005. Due to a lack of sufficient laboratory testing resources, the data likely underestimates the true prevalence of the virus. In addition, the numbers represent only those reported on official websites. As such, these numbers lag behind the actual numbers.

Ontario	2002		2003		2004		2005	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Humans	319	18	89	2	13	0	101	8
Horses	1007	N/A	41	N/A	9	N/A	0	0
Birds	281	281	242	242	250	250	300	300

Canada	2002		2003		2004		2005	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Humans	320	20	1223	10	25	0	226	12
Horses	356	N/A	445	N/A	13	N/A	3	N/A
Birds	555	555	1633	1663	416	416	447	441

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Where in Ontario have dead birds infected with West Nile virus been found?

Dead birds infected with WNV have been found in every region of Ontario.

Where else in the world does West Nile virus exist?

The United States has been hit harder with West Nile virus than Canada. In 2002, the U.S. had over 4000 human cases in 40 states and almost 300 deaths. In 2003 there were 9186 cases in 46 states and 231 deaths. In 2004 there were 2470 cases in 41 states and 88 deaths. For up-to-date information on American cases, visit the CDC's West Nile virus site at

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

In addition to the United States, West Nile virus is found in many countries in Europe, Africa, the Middle East and Asia.

5. Prevention

How can I protect myself and my family?

The best way to protect yourself from West Nile virus is to reduce the risk of being bitten by a mosquito. Here's what you can do:

- Before going outdoors, use insect repellents that contain DEET or other approved ingredients. (See Section 6, Insect Repellents.)
- Spray thin clothing with repellents containing DEET, since mosquitoes can bite through thin fabrics.
- Try to avoid spending time outdoors at dawn, dusk and early evening when mosquitoes are most active.
- Wear protective clothing such as long-sleeved shirts, long pants and a hat. Light-coloured clothing is best because mosquitoes tend to be more attracted to dark colours. Tightly woven material is best.
- Use mosquito netting over strollers, carriages and playpens to protect infants.
- Make sure that door and window screens fit tightly and have no holes or tears that may allow mosquitoes indoors.

What should I do to decrease the risk of West Nile virus in my community?

Mosquitoes reproduce by laying eggs in standing water. The eggs hatch into larvae, which live in the water for about a week before becoming pupae and then adult mosquitoes. Without standing water, mosquitoes cannot reproduce. The best thing your community can do, therefore, is to get rid of standing or stagnant water. As a homeowner or tenant, you should regularly inspect your property and do the following:

- Drain standing water from items like pool covers, saucers under flowerpots, recycling bins, garbage cans, etc.

- Remove unused items from around your property that have a tendency to collect water, including old tires.
- Remove tires used in children's swings, or cut a hole in the bottom to allow water to drain from inside the tire.
- Change the water in wading pools, birdbaths, pet bowls and livestock watering tanks twice a week.
- Cover rain barrels or openings to cisterns with screens.
- Clean out eaves troughs to prevent clogs that can trap water.
- If you have an ornamental pond, consider getting fish that will eat mosquito larvae (e.g. Koi or *Gambusia affinis*.) Keep aerators functioning and remove excess vegetation.
- Fill in any depressions in the yard that collect water that does not drain away in a couple of days.
- Cut grass on a regular basis, since adult mosquitoes like to hide in long grass during the day.
- A permit is not required in Ontario to use a larvicide (see 5.5 below) on your own property if the water is wholly contained on your property with no outflow. A domestic larvicide product is now available for homeowners for limited use. Refer to the Ministry of the Environment's website for more information.

What about my swimming pool and hot tub?

If your pool or hot tub is properly maintained, with circulating water and appropriate levels of chlorine and other pool chemicals, mosquito larvae will not be able to live there.

How far do mosquitoes fly?

Unlike birds and other insects, mosquitoes do not fly far from where they hatch—most fly less than a mile or two from their hatching area in their lifetimes. So, to protect yourself and others, keep your home and business properties free from potential mosquito breeding grounds.

What is my community doing?

In general in 2003, all Ontario municipalities attempted to eliminate mosquito breeding grounds. This was done by flushing catch basins, storm drains and drainage ditches weekly, and monitoring sewer lagoons or retention ponds. Municipalities and their public health units also participated in mosquito and dead bird surveillance programs.

In addition since 2003, each health unit in Ontario has performed a risk assessment at least yearly to determine whether or not to use pesticides in each municipality. Some municipalities used larvicides to kill mosquito larvae. Larvicides are chemical or biological agents such as methoprene (a chemical) and Bti (a bacterium) that are put into standing water that cannot be drained. They either prevent the larvae from developing into adults (as is the case with methoprene) or they kill the larvae (in the case of Bti). Larvicides are very specific to mosquitoes and do not affect other insects or animals. Adulticides are chemical pesticides like malathion that are sprayed more widely and may affect other species. Advance notice must be given to the public before an adulticide is used in a community.

6. Insect Repellents

What is "DEET"?

DEET is the most effective insect repellent available. The actual chemical that is usually abbreviated as "DEET" is N,N-diethyl-meta-toluamide. You may have to look for that name on the ingredient list. DEET is extremely effective at repelling insects like mosquitoes and ticks, but it doesn't kill them. It is available in many different products, including liquids, lotions, sprays and impregnated materials like wristbands. DEET works only at a close range, so you may still see mosquitoes flying nearby, but they won't land on you and bite. On skin, DEET only protects up to 4 centimetres around the area you applied it, so you have to cover all exposed areas.

Can I assume that the stronger the concentration of DEET in a product, the better it is?

No. DEET comes in concentrations ranging from 4 percent to 100 percent. A higher percentage of DEET in a repellent does not mean that your protection is better—just that it will last longer. As an example, a 5 percent solution of DEET will give you protection for about 2 hours, while 30 percent gives you about 6 hours of protection. However, DEET concentrations higher than 30 percent do not significantly increase the length of protection. These products have not been sold in Canada since December 31, 2004. You should choose a product that is appropriate for the amount of time you expect to be exposed to mosquitoes. If the repellent becomes ineffective over time, you can re-apply it. (Once mosquitoes start to land on you but not bite, failure of the repellent is imminent, and you should re-apply it.) As noted above, products with more than 30 percent DEET were phased out in Canada and retail sales are no longer allowed. However if you have these products, you may continue to use it on adults occasionally and according to the label directions.

How safe is DEET?

DEET is regarded as extremely safe for skin when used according to directions. It has been around since 1936 in the military and 1957 in the general population. It has been tested and retested, and looked at for both short-term and long-term effects. Note, however, that DEET is capable of dissolving watch crystals, frames of glasses and some synthetic fabrics.

What is the safest way to use DEET?

The Environmental Protection Agency (EPA) in the U.S. gives the following advice for DEET use:

- Read and follow all directions and precautions on the product label.
- Do not apply over cuts, wounds, or irritated skin.

- Do not apply to hands or near the eyes and mouths of young children.
- Do not allow young children to apply this product themselves.
- Apply sparingly. (Use just enough repellent to cover exposed skin and/or clothing.)
- Do not use under clothing.
- Re-apply DEET only when mosquitoes start to land on you.
- After returning indoors, wash treated skin with soap and water.
- Wash treated clothing before wearing it again.
- Do not spray aerosol and pump products in enclosed areas or near food.
- To apply to face, spray on hands first and then rub on face. Do not spray directly onto face.

Should pregnant or nursing women use DEET?

Yes. There are no reports of harmful effects when DEET is used on pregnant or nursing women, and no recommendations against its use.

What about using DEET on babies or children?

It depends on the age of the child. No serious illness has been seen when the product is used on children. However, since no scientific studies have been done to determine the safety in children, a cautious approach is advised. Health Canada suggests the following:

- on children under 6 months of age, do not use DEET
- for children 6 months to 2 years of age, apply DEET once only per day using a 10 percent concentration or less
- for children between 2 and 12 years of age, apply DEET no more than 3 times per day using a 10 percent concentration or less
- do not put DEET on the faces or hands of children, since they may put their hands in their mouths and eyes

What about products containing both DEET and sunscreen? Are these combination products okay to use?

No. Sunscreen is supposed to be applied liberally and frequently, while DEET should be applied sparingly. Health Canada directed that these combination products not be sold in Canada after December 31, 2003. If you have these products, you should dispose of them in your regular garbage. Sunscreen is supposed to be applied about 15 to 30 minutes before sun exposure, so put on the sunscreen ahead of time, and then apply the DEET just before going outside. Re-apply the sunscreen frequently, and the DEET only as directed.

If I don't want to use DEET, what about all the "natural" or home remedies?

There are some "natural" or non-DEET products that do provide some protection, but many others either do not work or have not yet been tested. In addition, some "natural" remedies should not be used on infants and young children because they may act as skin sensitizers, putting children at risk for allergic reactions. For details about these products, go to the suggested links listed at the end of this document. Here are some quick facts about the alternatives, from the best to the worst:

Federally registered (approved) products:

- Eucalyptus repellent products (p-menthane 3,8-diol, e.g., Off! Botanicals): provide up to 2 hours of protection, not for children under 3 years of age
- Soybean oil repellents (e.g., Bite Blocker for Kids 2 percent soybean oil): 1 to 3.5 hours protection

- Citronella repellents: 30 minutes to 2 hours, not for children under 2 years of age – studies in 2004 resulted in uncertainty about the safety and usefulness of these products (the Pest Management Regulatory Agency of Canada has recommended that they be phased out)
- Lavender repellents: 30 minutes, not for children under 2 years of age. Studies in 2004 resulted in the manufacturer discontinuing this product, and its approval will be phased out by March

Non-federally registered (unapproved) products:

- Avon Skin-So-Soft: bath oil and lotion protect for less than 10 minutes
- Avon Skin-So-Soft Bug Guard and Bug Guard Plus: protect for 10 to 20 minutes
- Wrist bands impregnated with various chemicals: not effective except on the wrist (repellent only has a range of 4 centimetres)
- Vitamin B1 (thiamine, taken internally): no effect
- Garlic (taken internally): no effect
- Bug zappers: not proven effective
- Citronella candles: not very effective
- Ultrasonic devices: do not repel mosquitoes
- Various plants (e.g., marigolds): not supported by scientific tests
- Dryer sheets, bananas, Vick's Vaporub, vanilla, etc: no data found

What about mosquito coils?

Mosquito coils are coiled clay-like materials that generally contain natural or synthetic pyrethrum, a chemical derived from plants like marigolds. Coils are designed to be burned outdoors; the smoke from the burning coils is supposed to repel insects like mosquitoes. Data on the effectiveness of coils could not be found, although they are widely used by campers. Wind will reduce any effect.

7. Workplace Issues

Which workers are most at risk from West Nile virus?

Anyone working outdoors when mosquitoes are actively biting is at risk. Occupations especially at risk include: farmers, foresters, landscapers, groundskeepers, painters, roofers, pavers, construction workers, and other outdoor workers.

Laboratory or health care workers who experience needle-stick injuries or cuts while handling needles used on West Nile virus patients, or who are exposed to the tissues or fluids of these patients are also at risk. Workers are at low risk of West Nile virus infection through normal contact with WNV-infected persons or animals. The Public Health Agency of Canada has posted on its website an Occupational Health Advisory related to precautions that should be taken by workers handling dead birds or animals. Go to http://www.phac-aspc.gc.ca/wnv-vwn/work_wnv_e.html

In addition, Ontario's Ministry of Labour has published advice at their link: http://www.labour.gov.on.ca/english/hs/ua_wnv_faq.html

Am I eligible for workers' compensation if I get West Nile virus on the job?

Yes. In Ontario, the Workplace Safety and Insurance Board (WSIB) has stated that any workers infected with West Nile virus in the course of their employment will be entitled to the usual compensation benefits and services. As with all occupational disease claims, the entitlement is decided on a case-by-case basis. Alberta's Workers' Compensation Board has made a similar statement. To read the WSIB announcement, go to <http://www.wsib.on.ca/wsib/wsibsite.nsf/Public/policywestnile>.

As an employer, what are my responsibilities?

Employers, in consultation with their joint health and safety committees or health and safety representatives, should approach West Nile virus like any other workplace hazard. In other words, they should assess the risks; establish standards, policies and procedures; communicate those standards; provide training; and measure and evaluate for West Nile virus infection prevention.

- A risk assessment should include looking at employees who work outdoors, as well as the presence of potential mosquito breeding grounds on the premises, and the condition of screens on doors and windows that may be open during warm weather. Laboratory and health care worker risks should be assessed as they are for other blood-borne pathogens.
- Standards, policies and procedures should be established to deal with, for example, recommended work wear and the use of insect repellents. Standards may also be needed regarding the elimination or treatment of mosquito breeding grounds on the property, the condition of screens, or any other issues identified in the risk assessment. Employers may wish to consider providing mosquito repellent for outdoor workers. Required or recommended uniforms or clothing for outdoor workers should balance the risk of mosquito bites with the risk of heat stress.
- Standards, policies and procedures must be clearly communicated to workers.
- A responsible employer will ensure that any employees at risk for West Nile virus or exposure to mosquitoes has sufficient training to understand how to reduce the risks, both at work and at home.
- Measurement and evaluation should include surveillance for exposure to mosquitoes, symptoms of West Nile virus, absenteeism, inspections of the relevant physical conditions of the workplace, both indoors and out, and compliance with procedures.

NIOSH makes the following recommendations for employers:

- When possible, schedule work to avoid having workers outdoors when mosquitoes are most active and biting.
- Make insect repellent available to workers.
- Recommend that outdoor workers wear long-sleeved shirts and long pants, and include these in uniform options.
- Eliminate as many sources of standing water/mosquito breeding grounds as possible:
 - Change the water in animal drinking troughs, ponds, and other areas every few days or aerate it.
 - Remove discarded tires from the worksite.
 - Turn over, cover, or remove equipment such as tarps, buckets, barrels, and wheelbarrows that collect water.
 - Discard tires, buckets, cans, and containers in the area.
 - Place drain holes in containers that cannot be discarded.
 - Clean out rain gutters and ditches.
 - Remove debris—leaves, twigs, and trash—from ditches.
 - Fill in ruts and other areas that collect water.

8. Sources of Information

On West Nile virus:

- Canadian Cooperative Wildlife Health Centre
<http://wildlife1.usask.ca>
- Canadian Pediatric Society
www.caringforkids.cps.ca
- Centers for Disease Control and Prevention
www.cdc.gov
- Public Health Agency of Canada West Nile Virus Surveillance
www.phac-aspc.gc.ca
- Public Health Agency of Canada West Nile Virus Information Sheets
www.phac-aspc.gc.ca
- Ministry of Health and Long Term Care (Ontario)
www.health.gov.on.ca
- Ministry of Agriculture and Food (Ontario)
www.omafra.gov.on.ca
- Ministry of Labour (Ontario)
www.labour.gov.on.ca
- National Institute for Occupational Safety and Health
www.cdc.gov/niosh

On mosquitoes and repellents:

- American College of Physicians (on mosquitoes and repellents)
www.annals.org
- Centers for Disease Control and Prevention on repellents
www.cdc.gov
- Environmental Protection Agency on DEET
www.epa.gov
- Public Health Agency of Canada on insect repellents
www.pmra-arla.gc.ca
- New England Journal of Medicine paper on insect repellents
<http://content.nejm.org>
- Pest Management Regulatory Agency (PMRA), Canada
www.pmra-arla.gc.ca

FAQs

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Website: www.iapa.ca