



## Ordering Arbovirus Serology and Other Zoonotic Tests – Complementary Notes

Supplementary information is provided in the table that follows to assist with the ordering of tests on the new ProvLab Zoonotic Serology Requisition. Many of these tests are sent to the National Microbiology Laboratory, Winnipeg, and the selection of the appropriate assay(s) information relating to clinical history, onset of illness and epidemiologic information is now a requirement.

Completion of the clinical and epidemiologic history, notably date of onset of illness, recent travel history, vector exposures and symptoms assist with the appropriate test utilization and interpretation of results, or supplemental testing and follow-up samples, when appropriate.

While testing for a variety of infectious agents is generally offered to assist with a recent illness, determination of immunity following vaccination is available where indicated and requires dates of vaccination for interpretation of the result.

The ProvLab Guide to Services at

<https://www.albertahealthservices.ca/webapps/labservices/indexProvLab.asp> provides further information on the collection and type(s) of samples, transport and other details.

Molecular testing is available for some infections/agents and can be highly fruitful, especially if the patient is in the acute stages of an infection and potentially viraemic, usually within 7 days after the onset of symptoms. A discussion with the Microbiologist/Virologist is highly recommended to determine the utility of testing and the appropriate sample(s) collection.

*Failure to provide the necessary history/epidemiologic information OR contact the Microbiologist/Virologist where indicated can result in test cancellation.*

Zoonotic infections are often transmitted by specific vectors, such as ticks and mosquitoes that have defined geographical locations. Hence, when considering a travel-related infection, the type of vector and recent travel destination(s) can help narrow the potential diagnosis. In some circumstances, the country/region where the infection was acquired can affect the confirmatory testing to be performed, which is another reason to provide this information on the ProvLab Zoonotic requisition.

In the table that follows, the information is organized, alphabetically, by the infectious agent or disease, together with respective vector(s), geographical distribution and incubation period. Clinical descriptions have not been included for brevity, as the spectra of symptoms and manifestations are extremely broad.

Testing is available where indicated, however for some infections/agents no specific assays are either available or alternatively, cross-reactivity has been used as a surrogate as the organisms share common dominant antigenic features, notably within the *Rickettsia* genus. For completeness, infectious agents/diseases are also included in this Table where testing has been discontinued due a lack of reagent availability, for your information.

Note that some infections are risk group 4 pathogens (where indicated) and the laboratory and zone Medical Officer of Health (MOH) MUST be alerted if the disease or agent is suspected. The zone MOH will then coordinate the collection of specimens in conjunction with the ProvLab for the appropriate testing and the safety of laboratory staff and associated healthcare workers.

This document will be updated regularly and the updates will be recorded in the table on page 2.



**Revision History of:**

**Ordering Arbovirus Serology and Other Zoonotic Tests – Complementary Notes**

<b>Date Updated</b>	<b>Details of Update</b>
February 03, 2016	New
July 26, 2016	Revisions made to the following Sections, Chikungunya virus, Dengue virus, Eastern Equine virus (EEE), Herpes B, Lymphocytic Choriomeningitis virus (LCMV), Macacine herpes virus 1 (formerly Cercopithecine herpesvirus 1), Rickettsia parkeri, Yellow fever virus and Zika virus.
March 2, 2017	Links to point to new ProvLab website
June 2, 2017	Updates & additions to the following Sections; Anaplasma, Tick-borne Relapsing fevers, Crimean-Congo hemorrhagic fever, Lyme disease, scrub typhus, murine typhus, St Louis encephalitis virus, Tularemia, Yellow fever virus & Zika virus.
Dec 15, 2017	Updates & additions to the following Sections: Crimean-Congo hemorrhagic virus, Jamestown Canyon virus, Powassan virus, West Nile virus, Tick-borne encephalitis virus & Yellow Fever virus
August 17, 2018	Updates and additions to the following Sections: <i>Bartonella quintana</i> , <i>Chlamydophila psittaci</i> , Mayaro virus, Seoul virus
January 2019	Updates and additions to the following Sections: <i>B. miyamotoi</i> , Jamestown Canyon virus, Nipah virus, Snowshoe Hare virus, Zika virus
May 2019	Updates and additions to the following Sections: Mayaro virus, <i>Coxiella burnetii</i> , <i>Orientia tsutsugamushi</i> , Lyme disease & Zika virus
October 2020	Updates to the following Sections: Eastern Equine Encephalitis (EEE), Zika virus and website links for Provlab



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Agent/ Disease	Usual Vector	Primary Vector Species	Geographical Distribution	Incubation Period	Laboratory Tests (Referred out except where indicated)	Comments
<i>Anaplasma phagocytophilum</i> (Human granulocytic ehrlichiosis [HGE])	Tick	In N. America: <i>Ixodes scapularis</i> & likely <i>Ixodes pacificus</i>  In Europe: <i>Ixodes persulcatus</i> & <i>I. ricinus</i>	More commonly reported from the upper midwestern and northeastern areas of the US. Widely distributed in Europe. Distribution in Canada uncertain but likely in provinces bordering US. States with reported infections. Recently the province of Manitoba has reported cases. Alberta has recorded two lab-confirmed cases in 2008 and recently 2017.	One to two weeks after tick bite (Median 9 days)	Serology  For molecular testing contact Microbiologist/Virologist On Call*	Previously classified within the <i>Ehrlichia</i> genus as <i>E phagocytophilum</i> .  Sensitivity of molecular testing on whole blood is high (~80%) in the first 7 to 10 days after onset of symptoms
<i>Bartonella henselae</i> (Cat scratch fever)	none		Global, acquired when scratched by feral or domestic cats, mainly kittens. Infected fleas transmit organism between felines, direct transmission by fleas to humans is unproven.	One to three weeks	Serology  For molecular testing contact Microbiologist/Virologist On Call*	Serologic cross-reactivity between <i>B. henselae</i> and <i>B. quintana</i> occurs.
<i>Bartonella quintana</i>		Possibly fleas and human body louse	Increasingly recognized as an etiology of culture negative endocarditis	unknown		
<i>Borrelia</i> spp – see below Tick-borne relapsing fevers – see <i>Borrelia hermsii</i> , <i>B. parkeri</i> & <i>B. turicatae</i> <i>Borrelia burgdorferi</i> , <i>afzelii</i> & <i>garinii</i> – see Lyme disease Louse borne relapsing fever – see <i>Borrelia recurrentis</i>						

\* To contact the Microbiologist/Virologist-on-call (MVOC), In Calgary phone 403-333-4942, in Edmonton phone 780-407-8822. Failure to contact the MVOC where indicated may result in test cancellation.



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<i>Borrelia hermsii</i> <i>Borrelia parkeri</i> <i>Borrelia turicatae</i> (Tick-borne relapsing fevers [TBRF])	Tick	<i>Ornithodoros hermsi</i> <i>O.parkeri</i> & <i>O.turicata</i> are the respective tick hosts	Interior of British Columbia, and West, south and southwest US are endemic areas for <i>B.hermsii</i> . Relapsing fever infections due to <i>Borrelia turicatae</i> & <i>B.parkeri</i> are infrequently documented in areas where the host tick occurs. A case of <i>B.turicatae</i> was reported from Texas in 2015 where the tick is endemic	7 to 10 days after tick bite	Serology  As molecular testing may be preferable, contact the Microbiologist/ Virologist On Call*	Testing for <i>B.hermsii</i> must include travel to & tick bite in endemic areas. Cross-reactivity with other <i>Borrelia spp</i> not well documented.
<i>Borrelia miyamotoi</i>	Tick	<i>Ixodes spp</i>	Distribution in North America, Europe and Asia, is restricted to tick vector habitat. Emerging disease with cases diagnosed from NE USA, especially Massachusetts. Currently no published reports of lab-confirmed cases in Canada.	Estimated to be 12-16 days, possibly up to 3 weeks after tick bite	As molecular testing is the primary diagnostic tool, contact the Microbiologist/ Virologist On Call*	Clinical features are similar to a relapsing fever presentation. Maybe referred to as “hard tick-borne relapsing fever”
<i>Borrelia recurrentis</i> (Louse borne relapsing fever)	Human louse	Primarily <i>Pediculus humanus</i> , infrequently <i>Pediculus humanis capitis</i>	Sporadic cases and outbreaks in sub-Saharan Africa, particularly war zones and refugee camps, in Ethiopia, Sudan, Eritrea, and Somalia.	5 to 18 days (Median 8 days)	None available	
California serogroup viruses – see LaCrosse and Jamestown Canyon viruses						A wide ranging group of mosquito transmitted viruses that are serologically cross-reactive
Cat scratch fever - see <i>Bartonella henselae</i>						

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Chikungunya virus	Mosquito	<i>Aedes aegypti</i> & <i>Ae. albopictus</i>	Similar to dengue, tropical & subtropical regions of Asia, Pacific, and Africa. Recently extended to the Caribbean, south and central America, and localized areas in Italy and France. In 2020 no local transmission was reported in the USA & Puerto Rico.	1 to 12 days (Median 3 to 7 days)	Serology performed at ProvLab  For molecular testing additionally collect an EDTA blood, if the onset of symptoms is within a period of 7 days	Co-infection with dengue virus has been documented in areas where both viruses co-circulate
<i>Chlamydophila psittaci</i> (previously <i>Chlamydia psittaci</i> ) [Psittacosis, Ornithosis]	None		Widespread, risk groups are bird owners, aviary and pet shop employees, poultry workers, and veterinarians.	5 to 19 days	Serology – no longer available.  Molecular testing available for limited scenarios, contact the Microbiologist/Virologist-on-Call*	Requires history of recent exposure to birds, usually <i>psittacine sp</i> (parrots, parakeets, macaws); turkeys and ducks in abattoirs.
Colorado tick fever virus	Tick	<i>Dermacentor andersoni</i>	Often at higher elevations (4,000 to 10,000 ft above sea-level) in western USA and Canada. Central Oregon, USA, reported 5 cases in 2018 as well as Saskatchewan.	1 to 14 days	Serology Requires special request through Microbiologist/Virologist On Call*	
<i>Coxiella burnetii</i> (Q fever)	Rarely ticks		Worldwide, commonly acquired by exposure to infected fomites. Sheep & goats are primary reservoirs; inhalation or ingestion of infected fomites are another route. 50% of infections are asymptomatic.	2 to 6 weeks (Median 2 to 3 weeks)	Serology  Contact Microbiologist/Virologist On Call	Molecular testing recommended on whole blood within first two weeks of infection or on heart valves or biopsy material

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Crimean-Congo hemorrhagic fever (CCHF)	Tick	<i>Hyalomma spp</i>	Most of Africa, south eastern Europe, Middle East & Arabian region, most of southern Asia to Western China. Most of the current cases are reported from Pakistan, India, Iran and Oman with a 30% case fatality rate. A recent case in July, 2017 from central Spain suggests a wider geographic expansion.	1 to 9 days (median 1-3 days)	Serology & Molecular testing Requires notification through Microbiologist/Virologist-on-Call * as this is a <b>Risk Group 4 Pathogen</b> .  <b>Must also notify zone MOH</b>	
Dengue virus	Mosquito	<i>Ae. aegypti</i>	Tropical & subtropical regions of Asia, Pacific, the Americas and Caribbean.	3 to 14 days	Serology testing performed at ProvLab For molecular testing additionally collect an EDTA blood, if the onset of symptoms is within a period of 10 days	Serology can be cross-reactive with other flaviviruses such as West Nile virus & Zika virus
Eastern Equine Encephalitis (EEE)	Mosquito	Various includes <i>Aedes</i> and <i>Culex</i> sp.	Comparatively rare and restricted mainly to Atlantic & Gulf coast states and Great Lakes region. In Canada, likely the eastern provinces bordering the US Atlantic States. <i>2019 was an active year in the USA with most cases in Michigan &amp; Massachusetts. Ontario reported equine cases in both 2018 &amp; 2019.</i>	4 to 10 days	Serology	In 2018, 3 solid organ recipients were reported to have acquired the virus from an infected donor in the USA.

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<i>Ehrlichia chaffeensis</i> (Human monocytic ehrlichiosis – HME)	Tick	<i>Amblyomma americanum</i> (Lone star tick)	Restricted to southern, south-eastern and south-central USA. Permissive tick vector not found in Canada.	1 to 2 weeks after tick bite	Serology  Contact Microbiologist/Virologist On Call* if molecular testing required	Only performed if recent travel to endemic region and tick bite are verified.  Molecular testing on whole blood is recommended in first 7-10 days after symptom onset
<i>Ehrlichia ewingii</i>	Tick	<i>Amblyomma americanum</i> & <i>Dermacentor andersonii</i>	as above	similar to above	No specific serologic assay, cross reactive with <i>E. chaffeensis</i> antigens	
<i>Ehrlichia canis</i>	Tick	<i>Rhipicephalus</i> sp in dogs	Likely global distribution as canids and felines are susceptible. Documented human infections are rare. However there is extensive serologic cross-reactivity between <i>E. canis</i> and <i>E. chaffeensis</i> therefore cases due to <i>E. canis</i> could be misclassified as <i>E. chaffeensis</i> cases	probably same as above		
<i>Ehrlichia muris</i>	Tick	<i>Ixodes persulcatus</i> & <i>Haemaphysalis flava</i>	Unknown distribution. Etiologic agent reported from rodents and deer in Midwest USA. Documented human infections are rare and associated with significant immunosuppression.	unknown but probably same as above		
Epidemic typhus – see <i>Rickettsia prowazekii</i>						
Flea-borne spotted fever or flea-borne typhus – see <i>Rickettsia felis</i> and <i>Rickettsia typhi</i>						

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Hantavirus (Hantavirus Pulmonary Syndrome [HPS])			Widely distributed in Canada, north and south America. The deer mouse ( <i>Peromyscus maniculatus</i> ) is the rodent host in Alberta; two cases were reported in 2019	7 to 39 days (Median 18 days)	Serology  Molecular testing in acute cases requires dedicated blood and possibly other samples as well as <u>advance notification</u> , consult Microbiologist/Virologist  On Call*	Other hantaviruses, e.g., Bayou virus, Black Creek Canal virus found in USA, also cause infections. Old World hantaviruses also cause non-pulmonary syndromes.
Herpes B (B virus, monkey B virus, herpesvirus simiae & herpesvirus B) – see <i>Macacine herpesvirus 1</i>						
Human granulocytic ehrlichiosis (HGE) – see <i>Anaplasma phagocytophilum</i>						
Human monocytic ehrlichiosis (HME) – see <i>Ehrlichia chaffeensis</i>						
Jamestown Canyon virus (JCV)	Mosquito	Various species, including <i>Aedes</i> , <i>Coquillettidia</i> , <i>Culex</i> & <i>Culisetta</i>	Although widely distributed in N. America, since year 2000, most cases have been reported from the states adjacent to the Great Lakes, notably Wisconsin and eastward, including Ontario. The US states of Maine & New Hampshire have reported cases in 2017, and in 2018 a case was reported from Manitoba, Canada	5 to 15 days	Serology  NML will only accept acute and convalescent samples for serology testing	Serology within the California serogroup (LaCrosse, JCV and Snowshoe hare virus) is cross reactive
Japanese encephalitis virus (JE)	Mosquito	<i>Culex spp</i> mainly <i>Culex tritaeniorhynchus</i>	Widely distributed in tropical and temperate Asia & SE Asia, from Pakistan & India to N. Korea and Japan, and south to Papua New Guinea and neighbouring areas of Australia	5 to 15 days	Serology	NACI guidelines do not recommend serologic testing before or after receipt of the vaccine
Kunjin virus – see West Nile virus						

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La Crosse encephalitis	Mosquito	<i>Ochlerotatus (Aedes) triseriatus</i>	Restricted to the upper Midwestern USA such as, Minnesota, Wisconsin, Iowa & Ohio. Recently most cases have occurred in the mid-Atlantic states, notably Virginia, West Virginia, N. Carolina & Tennessee.	5 to 15 days	None available	Serology can be cross-reactive within the California serogroup (Jamestown Canyon and Snowshoe Hare viruses)
<i>Leptospira spp</i> (Leptospirosis)			Worldwide, more common in temperate and tropical areas. Activities and occupations resulting in exposure to contaminated lakes, floodwaters, rivers or infected livestock increase risk of infection	2 days to 4 weeks (Median 10 days) Illness can be biphasic	Serology	Pathogenic leptospires species belong to <i>Leptospira interrogans</i> , further subdivided into serovars
Louse borne relapsing fever see <i>Borrelia recurrentis</i>						

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Lyme disease ( <i>Borrelia burgdorferi</i> , <i>afzelii</i> and <i>garinii</i> )	Tick	In Canada and USA <i>Ixodes scapularis</i> and <i>I. pacificus</i> . in Europe & Asia primarily <i>I. ricinus</i> & <i>I. persulcatus</i>	Distribution in North America, Europe and Asia, is restricted to tick vector habitat.  In Canada, endemic provinces are British Columbia, Manitoba, Ontario, Quebec, New Brunswick & Nova Scotia. NS had the highest reported incidence in 2016 for Canada. <a href="https://www.canada.ca/en/public-health/services/diseases/lyme-disease/risk-lyme-disease.html">https://www.canada.ca/en/public-health/services/diseases/lyme-disease/risk-lyme-disease.html</a>  Alberta is presently NOT considered endemic for Lyme disease presently <a href="https://www.alberta.ca/lyme-disease-tick-surveillance.aspx">https://www.alberta.ca/lyme-disease-tick-surveillance.aspx</a>	3 to 30 days after tick bite (Median 7 to 10 days)	Serologic screening performed at ProvLab; samples with positive and equivocal results are sent to the National Microbiology Laboratory for confirmatory Immunoblot testing before being reported	In North America <i>B. burgdorferi</i> is the etiologic agent. In Europe and Asia, two additional genospecies, <i>B. garinii</i> and <i>B. afzelii</i> , cause Lyme disease, and require travel history for testing.  Refer to the Testing and Interpretation bulletin at <a href="https://www.albertahealthservices.ca/assets/wf/plab/wf-provlab-appendix-laboratory-testing-of-lyme-disease-in-alberta.pdf">https://www.albertahealthservices.ca/assets/wf/plab/wf-provlab-appendix-laboratory-testing-of-lyme-disease-in-alberta.pdf</a> or at the ProvLab Guide to Services under “Lyme disease”
Lymphocytic Choriomeningitis virus (LCMV)			Global distribution as the primary host is the common house mouse ( <i>Mus musculus</i> ). Other rodents e.g., hamsters, can become infected if exposed and transmit the virus. Transmission is through inhalation of infected urine or droppings. Most recent case occurred in Minnesota.	8 to 13 days	Serology	

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<i>Macacine herpesvirus 1</i> (formerly <i>Cercopithecine herpesvirus 1</i> )			An alphaherpes virus endemic in macaques (Old World monkeys, e.g., rhesus monkeys) that are its natural host. Reported infections in humans following bites and scratches are very rare, however the mortality and residual neurologic sequelae are high. Macaque colonies in Asia are frequent tourist destinations where exposures occur. Rhesus monkeys introduced into Puerto Rico & some Caribbean islands are also potential sources.	less than 2 days to up to 10 years (following reactivation of latent infection)	Contact your local public health first who will in turn notify the ProvLab if testing is required	
Mayaro virus	Mosquito	Primarily <i>Haemagogus janthinomys</i> & possibly <i>Aedes aegypti</i>	An alphavirus, in the same genus as Chikungunya virus, acquired from mosquitoes. First described in Trinidad, now most cases are reported from the Amazon Basin including Brazil & Peru & recently Ecuador in 2019. May also be found in Haiti. Recent Alberta travel-related case in 2017 in a traveler returning from Peru	1 to 12 days (Median 3 to 7 days)	Serology – see Comments  Contact Microbiologist/Virologist On Call* for molecular testing	Serologic cross reactivity has been described between Chikungunya and Mayaro virus as these agents are closely related
Murine typhus see <i>Rickettsia typhi</i>						

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Nipah virus			Fruit bats are the host reservoir of this agent. Recent cases and outbreaks have been reported from Kerala State, India, in August 2018.	5-14 days	Serology & Molecular testing Requires notification through Microbiologist/Virologist-on-Call * as this is a <b>Risk Group 4 Pathogen</b> .  <b>Must also notify zone MOH</b>	
<i>Orientia tsutsugamushi</i> (Scrub typhus)	Rodent mites (chiggers)	Larval stages of <i>Leptotrombidium sp</i>	Japan, East Russia, Central, South & SE Asia and Northern Australia. Recent ProMed reports now cite south India and southeastern & central Nepal with significantly increased case counts. Chiloe Island, an island off Chile, has also confirmed a cluster of locally acquired infections.	6 to 21 days (Median 10 to 12 days)	Serology  Contact Microbiologist/Virologist On Call * for molecular testing	Molecular testing on the eschar material has high sensitivity (~95%). The serologic response is usually absent 7 – 10 days after infection whereas molecular testing on whole blood has about 80% sensitivity.
Ornithosis — see <i>Chlamydomphila psittaci</i>						
Powassan virus	Ticks	<i>Ixodes cookei</i> , <i>I. marxi</i> & <i>I. scapularis</i> in N. America, whereas in Europe, <i>Ixodes persulcatus</i> & other spp	Endemic in northeastern US states and Great Lakes, southeastern Canadian provinces and Russian far East. Divided into two genetically distinct lineages, Powassan and Deer tick virus, that are maintained in separate vectors and host species New York, Minnesota & Wisconsin have recorded the highest number of cases	7 to 14 days	Serology	
Psitticosis – see <i>Chlamydomphila psittaci</i>						

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Q fever – see <i>Coxiella burnetii</i>						
Rabies virus			Global, although human infections acquired in Canada are very rare. In Alberta, bats are the primary host, elsewhere foxes, raccoons, skunks, and wolves.	Variable, from days to years (Median 20 to 60 days)	Serology  Contact Microbiologist/Virologist On Call* for testing in <u>suspected cases</u> . Must notify zone MOH prior to sample collection who will provide guidance on testing	For vaccination titres, MUST provide vaccination date on requisition

<i>Rickettsia spp</i> (Tick-Borne) are arranged based upon continental distribution			Manifestations range from rash-like illness to non-specific signs without rash, and with or without eschars at inoculation site			
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<b>North &amp; South America</b>						
<i>Rickettsia rickettsii</i> (Rocky Mountain Spotted Fever [RMSF] and Brazilian spotted fever)		Commonly <i>Dermacentor andersoni</i> , <i>D. variabilis</i> , <i>Amblyomma americanum</i> , <i>A. cajennense</i> , <i>Rhipicephalus sanguineus</i>	Although widely distributed in continental USA, most cases are reported from N. Carolina, Indiana, Oklahoma, Arkansas, Tennessee, Missouri & Nebraska. Recently, cases were identified in eastern Arizona that were not previously reported from there. No locally acquired cases of RMSF reported from Canada for past two decades	3 to 14 days	Serology	

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<i>Rickettsia parkeri</i>		<i>Amblyomma maculatum</i> (Gulf Coast tick)	Recently recognized human pathogen. Geographic distribution of the tick is southeastern USA, notably Georgia	2 to 14 days	Serology  Molecular testing available if material from the eschar is scraped and sent in Viral transport medium  Contact Microbiologist/Virologist On Call* for molecular testing	
<b>Europe, Asia and Japan</b>						
<i>Rickettsia africae</i> African tick bite fever		<i>Amblyomma variegatum</i> & <i>A.hebraeum</i>	Although mainly in Africa, occurs in southern Europe and French West Indies	1 to 15 days (Median 4 days)	No specific serology tests available, however cross reactivity with <i>R.rickettsia</i> (spotted fever) antigen is recognized	
<i>Rickettsia conorii</i> & sub spp includes Mediterranean spotted fever or Boutonneuse fever  Israeli spotted fever  Astrakhan fever		<i>Rhipicephalus sanguineus</i> , <i>Dermacentor spp</i> , <i>Ixodes</i> , <i>Haemaphysalis spp</i> & others	Mediterranean, Central Europe, India, Israel, Russia, Portugal and sub-Saharan Africa	Variable, 1 to 16 days (Median 5 to 7 days)	Molecular testing available if material from the eschar is scraped and sent in Viral transport medium	
<i>Rickettsia helvetica</i> Aneruptive fever		<i>Ixodes spp</i>	Central & northern Europe and Asia	Variable, usually 5 to 14 days	Contact Microbiologist/Virologist On Call* for molecular testing	
<i>Rickettsia massiliae</i> rickettsiosis		<i>Rhipicephalus sanguineus</i> & other <i>Rhipicephalus spp.</i>	France, Greece, Spain, Portugal, Switzerland, Sicily also Central Africa & Mali	Probably similar to <i>R.conorii</i> infections above		
<i>Rickettsia sibirica</i> Siberian tick typhus North Asian tick fever Lymphangitis-associated rickettsiosis (LAR)		<i>Dermacentor</i> & <i>Haemaphysalis spp</i>	Siberia, Pakistan, Northern China. Cases of LAR also commonly reported from France	2 to 7 days		Lymphangitis-associated rickettsiosis (LAR) is caused by <i>R.sibirica mongolitimonae</i> a subspecies of <i>R.sibirica</i>

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**Ordering Arbovirus Serology and Other Zoonotic Tests – Complementary Notes**

Agent/ Disease	Usual Vector	Primary Vector Species	Geographical Distribution	Incubation Period	Laboratory Tests (Referred out except where indicated)	Comments
<i>Rickettsia japonica</i> Japanese spotted fever		Various including <i>Haeamaphysalis</i> , <i>Dermacentor</i> & <i>Ixodes</i> sp	Japan & China	2 to 18 days (Median 6 to 7 days)		
<i>Rickettsia slovaca, raoultii</i> <i>and rioja</i> TIBOLA/DEBONEL		Frequently <i>Dermacentor marginatus</i> , less often <i>D.reticulatus</i>	Mainly in Hungary & Spain, more recently France, Italy and Bulgaria have reported an upswing in cases with a few reports from Portugal	1 to 15 days (median 5 days)	No specific serology tests available, cross reactive with Spotted fever ( <i>R.rickettsia</i> ) antigens	This syndrome of tick-borne lymphadenopathy (TIBOLA), and Dermacentor-borne necrosis erythema lymphadenopathy (DEBONEL) is more frequent in women & children.
<b>Australia</b>						
<i>Rickettsia australis</i> Queensland tick typhus		<i>Ixodes holocyclus</i> & <i>I.tasmani</i>	East coast of Australia and Tasmania	7 to 10 days	No specific serology tests available, cross reactive with Spotted fever ( <i>R.rickettsia</i> ) antigens	
<i>Rickettsia honei</i> Flinders Island spotted fever or Thai tick typhus		<i>Ixodes</i> & <i>Rhipicephalus</i> spp	South east Australia, Flinders Island and Thailand	probably similar to above		
<b>Africa</b>						
<i>R. africae</i> African tick bite fever		<i>Amblyoma variegatum</i> & <i>A.hebraeum</i>	Africa (Botswana, Zimbabwe, Swaziland & South Africa) and southern Europe	1 to 15 days (Median 4 days)	No specific serology tests available cross reactive with Spotted Fever antigens  Molecular testing available if material from the eschar is scraped	
<i>R. conorii</i> & sub spp		<i>Rhipicephalus sanguineus</i> , <i>Dermacentor</i> spp, <i>Ixodes</i> , <i>Haemaphysalis</i> spp & others	Sub-Saharan Africa and also countries bordering the Mediterranean Sea, Central Europe, sub- India, Israel, Russia, Portugal.	Variable, 1 to 16 days (Median 5 to 7 days)		

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<i>Rickettsia massiliae</i> rickettsiosis		<i>Rhipicephalus sanguineus</i> & other <i>Rhipicephalus spp.</i>	Central Africa & Mali and in Europe includes France, Greece, Spain, Portugal, Switzerland & Sicily	probably similar to above	and sent in Viral transport medium  Contact Microbiologist/Virologist On Call* for molecular testing	
<i>Rickettsia felis</i> Flea-borne spotted fever	fleas		Australia, north and south America and southern Europe	1 to 2 weeks (Median 12 days)	Cross reactive with Spotted Fever antigens  Contact Microbiologist/Virologist On Call* for molecular testing	
<i>Rickettsia prowazekii</i> Epidemic typhus or sylvatic typhus	fleas	Human body louse	Central Africa, Asia, Central & South America, isolated US States where humans are in contact with flying squirrel ectoparasites	1 to 2 weeks (Median 12 days)	Cross reactive with Typhus group antigens  Contact Microbiologist/Virologist On Call* for molecular testing	
<i>Rickettsia typhi</i> Murine typhus	fleas		Worldwide, generally associated with rat populations. In the USA, coastal areas and seaports around the Gulf of Mexico. Los Angeles metro, Pasadena & Long Beach have 59 cases in 2018 increasing to 124 cases in 2019	6 to 14 days (Median 12 days)	Serology for Typhus group  Contact Microbiologist/Virologist On Call* for molecular testing	

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Agent/ Disease	Usual Vector	Primary Vector Species	Geographical Distribution	Incubation Period	Laboratory Tests (Referred out except where indicated)	Comments
Ross River virus	Mosquito	Primarily <i>Aedes camptorhynchus</i> , in other regions <i>Culex annulirostris</i>	Australia, primarily the western states of Queensland and New South Wales. Wider distribution includes Indonesia, Papua New Guinea and some Pacific Islands	7 to 9 days	Serology - restricted  Requires special request through Microbiologist/Virologist On Call*	Clinical history MUST include dates of onset of illness, travel and countries visited within 3 months of onset
Scrub typhus – see <i>Orientia tsutsugamushi</i>						
Seoul virus (Old World Hantavirus)			Worldwide, natural host is the Norway rat. In 2017 a survey of Canadian pet rat owners were found to be antibody positive. Infected ratteries in the USA, were the likely source of the exported rats to Canada.	1 to 2 weeks after exposure	Serology and molecular testing Requires special request through Microbiologist/Virologist On Call*	Symptoms vary from asymptomatic to haemorrhagic fever with renal syndrome
Sin Nombre virus – see Hantavirus						
St Louis Encephalitis virus (SLE)	Mosquito	<i>Culex spp</i>	Canada to Argentina, mainly in Midwest and Southeast USA. Recent cases have been reported from southern Nevada and adjoining areas in southern California	5 to 15 days	Serology - restricted  Requires special request through Microbiologist/Virologist On Call*	
Snowshoe Hare virus	Mosquito	<i>Aedes vexans</i> & <i>Ochlerotatus trivittatus</i>	Wide distribution In USA and Canada based upon vector and host geography.	5 to 15 days	Serology NML will only accept acute and convalescent bloods for serologic testing	Belongs to the California serogroup, serology within this group is cross reactive.

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Agent/ Disease	Usual Vector	Primary Vector Species	Geographical Distribution	Incubation Period	Laboratory Tests (Referred out except where indicated)	Comments
Tick-borne encephalitis virus	Tick	<i>Ixodes ricinus</i> & <i>I.persulcatus</i> & possibly <i>Dermacentor reticulatus</i>	Central & eastern Europe, the Baltic, Siberia, Russia and northern China are endemic areas.	4 to 28 days (Median 7 to 14 days)	Serology & Molecular testing Requires notification through Microbiologist/Virologist-on-Call* as this is a <b>Risk Group 4 Pathogen</b> .  <b>Must also notify zone MOH</b>	Can be acquired by consuming contaminated milk products, especially milk
Tick-borne relapsing fever – see <i>Borrelia sp</i>					Serology	
Tularemia ( <i>Francisella tularensis</i> )		Infrequently acquired from infected tick, flea or biting insect, most often from handling infected animals	Widely distributed in America, Canada, northern Europe & Asia. Rabbits, hares and rodents are common hosts.	1 to 14 days (Median 3-5 days)	Serology  Culture – Must contact Microbiologist/Virologist On Call* before submitting samples for culture	
West Nile virus	Mosquito	<i>Culex</i> and <i>Aedes spp</i>	Global including Canada, North & South America  Kunjin virus, a sublineage of West Nile virus, is found in tropical Australia, eastern Queensland & infrequently SE Australia, Malaysia & Papua New Guinea	2 to 14 days (Median 2-6 days)	Serology and molecular testing performed at ProvLab	Phylogenetically, West Nile virus is subdivided into two main lineages. Most N. American and European strains cluster within lineage 1. Kunjin virus is a 1b clade within this lineage
Venezuelan equine encephalitis virus (VEE)	Mosquito	<i>Culex</i> , <i>Aedes sp</i> and others	South & central America, notably Panama, are endemic areas. Past outbreaks have spread into Texas	2 to 6 days	Serology - restricted  Requires special request through Microbiologist/Virologist On Call*	

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Agent/ Disease	Usual Vector	Primary Vector Species	Geographical Distribution	Incubation Period	Laboratory Tests (Referred out except where indicated)	Comments
Western Equine Encephalitis virus	Mosquito	<i>Culex tarsalis</i>	No human cases reported since 2007. Distribution includes irrigated areas of North, Central, and South America; in the USA cases have been reported from the plains regions of western and central states	5 to 15 days	Serology - restricted  Requires special request through Microbiologist/Virologist On Call*	
Yellow Fever virus	Mosquito	Various, <i>Aedes aegypti</i> , <i>Ae. africanus</i> , <i>Haemagogus</i> and <i>Sabethes spp</i>	Restricted to two main areas, the Amazon basin in South America, and much of the tropical regions in central and west Africa. Since January 2017, there has been a resurgence in Brazil in the eastern States affecting both humans & monkeys. Nigeria also reported cases in 2017	3 to 6 days	Serology & Molecular Testing  Suspected cases MUST BE notified to zone MOH and to the Microbiologist/Virologist On Call*, BEFORE sending samples	For vaccination titres; MUST provide vaccination date on requisition
Zika virus	Mosquito	Various <i>Aedes spp</i> including <i>Ae. aegypti</i> , <i>Ae. africanus</i> & <i>Ae. albopictus</i>	Since 2016, there has been a sharp decline in cases and circulation of this virus. Presently no cases reported for the continental USA, although the Territories of Puerto Rico & US Virgin Islands reported local transmission in 2020. <a href="https://travel.gc.ca/travelling/health-safety/travel-health-notices/152?_ga=2.121658891.1439584141.1518032976-164036552.1495382771">https://travel.gc.ca/travelling/health-safety/travel-health-notices/152?_ga=2.121658891.1439584141.1518032976-164036552.1495382771</a>	3 to 12 days	In response to changing national guidelines, serology requests are now referred to the National Microbiology Laboratory, Winnipeg, and require approval through the Microbiologist/Virologist On Call*  For molecular testing, contact the Microbiologist/Virologist On Call.	Testing only available in specific clinical scenarios, refer to the Bulletin at: <a href="https://www.albertahealthservices.ca/assets/wf/lab/wf-lab-bulletin-pl-changes-to-zika-virus-serology-testing.pdf">https://www.albertahealthservices.ca/assets/wf/lab/wf-lab-bulletin-pl-changes-to-zika-virus-serology-testing.pdf</a>

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