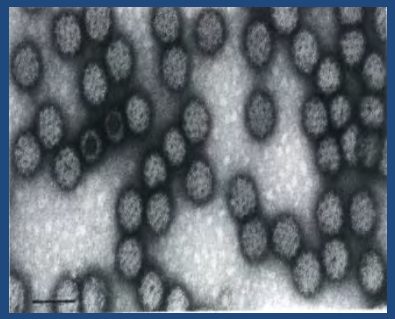
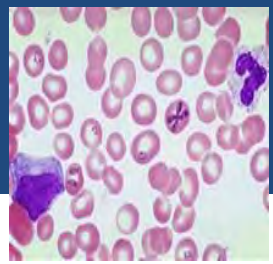


New Infectious Disease Risks
or
Why Microbiologists are never out of work!

GHEST Symposium, Hamilton, ON

September 22, 2018



Dr. Margaret Fearon
Medical Director, Medical Microbiology,
Canadian Blood Services

Canadian Blood Services
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Conflicts of Interest – None to declare

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Learning Objectives

- *Learn which new or re-emerging infectious diseases we are monitoring now.*
- *Understand how CBS monitors and assesses infectious disease risks to the blood supply.*
- *Learn what strategies CBS uses to mitigate risk.*

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What do we test for?

A Review of Blood Donor Testing

Donor testing		Implementation Date
– HIV1/2	Antibody (Ab) and	1985
	nucleic acid testing (NAT*)	2001
– HBV	HBsAg, anti-HBc and NAT*	1972, 2005, 2010
– HCV	Ab and NAT*	1990, 1999
– HTLV1/2	Ab	1998 (HTLV 1 – 1990)
– WNV	NAT (pools of 6)	2003 (seasonal testing began in 2015)
– Syphilis	Ab	1949
– CMV	Ab (selected units)**	1984
– *Chagas*	*Ab (selective donor testing)*	*2010*

Donors who test RR for any TD marker are permanently deferred (can no longer donate).
Lookback on previous donations is performed as appropriate
Public Health is notified as per legal requirements

*NAT testing for HIV, HCV and HBV performed on Roche Cobas p680/8800 (Multiplex NAT) in pools of 6

**CMV antibody tested negative product now only available for intrauterine transfusions (Oct. 2017)

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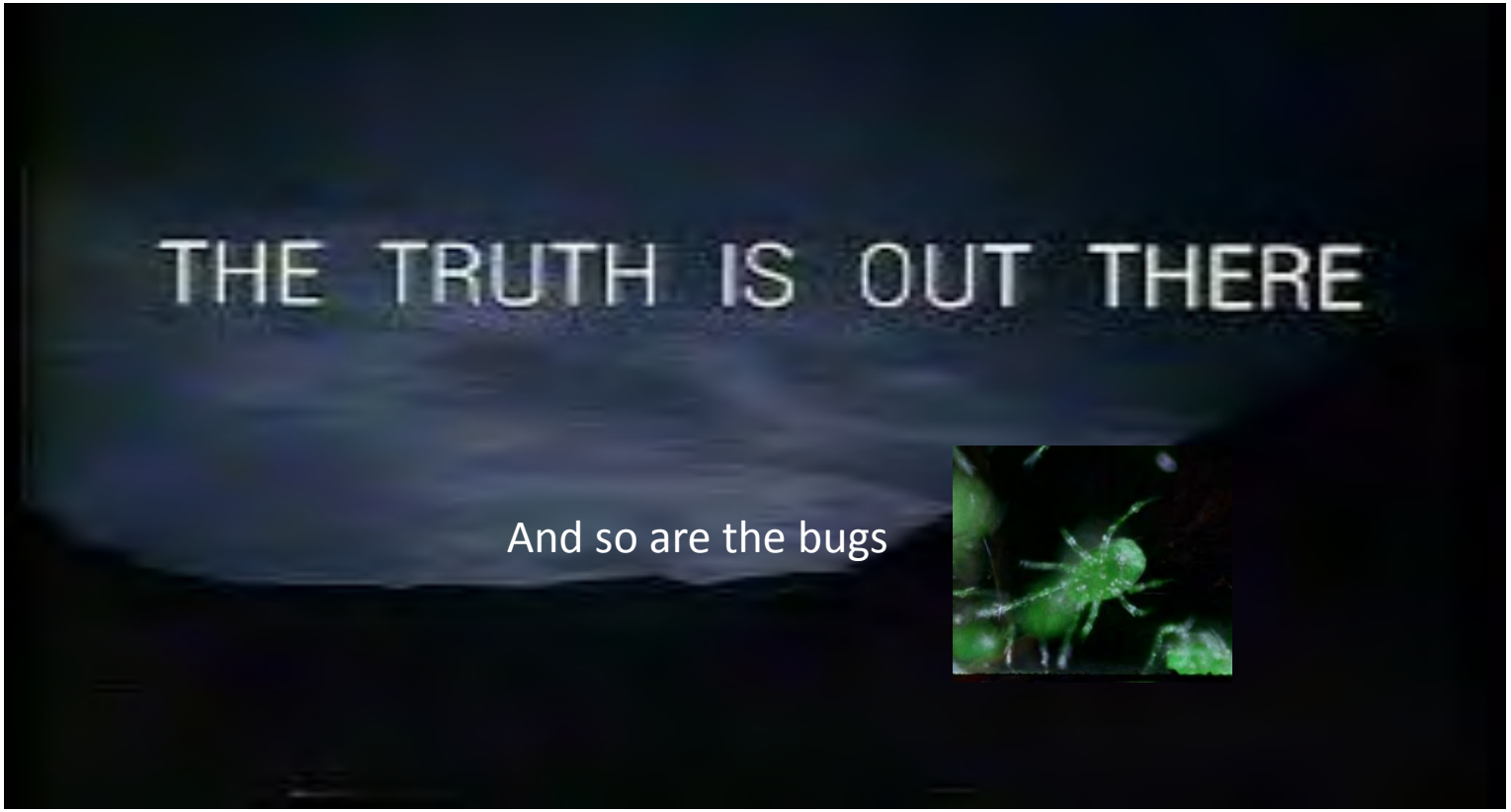
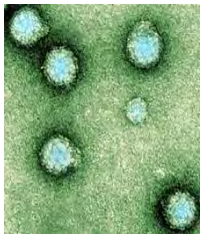
What's out there?



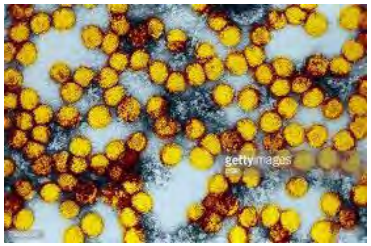
Current Emerging Infectious Disease Risks

Aedes aegypti

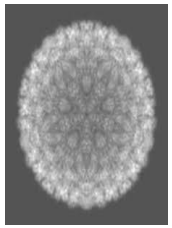
Chikungunya



Yellow fever virus



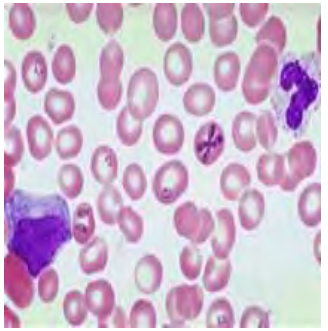
Dengue virus



Zika

Black legged Tick (*Ixodes scapularis*)

Babesia microti



Hepatitis E

An 'Old' Emerging Infectious Disease

2018 West Nile Season to September 20
Total Positive Donors 36 (23 M, 13 F)

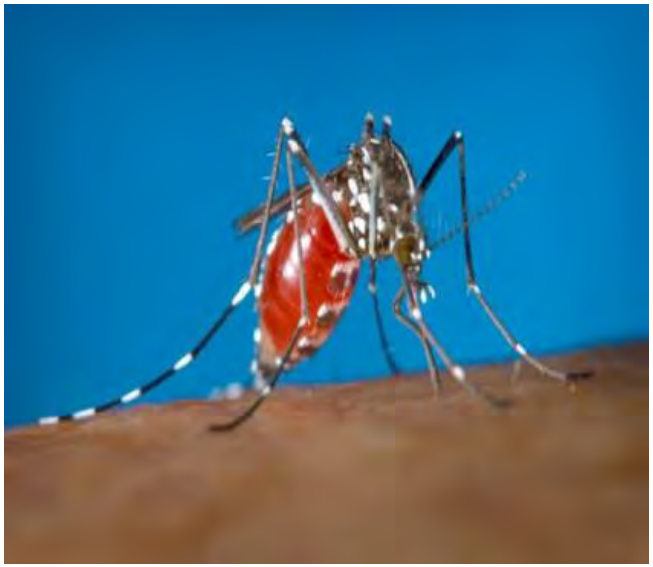
Province	Total	Symptomatic*	Asymptomatic	Information not available
Ontario	15	5	9	1
Manitoba	7	3	1	3
Saskatchewan	6	6	0	0
Alberta	7	3	2	2
New Brunswick	1**	0	1	0

*Symptoms most commonly reported are headache, muscle aches, lethargy, rash.
**Donor had just received Japanese encephalitis vaccine for travel.

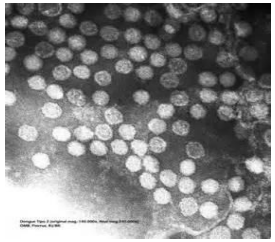
Mosquito-borne Diseases

Aedes aegypti

Aedes albopictus

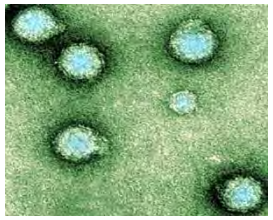


Dengue

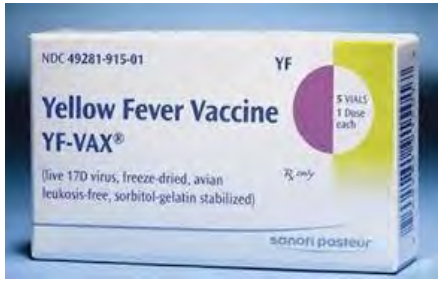


Zika Virus

Chikungunya



Yellow fever



Four viruses common in the tropics.

- Spread by mosquitos (*Aedes aegypti, Aedes albopictus*).
- Similar acute illness – fever, rash, muscle and joint pain. Similar incubation 3-7 days.
- **Dengue** ('breakbones fever') is widespread in Latin America, with endemic cases in Texas.
- **Chikungunya** ('that which bends up') arrived in the Caribbean and South America in **2013**. No cases reported recently.
- **Zika virus** appeared in Brazil in March **2015** and rapidly spread into other parts of South America, and the Caribbean. Small number of endemic cases in Florida and Texas. Now waning.
- Currently (**2017-2018**) a large outbreak of **Yellow Fever** in Brazil.

Four possible cases of TT Zika in Brazil.
No cases of TT chikungunya reported to date.
Malaria travel deferral covers many but not all affected areas.

The main risk for Canada is infection in returning travelers.

Zika Virus

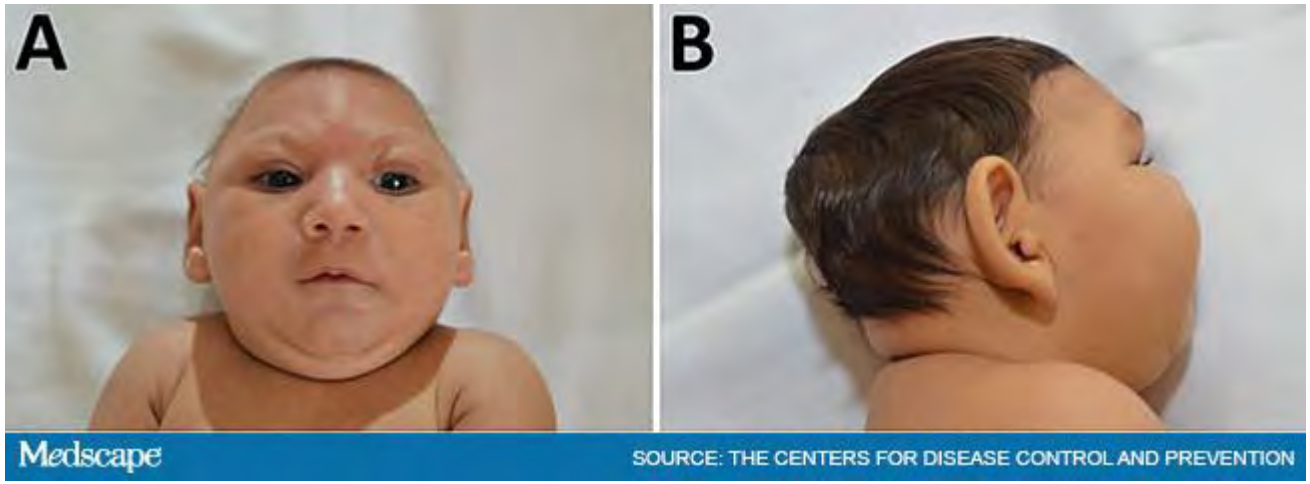
- Vector borne- *Aedes aegypti, aedes albopictus*
- Flavivirus (same family as West Nile)
- First large reported outbreak on Yap in the North Pacific,
- 2016 outbreak started in Brazil, spread into other parts of Latin America and Caribbean.

FIGURE 1

Conjunctivitis in a case of imported Zika virus infection from French Polynesia, Japan, January 2014

Although the patient was afebrile upon examination, both bulbar conjunctivas appeared congested.

Associated with microcephaly and other fetal malformations
In infants of mothers who contract Zika virus during pregnancy.



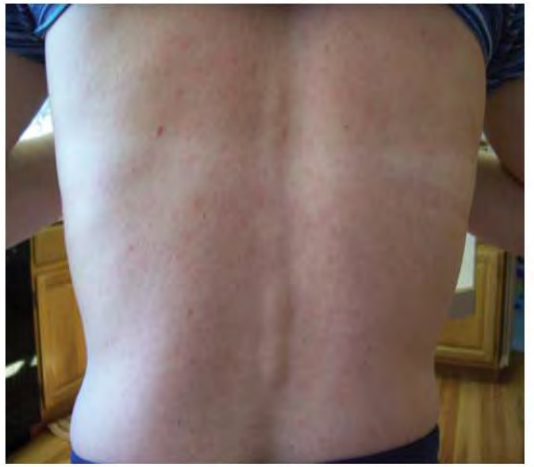


Figure. Maculopapular rash on patient 3 infected with Zika virus, Colorado, USA.

Zika Virus in Canada

- 568 travel related cases reported to Public Health Agency of Canada (PHAC), Oct. 2015 – May 2018.
- 4 cases of sexual transmission, 44 cases in pregnant women, 4 cases of congenital Zika.
- Latest onset date March, 2017.

In Canada, CBS and Héma Québec Implemented a 21 day travel deferral for donors to mitigate Zika risk.

No cases of TT Zika have been reported outside of Brazil.

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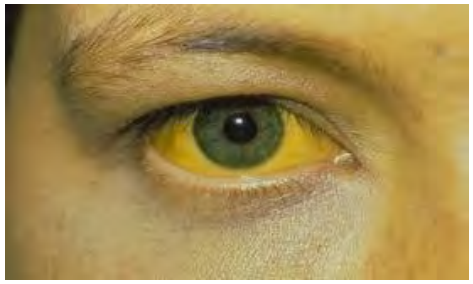
Yellow Fever



- Flavivirus (same family as West Nile virus).
- Mild Flu-like illness to severe acute illness with jaundice, haemorrhage and organ failure (15-25% of patients).
- Yellow fever **vaccine** (live vaccine) is very effective.
- Yellow fever is theoretically transfusion transmitted, both from infected donors (we defer 3 months after recovery) and has been reported from recently vaccinated donors (we defer 4 weeks).
- Large outbreak in Brazil, since early 2017, with 11 reported cases (and 2 deaths) in unvaccinated European travelers.

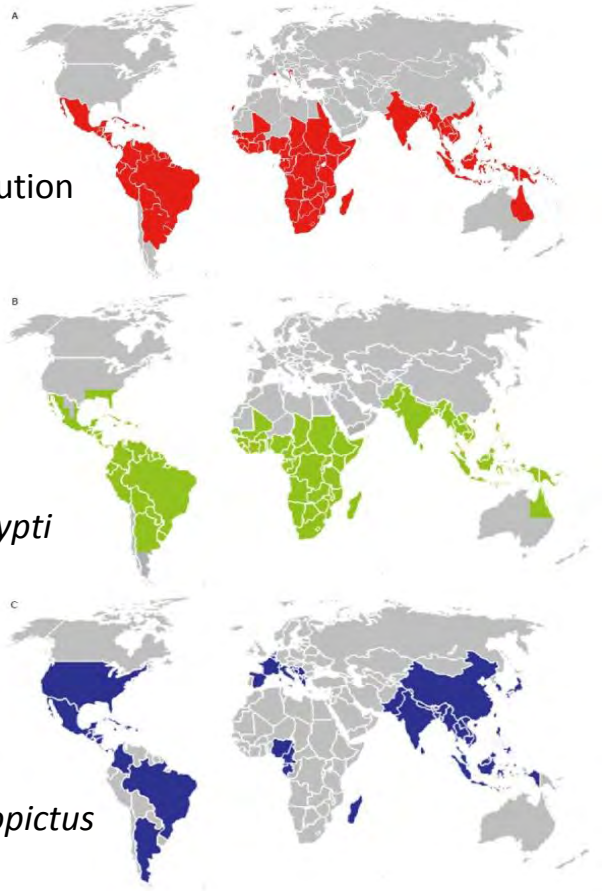
CDC: MMWR
Transfusion-Related Transmission of Yellow Fever Vaccine Virus --- California, 2009
Weekly January 22, 2010 / 59(02);34-37

CDC: MMWR
Fatal Yellow Fever in Travelers to Brazil, 2018
Weekly / March 23, 2018 / 67(11);340–341

Reported cases of Yellow fever rare in Canada

Dengue

- Another member of the Flavivirus family. Four serotypes with little cross-immunity.
- 75% of cases asymptomatic. Symptomatic range from Febrile illness to haemorrhagic fever to dengue shock syndrome.
- Dengue vaccine, *Dengvaxia* (Sanofi Pasteur)a tetravalent vaccine licensed in 2015. Vaccination campaigns in high risk areas suspended with identification of severe dengue infection in some vaccinees.



Global distribution of dengue

Range of *Aedes aegypti*

Range of *Aedes albopictus*

200 – 300 cases of Dengue reported to PHAC every year – all travel related.

Transfusion transmission cases reported in Singapore, Hong Kong, Puerto Rico and Brazil.

Likely under-reporting of cases in outbreak setting.

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Is transfusion-transmitted dengue fever a potential public health threat? Bruno Pozzetto, Meriam Memmi, and Olivier Garraud World J Virol. 2015 May 12; 4(2): 113–123. Published online 2015 May 12. doi: 10.5501/wjv.v4.i2.113

“Clearly there has been a lack of imagination about how much can go wrong.”

Rachel Maddow

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What else besides mosquito borne infections?

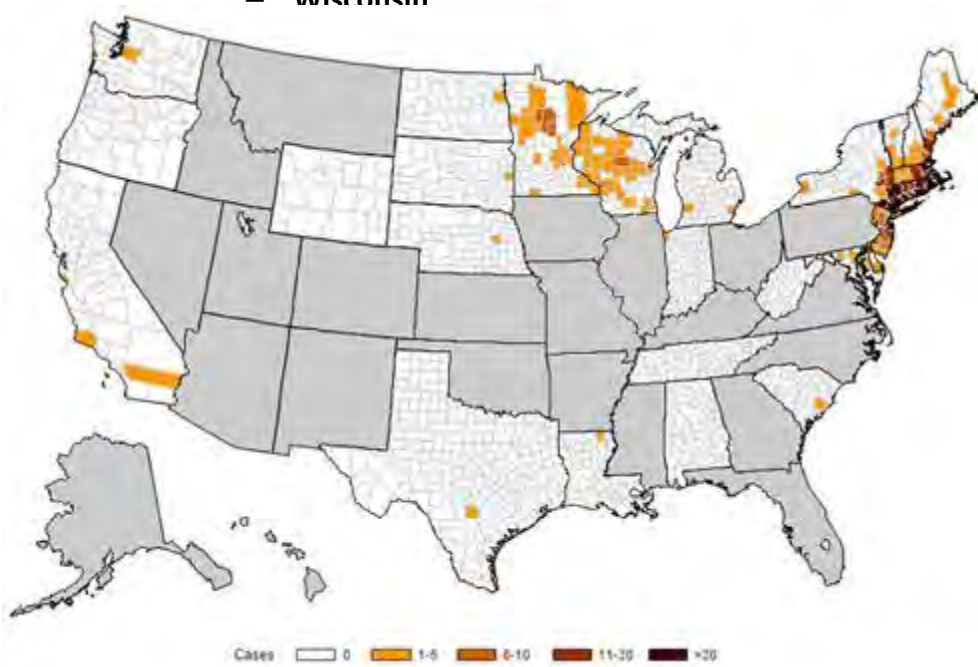
Tick borne Infections

and …Pig-borne?

Babesiosis

- Babesiosis is caused by a protozoan parasite (*Babesia microti, duncani*) spread by infected ticks.
- Most infections asymptomatic or unrecognized
- Incubation 1-6wks.(9 post transfusion)
  - Flu like symptoms
  - Severe: hemolytic anemia, thrombocytopenia, renal failure, ARDS
- Overall mortality~5% (higher if at-risk)
  - i.e. immunocompromised,
  - asplenics,
  - Transfusion – transmitted cases > 200 reported cases from 1979 – 2017 in the U.S.
  - One case in Canada.

- Majority of U.S. Cases reported in:
  - **Connecticut**
  - **Massachusetts**
  - **Rhode Is.**
  - **New York State**
  - **New Jersey**
  - **Wisconsin**



Number of reported cases of babesiosis, by county of residence — 31 states, 2014
1,744 total case-patients
CDC, Atlanta

ISSN 1188-4169

Canada Communicable Disease Report

Relevé des maladies transmissibles au Canada

Date of Publication: 15 January 2000 Vol. 26-02 Date de publication : 15 janvier 2000

Contained in this issue:

Contenu du présent numéro :

TRANSFUSION-TRANSMITTED BABESIOSIS IN ONTARIO: FIRST REPORTED CASE IN CANADA

Introduction

Human babesiosis is a tick-borne zoonosis caused by protozoa of the genus *Babesia*. While the genus comprises over one hundred species, most cases of human babesiosis in North America are caused by *Babesia microti*[1-4]. The great majority of these cases are transmitted by the bite of the deer or blacklegged tick, *Ixodes scapularis*[2-4]. The clinical manifestations of babesiosis range from asymptomatic to severe and occasionally fatal disease characterized by fever, intravascular hemolysis, hemoglobinuria, and renal failure. Severe disease is more common in asplenic individuals, elderly patients, and those with underlying immunodeficiency states including the acquired immunodeficiency syndrome[5,6].

Babesia parasites invade and survive within erythrocytes. They remain viable under blood bank conditions and there have been several well documented cases of babesiosis acquired from blood transfusion in the United States[7-11]. We report the first transfusion-transmitted case of babesiosis in Canada.

Methods

Whole blood samples from the blood donors and the recipient were examined using Giemsa-stained thick and thin films and by the polymerase chain reaction (PCR) for parasite DNA. At least 400 thick smear fields were examined at a magnification of 1,000 times. In addition, at least 400 thin smear fields were examined at a magnification of 1,000 times. Genomic DNA was extracted from whole blood using Qiagen columns and *Babesia* DNA was amplified as previously described[1,12].

Serum specimens were also tested at the United States Centers for Disease Control and Prevention by indirect immunofluorescent antibody (IFA) assay for reactivity to *B. microti* and for human monocytic and human granulocytic ehrlichiosis, and Lyme disease (by enzyme-linked immunosorbant assay [ELISA] and Western blot) by the Ontario Provincial Ministry of Health laboratory.

BABÉSIOSE POST-TRANSFUSIONNELLE EN ONTARIO : PREMIER CAS SIGNALÉ AU CANADA

Introduction

La babésiose humaine est une zoonose transmise par des tiques qui est causée par un protozoaire du genre *Babesia*. Plus d'une centaine d'espèces appartiennent à ce genre, mais la plupart des cas de babésiose humaine en Amérique du Nord sont dus à *Babesia microti*[1-4]. La grande majorité de ces cas sont transmis par la morsure de la tique occidentale à pattes noires, *Ixodes scapularis*[2-4]. Le tableau clinique varie, allant d'une infection asymptomatique à une maladie grave parfois fatale, caractérisée par de la fièvre, une hémolyse intravasculaire, une hémoglobinurie et une insuffisance rénale. Sont plus souvent atteints d'une maladie grave les sujets splénectomisés, les patients âgés et ceux qui souffrent d'un déficit immunitaire sous-jacent, notamment d'un syndrome d'immunodéficience acquise[5,6].

Les parasites du genre *Babesia* envahissent les érythrocytes et survivent à l'intérieur de ces derniers. Ils demeurent viables dans les banques de sang et il existe plusieurs cas bien documentés de babésiose transmise par des transfusions sanguines aux États-Unis[7-11]. Le présent rapport fait état du premier cas de babésiose post-transfusionnelle au Canada.

Méthodologie

Des échantillons de sang total prélevés chez les donneurs de sang et le receveur ont été examinés au moyen de frottis sanguins (gouttes minces et épaisses) avec coloration de Giemsa et d'une réaction d'amplification par la polymérase (PCR) pour l'analyse de l'ADN du parasite. Au moins 400 champs sur gouttes épaisses ont été examinés, agrandis 1 000 fois. De plus, au moins 400 champs sur gouttes minces ont été examinés, agrandis 1 000 fois. L'ADN génomique a été extrait du sang total à l'aide de colonnes Qiagen, et l'ADN de *Babesia* a été amplifié par la méthode déjà décrite[1,12].

Des échantillons de sérum ont également été testés aux Centers for Disease Control and Prevention des États-Unis, par immunofluorescence indirecte (IFA) pour détecter les réactions à *B. microti* et une ehrlichiose monocytaire ou granulocytaire humaine, et le Laboratoire du ministère provincial de la Santé de l'Ontario a effectué un dosage immunoenzymatique (ELISA) et un Western blot pour déterminer s'il s'agissait d'une maladie de Lyme.

CASE REPORT

The first case of locally acquired tick-borne *Babesia microti* infection in Canada

Jared MP Bullard MD FRCPC[1,2,5], Arshad N Ahsanuddin MD[4], Anamarija M Perry MD[4], L Robbin Lindsay PhD[2,5], Mahmood Iranpour PhD[5], Antonia Dibernardo BSc[5], Paul G Van Caeseele MD FRCPC[1,2,5]

JMP Bullard, AN Ahsanuddin, AM Perry, et al. The first case of locally acquired tick-borne *Babesia microti* infection in Canada. Can J Infect Dis Med Microbiol 2014;25(6):e87-e89.

A child with a complicated medical history that included asplenia acquired an infection with *Babesia microti* in the summer of 2013 and had not travelled outside of Manitoba. Although the clinical findings were subtle, astute laboratory work helped to reach a preliminary identification of *Babesia* species, while reference laboratory testing confirmed the diagnosis. Blacklegged ticks (*Ixodes scapularis*) are known to transmit *Borrelia burgdorferi* and *Anaplasma phagocytophilum* in the province; however, the present case represents the first known instance of tick-borne *B microti*, both in Manitoba and in Canada. The expanding territory of the blacklegged tick increases the relevance of this emerging infection. Clinicians, laboratory medical practitioners and public health officials should be aware of *B microti* as a potential locally acquired infection in Canada.

Key Words: *Babesia microti; Babesiosis; Blacklegged ticks; Canada; Emerging infection; Local acquisition*

Le premier cas d'infection à *Babesia microti* transmis par une tique à être contracté au Canada

Un enfant ayant des antécédents médicaux complexes, qui incluaient une asplénie, a contracté une infection à *Babesia microti* pendant l'été 2013, sans avoir quitté le Manitoba. Même si les résultats cliniques étaient discrets, un travail de laboratoire astucieux a contribué à l'identification préliminaire d'une espèce de *Babesia*. Le test du laboratoire de référence a confirmé le diagnostic. On sait que les tiques occidentales à pattes noires (*Ixodes scapularis*) transmettent le *Borrelia burgdorferi* et l'*Anaplasma phagocytophilum* dans la province. Le présent cas est toutefois la première occurrence connue de *B microti* à tique, tant au Manitoba qu'au Canada. L'expansion du territoire de la tique occidentale à pattes noires renforce la pertinence de cette infection émergente. Les cliniciens, les praticiens de laboratoires médicaux et les directeurs de la santé publique devraient savoir que le *B microti* peut être transmis localement au Canada.

CASE PRESENTATION

A seven-year-old boy presented to the emergency department at the Winnipeg Children's Hospital (Winnipeg, Manitoba) on August 7, 2013, with a five-day history of fever (up to 39.5°C) and a headache. He also complained of mild anorexia and malaise. He experienced no other meningeal or respiratory tract symptoms and there was no nausea, vomiting or diarrhea. His urine output was maintained, although urine was darker than normal. He did not complain of arthralgias, arthritis or myalgias. No rash, jaundice or icterus had been noted by his parents. His medical history consisted of multiple congenital anomalies related to a midline defect syndrome that had not been formally diagnosed. These consisted of hydrocephalus treated with a ventriculoperitoneal shunt; panhypopituitarism; partially corrected tetrology of Fallot and dextrocardia; and asplenia secondary to mid-gut malrotation, which was surgically corrected at two weeks of age. The patient had travelled with his relatives to the southeast corner of Manitoba to stay at a cabin four weeks before the onset of symptoms. He did not recall specific tick bites but had numerous mosquito bites during the 48 h he was there. He did not report any other animal exposures. The patient had received blood transfusions for his surgeries during his first month of life, but not after.

Screening blood tests, including electrolyte, urea and creatinine levels, were all within normal limits. His white blood cell count, hemoglobin and platelet levels were also normal. A manual slide review was performed due to abnormalities consistent with his asplenia, and a parasite believed to represent *Plasmodium falciparum* was noted. Blood smears were produced using the remaining blood sample. Numerous ring-form trophozoite parasites were observed within erythrocytes, and a lack of pigment and occasional tetrads/Maltese cross formations were noted (Figure 1). Based on these findings, and a lack of a significant travel history, identification was deemed to be consistent with *Babesia* species.

Twenty-four hours after initial evaluation, the patient was notified to return to the emergency department and the Pediatric Infectious Diseases Service was consulted. At this point, the patient was asymptomatic and the parasitemia level was determined to be 1%. He was diagnosed with mild babesiosis and prescribed a six-week course of atovaquone and azithromycin. Serology testing for *Borrelia burgdorferi* was ordered and found to be negative. Follow-up bloodwork was performed one week into his treatment course. At that time, the patient continued to have headache and intermittent, nonspecific abdominal pain. A mild anemia and slightly increased transaminase levels and bilirubin were noted. A blood specimen was collected and sent to the National Microbiology Laboratory for confirmation of *Babesia microti* infection, and to rule out infection with *B burgdorferi* and/or *Anaplasma phagocytophilum*. While polymerase chain reaction (PCR) was negative for the latter two organisms, real-time PCR was performed using primers that target the chaperonin-containing t-complex eta (CCTη) (1) and subsequently confirmed using a second real-time PCR assay targeting the 18S ribosomal RNA gene (in-house/Applied Biosystems,

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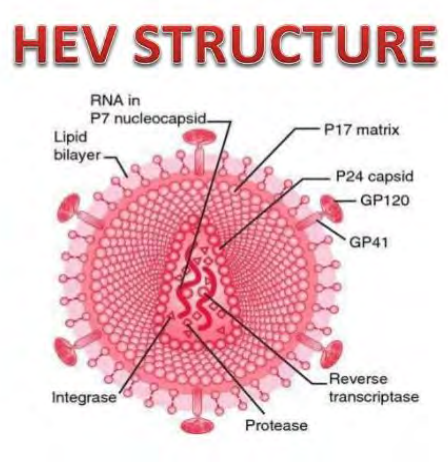
Hepatitis E Virus



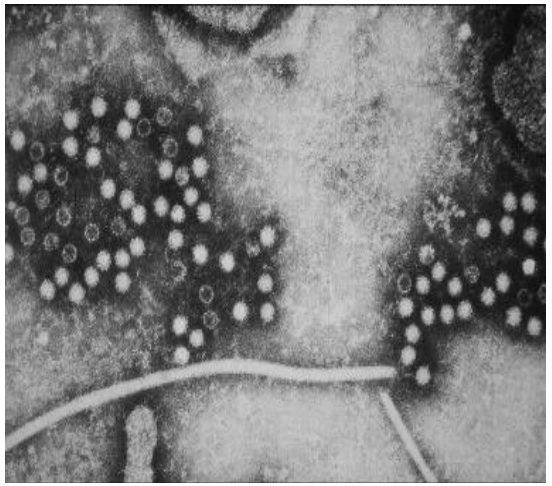
- Non-enveloped RNA virus, Family Hepeviridae
- 4 genotypes (24 subtypes)

1 and 2

- Human strains – Asian and African
- Cause large waterborne outbreaks in developing countries

3 and 4

- Human and animal strains from Europe, North and
- South America, New Zealand and Asia
- Cause sporadic cases
- Probable zoonotic spread



Hepatitis E

- Similar clinically to hepatitis A with no development of chronic hepatitis post acute infection.
- Prevalence in North America unknown but recent studies show it may be commoner than originally thought. Travel is not the only risk factor.
- Contact with pigs, raw pork a risk factor?
- Cases of transfusion transmission have been reported in endemic countries and recently in the U.K., with development of chronic hepatitis in some cases.

**Fearon M, O'Brien S. Hepatitis E in Canadian Blood Donors. Transfusion 2017;57:1420-1425*

Preparing for Emerging Infectious Disease Risks

- **Surveillance**
  - PHAC, WHO, CDC, ProMED mail
  - Collaboration with public health:
    - Diagnostic testing data from National Microbiology Laboratory and provincial Public Health Laboratories
  - Collaboration with Veterinarians, Etymologists, Ornithologists
    - Animal, Bird, Tick and Mosquito surveillance data
  - Transfusion Transmitted Disease committee (AABB), Emerging Infectious Diseases committee (European Blood Alliance)

- **Donor Prevalence Studies**

- **Donor surveys** – risk behaviours, travel

- **Analysis using Risk Based Decision Making Framework (Alliance of Blood Operators)**

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Surveillance

Brazil yellow fever outbreak largest in decades; 846 cases

In this Jan. 16, 2018, file photo, a banner explaining how the yellow fever is transmitted hangs at the entrance of a park in Sao Paulo, Brazil. (AP Photo/Andre Penner)

YELLOW FEVER - AMERICAS (25): BRAZIL
****
A ProMED-mail post
<http://www.promedmail.org>
ProMED-mail is a program of the
International Society for Infectious Diseases <http://www.isid.org>

In this update:
[1] National
[2] Monkeys, Rio Preto, Sao Paulo state

******
[1] National
Date: Wed 28 Mar 2018
Source: Brazil Ministry of Health [in Portuguese, trans. Mod.TY, edited]
<http://portalms.saude.gov.br/noticias/agencia-saude/42916-febre-amarela-ministerio-da-saude-atualiza-casos-no-pais-5>

The Ministry of Health on this Wednesday [28 Mar 2018] updated the information provided by the state secretariats of health concerning the yellow fever situation in the country. During the monitoring period [1 Jul 2017 to 27 Mar 2018] there were 1131 confirmed cases of yellow fever in the country with 338 deaths. In total, during this period 4414 suspected cases were reported; of which 2368 were discarded and 915 remain under investigation. Last year [2017] during the same monitoring period [July 2016 to 20 Mar 2017], there were 660 confirmed cases and 210 confirmed deaths. Since last year [2017], these reports of yellow fever cases show a pattern of disease seasonality, occurring mainly in summer, with the period of analysis considered to be 1 Jul-30 Jun of each year.

Yellow fever in Brazil

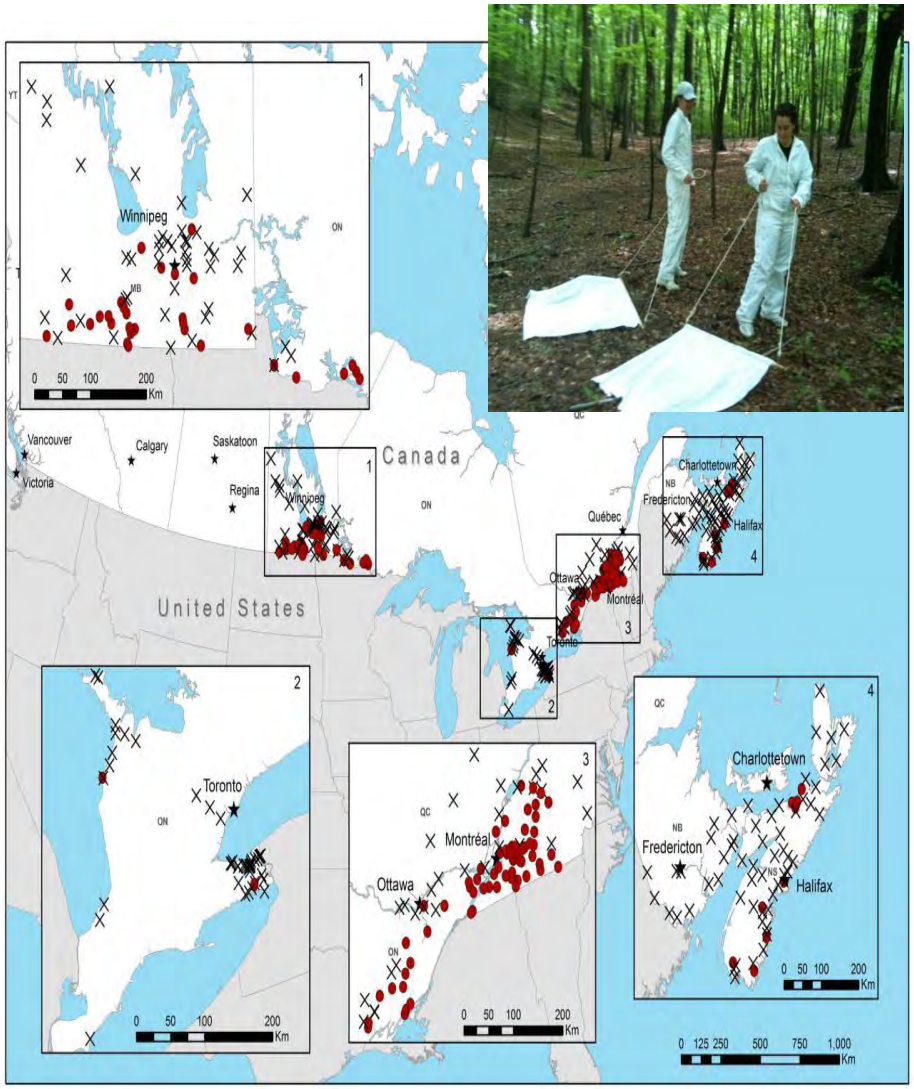
Public Health Agency of Canada | Agence de la santé publique du Canada

Level 2
Practise special precautions

Updated: January 30, 2018
Travel Health Notice
Yellow fever is a serious and occasionally fatal disease. It is caused by a virus which is spread to humans by infected mosquitoes. The most effective way to prevent yellow fever is to be vaccinated.
An outbreak of yellow fever continues to evolve in parts of Brazil and in areas not normally deemed to be at risk of yellow fever transmission.
On January 16, 2018, the World Health Organization (WHO) updated the list of additional areas where yellow fever vaccination is recommended for travellers. This includes the entire states of Espírito Santo, Rio de Janeiro, São Paulo, and areas in Bahia State (see European Centre for Disease Prevention and Control map).

Surveillance

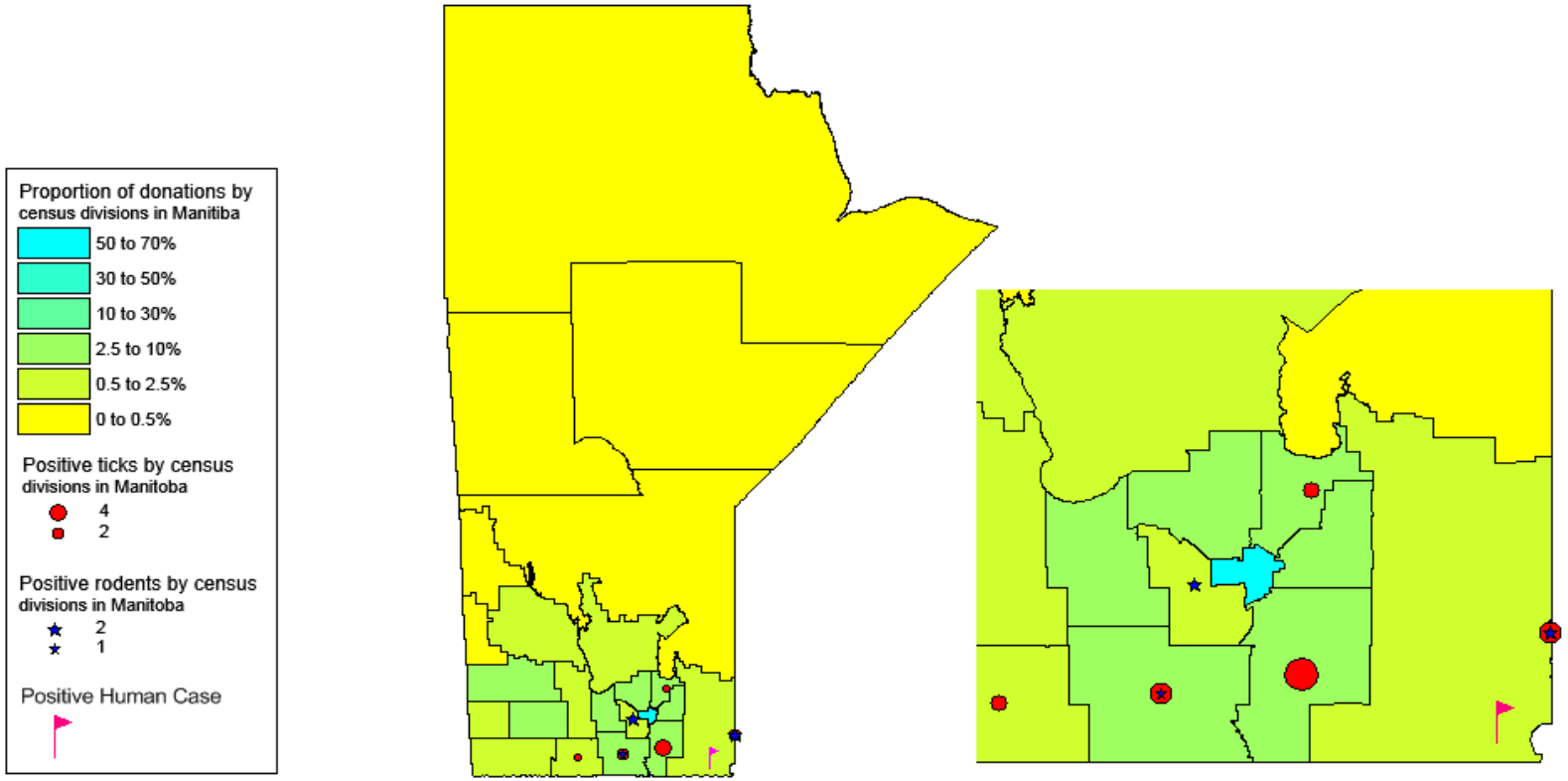
Mosquito surveillance - Dr. Robbin Lindsay spending quality time in the Windsor sewer system



Results of Active Tick Surveillance 2008-2012

Ogden N. et al. Environmental Risk from Lyme Disease in central and eastern Canada: a summary of recent surveillance information. CCDR 2014;40:58-67

Positive ticks and rodents with proportion of CBS donations by census divisions in Manitoba*



O'Brien S, Delage G. et al. Seroprevalence of Babesia microti infection in Canadian blood donors. Transfusion 2016:56:237-243

Donor Prevalence Studies

Results : CBS and Héma Québec Seroprevalence Study #1

Babesia microti IgG Antibody

Samples tested (n= 13,993) from July 15, 2013 – Dec. 11, 2013

No. Tested	Clinic	Babesia microti IgG Ab. Test Result	
		Negative	Positive
158	Toronto	158	0
6364	South Central Ontario	6364	0
1765	N.S./N.B.	1765	0
1775	Winnipeg	1775	0
3931	Hema Quebec	3931	0
TOTAL		13,993	0

HÉMA-QUÉBEC

O'Brien S, Delage G, Lindsay R. et al Seroprevalence of *Babesia microti* infection in Canadian blood donors. Transfusion 2016;56:237-243

Canadian Blood Services
Société canadienne du sang

Babesia Prevalence Study #2
June – November, 2018

- 50,000 Canadian blood donors (CBS and HQ)
- Testing using a highly sensitive (transcription mediated amplification) TMA-NAT assay which detects all species (Grifols) by the American Red Cross.
- Antibody testing of a subset of donors (14,000).
- Donors from every province will be tested.

American Red Cross

HÉMA-QUÉBEC

Canadian Blood Services
Société canadienne du sang

Babesia Study #2 – CBS Results to September 20, 2018

	Total Tested	Total Negative	Total Positive
NAT (nucleic acid testing)	17,056	17,056	0
Antibody (to *B. microti* only)	5358	5358	0

American Red Cross

HÉMA-QUÉBEC

Canadian Blood Services
Société canadienne du sang

Results : CBS and Héma Quebec Seroprevalence Study #1

Hepatitis E Antibody

Table 1: Anti-HEV Data (n = 4110) July 15, 2013 – Dec. 11, 2013

No. Tested	Collection Site	Anti-HEV Result		Seroprevalence rate (%)
		NEG	POS	
1469	South Central Ontario	1383	86	5.85
333	N.S./N.B.	327	6	1.80
356	Winnipeg	338	18	5.06
1952	Quebec	1821	131	6.71
TOTAL		**3869**	**241**	**5.86**

PCR Results: Of **13,993** donors tested there were **0 PCR positives**

HÉMA-QUÉBEC

Canadian Blood Services
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Hepatitis E Prevalence Study #2

- CBS, HQ the American Red Cross (ARC) and Sanquin (Netherlands)
- 50,000 Canadian blood donors (30,000 CBS, 20,000 HQ)
- Collection October 2016 to spring 2017.
- NAT testing (ROCHE Cobas HEV ID- NAT) by the ARC
- All NAT positives go to Sanguin:
  - Antibody testing
  - Serotyping, genotyping, viral load

HÉMA-QUÉBEC

Sanquin

American Red Cross

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Canadian Results Hepatitis E Study #2

11 positives/50,765 valid results

Total: 1:4615 (95% CI: 1:2579-1:9244)

HQ: 1:2920 (95% CI: 1:1417-1:7262)

CBS: 1:7582 (95% CI: 1:2961-1:27,825)

Site	Sex	Age	Province	cobas®HEV Test (Ct value; max = 50)	Viral load (IU/mL)	IgM (S/CO)	IgG (S/CO)	Follow-up IgM (S/CO)	Follow-up IgG (S/CO)
HQ	M	34	Quebec	36.86	68	0.04	0.28	0.05	13.55
HQ	M	60	Quebec	38.92	<10	0.05	1.21	0.1	41.4
HQ	M	59	Quebec	38.89	55	0.01	0.04	0.25	14.62
HQ	M	70	Quebec	38.89	<10	0.47	>15	0.05	276
HQ	F	21	Quebec	34.55	151	2.21	5.87	2.17	31.1
HQ	M	39	Quebec	40.41	28	9.33	14.98	0.91	87.8
HQ	F	41	Quebec	38.29	20	0.01	0.26	2.02	92.4
CBS	M	62	N.S.	37.94	32	0.02	0.03	2.33	147.3
CBS	M	56	Alberta	38.97	43	0.38	0.02	0.76	50.4
CBS	M	17	Alberta	32.35	3080*	0.01	0	0.56	14.91
CBS	M	53	Ontario	39.41	<10	0	0.02	0.1	26.3

*Genotype 3 (unique)

Donor Travel Surveys

Our donors like to travel in the winter…

CBS Donor Travel Survey 2014

Table 5 - Weighted percentages of travel destinations of all whole blood donors in the survey sample, and the projected number of donors in the donor population with travel outside Canada in the past 12 months

	All respondents (n=8,908)	CBS Donors (N=415,829)	
	% of sample	Projected Number Donors	95% C.I.
Travel destinations			
United States	48.0	199,628	(195,314 - 203,942)
Mexico	7.1	29,530	(27,312 - 31,748)
Caribbean	9.3	38,852	(36,339 - 41,365)
South America	0.7	3,035	(2,300 - 3,770)
Central America	0.5	1,984	(1,389 - 2,579)
Europe	9.8	40,625	(38,061 - 43,189)
Middle East	0.6	2,689	(1,997 - 3,381)
Africa	0.4	1,468	(956 - 1,980)
Asia	2.1	8,527	(7,303 - 9,751)
Australia / New Zealand / South Pacific	1.0	4,238	(3,371 - 5,106)

Note: A donor could select more than one travel destination.

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Analysis - Assessing Risk

ALLIANCE OF BLOOD OPERATORS'

Risk-Based Decision-Making Framework for Blood Safety

Changing the Decision-Making Paradigm

Sponsored by the ABO, a team of experts gathered to map out a strategy to change the decision-making paradigm.

A health sector focus

A consistent, standardised approach to decision-making

Evidence-based decisions using risk assessment tools

Acceptable risk based on societal considerations

Multiple sectors included in the decision-making process

The ABO Risk-Based Decision Making Framework for Blood Safety

https://riskframework.allianceofbloodoperators.org/log-in/

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Example – Babesia, an emerging risk
Risk Management Options

Scenario 1	Low risk: manage through public health and tick surveillance coupled with periodic blood donor seroprevalence studies
Option A	When risk is low, maintain surveillance (i.e. monitor public health surveillance for disease such as Lyme disease, ticks and human cases, in Canada and U.S.) and undertake enhanced surveillance in the form of a blood donor seroprevalence study every 3-5 years. Timing of the study will be guided by data emerging from ongoing surveillance such as increased babesiosis in U.S. states or human cases in Canada.

Scenario 2	Risk escalates: requires a more substantial mitigation response, over and above the ongoing prevalence surveillance.
Option B	If risk increases based on information from Options A, stop collecting blood from the risk area.
Option C	If risk increases based on information from A, undertake selective testing for babesiosis of a) donors living in high risk areas and b) travellers to US or Canadian risk areas.
Option D	Maintain a small inventory of babesia tested units for selected patients, e.g. neonates.
Option E	Implement universal testing for babesiosis.
Option F	Implement pathogen reduction technology.

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I did the math
we can't afford the dog

Example: Risk Assessment
Risk of Zika virus Infection from Donors Who Travel to Endemic Areas

RIU_{travel} = R_{zika} x Par x DV

(Without 21 day travel deferral)

If you can't convince them, confuse them.

RIU_{travel} = 0.000522151 x 0.0226 x 0.2190

(Without 21 day travel deferral) = 0.000002584, 1 IN 386,996

Assuming 99% of risk from travelers is addressed by 21 day deferral

RIU_{travel} = 1 in 38,699,600

(With 21 day travel deferral for donors travelling outside Canada, the continental U.S. and Europe)

Germain M, Delage G et al Mitigation of the threat posed to transfusion by donors travelling to Zika-affected areas: a Canadian risk-based approach. Transfusion2017;57:2463-2468

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Mitigation Strategies

'In preparing for battle, I have always found that plans are useless but planning is indispensable.'

Dwight D. Eisenhower

- Donor Selection

  Risk factors –Travel, behavioral, medical

- Donor Deferral

  Indefinite - HIV positive

  Time limited - 21 day travel deferral (Zika, Dengue, Chikungunya),
  - 4 week deferral after Yellow fever vaccine

- Donor Testing

  Universal - HIV

  Selective - Chagas Disease – for risk only
  - West Nile Virus - seasonal

- Pathogen Inactivation (not yet widely implemented)
  - Licensed product available for Plasma (SD Plasma *Octaplasma* *(*Octapharma)and now Platelets and Plasma (*Intercept* (Cerus)
  - *Not effective against all pathogens – ie. Hepatitis E, Human Parvovirus*

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Babesia Mitigation in the U.S.

- Blood donor testing in some highly endemic areas (northeastern U.S.) have been implemented by some blood operators, under IND - antibody testing and/or NAT (*Antibody Assay recently FDA approved*)
  - Issues
    - Infection is geographic, but donors travel.
    - Infection is seasonal but parasite may persist for months.
    - Current antibody test detects only *B. microti.*
    - Neither antibody nor NAT will detect all infections.
- FDA has recently published *Draft Guidance* on Babesia mitigation, recommending regional testing of all donors in endemic areas, and deferral of positive donors for at least 2 years.

Hepatitis E Mitigation Strategies in Europe

- In 2016 the NHSBT (UK) started selected HEV donor (NAT) testing (similar to CMV tested inventory). January 2017 they switched to universal donor testing for logistical reasons.
- Hepatitis E donor testing also occurring in:
  - Ireland (universal donor screening)
  - Netherlands (universal donor screening – donor prevalence 24%)
  - France (40% of plasma and all organ transplant donors)
- However, the real risk is dietary
- In the Netherlands, 1:700 cases per year due to transfusion transmission.
- One year of living in the Netherlands = risk from 30 RBC components.

Red meat is not bad for you

Fuzzy green meat is bad for you.

O'Gorman J, Burke A. et al Hepatitis E virus-key points for the clinical haematologist. British Journal of Haematology.2018:doi:1111/bjh.15133

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Hepatitis E Mitigation Strategy in Canada

- Prevalence in Canadian blood donors still very low. In positive donors, viral loads are below that seen in cases of transfusion transmission in the UK and Germany*.
- No FDA or Health Canada approved donor sceening assay.
- Currently performing a Risk Based Decision making analysis in collaboration with Héma Québec, using data from the recent HEV prevalence study.
- Recommendations will be presented to our Executive Management Teams.

*Hewitt P, Ijaz S. et al. Hepatitis E virus in blood components: a prevalence and transmission study in southeast England. Lancet 2014;384:1766-73

Dreier J, Knabbe C et al. Transfusion transmitted hepatitis E:NAT screening of blood donations and infectious dose. Frontiers in Medicine 2018;5:5.doi:10.3389/fmed.2018

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IT WAS THE GERMAN CHANCELLOR, Otto von Bismarck, who warned his countrymen that "laws are like sausages, it is better not to see them being made."

If you think preparedness is expensive, try disease.

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