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Oropouche Virus – What You Need To Know

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Public Health Ontario

December 5, 2024

PHO Microbiology Rounds

Disclosure

- No commercial disclosures
- In addition to my role as a Clinical Microbiologist at Public Health Ontario, I am also an Assistant Professor in the Department of Laboratory Medicine & Pathobiology at the University of Toronto

Learning Objectives

By the end of this session, participants will be able to:

- Describe the important virologic properties of the Oropouche virus and related zoonotic and vector-borne viruses
- Explain the current epidemiologic patterns of Oropouche virus infections in the Americas and how it may impact people living in Ontario
- Discuss important drivers that may be contributing to the current Oropouche virus outbreaks
- Describe laboratory testing methods and algorithms for the detection of Oropouche virus infection

Oropouche Virus and Oropouche Fever Made Headlines in 2024

A virus spread by tiny insects is on the rise in Brazil and Cuba. Here's how to protect yourself [1]

People move virus north beyond its traditional niche in Amazon

Amina Zafar · CBC News · Posted: Aug 30, 2024 4:00 AM EDT | Last Updated: August 30

Canada warns pregnant travellers of 'risks' from Oropouche fever [2]

By Saba Aziz • Global News
Posted September 4, 2024 10:07 am · Updated September 4, 2024 10:20 am · **2 min read**

What is Oropouche virus? The emerging threat is raising concern among health officials [3]

By Deidre McPhillips, CNN
5 minute read · Published 3:42 PM EDT, Tue August 27, 2024

HEALTH

'Sloth fever,' or the Oropouche virus, has entered the US, here's what to know [4]

Travelers returning to US from Cuba contracted the virus in recent months

By Melissa Rudy · Fox News
Published August 28, 2024 3:39pm EDT

BBC

Home News US Election Sport Business Innovation Culture Arts Travel Earth Video Live

Oropouche: The mysterious 'sloth virus' with no treatment [5]

29 August 2024

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Onur Erem, André Biernath and Richard Gray

Origins of Oropouche Virus and Oropouche Fever

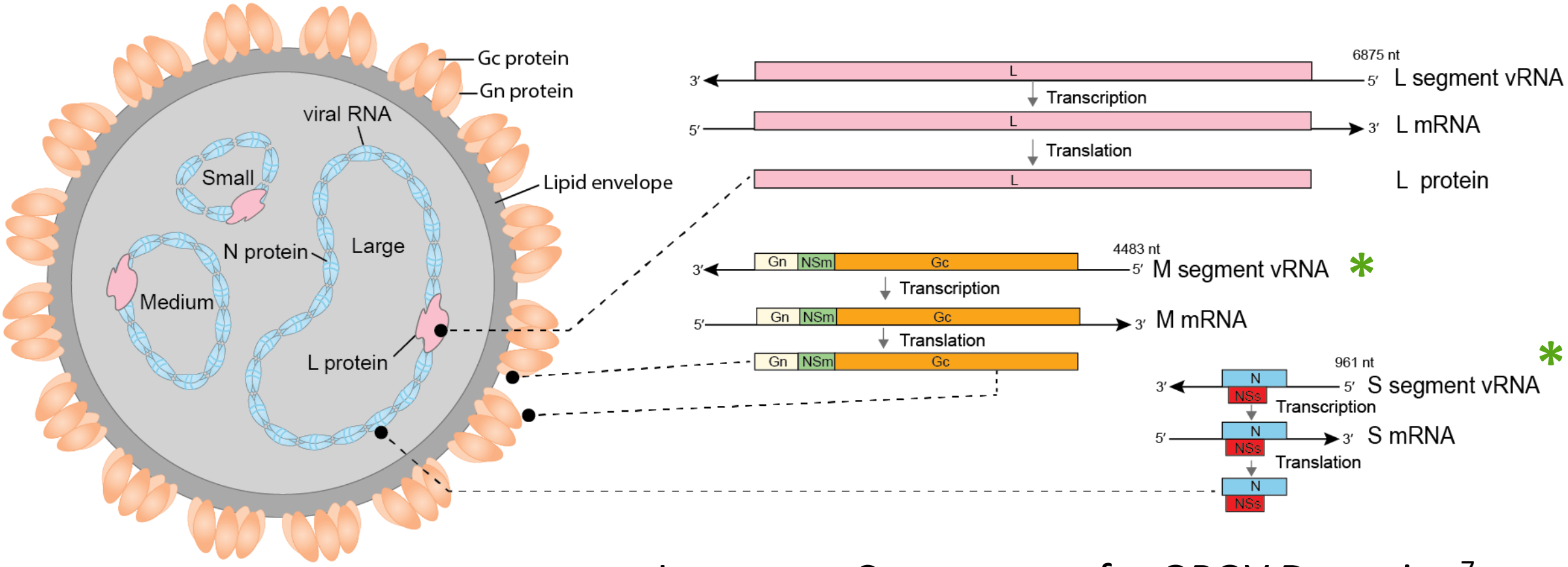
© Google Maps. 2024[6]

Virological Properties of Oropouche Virus

Orthobunyavirus oropoucheense (Oropouche Virus, OROV)

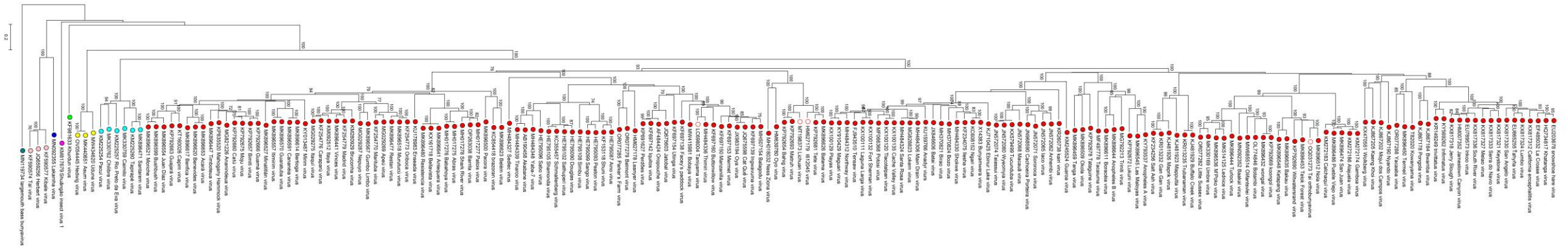
- Emerging arthropod-borne virus
- **Family**: *Peribunyaviridae*; **Genus**: *Orthobunyavirus*
- Single-stranded, negative sense RNA virus
- Circulates in Central and South America and the Caribbean[7,8]
  - endemic in many South American countries
  - several outbreaks have occurred in past 10 years in Amazon region
- Suggested to be one of the most important vector-borne diseases in Latin America but true burden of disease is unknown[7,8]

Oropouche Virus Genome Structure (*Peribunyaviridae*)



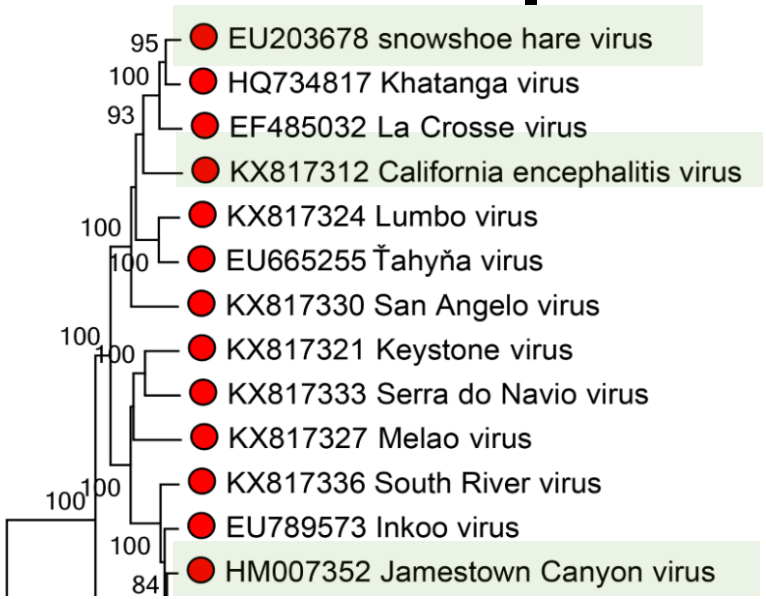
* Important Components for OROV Detection[7]

Related Viruses Within the *Orthobunyavirus* Genus

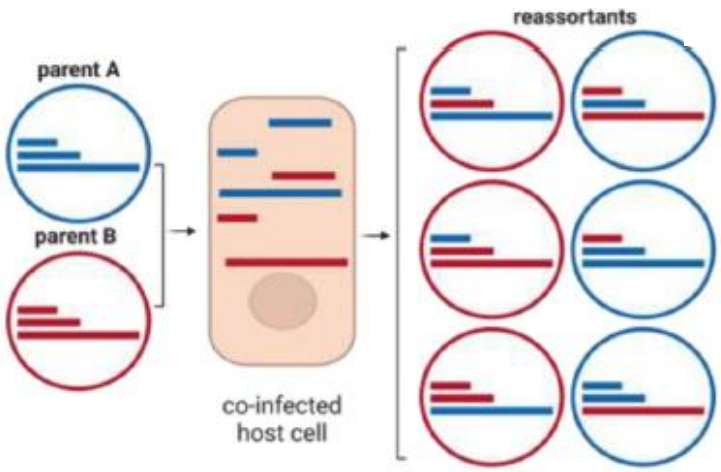


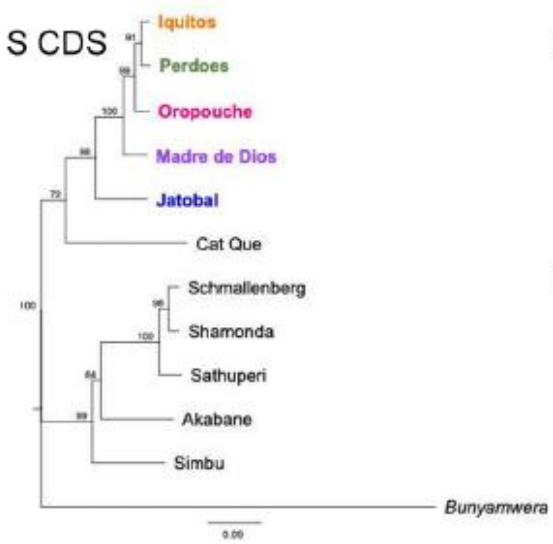
Oropouche and Oropouche-like viruses “Simbu serogroup”[7]

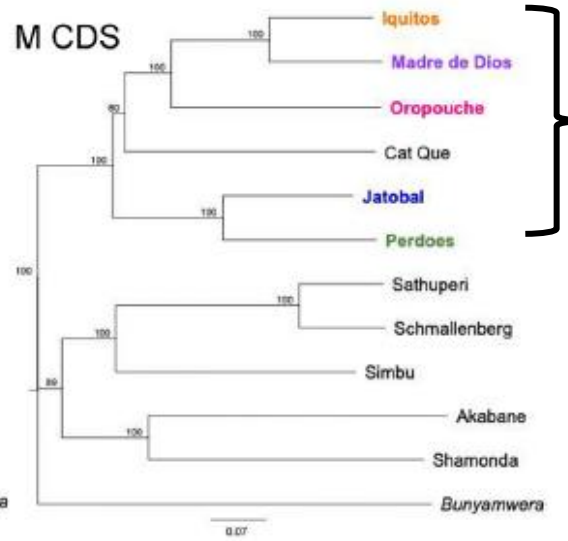
Orthobunyaviruses that are found in Canada



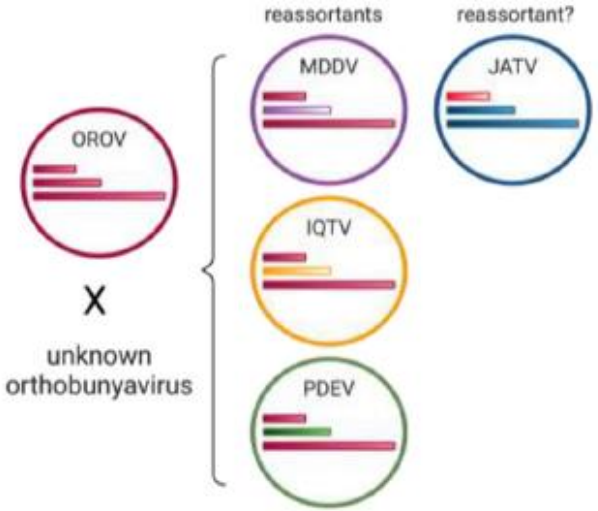
Description of Oropouche-like Reassortant Viruses

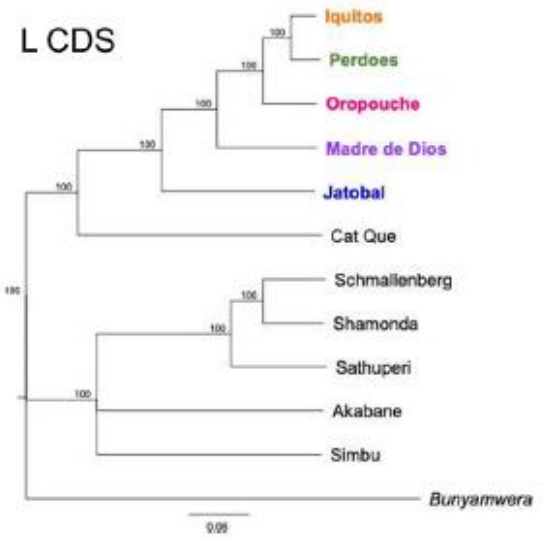






Variation in M gene[9,10]



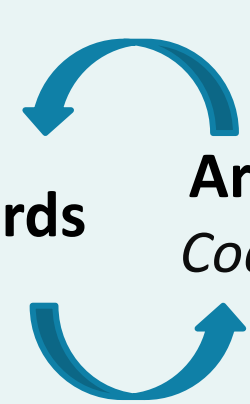


Current Epidemiology of Oropouche Virus

Transmission Cycles of OROV are Poorly Understood

Sylvatic Cycle[11]

Three-toed Sloth
Bradypus tridactilus



Birds

Arthropods (Mosquitos)
Coquillettidia venezuelensis
Aedes serratus

Marmoset
Callitrix flaviceps

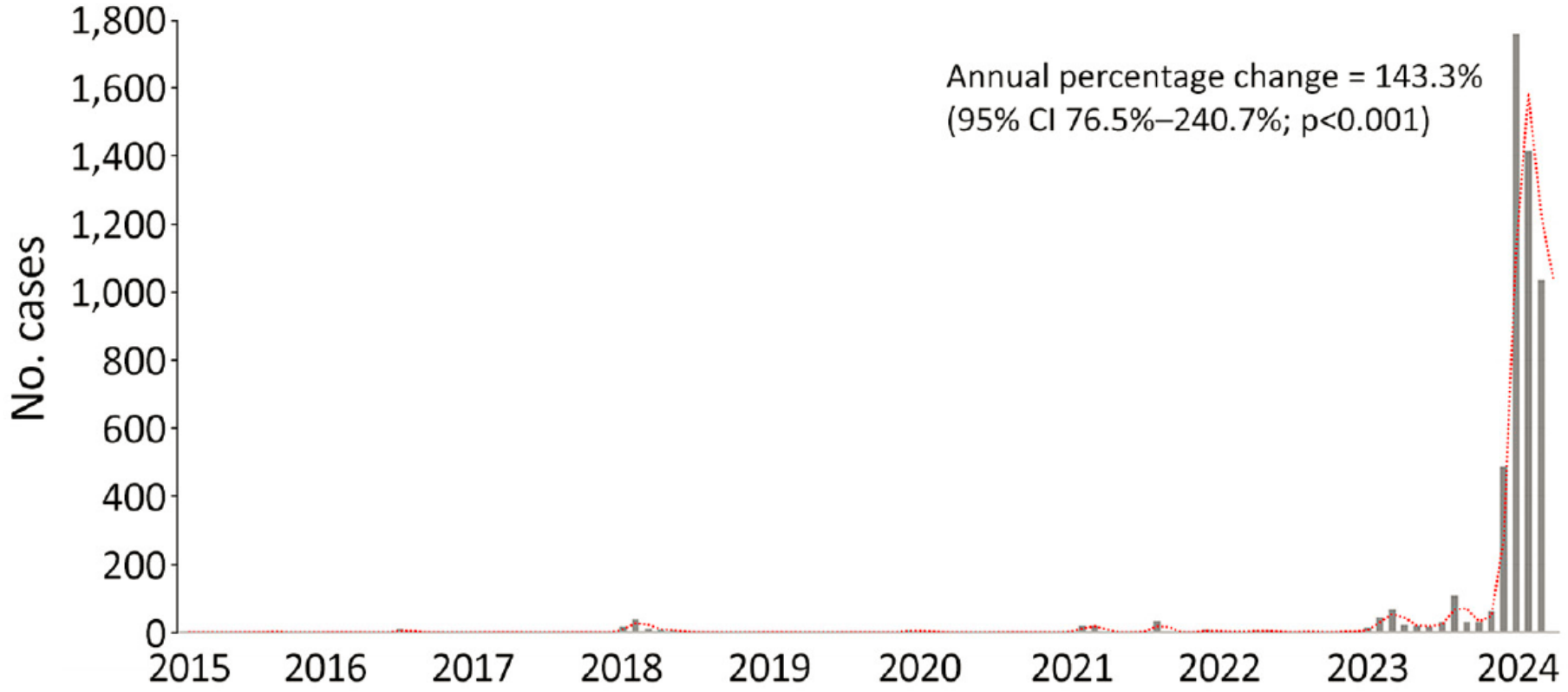
Humans

Urban Cycle[11]

Arthropods (Midges, Mosquitos)
Culicoides paraensis
Culex quinquefasciatus

Cause for Concern of OROV Re-Emergence/Outbreaks

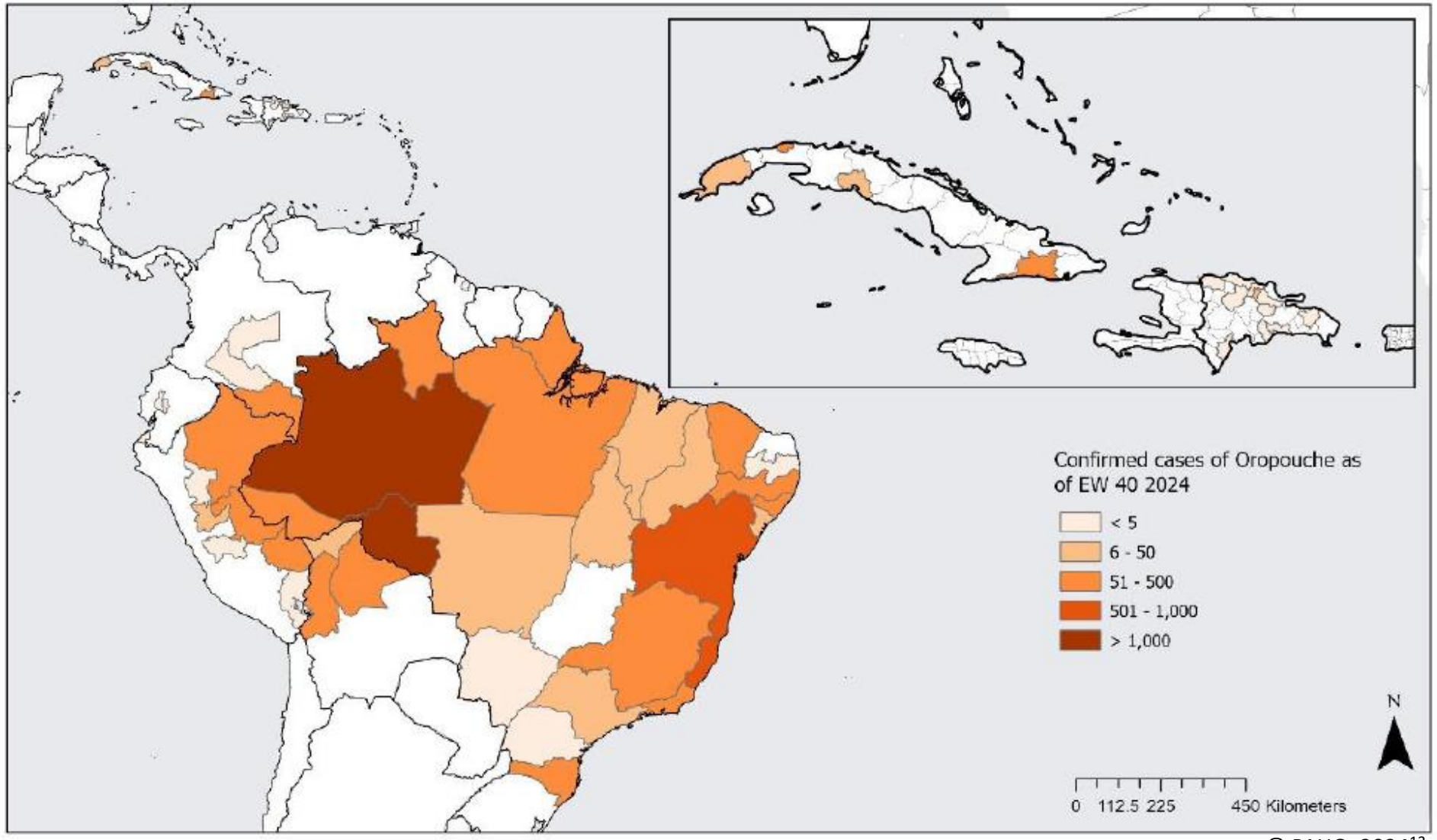
Increase in cases first noted in Brazil between Dec 2023 and May 2024[12]



Evolving OROV Situation in 2024 in The Americas

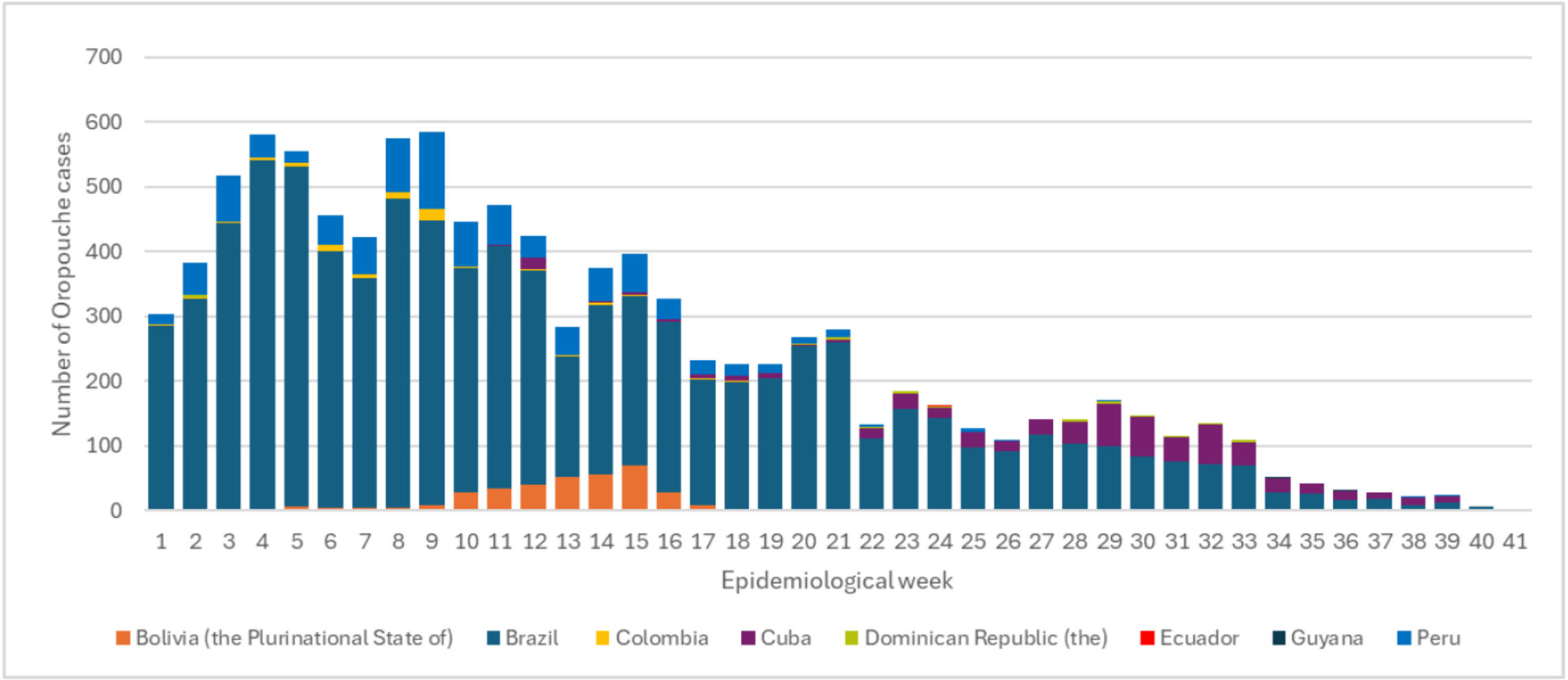
Country	No. of Confirmed Cases (EW 40)
Bolivia	356
Brazil	8,258
Colombia	74
Cuba	555
Dominican Republic	23
Ecuador	2
Guyana	2
Peru	936
Total	**10,275**

Evolving OROV Situation in 2024 in The Americas, Continued



© PAHO, 2024[13]

Expansion of OROV Infection in The Americas in 2024



Travel-Associated Oropouche Virus Infections

Continent or Country	No. of Confirmed Cases
Canada	2
United States	94
Europe	30
Total*	**126**

* As of Nov 19, 2024; estimations based on available data

Clinical Manifestations of Oropouche Virus Infection

Clinical Signs and Symptoms of OROV Infection

- Incubation period estimated to be **4 to 10 days** from exposure
- Initial symptoms are mild and non-specific, resembles infections with Dengue virus, Chikungunya virus or Zika virus infection
  - Fever, headache, myalgia, arthralgia, anorexia, dizziness, chills, nausea, gastrointestinal symptoms, photophobia, retro-orbital pain, ± rash
- **Symptom relapse can occur after initial resolution (e.g. days to weeks)**
- Progression to severe disease (e.g. neuroinvasive disease) or presentation with hemorrhagic manifestations is not typical

Clinical Signs and Symptoms of OROV Infections in 2024

Oropouche Fever, Cuba, May 2024

Ana Julia Benitez,[1] Mayling Alvarez,[1] Lissette Perez, Rosario Gravier, Silvia Serrano, Denelsys Milagro Hernandez, Melissa Maria Perez, Gladys Gutierrez-Bugallo, Yanet Martinez, Ariamys Companioni, Carilda Peña, Jose Raul de Armas, Dayana Couto, Iliovanys Betancourt I, Madelaine Rivera Sanchez, Sonia Resik, Vivian Kouri, Maria G. Guzman

Source: Benitez AJ, Alvarez M, Perez L, Gravier R, Serrano S, Milagro Hernandez D, et al. Oropouche fever, Cuba, May 2024. Emerg Infect Dis. 2024;30(10):2155-9. Available from: https://doi.org/10.3201/eid3010.240900

Characteristics of Locally-Acquired OROV Infections in Cuba

Table 1. Epidemiologic characteristics of confirmed cases of Oropouche fever, Cuba, 2024*

Data	Values
M:F ratio	51/48 (1.1)
Median days of sample collection according to illness onset (range)	2 (0–4)
Median age, y (range) [IQR]	34.5 (4–83) [18–50.5]

*IQR, interquartile range.

Table 2. Clinical characteristics of patients with confirmed Oropouche fever, Cuba, 2024

Clinical signs/symptoms	No. (%) patients
Fever	86 (86.9)
Headache	71 (71.7)
General malaise	51 (51.5)
Arthralgia	22 (22.2)
Asthenia	18 (18.1)
Anorexia	16 (16.2)
Retroocular pain	14 (14.1)
Abdominal pain	8 (8)
Vomiting	7 (7)
Diarrhea	7 (7)
Chills	4 (4)
Lumbar pain	3 (3)

Source: Benitez AJ, Alvarez M, Perez L, Gravier R, Serrano S, Milagro Hernandez D, et al. Oropouche fever, Cuba, May 2024. Emerg Infect Dis. 2024;30(10):2155-9. Available from: https://doi.org/10.3201/eid3010.240900

Clinical Signs and Symptoms of Travel-Associated OROV Infection

Morbidity and Mortality Weekly Report

Oropouche Virus Disease Among U.S. Travelers — United States, 2024

Andrea Morrison, PhD[1]; Jennifer L. White, MPH[2]; Holly R. Hughes, PhD[3]; Sarah Anne J. Guagliardo, PhD[3]; Jason O. Velez[3]; Kelly A. Fitzpatrick, MSPH[3]; Emily H. Davis, PhD[3]; Danielle Stanek, DVM[1]; Edgar Kopp, MS[4]; Peter Dumoulin, PhD[4]; Timothy Locksmith, MS[4]; Lea Heberlein, DrPH[4]; Rebecca Zimler, PhD[1]; Joshua Lassen, MPH[1]; Carolina Bestard, MPH[5]; Edhelene Rico, MPH[5]; Alvaro Mejia-Echeverri, MD[5]; Kay-Anna Edwards-Taylor[6]; Douglas Holt, MD[6]; Dionisia Halphen, MPH[7]; Kaitlynn Peters, MHS[8]; Cheryl Adams[9]; Amanda M. Nichols, MPH[10]; Alexander T. Ciota, PhD[11]; Alan P. Dupuis II[11]; P. Bryon Backenson, MS[2]; Jennifer A. Lehman[3]; Shelby Lyons, MPH[3]; Hannah Padda, DVM[3,12]; Roxanne C. Connelly, PhD[3]; Van T. Tong, MPH[13]; Stacey W. Martin, MSc[3]; Amy J. Lambert, PhD[3]; Aaron C. Brault, PhD[3]; Carina Blackmore, DVM[14]; J. Erin Staples, MD, PhD[3]; Carolyn V. Gould, MD[3]

Source: Morrison A, White JL, Hughes HR, Guagliardo SAJ, Velez JO, Fitzpatrick KA, et al. Oropouche virus disease among U.S. travelers - United States, 2024. MMWR Morb Mortal Wkly Rep. 2024;73(35):769-73. Available from: https://doi.org/10.15585/mmwr.mm7335e1

Characteristics of Travel-Associated OROV Infections in USA

- 21 returned travelers from Cuba; majority from FL
- Median age: 48
- 48% were female
- Most patients were assessed during acute illness
- Three individuals had recurrence of symptoms

TABLE 1. Characteristics of U.S. travelers with Oropouche virus disease (N = 21) — United States, 2024

Characteristic	No. (%)
Age group, yrs	
0–19	2 (10)
20–39	5 (24)
40–59	10 (48)
≥60	4 (19)
Sex	
Female	10 (48)
State of residence	
Florida	20 (95)
New York	1 (5)
Location of travel	
Cuba	21 (100)
Symptom onset, month	
May	1 (5)
June	6 (29)
July	14 (67)

Signs/Symptoms of Travel-Associated OROV Infections in USA

TABLE 2. Signs and symptoms* reported by U.S. travelers with Oropouche virus disease (N = 21) — United States, 2024

	Sign or symptom											
Patient	Fever	Myalgia	Headache	Fatigue/ Malaise	Arthralgia	Diarrhea	Retroorbital pain	Abdominal pain	Nausea/ Vomiting	Back pain	Rash	Mucosal bleeding
A	X	X	X	X	X	—	X	—	X	X	—	—
B	X	X	X	X	X	—	X	—	—	—	X	—
C	X	X	X	X	X	—	—	—	—	X	X	—
D	X	X	X	X	X	X	—	X	—	—	—	—
E	X	X	X	X	—	X	—	X	X	—	—	—
F	X	X	X	X	—	X	—	X	—	X	—	—
G	X	X	X	X	—	—	—	—	—	—	—	—
H	X	X	X	—	X	—	—	—	X	—	—	—
I	X	X	X	—	X	—	—	X	—	—	—	X
J	X	X	X	—	—	—	—	—	X	—	—	—
K	X	X	X	—	—	X	—	—	—	—	X	—
L	X	X	X	—	—	—	—	—	—	—	—	—
M	X	X	X	—	—	—	—	—	—	—	—	—
N	X	X	—	X	X	—	—	—	—	X	X	—
O	X	X	—	X	X	X	—	—	—	—	—	—
P	X	X	—	—	X	X	X	X	—	—	—	—
Q	X	X	—	—	X	X	—	—	—	—	X	—
R	X	—	X	X	—	X	X	X	X	—	—	—
S	X	—	X	X	X	X	—	—	—	—	—	—
T	X	—	—	X	—	X	—	—	—	—	X	—
U	—	X	X	X	X	—	X	—	X	—	—	—
Total no. (%) reporting sign or symptom	20 (95)	18 (86)	16 (76)	13 (62)	12 (57)	10 (48)	5 (24)	6 (29)	6 (29)	4 (19)	6 (29)	1 (5)

Possible Vertical Transmission of OROV in Recent Outbreak

- On July 17, 2024, PAHO issued an epidemiological alert over OROV infections associated with adverse pregnancy outcomes (e.g. fetal deaths, congenital abnormalities) in Brazil[17-19]
- OROV detected in fetal tissues by PCR (e.g. brain, liver, kidneys, CSF, placenta and umbilical cord); pathological findings also noted
- Frequency of vertical transmission and if timing of OROV disease during pregnancy increases the risk of an adverse outcome are unknown

Factors Contributing to Oropouche Virus Outbreaks

What is Driving Changes in OROV Dynamics in The Americas?

- Changing climates (e.g. increased humidity, rainfall and temperature)
- Modification of vector distribution/proliferation
- Establishment of new urban hotspots for transmission
- Human behavior and activities (e.g. deforestation, urbanization, mobility)
- Possible virus re-assortment/emergence of new viral variant

Novel Re-Assortant Oropouche Virus Identified in Brazil

- Naveca and colleagues generated 75 OROV genomes from Brazilian outbreak blood samples using amplicon-based whole genome sequencing[21]
- Phylogenetic analyses indicated discordance between OROV genomic segments (S, L, M) suggesting successive reassortment events throughout the evolutionary timeline of OROV in South America[21]
- Current $OROV_{BR\text{-}2015\text{-}2023}$ clade is an $M_1L_2S_2$ reassortant virus that acquired the M segment from $OROV_{BR\text{-}2009\text{-}2018}$ clade and L+S segments from $OROV_{PE/CO/EC\text{-}2008\text{-}2021}$ clade which has circulated since the late 2000s[21]

Public Health Response in OROV Affected Areas

- Investigation and identification of possible transmission cycles
- Increased active Dengue and Oropouche infection surveillance (monitoring of acute febrile illnesses)
- Vector control measures implemented in areas of confirmed transmission (insecticide treatments, source reduction, environmental management)
- Greater recognition that preparedness, communication and surveillance are critical in preventing/limiting further outbreaks

Laboratory Testing for Oropouche Virus

What Testing is Available in Canada for Oropouche Virus?

Limited testing available in Canada:

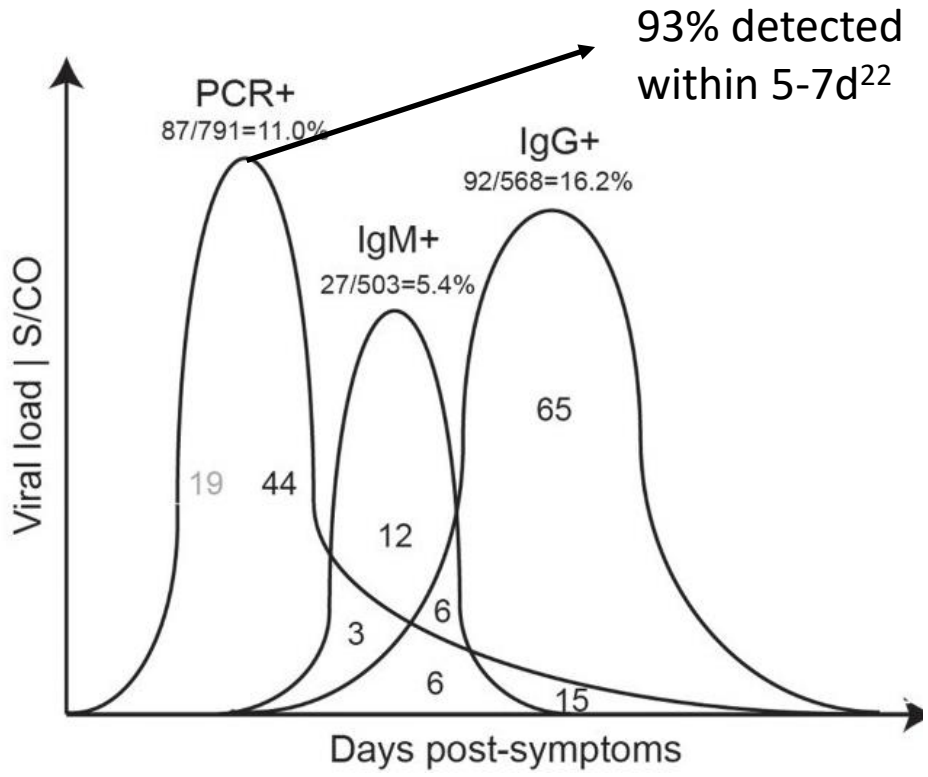
- testing not considered routine; restricted indications for testing
- **last resort test** due to uncertain clinical utility

PCR:

- Detection of *S* and *M* genes
- Investigational use only

Serology:

- PRNT only (at CDC)
- No IgM/IgG testing available



Oropouche Virus Testing at PHOL

- Test information sheet available on PHO's website[23]
  - PCR and serology (PRNT) available for **investigational use only**
- OROV testing is considered a **special request** and **requires PHO Microbiologist approval**; eligible requests are referred out to the NML
- Clinical risk assessment encouraged prior to requesting testing - review clinical status, travel and exposure history and consideration of alternative diagnoses (e.g. Dengue virus infection)

PHOL Oropouche Virus Testing Information

Home › Laboratory Services › Test Information Index › Oropouche Virus

Oropouche Virus

https://www.publichealthontario.ca/en/Laboratory-Services/Test-Information-Index/Oropouche-Virus

Consistent with O. Reg. 671/92 of the *French Language Services Act*, laboratory testing information on this page is only available in English because it is scientific or technical in nature and is for use only by qualified health care providers and not by members of the public.

This page provides testing information for Oropouche virus at Public Health Ontario (PHO). The causative agent of Oropouche fever is the Oropouche virus, an RNA virus that is a member of the *Peribunyaviridae* family. This arthropod-borne virus (arbovirus) is transmitted primarily by the bite of an infected midge or mosquito[1]. Recent evidence also suggests mother-to-fetus (vertical) transmission may be possible, but a clear relationship has not yet been established[2,3]. The virus is believed to have a similar geographic distribution and clinical presentation as other more common arboviruses, including **Dengue virus**, **Chikungunya virus** and **Zika virus**. Cases of Oropouche fever have been detected predominantly in Central and South America and the Caribbean[1,2,4].

- As of August 12, 2024, 5 countries in South America and the Caribbean (Bolivia, Brazil, Colombia, Cuba and Peru) are currently experiencing outbreaks of Oropouche fever.
- Recommendations for laboratory testing have been described by the Pan American Health Organization (PAHO) and the Centers for Disease Control and Prevention (CDC)[5,6].

Testing Indications	Specimen Collection and Handling	Requisitions and Kit Ordering
Test Frequency and Turnaround Time (TAT)	Test Methods	Reporting
References		

Criteria for Oropouche Virus Testing at PHOL

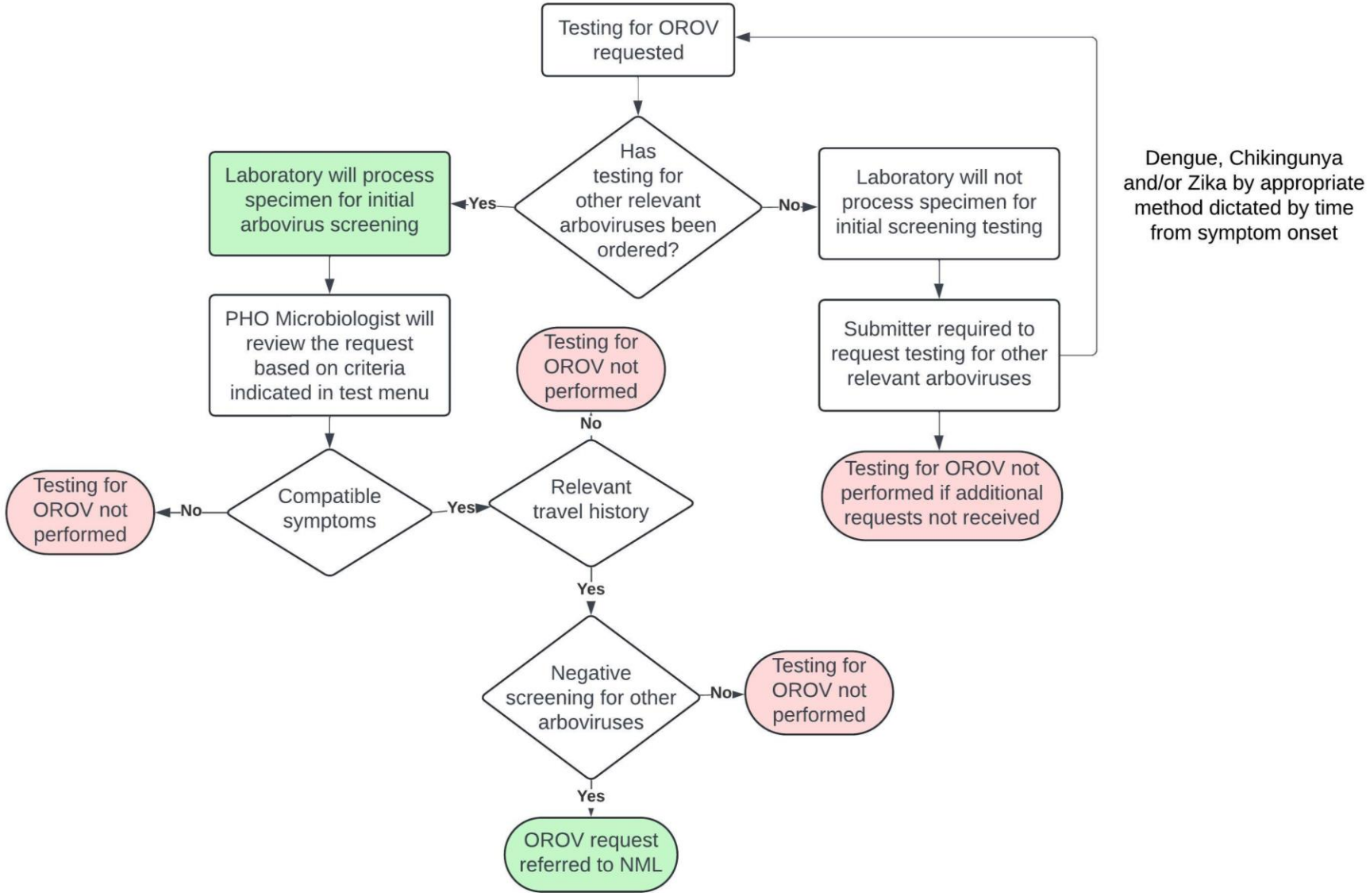
Individuals that may be considered for OROV testing include[23]:

Returned travelers OR **individuals who reside in areas of risk** that meet the following criteria:

- Compatible symptoms
- Travel to an area with documented or suspected OROV transmission
- Testing for other relevant arboviruses has been performed*
- OROV testing may impact patient management

*Dengue virus, Chikungunya virus, and/or Zika virus as appropriate

Assessing Eligibility for OROV Testing at PHOL



Oropouche Virus Risk to Canadians

Risk Assessment for OROV Infection in Canada

- Anticipated to be **low-risk** to general population
- International travelers to areas of ongoing transmission should take precautions (especially if pregnant)
- Climate in Canada unable to sustain probable vectors for cases to be domestically-acquired
- Risk assessments/testing approaches not well described for pregnant travelers; health impacts estimated by PHAC to be **major**

Source: Public Health Agency of Canada. Rapid risk assessment: Oropouche virus (OROV), public health implications for Canada [Internet]. Ottawa, ON: Government of Canada: 2024 [cited 2024 Nov 27]. Available from: https://www.canada.ca/en/public-health/services/emergency-preparedness-response/rapid-risk-assessments-public-health-professionals/oropouche-virus.html#a3

Considerations for OROV Infection Prevention

Similar preventative measures will apply as for other arboviruses

- Pre-travel consultation with healthcare provider or travel clinic
- Use of approved insect repellent (and regular re-application)
- Limit outdoor activities during active vector times
- Wear light-coloured clothing that limits amount of exposed skin
- Use mosquito netting when sleeping outdoors or in non-enclosed spaces and protect living spaces with screens
- Wear insecticide-treated clothing

Source: Canada. Ministry of Travel and Tourism. Oropouche virus disease in the Americas [Internet]. Ottawa, ON: Government of Canada: 2024 [cited 2024 Nov 27]. Available from: https://travel.gc.ca/travelling/health-safety/travel-health-notices/534

Areas Requiring Additional Investigation

- Epidemiologic trends (e.g. reservoirs, vector ecology, transmission cycles)
- Additional information on clinical presentation, sequelae, morbidity/mortality and vertical transmission
- Identification of risk factors for severe disease
- Improved laboratory diagnostics, development of treatments/vaccines

Questions?

Shawn Clark (Shawn.Clark@oahpp.ca)

Public Health Ontario keeps Ontarians safe and healthy. Find out more at **PublicHealthOntario.ca**

Ontario

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7. International Committee on Taxonomy of Viruses. Peribunyaviridae [Internet]. ICTV: 2024 [cited 2024 Nov 26]. Available from: https://ictv.global/report/chapter/peribunyaviridae/peribunyaviridae/orthobunyavirus

8. International Committee on Taxonomy of Viruses. Bunyaviridae [Internet]. ICTV: 2024 [cited 2024 Nov 26]. Available from: https://ictv.global/report_9th/RNAneg/Bunyaviridae

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