

A Literature Review of Zika Virus

Technical Appendix

Technical Appendix Table 1. Seroprevalence surveys of Zika virus infection by location, January 1, 1952–February 10, 2016*

Continent/country	% Seropositivity (details)	Years survey performed	Laboratory assessment method	Ref
Africa				
Kenya	17.6 (476/2,698 serum samples)	1966–1968	HI only	(74)
Nigeria†	a) 31.2 (59/189 by HI; 40.3 (121/300 by neutralization) b) 56.2 (150/267) c) 11.5 (15/131 by HI, 1965 and 1970); 12.2 (18/147 by HI and neutralization, 1970–1971)	a) 1971–1975 (b) 1980 c) 1965, 1970–1971	a) HI and/or neutralization b) HA and HI only c) HI or HI followed by neutralization	a) (75) b) (76) c) (77)
Côte d'Ivoire	47.6 (20/42)	1999	IgG by ELISA only	(78)
Senegal	6.7 (57/852)	1988, 1990	IgM by ELISA only	(79)
The Gambia	86.0 (37/43 by HI); 23.8 (10/28 by CF)	1979	HI or CF	(80)
Uganda‡	a) 12 (261 patients tested)‡ b) 6.1 (8/132) c) 6.1 (6/99)	(a) 1945–1948 (b) 1984 (c) Not specified	(a) Viral neutralization (b) HI only (c) Not specified§	a) (81) b) (82) c) (52)
Tanzania	17 (36 patients tested)‡	1945–1948	Viral neutralization	(81)
Zambia	6.0 (217/3,625)	Unspecified	Unspecified¶	(83)
Asia				
Borneo	44.1 (49/111)	1996–1997	“Plasma samples were tested for neutralizing antibody...sera were screened at a 1:10 dilution. Endpoint titrations were conducted for samples that tested positive (i.e., titer >10).”	(84)
Pakistan	2.3 (1/43)	1979, 1980	Initial screen for antibodies (not further specified), followed by CF	(85)
Oceania				
Yap Island, Micronesia	74.3 (414/557)	2007	IgM by ELISA only	(5)

*Summary data of all seroprevalence surveys of Zika virus antibodies in humans, reported in peer-reviewed literature, 1952–2016. Publications for which the abstract only was accessible or that did not provide complete data were excluded. CF, complement fixation; HA, hemagglutination assay; HI, hemagglutination-inhibition; Ref, Technical Appendix reference number.

† Multiple studies were found for Nigeria and Uganda; these studies are indicated separately with a, b, c.

‡ Study for Uganda and United Republic of Tanzania reported only numbers of patients tested and whole percentages of seropositive patients (81).

§Methodology information provided in primary source: “Human sera tested for presence of Zika virus antibody...Only those sera which were found to neutralize 100 or more LD50 have been considered as positive” (52).

¶Methodology information provided in primary source: “Serum was assessed for IgG and IgM antibodies” (83).

Technical Appendix Table 2. Outbreaks and case reports of laboratory-confirmed Zika virus infection by location, January 1, 1952–February 10, 2016*

Continent/country	No. cases	Years	Ref	Comments
Africa				
Cape Verde	17	2015	(86)	15 IgM positive only; 2 positive by reverse transcription PCR
Gabon	5	2007–2010	(23)	
Nigeria	5	1952, 1971–1975	(2,75)	
Uganda	1	Not specified	(40)	
Asia				
Cambodia	1	2010	(56)	
Indonesia	7	1977–1978	(24)	
Japan	3	2013–2014	(87,88)	Imported cases (ex-Thailand, ex-French Polynesia)
Thailand	7	2012–2014	(89)	
Philippines	1	2012	(67)	
Caribbean				
Dominican Republic	10	2016	(90)	8 local cases; 2 imported cases (ex-El Salvador)
Guadeloupe	10	2016	(91)	
Jamaica	1	2016	(92)	
St. Croix, US Virgin Islands	1	2016	(93)	
Central America				
Costa Rica	2	2016	(94)	1 case imported (ex-Colombia); other case not specified
Mexico	3	2015	(95)	2 local cases; 1 imported case (ex-Colombia)
Nicaragua	2	2016	(91,96)	
Europe				
Denmark	1	2016	(91,97)	Imported case (ex-Mexico and Brazil)
Finland	1	2015	(3)	Imported case (ex-Maldives)
France	1	2013	(98)	Imported case (ex-French Polynesia)
Germany	4	2013, 2014, 2016	(57,99,100)	Imported cases (ex-Haiti, ex-Malaysian Borneo, ex-Thailand)
Italy	3	2013–2014, 2015	(60,101)	
Netherlands	13	2015	(102,103)	Imported cases (ex-Suriname [1]; country of import unspecified [12])
Norway	1	2013	(61)	Imported case (ex-Tahiti)
Portugal	5	2016	(91,104)	Imported cases (ex-Brazil)
Spain	7	2016	(105)	Imported cases (country of import unspecified)
Sweden	1	2015	(91,106)	Imported case (country of import unspecified)
United Kingdom	6	2014–2016	(107)	Imported cases (ex-Colombia [3], ex-Cook-Islands [1], ex-Guyana/Suriname [1], and ex-Mexico/Venezuela [1])
North America				
Canada	2	2013, 2016	(14,46)	Imported cases (ex-Thailand, ex-El Salvador)
United States	56	2008, 2013, 2016	(10,12,36,68)	Cases reported in Arkansas (1), California (2), Colorado (3), Delaware (1), District of Columbia (3), Florida (16), Georgia (1), Hawaii (4), Illinois (3), Massachusetts (2), Minnesota (1), Nebraska (2), New Jersey (1), New York (1), Ohio (1), Oregon (1), Pennsylvania (2), Virginia (1), Texas (10). All were imported cases, except for 2 autochthonous sexually-acquired cases, including 1 in Colorado and 1 in Texas. Reported locations of import include Senegal, French Polynesia, South America, Easter Island, and Hawaii.
Oceania				
Australia	3	2014 (1 case); year unspecified (2 cases)	(39,108,109)	Imported cases (ex-Indonesia [2], ex-Cook Islands [1])
Cook Islands	50	2014	(6)	932 additional suspected cases
Easter Island	53	2014	(7,110,111)	One imported case (ex-Tahiti); 40 additional suspected cases

Continent/country	No. cases	Years	Ref	Comments
Fiji	1	2015	(112)	
French Polynesia	383	2013–2014	(14)	32,000 additional suspected cases
New Caledonia	1,385	2014	(8)	
New Zealand	67	2002–2015, 2016	(113)	Imported cases (ex-Cook Islands [27], ex-Vanuatu [1], ex-Tonga [4], ex-Samoa [4], unspecified country of import [1])
Samoa	1 (at least)	2016	(91,114)	
Solomon Islands	4	2015	(115)	
Tonga	1	2016	(113)	
Vanuatu	2	2015	(115)	
Yap, Federated States of Micronesia	108	2007	(5)	919 additional suspected cases
South America				
Barbados	3	2016	(116)	
Bolivia	1	2016	(117)	
Brazil	69	2015–2016	(14,54,118–121)	440,000–1,300,000 estimated total cases
Chile (Mainland)	3	2016	(122)	Imported cases (ex-Venezuela [1], ex-Colombia [1], ex-Brazil [1])
Colombia	1,050	2015	(123)	
Curacao	1	2016	(91)	
Ecuador	6	2016	(116)	2 local cases; 4 imported cases (ex-Colombia [3], ex-Venezuela [1]).
El Salvador	3	2015–2016	(124,125)	3,836 additional suspected cases
French Guiana	59	2016	(91)	
Guatemala	1	2015	(124)	
Guyana	164	2016	(91)	
Haiti	5	2016	(100)	
Honduras	2	2015	(126)	
Martinique	2	2016	(91)	
Panama	4	2015	(127)	
Paraguay	6	2015	(128)	
Puerto Rico	9	2016	(10)	1 imported case; 8 local cases
Saint Martin	1	2016	(129)	
Suriname	6	2015	(130)	
Venezuela	4	2015	(131)	

*Data represent outbreaks and case reports for all reported laboratory-confirmed cases of Zika virus infection (confirmed by serology and/or RT-PCR, or mode of laboratory testing not specified), including those reported in peer-reviewed literature; public health agency Web sites, bulletins, and broadcasts; and media reports, January 1, 1952–February 10, 2016. Ref, Technical Appendix reference number; ex-, exported from.

Technical Appendix Table 3. Symptoms and sequelae of 195 symptomatic patients with confirmed Zika virus infection reported in Peer-reviewed literature for 1964–2016*

Symptom	No. of patients	% Total patients
Rash	131	67.2
Fever	124	63.6
Arthralgia	56	28.7
Myalgia	46	23.6
Headache	42	21.5
Conjunctivitis	40	20.5
Retroorbital pain	22	11.3
Edema	19	9.7
Pruritus	15	7.7
Fatigue/asthenia	14	7.2

*Data represent reports that included clinical symptoms and sequelae for all symptomatic patients with laboratory-confirmed Zika virus infection (confirmed by serologic testing or RT-PCR, or mode of laboratory testing not specified), with a complete and detailed account of symptoms reported in peer-reviewed literature for January 1, 1964–February 3, 2016 (age range of patients was 4 days–76 years). Reports only for this period included symptoms and therefore met criteria for inclusion in the table. Patients may have experienced ≥ 1 symptom. Less prevalent reported symptoms and sequelae (<5% of patients with reported symptoms) include microcephaly, cerebral calcifications, Guillain-Barré syndrome, prostatitis, hematospermia, hematuria, hypotension, gingival bleeding, hearing loss, pruritus, malaise, diarrhea, nausea/vomiting, constipation, edema, sore throat, cough, stomach pain, anorexia, lightheadedness, dizziness, chills, oral aphthous ulcers, photophobia, lymphadenopathy, rhinorrhea, and burning sensation of palms/soles.

References: (3,7,8,11,23–25,34,36,37,39–41,46,47,56,57,60–62,68,75,87,88,99,101,108,109).

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