TTID WP
VIROLOGY SUBGROUP

ISBT TTID Working Party Meeting, Copenhagen
17 June 2017

SUBGROUP CHAIRS:
Jose Levi, Hospital Israelita Albert Einstein Blood Bank, São Paulo, Brazil
Helen Faddy, Australian Red Cross Blood Service, Brisbane, Australia
SHORT BIOGRAPHY – JOSÉ EDUARDO LEVI

BRAZILIAN, BORN IN 1967
BIOLOGIST, PhD in VIROLOGY, UNIVERSITY OF SÃO PAULO
ISBT MEMBER SINCE 2005, WP-TTID MEMBER SINCE > 10 YEARS
WORKING ON BLOOD SCREENING SINCE 1996
120 PAPERS PUBLISHED ON PEER-REVIEWED JOURNALS

CURRENT AFFILIATIONS

HOSPITAL ISRAELITA ALBERT EINSTEIN BLOOD BANK,
SÃO PAULO, BRAZIL

FUNDAÇÃO PRÓ-SANGUE/HEMOCENTRO DE SÃO
PAULO, BRAZIL

VIROLOGY LAB, TROPICAL MEDICINE INSTITUTE, UNIV.
OF SÃO PAULO, BRAZIL
SHORT BIOGRAPHY – Helen Faddy

- Australian, mid-career researcher
- BIOLOGIST (microbiology/biochemistry/cell biology), PhD, University of Queensland
- ISBT member since 2012
- Working on emerging TTIs and blood safety since 2009
- 49 papers published in peer-reviewed journals

CURRENT AFFILIATIONS

- Australian Red Cross Blood Service
- University of Queensland
- Queensland University of Technology
Virology Subgroup Membership

36 Individual Members and Observers

- Africa: 2
- Asia-Pacific: 4
- Europe: 14
- Middle-East: 2
- North America: 10
- South America: 1

Slide prepared by Jessica Bailey
Agenda

THIS MORNING:

- **HEV**: Global update & recent screening decisions (Hans Zaaijer)
- **ZIKV**: Global update & ECDC consultation conclusions (Dragoslav Domanovic)
- **YFV**: Global update, focus on Brazil (Jose Levi)

AFTERNOON BREAKOUT SESSION (all invited)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZIKV</td>
<td>FU of NAT+ donors</td>
</tr>
<tr>
<td></td>
<td>Animal infectivity studies</td>
</tr>
<tr>
<td>HEV</td>
<td>HEV - Latest findings on HEV3 sources and phylogeny</td>
</tr>
<tr>
<td></td>
<td>HEV - Data and policy considerations from Japan</td>
</tr>
<tr>
<td>HIV</td>
<td>HIV - Donations from HIV+ donors on ART at SANBS</td>
</tr>
<tr>
<td></td>
<td>HIV – Potential impact of ART &amp; pre-exposure prophylaxis on blood safety</td>
</tr>
<tr>
<td>Brainstorm</td>
<td>New ideas &amp; directions for Subgroup</td>
</tr>
<tr>
<td>All</td>
<td>Mike Busch</td>
</tr>
<tr>
<td></td>
<td>Marion Vermeulin</td>
</tr>
<tr>
<td></td>
<td>All</td>
</tr>
</tbody>
</table>
HEV – a global update
ISBT, TTID-WP, June 17th 2017

prof.dr. Hans L. Zaaijer MD PhD
Sanquin Blood Supply Foundation - Blood-borne Infections, and Academic Medical Centre – Clinical Virology Amsterdam NL
(h.zaaijer@sanquin.nl)

topics

- current findings

- considerations and policies, recent decisions on screening
Results of routine donor screening

Ireland:
Universal ID-NAT since January 4th 2016, for 3 year period.

Dr. O’Riordan (IPFA/PEI meeting, May 16th 2017) reported:
Jan 2016 – March 2017: 176,918 donations: 43 RR
1:4114 donations HEV+, 1:1887 donors HEV+

United Kingdom:

Prof. Tedder (IPFA/PEI) reported:
Mar 2016 – Feb 2017: 592,960 donations, 225 RR
1:2635 donations HEV+
( median HEV load decreasing? 3,5-4E in 2013/14 → 2,5-3E in 2016/17 )
Results of studies and plasma screening

Canada:
Dr. Margaret Fearon (Canadian Blood Services) reports:
ID-NAT on 51,366 Canadian blood donors:
11 / 51,366 HEV+ = 1:4670, low HEV loads (predom. < 200 IU/mL)

France:
Abravanel ea (EID 2017): 919 French hep E patients:
904 HEV genotype 3, of which 5 HEV gt3-rabbit.

Holland:
Routine screening of plasma in 96-pools:
HEV infection pressure > 4-fold fluctuation over the years:
To screen or not to screen: considerations

- Wide range of HEV incidences. (USA, Australia versus S. France, Holland).
- Decreasing level of viremia in UK? Low viremia in America? (Mild strain? Primer/probe mismatch?)
- Only ~1:700 HEV infections by blood (independent of local incidence), sources and transmission routes should be elucidated and eradicated.
- Only a subset of recipients at risk.
- Public trust in blood safety, liability.

In highly endemic areas: governments and pig producers remain passive,
- insufficient elucidation of transmission routes of HEV.
- no study into infectivity of HEV PCR+ food items.
- no willingness to make pig meat HEV free.
- is HEV donor screening feasible?

Cost-effectiveness of the screening of blood donations for hepatitis E virus in the Netherlands

Anneke S. de Vos, Mart P. Janssen, Hans L. Zaalje, and Boris M. Hogema

HEV dose and chance of transmission

Fit of HEV transmission probability, based on the 43 cases by Hewitt & Tedder

estimated chance of HEV transmission: 7000 IU = 10%, 275,000 IU = 50%
viremia ≠ dose

HEV transm. risk: 7000 IU = 10%, 275,000 IU = 50%

- The likelihood of transmission from components containing very low levels of HEV RNA appears small.

<table>
<thead>
<tr>
<th>component</th>
<th>approx. plasma content</th>
<th>donor: 10 IU/ml Dose per 1 transf.:</th>
<th>donor: 100 IU/ml Dose per 1 transf.:</th>
<th>donor: 1000 IU/ml Dose per 1 transf.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC concentrate</td>
<td>10 ml</td>
<td>100 IU</td>
<td>1000 IU</td>
<td>10,000 IU</td>
</tr>
<tr>
<td>pooled PLTs conc in plasma</td>
<td>322 ml</td>
<td>3220 IU</td>
<td>32,200 IU</td>
<td>322,000 IU</td>
</tr>
<tr>
<td>pooled PLTs conc in PASIII</td>
<td>124 ml</td>
<td>1240 IU</td>
<td>12,400 IU</td>
<td>124,000 IU</td>
</tr>
<tr>
<td>apheresis PLTs in plasma</td>
<td>400 ml</td>
<td>4000 IU</td>
<td>40,000 IU</td>
<td>400,000 IU</td>
</tr>
<tr>
<td>apheresis PLTs in PASIII</td>
<td>160 ml</td>
<td>1600 IU</td>
<td>16,000 IU</td>
<td>160,000 IU</td>
</tr>
<tr>
<td>quarantine plasma</td>
<td>310 ml</td>
<td>3100 IU</td>
<td>31,000 IU</td>
<td>310,000 IU</td>
</tr>
<tr>
<td>SD plasma (1170 donors)</td>
<td>200 ml</td>
<td>200/1170 = 1.7 IU</td>
<td>20,000/1170 = 17 IU</td>
<td>200,000/1170 = 170 IU</td>
</tr>
</tbody>
</table>

EMA report: SD plasma 41 IU/mL transmitted HEV. "13 units of 200ml ,, dose = 106600 IU ! Huzly (EuroSurv. 2014) : a dose of 7056 IU transmitted HEV (via apheresis platelets).

Distribution of viral load in Dutch donors and probability of transmission by dose
Distribution of undetected viral load in donors and probability of transmission by dose

Modelling of Dutch HEV situation

133,000 HEV infections / year, 187 via transfusion (1:700).  
1722 SOT and BMT patients, per year: 
- 18.4 background infections: 12.1 chronic hep E 
- plus via transfusion: 4.9 chronic hep E → 1:3.5 via blood 

Summary and decision: 

1 in 700 HEV infections by blood transfusion, but 1 in 3.5 chronic infections caused by Dutch blood transfusion. 
HEV PCR on pools of 24 would prevent 174/187 transmissions and 4.52 of the 4.94 transfusion associated chronic hep E cases annually, at 1.4 M€ testing costs/year; and at ~ € 310,000 per prevented chronic case. 
Start of HEV PCR donor screening in NL per July 3rd 2017
Conclusion

*In countries with significant incidence of HEV genotype 3 infection:*

1) Blood establishments must choose between providing unscreened products that may seriously harm some recipients, and expensive screening that provides only limited protection, since most HEV transmissions occur not via blood transfusion.

2) Demand that sources of HEV gt3 are elucidated and eradicated.

---

**Blood-borne Infections team at Sanquin:**

Boris Hogema  
Michel Molier  
Marijke Molenaar  
Thijs vd Laar  
Marco Koppelman (NSS)  
Ed Slot  
Ryanne Lieshout  
Hans Zaaijer

© H.L. Zaaijer, 2017, Amsterdam, NL
From 2007:
77 countries - mosquito-borne Zika virus transmission.

From 2015:
70 countries - mosquito-borne Zika virus transmission;
13 countries - sexual transmissions;
31 countries - microcephaly and other CNS malformations;
24 countries - Guillain-Barré syndrome;

Epidemic is slowing down in the Americas and the Caribbean.

New information about Zika virus circulation has been documented in South East Asia.

On 15 May 2017, the Ministry of Health and Family Welfare-Government of India (MoHFW) reported three laboratory-confirmed cases of Zika virus disease in Bapunagar area, Ahmedabad District, Gujarat, State, India.
Zika epidemiological situation
South America

- Epidemic waves during the first half of 2016 are over in several countries in South America (e.g. Colombia, Brazil, Suriname and Venezuela)
- Very low level of transmission or sporadic cases are still possible
- Late austral summer 2016-2017: recent cases in April 2017 in northern Argentina (Chaco Province)

Source: Epi. Bull. MoH Brazil ; PAHO
Zika epidemiological situation
The Caribbean

- Zika reached all islands in the region in 2016
- Often single wave epidemic profile. E.g. Martinique, Guadeloupe: no cases within the past 3 months with appropriate vector-borne disease laboratory testing scheme
- Uncertainties about virus circulation in islands with a large population and/ or with challenges in vector control and diagnostic due limited laboratory capacity (e.g. Cuba, Hispaniola island, Puerto Rico, Jamaica)

Source: PAHO, MoHs
Zika epidemiological situation
Central America and Mexico

• In Panama, Honduras and Guatemala, large epidemic waves in the first half of 2016 were followed by the 2nd wave.

• During the summer 2016 epidemic front moved northwards to Belize and in Mexico (up to US border), then decrease during the winter months especially in the Northern parts and areas of high altitude.

• Mexico reported only confirmed cases, overall extent of the outbreak remains unknown (2015-2017 > 8,700 confirmed cases).

Source: PAHO, MoHs
On December 9, 2016, CDC removed the red area designation for the remaining 1.5-square-mile area of South Miami Beach after three mosquito incubation periods (45 days) passed without any new locally transmitted cases of Zika. Guidance for yellow areas now applies to the South Miami Beach area and all of Miami-Dade County.

On December 14, 2016, CDC issued guidance related to Zika for people living in or traveling to Brownsville, Cameron County, TX. On November 28, the Texas Department of State Health Services reported the state’s first case of local mosquito-borne Zika virus infection in Brownsville.
### Cases reported in USA, 1 January 2016 to 1 March 2017

<table>
<thead>
<tr>
<th>Transmission route</th>
<th>USA mainland (No of cases)</th>
<th>USA territories (No of cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Autochthonous (total)</strong></td>
<td>221 (215 FL; 6 TX)</td>
<td>38,161</td>
</tr>
<tr>
<td>• Vector-borne</td>
<td>147</td>
<td>NA</td>
</tr>
<tr>
<td>• Sexual</td>
<td>45</td>
<td>NA</td>
</tr>
<tr>
<td>• Congenital</td>
<td>27</td>
<td>NA</td>
</tr>
<tr>
<td>• Laboratory</td>
<td>1</td>
<td>NA</td>
</tr>
<tr>
<td>• Unknown person-to-person</td>
<td>1</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Travel related (total)</strong></td>
<td>4,779</td>
<td>145</td>
</tr>
</tbody>
</table>
Zika epidemiological situation

Africa

• Historical transmission based on publications review
• Angola: recent travel-associated case in Taiwan ex-Angola (10 April 2017). Three cases in 2016 (one travel associated, one local case and one microcephaly)
• Recent transmission (>2015) in Capo Verde, Angola and Guinea-Bissau

Source: PAHO, MoHs
Zika epidemiological situation
Asia and Pacific

- Historical transmission in most of the countries in Indochinese Peninsula (mainland Southeast Asia)

- The Maldives initiated testing for Zika virus in October 2016, following several travel-associated cases (two positive out of more than 500 Maldivians tested in 2016)

- Thailand reported over 600 confirmed Zika cases in 2016 (media quoting the local authorities on 15 November 2016)

- In Malaysia and the Philippines, new locally acquired cases have been reported in Dec 2016 and Feb 2017 respectively

- Singapore: first locally acquired case of Zika virus infection On 27 August 2016. Around 500 cases. Recent sporadic case reported (1 and 5 May 2017, single spatial cluster)

- South Pacific region: American Samoa reported 1,004 suspected cases including 58 laboratory confirmed cases from 1 January to 1 December 2016

Source: PAHO, MoHs
**Zika epidemiological situation**

*Europe*

*Aedes albopictus* mosquito widespread in European Mediterranean countries

*Aedes aegypti* present in Madeira and along the Black Sea

- Travel-related Zika cases in the EU in 2016
  - 2024 cases reported (21 MS)
  - 1082 cases in areas where *Aedes albopictus* is present. 33% of these cases in July–October
  - 107 in pregnant women (9 MS)
  - 20 sexual transmission events (6 MS)

- The peak of introduction coincided with permissive climatic conditions for transmission

- No autochthonous transmission

Source: PAHO, MoHs
ECDC Zika virus response

ECDC publications on Zika in 2013-2017 include:

• 10 Rapid Risk Assessments
• 42 Epidemiological updates
• Preparedness guides
• Interim Guidance for healthcare providers & Zika Virus laboratory diagnosis
• Scientific Advice, Policy Briefing & infographics
Zika virus infection threat to SoHO safety - ECDC response

ECDC Guide

Zika virus and safety of substances of human origin
A guide for preparedness activities in Europe

Stockholm, July 2016
Drivers and purpose of the guide

Drivers

• Global spread
• Transmissibility of Zika virus through SoHO
• Possibility of autochthonous transmission of Zika virus in Europe
• Serious consequences in pregnancy, GBS, other neurological complications
• Need for coordinated response at EU/EEA level
• Reinforcement of preparedness activities
• Positive experiences with the EU/EEA preparedness plan for WNV

Purpose

to support the operational preparation and implementation of national preparedness plans for the safety of substances of human origin (SoHO) during outbreaks of Zika virus infection.
**Purpose, key elements & level of application of preparedness guide**

**Purpose of the guide**

to support the operational preparation and implementation of national preparedness plans for the safety of substances of human origin (SoHO) during outbreaks of Zika virus infection.

<table>
<thead>
<tr>
<th>Key elements</th>
<th>Level of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission areas</td>
<td>EU Commission/ECDC</td>
</tr>
<tr>
<td>Risk assessment</td>
<td>National Competent Authorities for SoHO</td>
</tr>
<tr>
<td>Safety measures</td>
<td>Establishments for SoHO</td>
</tr>
<tr>
<td>SoHO supply</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
</tr>
</tbody>
</table>
Guide implementation survey (N= 29)
donor deferral after sexual exposure
European Blood Alliance survey

• Donor deferral of those who had sexual contact with a man diagnosed with Zika virus infection or with a man who travelled or lived in a Zika-affected area?
  - Not applied - 12
  - Partly applied - 3 (Only for donors after sexual contact with diagnosed)
  - Applied - 16

• Donor deferral for those who had sexual contact with a woman diagnosed with Zika virus infection or with a woman who travelled or lived in a Zika-affected area?
  - Not applied - 19
  - Partly applied - 3 (Only for donors after sexual contact with diagnosed)
  - Applied - 8
  - Not specified - 1
First Update of the Guide

Evolution of Zika virus epidemic,
New classification of countries and areas based on their epidemiological profile
Scientific developments since the first issue of the guide.

Open questions:
- Transmission risk areas
- Initiation & discontinuation of measures
- Deferral periods
- Deferral after sexual exposure
- Sperm donations
MEETING REPORT

Guide on the preparedness activities for assessing the risk and prevention of Zika virus transmission through SoHO

Expert consultation meeting
Stockholm, 11 – 12 May, 2017

Sally Baylis, PEI, Germany,
Arlinke Bokhorst, TRIP, the Netherlands,
Michael Busch, Bioscience, BSRI, CA, USA,
Patricia Galea, NCA, Malta,
Pierre Gallian, EBA, Amsterdam, the Netherlands,
Giuseppe Marrano, ISS, Italy,
Micha Cornelius Nuebling, WHO, Switzerland,
Giancarlo Liumbruno, ISS, Italy,
Ryanne Lieshout-Krikke, EBA, the Netherlands,
Sophie Lucas Samuel, Agence de la biomédecine, France,
Ingrida Pucinskaite, EU Comm., DG SANTE B4, Belgium,
Undine Samuel, Eurotransplant, the Netherlands,
Imand Sandid, NCA, France,
Jan Semenza, ECDC, Stockholm Sweden,
Ines Ushiro-Lumb, NHBTS, London, United Kingdom.
Purpose of the Meeting & Agenda

- to evaluate recent developments in the knowledge of Zika virus transmission through SoHO and sexual contact,
- to get an information on the outbreaks and implementation of prevention interventions in some countries and
- to discuss the risks and prevention of Zika virus transmission through SoHO in order
- to assess proposed changes to the first Update of the Zika preparedness guide

Session 1 –
Drivers of emerging infections, current epidemiological data and laboratory testing of Zika virus infection
Session 2 –
Experiences from US and French Antilles, WHO interim guide
Session 3 –
Risk of Zika virus transmission through various types of SoHO
Session 4 –
Implementation survey and open questions of the First update of the Guide
<table>
<thead>
<tr>
<th>Transmission category</th>
<th>Definition</th>
<th>SoHO relevant transmission areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Area with new introduction or re-introduction with ongoing transmission</td>
<td><strong>Areas with active transmission</strong></td>
</tr>
<tr>
<td>C2</td>
<td>Area either with evidence of virus circulation before 2015 or area with ongoing transmission that is no longer in the new or re-introduction phase, but where there is no evidence of interruption.</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Area with interrupted transmission and with potential for future transmission.</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Area with established competent vector (Aedes aegypti) but no known documented past or current transmission. Areas where Aedes albopictus mosquitoes are the only potential vectors are not included as there is no evidence that they can ensure sustained Zika virus transmission on their own. (ECDC subcategories)</td>
<td><strong>Areas without active transmission</strong></td>
</tr>
<tr>
<td>No risk</td>
<td>countries/territories/subnational areas currently not at risk of ongoing vector-borne ZIKV transmission because of the absence of a competent vector and favourable climate</td>
<td></td>
</tr>
</tbody>
</table>
Initiation and discontinuation of SoHO safety measures

In an area with active transmission in EU/EEA

- Immediate reactive interruption of blood and cells and tissues donation
- Assessment of the risk within seven days following the first case and decision on the initiation of safety measures
- Decision criteria should comprise, number and dynamic of further cases reported,
- Presence of competent vector and environmental permissive conditions
Main principles of measures

Areas with active transmission
• Temporary interruption of donations, OR Screening of donations/donors

Areas without active transmission
• Temporary deferral from donation – specific eligibility criteria for Zika virus infection

Organ donation – Individual assessment of organ donors, carefully weighing the benefits against the risks for the potential organ recipient. NAT testing may be used in symptomatic living donors to identify the pathogen.
Deferral period for the donation of blood and non-reproductive cells and tissues from living donors

Deferral of donors for **at least 28 days** (i) after cessation of symptoms in case of confirmed Zika virus infection, and (ii) after return from areas with active transmission, and (iii) after sexual contact with a man who has been diagnosed with Zika virus infection six months prior to the sexual contact or with a woman who has been diagnosed with Zika virus infection 8 weeks prior to the sexual contact.
Deferral period for the donation of sperm

Deferral of donors for **six months** (i) after cessation of symptoms in case of confirmed Zika virus infection, and (ii) after return from areas with active transmission, and (iii) after sexual contact with a man who has been diagnosed with Zika virus infection six months prior to the sexual contact or with a woman who has been diagnosed with Zika virus infection 8 weeks prior to the sexual contact.
Thank you for your attention!
YELLOW FEVER AND ZIKA BRAZIL 2017

WP-TTID, ISBT 2017 KOPENHAGEN

JOSÉ EDUARDO LEVI

HOSPITAL ISRAELITA ALBERT EINSTEIN BLOOD BANK, SÃO PAULO, BRAZIL

FUNDAÇÃO PRÓ-SANGUE/HEMOCENTRO DE SÃO PAULO, BRAZIL

VIROLOGY LAB, TROPICAL MEDICINE INSTITUTE, UNIV. OF SÃO PAULO, BRAZIL
1685 – First outbreak of Yellow Fever in Recife, Brazil, introduced from the Caribbean.

XVIII Century – No YFV outbreaks recorded

XIX Century – Huge outbreaks all over the Country

1942 – Last outbreak of urban YFV recorded

1942-1980 - Vector control + vaccination
TIME SERIES OF YFV HUMAN CASES IN BRAZIL 1980 - 2016
There were 797 YFV cases with 407 fatalities (52%).
TIME SERIES OF
HUMAN AND EPIZOOTIC YFV CASES IN BRAZIL 2014-2016

15 casos humanos
49 epizootias em PNH

*Até a SE-52/2016
Fonte: Sinan; GT-Arboviroses/UVTV/CGDT/DEVIT/SVS/MS

HUMAN
PRIMATES NON-HUMAN
HUMAN AND EPIZOOTIC YFV CASES IN BRAZIL 2014-2016
YELLOW FEVER HUMAN CASES BRAZIL 2016/2017

Confirmed cases
Under investigation
60-80%

Nordeste: 56.560.081
Centro-Oeste: 15.442.232
Sudeste: 85.745.520
Sul: 29.230.180

<50%

<40%
DISCARDED (1,909)
UNDER INVESTIGATION (514)
CONFIRMED (792)
274 DEATHS (ANOTHER 37 UNDER INVESTIGATION)

SOURCE: MS/SVS Informe 43/2017, Brazil
AGE AND GENDER OF CONFIRMED CASES
SOURCE: MS/SVS Informe 43/2017, Brazil
## Genome analysis of yellow fever virus of the ongoing outbreak in Brazil reveals polymorphisms

Myrna C Bonaldo¹, Mariela Martínez Gómez¹, Alexandre AC dos Santos¹, Filipe Vieira Santos de Abreu²,³, Anielly Ferreira-de-Brito², Rafaela Moraes de Miranda², Marcia Gonçalves de Castro², Ricardo Lourenço-de-Oliveira²

<table>
<thead>
<tr>
<th>Domain</th>
<th>Data</th>
<th>C</th>
<th>prM</th>
<th>E</th>
<th>N⁵¹</th>
<th>N⁵²A</th>
<th>N⁵²B</th>
<th>N⁵³</th>
<th>N⁵⁴M</th>
<th>N⁵⁴B</th>
<th>N⁵⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monkey</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Human</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mosquito</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Table:

<table>
<thead>
<tr>
<th>Clade</th>
<th>Protein id / Strain / Country / Year</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>KY885001/ES-505/BRA/2017</td>
<td>Monkey</td>
<td>KVRVVRNPATARMGNPVPKIAVITNMVAVSRFAKEDPIASTRVTILHNTKREVRIDTSTKIAAKASIVKKIML</td>
</tr>
<tr>
<td>AFH35044/Benh555417/Brazil/2002</td>
<td>Human</td>
<td>KVRVVRNPATARMGNPVPVIAVVTNMVAVSRFAKERAPIANSTRVTILHNTKREVRIDTGTNKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AZ07887/strain1A/Venezuela/2010</td>
<td>Monkey</td>
<td>KVRVVRNPATARMGNPVPVIAVITNMVAVSRFAKEDPIASTRVTILHNTKREVRIDTGTNKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AZ07885/strain6A/Venezuela/2005</td>
<td>Human</td>
<td>KVRVVRNPATARMGNPVPVIAVITNMVAVSRFAKERAPIANSTRVTILHNTKREVRIDTGTNKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AZ07889/strain8A/Venezuela/2006</td>
<td>Monkey</td>
<td>KVRVVRNPATARMGNPVPVIAVITNMVAVSRFAKERAPIANSTRVTILHNTKREVRIDTGTNKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AZ07888/strain2A/Venezuela/2004</td>
<td>Monkey</td>
<td>KVRVVRNPATARMGNPVPVIAVITNMVAVSRFAKEDPIASTRVTILHNTKREVRIDTGTNKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AZ07886/strain9A/Venezuela/2007</td>
<td>Monkey</td>
<td>KVRVVRNPATARMGNPVPVIAVITNMVAVSRFAKEDPIASTRVTILHNTKREVRIDTGTNKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35043/Benh646536/Brazil/2001</td>
<td>Mosquito</td>
<td>KKVVRNPATVRMGNPVSKIVAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35042/Benh22493/Brazil/2000</td>
<td>Human</td>
<td>KKVVRNPATVRMGNPVSKIVAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35041/Benh22205/Brazil/2000</td>
<td>Human</td>
<td>KKVVRNPATVRMGNPVSKIVAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35036/Benh22973/Brazil/1984</td>
<td>Human</td>
<td>KKVVRNPATVRMGNPVSKIVAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35039/Benh3519008/Brazil/1992</td>
<td>Mosquito</td>
<td>KKVVRNPATVRMGNPVSPVAGAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35037/Benh423602/Brazil/1984</td>
<td>Human</td>
<td>KKVVRNPATVRMGNPVSPVAGAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35033/Benh378600/Brazil/1980</td>
<td>Mosquito</td>
<td>KKVVRNPATVRMGNPVSPVAGAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35040/Benh526722/Brazil/1994</td>
<td>Human</td>
<td>KKVVRNPATVRMGNPVSPVAGAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
<tr>
<td>AFH35038/Benh463676/Brazil/1987</td>
<td>Human</td>
<td>KKVVRNPATVRMGNPVSPVAGAVITNMVAVSRFAKERSIAPSTRVTLHNTKREVPIVIDGADKIAVKAIVKKIML</td>
</tr>
</tbody>
</table>
Transfusion-Related Transmission of Yellow Fever Vaccine Virus — California, 2009

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Previous yellow fever vaccine (year)</th>
<th>Blood product received (quantity)</th>
<th>Underlying medical conditions</th>
<th>Symptoms and laboratory abnormalities†</th>
<th>Serologic evaluation</th>
<th>No. of days post-transfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature infant (24 wks estimated gestational age)†</td>
<td>Female</td>
<td>No</td>
<td>Irradiated red blood cells (4 aliquots; 30 cc total)</td>
<td>Prematurity, intraventricular hemorrhage</td>
<td>None</td>
<td>Negative / Not done</td>
<td>37</td>
</tr>
<tr>
<td>6 yrs</td>
<td>Male</td>
<td>No</td>
<td>Irradiated platelets (1 unit)</td>
<td>Wilms’s tumor (relapsed), recent chemotherapy</td>
<td>None</td>
<td>Positive / 160</td>
<td>36</td>
</tr>
<tr>
<td>66 yrs</td>
<td>Male</td>
<td>Yes (1964)</td>
<td>Platelets (1 unit)</td>
<td>Kidney/liver transplant (2005), diabetes, history of alcohol abuse</td>
<td>None</td>
<td>Positive / 160</td>
<td>33</td>
</tr>
<tr>
<td>58 yrs</td>
<td>Male</td>
<td>Yes (1975, 1986)</td>
<td>Fresh frozen plasma (2 units)</td>
<td>Chronic renal insufficiency, peritoneal and pulmonary tuberculosis, psoriasis (received Infliximab &gt;2 mos before)</td>
<td>None</td>
<td>Positive / 40,960</td>
<td>26</td>
</tr>
<tr>
<td>82 yrs</td>
<td>Male</td>
<td>Yes (1959, 1965)</td>
<td>Irradiated platelets (1 unit)</td>
<td>Diffuse large B cell lymphoma s/p chemotherapy and radiation treatment, prostate carcinoma</td>
<td>Deceased**</td>
<td>Premortem specimen not available for testing</td>
<td>—</td>
</tr>
</tbody>
</table>

* Based on electronic medical record review.
† In the 30 days after blood product transfusion (e.g., fever, rigors, headache, meningismus, paralysis, and mental status changes, and abnormalities in white blood cell count, transaminases, or cerebral spinal fluid [if clinically indicated]).
§ Immunoglobulin M enzyme-linked immunosorbent assay result and plaque reduction neutralization test titer.
¶ Received blood products during days 2, 4, 6, and 9 of life.
** Patient was discharged to inpatient hospice for underlying malignancy and died 20 days after receiving blood products. An autopsy was not performed.
<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th></th>
<th>2017</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CASES</td>
<td>DEATHS</td>
<td>JAN-MAY</td>
<td>JAN-MAY</td>
<td>DEATHS</td>
</tr>
<tr>
<td>CHKV</td>
<td>271,824</td>
<td>196</td>
<td>179,026</td>
<td>80,949</td>
<td>13</td>
</tr>
<tr>
<td>DENV</td>
<td>1,500,535</td>
<td>585</td>
<td>1,352,876</td>
<td>144,326</td>
<td>23</td>
</tr>
<tr>
<td>ZKV</td>
<td>215,319</td>
<td>4</td>
<td>191,992</td>
<td>9,351</td>
<td>0</td>
</tr>
<tr>
<td>ZKV FETAL</td>
<td>2,189*</td>
<td>182*</td>
<td>360&amp;</td>
<td>293</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* = 2015+2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; = ESTIMATED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THANK

YOU