Chikungunya virus (CHIKV) dissemination in the Americas (2013-2015)

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on behalf of

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1. Epidemiology – Introduction and spread in the Americas

2. Challenges for monitoring the spread and impact:
   a. Surveillance
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   a. Clinical management
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   c. Laboratory
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Epidemiology

Introduction and spread in the Americas
Spread of Chikungunya virus, 2004-2013

Local transmission in the Americas

6 December 2013
Oyster Pond, Saint Martin, France

Epidemiological Alert
Chikungunya Fever
9 December 2013

Given the detection of the first cases of autochthonous transmission of chikungunya fever in the Americas, the Pan American Health Organization (PAHO) / World Health Organization (WHO) recommends Member States establish and maintain the capacity to detect and confirm cases, manage cases and implement an effective public communication strategy to reduce vector presence, particularly in areas where the mosquito that transmits the disease is present.
Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
December 2013

Cases by month

109

50,000
100,000
142,462

New cases by subregion & month

Subregion
- Latin Caribbean
- Central America & M.
- Andean
- Non Latin Caribbean
- Latin America
- South Cone

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya

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Chikungunya Fever in the Americas
2013-2015

New cases by country (and historic cumm)

Country
Dominican Republic
El Salvador
Colombia
Haiti
Guatemala
Honduras
Guatemala
Nicaragua
Venezuela
Martiniq
Equador
Puerto Rico
Guyana
Brazil
French Guyana
Saint Martin
Grenada
Mexico
Curacao
Dornica
Paraguay
Barbados
Saint Vincent and the
Antigu and Barbuda
Bolivia
Suriname
Jamaica
Saint Lucia
Aruba
Saint Barteley
United States Virgin Is.
Saint Kitts and Nevis
British Virgin Islands
Bim Island
Cayman Islands
Costa Rica
Panama
Trinidad and Tobago
Peru
Barbados
Montserrat
Anguilla
Turks and Caicos Islands
United States of America
Belize

New cases by subregion & month

Subregion
Latin Caribbean
Central America & M.
Andean
Non Latin Caribbean
Latin America
South Cone

Cases by month
922

Data source: Chikungunya Fever in the Americas. Number of reported cases www.paho.org/chikungunya

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Show History
Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
March 2014

Show History

Cases by month
18,677

1
50,000
100,000
142,482

Subregion
- Latin Caribbean
- Central America & M.M.
- Andean
- Non Latin Caribbean
- Latin America
- South Cone

New cases by subregion & month

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya
Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
April 2014

Show History

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya
Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
May 2014

Show History

Cases by month
63,150

New cases by subregion & month

Subregion
- Latin Caribbean
- Central America & M.
- Andean
- Non Latin Caribbean
- Latin America
- South Cone

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya

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Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
June 2014

New cases by country (and historic cumm)

<table>
<thead>
<tr>
<th>Country</th>
<th>New Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominican Republic</td>
<td>126,795</td>
</tr>
<tr>
<td>El Salvador</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>45,526</td>
</tr>
<tr>
<td>Haiti</td>
<td>227</td>
</tr>
<tr>
<td>Guatemala</td>
<td>14</td>
</tr>
<tr>
<td>Honduras</td>
<td>104</td>
</tr>
<tr>
<td>Haiti</td>
<td>110</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>5</td>
</tr>
<tr>
<td>Guatemala</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td>1,304</td>
</tr>
<tr>
<td>Martinique</td>
<td></td>
</tr>
<tr>
<td>United States Virgin Is.</td>
<td>1,029</td>
</tr>
<tr>
<td>St. Kitts &amp; Nevis</td>
<td></td>
</tr>
<tr>
<td>British Virgin Islands</td>
<td></td>
</tr>
<tr>
<td>Antigua &amp; Barbuda</td>
<td>229</td>
</tr>
<tr>
<td>Dominica</td>
<td></td>
</tr>
<tr>
<td>Aruba</td>
<td>1</td>
</tr>
<tr>
<td>Anguilla</td>
<td>37</td>
</tr>
<tr>
<td>Turks and Caicos Is...</td>
<td></td>
</tr>
<tr>
<td>United States of Amer..</td>
<td></td>
</tr>
</tbody>
</table>

Cases by month
199,344

Subregion

- Latin Caribbean
- Central America & M.
- Andean
- Non Latin Caribbean
- Latin America
- South Cone

New cases by subregion & month

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya
Chikungunya Fever in the Americas
2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
July 2014

Cases by month
206,121

New cases by subregion & month

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya

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Chikungunya Fever in the Americas 2013-2015

New cases by country (and historic cumm)

Country
Dominican Republic 146,683
El Salvador 1,657
Colombia 1,471
Haiti 1,400
Guatemala 96
Honduras 76
Guatemala 72
Honduras 45
Venezuela 45
Marititaca 40
Ecuador 30
Puerto Rico 10
Guyana 10
Brazil 9
French Guiana 9
Saint Martin 9
Grenada 9
Mexico 9
Curaçao 9
Costa Rica 7
Paraguay 7
Barbados 7
Saint Vincent and the Grenadines 7
Antigua and Barbuda 7
Bolivia 6
Suriname 6
Jamaica 6
Saint Lucia 6
Aruba 2
Saint Barthelemy 2
United States Virgin Is. 1
Saint Kitts and Nevis 1
British Virgin Islands 1
Saint Maarten 1
Cayman Islands 1
Costa Rica 1
Panama 1
Trinidad and Tobago 1
Peru 1
Bermuda 1
Montserrat 1
Anguilla 1
Turks and Caicos Islands 1
United States of Amer. 5

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya
Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
September 2014

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya
Chikungunya Fever in the Americas 2013-2015

New Cases of Chikungunya by Month & Country

Month of Report
July 2015

Show History

Cases by month
77,345

Subregion
- Latin Caribbean
- Central America & M.
- Andean
- Non Latin Caribbean
- Latin America
- South Cone

New cases by subregion & month

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya
Chikungunya Fever in the Americas 2013-2015

New cases by country (and historic cumm)

Country
- Dominican Republic
- El Salvador
- Colombia
- Haiti
- Guadeloupe
- Honduras
- Guatemala
- Nicaragua
- Venezuela
- Martinique
- Ecuador
- Puerto Rico
- Guyana
- Brazil
- French Guiana
- Saint Martin
- Grenada
- Mexico
- Curacao
- Dominica
- Paraguay
- Barbados
- Saint Vincent and the Grenadines
- Antigua and Barbuda
- Bolivia
- Suriname
- Jamaica
- Saint Lucia
- Aruba
- Saint Kitts and Nevis
- British Virgin Islands
- Sint Maarten
- Cayman Islands
- Costa Rica
- Panama
- Trinidad and Tobago
- Peru
- Bahamas
- Montserrat
- Anguilla
- Turks and Caicos Islands
- United States of America
- Belize

Cases by month
- 21,601
- 50,000
- 100,000
- 142,482

New cases by subregion & month

Data source: Chikungunya Fever in the Americas. Number of reported cases. www.paho.org/chikungunya

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CHIKV in the Americas

As of EW 43, 2015
2013-2015

Suspected cases: 1,589,309
Confirmed cases: 39,388
Total: 1,628,697
Deaths: 253

www.paho.org/chikungunya
Cumulative incidence, 2013-2015 (EW24)
Introduction of CHIKV in the Americas
Why was expected?

- Imported cases detected on a regular basis across the region:
  - Cases in the French West Indies in 2006
  - Cases in Brazil in 2010

- *Aedes aegypti* is present in all sub-regions. Two countries with no reports - Canada and continental Chile

- Conditions were optimal with DENV outbreaks in almost all countries of the region starting during the 1980’s - except continental Chile, Canada and Uruguay
Why an outbreak of this magnitude in the Americas?

- No immunity among the population late 2013
- Very high indices of *Aedes aegypti* in most of the countries and territories of the region
- Important movements of population within and between sub-regions
- Perfect match between the CHIKV and *Aedes aegypti* strains of the region (Vega-Rua and al., *J Virol.* 2014:88:e00370-14)
- All countries, territories, and geographical areas with previous history of Dengue transmission were / are at risk!
Challenges

a. Surveillance
b. Definition of atypical and severe cases
c. Lethal cases: characterization, notification
Weeks monitoring 2013-2015

Suspected cases: 1,589,309  
Confirmed cases: 39,388

Total: 1,628,697
Deaths: 253

www.paho.org/chikungunya
Why CHIKV surveillance should be improved?

- Acute typical and atypical CHIKV cases are under reported
- Awareness of HCWs should be refreshed on a regular basis, still confusion between DENV and CHIKV and now ZIKV…
- Characterization, including laboratory, of severe and atypical cases and fatal CHIKV cases is sub-optimal in some countries

Venezuela, 2015 - Source: J Torres et al
Dominican Republic, 2014 - Source: V. Gomez

**Acute typical cases**

**Adults**
- Edema of hands and feet, erythema and palmoplantar swelling
- Widespread pain, predominantly in extremities
- Hyperalgesia and irritability, "rubber kid“ ("muñeco de goma")

**Children**

**Adults**

**Children**

Risk Factors

• Severe forms
  - Underlying conditions:
    • Cardiovascular disease (including HTA)
    • Respiratory diseases (chronic bronchitis, asthma)
    • Neurological disorders
  - Use of non-steroid antiinflammatory
  - > 60 years old
  - Newborns
  - Immunocompromised (diabetes mellitus)

• Death
  - >85 years old
  - Alcohol abuse

Detected in the Americas: Obesity

Severe and atypical acute cases - Adults

Similar

• Renal failure
• Hepatic failure
• Respiratory failure
• Elder age with underlying conditions

But different

• Nasal necrosis
• Extensive cutaneous lesions
Acute myocarditis, ACC, San Diego, USA, March 2015
- 83 patients evaluated prospectively
- Arrhythmias in 52% of cases
- 2 sudden deaths

Hypotension, Mendoza I, et al. XXV EMHCP, Milan, June 2015
- 257 patients evaluated prospectively
- Symptomatic hypotension in 20/25 patients, incl. 2 syncope
- Arrhythmias were recorded in 51% of cases
Atypical acute cases - children

• Extensive cutaneous lesions – Bullous dermatosis
• Hemorragic manifestations
• Neurologic manifestations
• Risk factors:
  - Less than 1 year old

Venezuela, 2015 - Source: J Torres et al
Mother to Child Transmission

- Peripartum risk ≈ 50%
- All symptomatic neonates were born to viremic mothers (n=19)
- 36/38 mothers had obvious ongoing symptoms of CHIK

Colombia, 2014-2015, Gomez et al.

### Characteristics of pregnant women with CHIK
**Sincelejo, Sucre, Colombia, Sep 2014 to Feb 2015**

<table>
<thead>
<tr>
<th>Symptoms (n=7)</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever, arthralgia and exanthema</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td>Edema</td>
<td>5</td>
<td>71%</td>
</tr>
<tr>
<td>Headache</td>
<td>2</td>
<td>29%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gestational age (n=7)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 32-36</td>
<td>1</td>
<td>14.3%</td>
</tr>
<tr>
<td>Week ≥37</td>
<td>6</td>
<td>85.7%</td>
</tr>
</tbody>
</table>

### Characteristics of newborns with CHIK infected
**Sincelejo, Sucre, Colombia, Sep 2014 to Feb 2015**

<table>
<thead>
<tr>
<th>Symptoms (n=8)</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maculopapular rash</td>
<td>5</td>
<td>63%</td>
</tr>
<tr>
<td>Hyperalgesia and respiratory  distress</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td>Sepsis, necrotizing enterocolitis, and adenopathies</td>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td>Bullous dermatitis and pericarditis</td>
<td>1</td>
<td>13%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode of Delivery (n=8, newborn)</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal</td>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td>Cesarean</td>
<td>6</td>
<td>75%</td>
</tr>
</tbody>
</table>

- Severe forms: 50% (1 death, D6, NEC)
- Specific manifestations: Skin (rash, epidermolysis, bullae); myocarditis, encephalopathy/encephalitis
Chronic cases

Post-Chikungunya Rheumatoid Arthritis, Saint Martin

Maud Foissac, Emilie Javelle, Simon Ray, Bruno Guérin, Fabrice Simon

Author affiliations: Hospital Jacques Puel, Rodez, France (M. Foissac, S. Ray, B. Guérin); Laveran Military Teaching Hospital, Marseille, France (E. Javelle, F. Simon)

DOI: http://dx.doi.org/10.3201/eid2103.141397
Lethality (deaths /1,000 cases) EW 33, 2015 - Cumulative data

Reunion Island, 2005-2006
- Mortality rate: 0.3 / 1,000 population
- Lethality: < 1 / 1,000 cases


Lethality Americas (countries with reported deaths) = 0.19 deaths / 1,000 cases
Analysis of fatal cases, Colombia, May 2015

- Multidisciplinary committee (gynecology, dermatology, internal medicine, virology, pathology and epidemiology)
- Characterization of 30 fatal cases
- Clinical records + anatomo-pathological findings
- PCR in tissues (both DENV + CHIKV)
- Most deaths directly related to CHIKV

- Age: Range: 17 days to 89 years old.
  - Higher risk in extreme ages (less than 1 year and older than 60 years)
- Comorbidities: ~100% of the adult fatal cases
- Clinical presentation: fever + arthralgia
  - Cutaneous manifestations 75%
  - Respiratory 33.3%
  - Hepatic 20.5%
  - Cardiologic 18%
  - Neurologic 8%
Regional and PAHO/WHO response

Public health action
The Chikungunya epidemic: Arbovirus + Alphavirus
A double impact

The CHIK

The Shock

The Check

Gauzere BA & Aubry P, Path Exot Ed. 2006
Regional response

• Network of GOARN regional partners activated: CDC Ft Collins and Puerto Rico, IP French Guiana, CARPHA, Inst. E. Chagas, UTMB, INEVH, IPK...

• Sub regional trainings on CHIK Clinical awareness and Case Management:
  - Caribbean (Guadeloupe - April 2014)
  - Central America (Nicaragua - May 2014)
  - Andes (Peru – September 2014)
  - Brazil (October 2014)

• Training on virology techniques (Gorgas Institute and CDC Ft Collins and Puerto Rico, INS Peru)

• Deployment of PAHO staff and GOARN experts (SSA France, CDC): St Marteen, Dominica, Dominican Republic, Haiti, Nicaragua, Paraguay, Peru, Colombia
Clinical management

- Clinicians should be trained to recognize CHIK and its differential diagnosis (including Dengue)
  - Training materials, guidelines and materials
- Health Services Organization
  - Select a referral hospital for severe cases
  - Special attention to older individuals (>65 yo) and pregnant women, young children
  - Define admission criteria
- Prevention of blood transmission of CHIKV
  - **Standard precautions** for handling blood (sharp containers)
  - Ensure safe blood transfusion
Monitoring and Surveillance

- Early warning
- Information dissemination to the international community
- Reiterate recommendations

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**Epidemiological Alert**

**Chikungunya Fever**

9 December 2013

Given the detection of the first cases of autochthonous transmission of the Chikungunya virus in the Americas, the Pan American Health Organization (PAHO) recommends Member States establish and maintain surveillance systems to confirm cases, manage cases and implement an effective public health response to reduce vector presence, particularly in areas where the mosquito species are present.

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**Epidemiological Alert**

**Chikungunya and dengue fever in the Americas**

29 August 2014

Given the continued spread of chikungunya virus in the Americas, and the start of the period with higher dengue circulation in Central America and the Caribbean, the Pan American Health Organization (PAHO) advises Member States who have the vector mosquito of both viruses (Aedes aegypti), to increase vector density reduction efforts, based on the Dengue Integrated Management Strategy (Dengue-IMS), in addition to establishing and maintaining dengue and chikungunya case management capacity, and to implement effective public communication strategies to eliminate mosquito breeding sites.
Guidance for surveillance and characterization of atypical, severe, and chronic cases

- Develop case definitions to assess the burden of disease
- Develop surveillance tools for characterizing the atypical and severe cases, as well as chronic cases:
  1. Severe and atypical cases
  2. CHIK Lethality
  3. Chronic cases
Acute clinical case
1) Clinical criterion: Fever > 38.5°C (101.3°F) and joint pain (usually incapacitating) of acute beginning
and
2) Epidemiological criterion: resident or visitor in areas with local transmission of CHIK on the last 15 days. (suspect case for epidemiological surveillance) or
3) Laboratory criterion: confirmation by laboratory: PCR, serology, or viral culture (confirmed case for epidemiological surveillance)
Atypical acute case
Clinical case of laboratory-confirmed CHIK accompanied by other manifestations: neurological, cardiovascular, dermatological, ophthalmological, hepatic, renal, respiratory, or hematological, among others.

Severe acute case
Clinical case of laboratory-confirmed CHIK that presents dysfunction of at least one organ or system that threatens life and requires hospitalization.
Suspect chronic case
Person with previous clinical diagnosis of CHIK that after 12 weeks of the beginning of the symptoms presents at least one of the following articular manifestations: pain, rigidity, or edema, continuously or recurrently.

Confirmed chronic case
Every suspect chronic case with a positive CHIK laboratory test.
Laboratory

- CHIKV infection only can be confirmed by laboratory assays:
  - Virus isolation
  - RT-PCR
  - Serological tests (MAC-ELISA)

- Dengue lab surveillance platforms are being used for CHIKV detection

- Reference Laboratories:
  - CDC Fort Collins → WHOCC
  - Pasteur Institute, French Guiana
  - CARPHA
  - IPK Cuba, INEVH Argentina, Evandro Chagas Institute Brazil
Laboratory capacity building

Reagents

PCR primes & probes and ELISA Kits

Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, and Peru

Collaboration:

CDC

Pan American Health Organization

World Health Organization
The Integrated Management Strategy for dengue prevention and control (IMS-Dengue)

- Implemented in 26 countries/territories and 4 sub-regions: Central America, Southern Cone, Andean and Caribbean

Integrated Vector Management
Risk communication

https://www.youtube.com/watch?v=K2kuwScFIMc

133 300 views
Conclusions
Take home messages

• Challenging co-circulation of DENV and CHIKV and ZIKV…

• CHIKV mortality is low compared to DENV, patients with co-morbidity mainly

• However CHIKV has / will have a double impact on health services delivery:
  - 1. first wave of acute cases with atypical severe cases and
  - 2. chronic cases……..

• Risk Communication is key even using basic messages as CHIKV is transmitted by mosquitoes!
Remaining questions…

Need for research/evidence to implement efficient measures

• Role of *Aedes albopictus* during CHIKV outbreaks?
• Possibility of a sylvatic cycle in the region?
• Can CHIKV become endemic in the American region?

Need to continue efforts to contain the spread of CHIKV

• Economic impact of the outbreak?
Thank you