The Epidemiologic Surveillance of Dengue Fever in French Guiana: When achievements trigger higher goals

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Epidemiological surveillance

- In the last decade, urgent needs for better surveillance
  - Influenza pandemic
  - Threat of bioterrorism
  - Chikungunya (Reunion Island)
  - Cholera (Haïti), ...

Objectives of infectious disease surveillance
- To monitor the health status of a community / population
- To provide early warning of disease outbreaks
- Spatio-temporal Analysis and Interpretation
- Dissemination of information
Dengue fever

- Most important mosquito-borne viral disease
- Acquired through the bite of Aedes aegypti
- Tropical/Subtropical area
  - 2.5 billion people at risk
- Four viral serotypes (DENV1 – DENV4)
- Spectrum of clinical illness
  - Influenza-like illness
  - Fatal dengue hemorrhagic fever (DHF)
  - Dengue shock syndrome (DSS)
  - Encephalitis or Hepatitis
- No vaccine, no curative treatment
- Vector control and treatment strategies
A multi-source surveillance system

7 Biological labs (1 NRC)
- Coastal area
- Serology, NS1, RT-PCR, virus isolation
- Secure Internet access
- Daily data transmission
  - patient identification, address, phone number
  - date of onset, date of blood sample, results
  - signs of severity (Y/N)
A multi-source surveillance system

- 7 Biological labs (1 NRC)
- 30 Sentinel GPs
  - Coastal area
  - Weekly data collection
  - Number of clinical cases
  - Syndromic case definition
    - sudden onset of fever $\geq 38^\circ C$
    - and pain syndrome
      - headache $\pm$ arthralgia $\pm$ myalgia $\pm$ retro-orbital pains
    - and no local infectious signs
  - Extrapolated incidence using ratio participating
A multi-source surveillance system

- 7 Biological labs (1 NRC)
- 30 Sentinel GPs

3 Hospital Centers
- Coastal area
- Daily Automated Internet Extraction
- Number of clinical cases
- Notification of clinical cases by the ED
  - Age, gender, zip-code
  - Reason for admission
  - Main medical diagnosis (ICD-10)
A multi-source surveillance system

- 7 Biological lab (1 NRC)
- 30 Sentinel GP
- 3 Hospital Centers

17 Health Centers (CDPS)
- Isolated territories
- Weekly Automated Extraction
- Satellite connection transmission
- Number of clinical cases by CDPS
- Same definition criteria as GP network
Global architecture of the system

LAB 1 – LAB 2 – LAB 3 – LAB 4 – LAB 5 – LAB 6 – LAB 7

Manual data Entry

Platform of collection of the biologically confirmed cases

CIRE AG

Surveillance Base

- Spatiotemporal analysis and interpretation of the data
- Early warning system and Reports dissemination
- Secure access for the suppliers to consult their own data

GPs

Number of cases

Individual data

Hospitals

Number of cases

Individual data

CDPS

30 Sentinel GPs

ED Cayenne

2 Others ED

17 CDPS

LABM

GPs

CDPS

Hospital Centers

Health authorities

Vector Control

MIE 2011, Claude FLAMAND, 5/10
Surveillance Indicators

- Weekly monitoring of
  - Dengue-like syndromes
    - GPs, CDPS, ED
  - Biologically confirmed cases
  - Rate of positivity of dengue cases biologically confirmed
  - Distribution of circulating serotypes
  - Number of hospitalized dengue cases
    - distribution of DF, DHS, DSS and others
## Data analysis and Interpretation
### Epidemiological phases of the PSAGE

<table>
<thead>
<tr>
<th>Stage</th>
<th>Epidemiological criteria</th>
<th>Main Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 - Sporadic transmission</strong></td>
<td>Presence of sporadic cases</td>
<td>to contain the number of sporadic cases</td>
</tr>
<tr>
<td><strong>2 - Dengue fever clusters in area(s)</strong></td>
<td>Presence of Clusters ± epidemiological links</td>
<td>to detect and to control the spread of the cluster(s)</td>
</tr>
<tr>
<td><strong>3 - Pre-alert epidemic</strong></td>
<td>2 weeks above the statistical threshold for clinical and confirmed cases</td>
<td>to minimize the impact of an epidemic</td>
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<tr>
<td></td>
<td>- Preparedness and mobilization</td>
<td></td>
</tr>
<tr>
<td><strong>4 - Confirmed Epidemic</strong></td>
<td>2 additional weeks of exceedance</td>
<td>to minimize the impact of the epidemic</td>
</tr>
<tr>
<td><strong>5 - End of epidemic</strong></td>
<td>Decrease of clinical cases under the threshold during 2 weeks</td>
<td>to « level off » the control measures</td>
</tr>
</tbody>
</table>

* Shewhart Control Chart for Individual measurements based on moving ranges- size 2.
Results From 2006 to 2010

37,812 clinical cases
10,724 biological confirmed cases

Warning Alert threshold: Stage 4

Spatial distribution of the cumulative incidence of biologically confirmed cases, French Guiana, January - July 2010 - Week 1 - 30

Spatial distribution of the cumulative incidence of dengue-like syndromes, French Guiana, June - July 2010 - Week 22 - 30
# Results

From 2006 to 2010

37,812 clinical cases
10,724 biological confirmed cases

<table>
<thead>
<tr>
<th>Outbreaks identified</th>
<th>Cases (N)</th>
<th>Serotypes</th>
<th>Hospitalizations</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Clinical cases</strong></td>
<td><strong>Biological confirmed cases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W2006-01 – W2006-34</td>
<td>15,700</td>
<td>2,300</td>
<td>DEN-2</td>
<td>204</td>
</tr>
<tr>
<td>W2009-01 – W2009-38</td>
<td>13,900</td>
<td>4,129</td>
<td>DEN-1</td>
<td>241</td>
</tr>
<tr>
<td>W2009-53 – W2010-38</td>
<td>9,400</td>
<td>2,431</td>
<td>DEN-4, DEN-1</td>
<td>92</td>
</tr>
</tbody>
</table>
Discussion

• Validity and performances of the system
  – Ability to manage heterogeneous data
  – Acceptability, Timeliness, Data Quality

• Utility of the system
  – Monitoring of dengue patterns in the whole territory
  – Early warning of disease outbreaks
  – Real time information to health authorities
  – Increase collaboration/communication between actors

• Future works
  – Implementation of other statistical methods for detecting outbreaks
  – Outbreak prediction
    • Use of others data sources (climatic, environmental variables)
  – Development of research projects
Thanks for your attention

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