Human Plague in the 21st century

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Global Alert and Response
WHO Geneva
World notification of plague
1969-2009

2009: 984 cases (71 deaths)
Plague: an anthropozoonosis

Medical / Public health emergency
## Lethality of human plague in 2009

**Global CFR = 7.2 %**

<table>
<thead>
<tr>
<th>Country</th>
<th>CFR</th>
<th>Confirmed Cases</th>
<th>Disease Form</th>
<th>Area Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR. Congo</td>
<td>4.4%</td>
<td>27/618</td>
<td>90% are suspected cases</td>
<td>Pulmonary form: 7%</td>
</tr>
<tr>
<td>Libya</td>
<td>20.0%</td>
<td>1/5</td>
<td>All confirmed.</td>
<td>Bubonic</td>
</tr>
<tr>
<td>Madagascar</td>
<td>13.1%</td>
<td>38/289</td>
<td>confirmed cases: CFR 16%</td>
<td>Pulmonary form: 7%</td>
</tr>
<tr>
<td>Uganda</td>
<td>3.8%</td>
<td>1/26</td>
<td>All confirmed</td>
<td>Bubonic</td>
</tr>
<tr>
<td>Tanzania</td>
<td>0%</td>
<td>0/2</td>
<td>No confirmed case</td>
<td>Bubonic</td>
</tr>
<tr>
<td>Peru</td>
<td>0%</td>
<td>0/25</td>
<td>No confirmed case</td>
<td>Bubonic</td>
</tr>
<tr>
<td>USA</td>
<td>14.3%</td>
<td>1/7</td>
<td>All confirmed</td>
<td>Bubonic</td>
</tr>
<tr>
<td>China</td>
<td>25.0%</td>
<td>3/12</td>
<td>All confirmed</td>
<td>Pneumonic</td>
</tr>
</tbody>
</table>
Geographical distribution

Distribution of human plague cases by country, 2009
Focal distribution of human plague

- Some countries + plague cases
  - In these countries, some regions,
  - In these regions, some districts,
  - In these districts, some villages

- Human plague distribution only a proxy of the true plague distribution:
  - Human cases not diagnosed
  - Human transmission, a rare event
  - Absence of human population
Plague natural focus

Y. pestis + Sensible animal species + Adapted flea species

Absence of any animal surveillance in most of the endemic countries
Epidemiological silence
### Emergence / Re-emergence?

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Absence Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>1989</td>
<td>&gt;45 years</td>
</tr>
<tr>
<td>Kenya</td>
<td>1990</td>
<td>10 years</td>
</tr>
<tr>
<td>Uganda</td>
<td>1982</td>
<td>22 years</td>
</tr>
<tr>
<td>South Africa</td>
<td>1982</td>
<td>10 years</td>
</tr>
<tr>
<td>India</td>
<td>1994</td>
<td>27 years</td>
</tr>
<tr>
<td>Malawi</td>
<td>1994</td>
<td>31 years</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1997</td>
<td>27 years</td>
</tr>
<tr>
<td>Zambia</td>
<td>1997</td>
<td>&gt;33 years</td>
</tr>
<tr>
<td>Algeria</td>
<td>2003</td>
<td>&gt;50 years</td>
</tr>
<tr>
<td>Lybia</td>
<td>2009</td>
<td>&gt;20 years</td>
</tr>
</tbody>
</table>

Re-emergence of human plague in the last decades
Prevention and Control
Human plague in the world: one disease but different public health challenges

Different reservoirs:

Risk of human transmission different

Rich/Poor:

Different control capacities
Central Asia

Wild rodents in the steppe → Huge natural foci but a sporadic disease affecting farmers and hunters.
Central Asia: Plague in Kazakhstan

- 40% of the territory = 1 million km²
- Last human cases in 2003
- Every year:
  - Half million rodents and fleas trapped and analysed
  - Hundreds of thousands km² desinsectized
  - 125,000 persons vaccinated ... + a lot of camels!
- Economic impact
Northern Africa

- Small clusters of bubonic plague in rural / nomadic population
- Role of domestic rodents
- Proximity of international ports
Northern Africa

**Algeria**

**Oran 2003:** 18 cases / 1 death

After 50 yrs of silence

**Laghouat 2008:** 4 cases / 1 death

**Libya**

**Tobruk 2009:** 5 cases / 1 death

After 25 yrs of silence
Sub Saharan Africa

Domestic rodents + poverty ➔ High endemicity + severe outbreaks.

Rural + Urban.

Sindani majudaru tiyo kudo nego dhanu ka jucobi kudo kendo, kuno ke kan ucobi
The Democratic Republic of Congo: High endemicity + severe outbreaks

Ituri: +/- 1000 cases / year

Zobia 2005:
130 cases / 57 deaths

Bolebole 2006: 162 cases / 54 deaths
Prevention and Control of plague: principles
Prevention

Living conditions: better sanitation, rat proofing

Vaccine

- Live, attenuated
  - Doesn’t protect against pneumonic plague. Variably immunogenic.
  - Neurological side effects.
  - Not suitable for use during outbreaks

- Recombinant (phase II), DNA vaccine under development: Public health ??
Control

- Improvement of early detection
- Improvement of control strategy
- Risk assessment
Early detection and confirmation in remote areas

Pneumonic plague outbreak
Zobia, DRC, 2005

Collection kits and Rapid tests
Training
Improvement of control strategy

Vector and rodent control
Risk assessment

- Surveillance of circulating strains
  - antibioresistance
    - Madagascar 1995
    - resistant to chloramphenicol, streptomycin, tetracycline, and sulfonamides
    - plasmid containing the resistance came from an enterobacteria.
  - F1 negative strains in nature and lab

- Mapping and monitoring of natural foci / human population distribution: localization, limits, ecological characteristics
Potential for an international spread

La Libertad, Peru, 2010

After 13 yrs of silence, bubonic plague upsurge: 28 cases / 4 deaths

Panamerican road
International port

Bioterrorism

WHO, 1970:

50 kg of aerosolized *Yersinia pestis* in a city of 5 million people,

- would infect 150,000 and kill 36,000
- would spread over 10 km in a 1 hour period
Thank you