Leptospirosis as a global threat for both animals and humans: The GLEAN Story

Claudia Munoz-Zanzi
Division of Epidemiology and Community Health
School of Public Health
University of Minnesota
Leptospirosis: a public health perspective

Zoonosis
+ Environmental disease
+ Occupational disease

- Complex natural history
- Complex pathogen
- Non specific clinical presentation + severe forms

Estimating the magnitude of the problem: the Leptospirosis Burden Epidemiology Reference Group (LERG)

Increasing concerns at country level, WHO mandated by expert consultation in 2006

557,000 cases incl. 56,000 deaths worldwide each year.

1,000,000 cases, 100,000 deaths annually when adjusted for potential under-reporting due to incomplete case confirmation

40% of cases - acute renal injury  CFR 12.0 %

19% of cases - acute lung injury  CFR 16.4 %

in some areas as high as 975 cases per 100,000

http://www.who.int/zoonoses/diseases/lerg/en/
Leptospirosis transmission cycle

Leptospirosis transmission cycle

- Components

Leptospirosis transmission cycle

- Components
- Transmission dynamics within each host species

Leptospirosis transmission cycle

- Components
- Transmission dynamics within each host species
- Interactions between Components

Variations expected by social (urban, farms, villages) and environmental/ecological (temperate, tropical, subtropical, arid, Mediterranean) conditions

Impact of climate/weather
Endemic + epidemic

Epidemic vs. endemic

Baseline scenarios

- Very rare, only sporadic cases
- Seasonal, endemic levels
Leptospirosis Outbreaks
1970-2011 (n = 275)

Source: C. Munoz Zanzi
## Outbreak source

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Proportion (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated Flood Water</td>
<td>28.2 (77)</td>
</tr>
<tr>
<td>Contaminated Water - Other</td>
<td>15.4 (42)</td>
</tr>
<tr>
<td>Contaminated Water - Recreational</td>
<td>13.9 (38)</td>
</tr>
<tr>
<td>Occupational Exposure</td>
<td>16.5 (45)</td>
</tr>
<tr>
<td>Other*</td>
<td>10.6 (29)</td>
</tr>
<tr>
<td>Unknown</td>
<td>15.4 (42)</td>
</tr>
</tbody>
</table>
Philippines, 2009

680 cases of leptospirosis /yr with seasonal peak during the rainy season

Typhoon Pepeng: 3 October

Typhoon Ondoy: 26 September

Thousands of people displaced and housed in emergency evacuation centers

In the 2 following weeks, 505 suspect cases and 15 deaths in Manila alone!
Looking for a clear and coherent strategy

Detection and confirmation
- What is a leptospirosis case?
- What is an outbreak?
- How to confirm the cases?

Control
- Case management:
  - Early diagnosis and treatment.
  - Severe cases
  - Logistic issues
- A role for human immunization?
  - Vaccine serovar specific.
  - Limited availability.
  - Does not prevent carriage and release
- Mass chemoprophylaxis?
  - Efficacy, Logistic issues
  - High risk groups?
  - Up to 6 months of flood waters
- Decontamination of the environment?
- Rodent control?

Prediction
- Prediction and preparedness are essential but many key questions are pending
Large-scale risk assessment based on environmental variables: American Samoa

Figure 4. Predicted leptospirosis seroprevalence based on environmental variables. Predicted values were calculated using Model A, based on four environmental variables (altitude, piggeries, vegetation, and soil type).

Eco-epidemiological approach to understanding leptospirosis

Epidemiological studies:

↑ *Leptospira* in dogs:
   - ↑ dog density, ↑ slums
   - ↑ rainfall 1-month prior

↑ *Leptospira* in rodents:
   - ↑ farms, ↑ Spring, ↑ mice

↑ *Leptospira* in puddles:
   - ↑ dogs ↑ temperature 1-week prior
   - ↑ No. rodent signs, ↑ rainfall 1-week prior
   - ↓ farm household income

Molecular/serology studies:

Spatial studies:

↑ *Leptospira* in puddles from slums:
   - ↑ Positive rodent 50 m buffer
   - ↑ Specific habitats (wetlands, forest) in a 250m buffer
   - ↑ Flow accumulation index, rainfall 1-week prior
GLEAN initiative

Mission
To reduce the impact that leptospirosis outbreaks have on communities through providing cost-effective, implementable and sustainable solutions.

Overarching goals
To better understand the relationship between leptospirosis and various associated factors including environmental, biological, ecological, economic and demographic,
To provide more timely warnings of the onset of outbreaks,
To improve the efficacy of prevention and control strategies.
The **Global Leptospirosis Environmental Action Network (GLEAN)**

An One Health Approach

---

**GLEAN**: An international Community of Practice

Medical Clinicians, Public health specialists, Veterinarians, Climatologists, Statisticians, Rodent specialists, Biologists, Anthropologists, Ecologists, Water and Sanitation Specialists, Economists...

---

- Reducing the impact of leptospirosis outbreaks through cost-effective, implementable and sustainable solutions
- Early warning systems and Improved prevention and control strategies
- Increasing the knowledge of the relationship between environmental, biological, ecological, economic, demographic factors
How to reduce the impact of the outbreaks?
4 levels of potential intervention
5 years of efforts

- **Predict**
  - Determine baseline disease incidence
  - What are the main drivers? What are their predictive potential?
  - What type of prediction to inform public health decisions?
  - Develop tool / validate on site

- **Prevent**
  - Relative importance of potential preventive measures?
  - Role of animals / human vaccination?

- **Detect**
  - Improve lab confirmation (protocols, bank of reference sera, evaluation of rapid tests, reference lab network, training..)
  - Develop outbreak detection algorithms (case definition, epidemic threshold?)

- **Intervene**
  - Guidance for outbreak control and investigation
  - Outbreak preparedness and capacity building
The GLEAN initial partners
1st GLEAN meeting Marseille, France 2011

- Urban outbreaks linked to natural catastrophes, a priority.
- Technical framework document to address the various control aspects of the disease at the 4 levels of potential intervention (predict, prevent, detect and respond).

2nd GLEAN meeting Ispra, Italy 2012

- GLEAN initiative organized: project proposal + operational framework
- Regional case studies
- Outbreak control: preliminary recommendations

3rd GLEAN meeting Brasilia, Brasil 2013

- GLEAN steering committee, membership.
- Short and long-term plans
- Funding, partners, collaborators
- Regional case studies