

Global burden of Human Leptospirosis and cross-sectoral interventions for its prevention and control

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on behalf of the Leptospirosis Epidemiology Reference Group (LERG) & The Global Leptospirosis Environmental Action Network (GLEAN)

Background

- Leptospirosis is an important globally distributed neglected tropical zoonotic disease, although the worldwide incidence has never been systematically assessed
- The broad and often nonspecific clinical spectrum of the disease likely leads to significant under-reporting
- Laboratory confirmation techniques are technically demanding, usually require paired samples, and may be inaccessible in resource-poor settings.
- A systematic review of the global literature was undertaken in order to better inform governmental and non-governmental priorities for research, infrastructure development, healthcare policies, and surveillance activities.
- There is an increase in the reporting of large leptospirosis outbreaks following natural catastrophes
- Outbreak related prevention and control strategies still need to be clarified

Objectives LERG

1. to provide estimates on the global burden of leptospirosis according to age, sex and region expressed in disability adjusted life years (DALYs)
2. DALYs to provide evidence to influence policy by increasing awareness and commitment to reduce the impact of this disease on people's health and livelihoods
3. to encourage countries to undertake active disease surveillance and strengthen control measures
4. Findings to direct global research and action against human leptospirosis

Objectives GLEAN

1. to increase the knowledge and understanding of the relationships between leptospirosis and various associated factors including environmental, biological, ecological, economic and demographic influences on the disease
2. to provide more timely warnings of the onset of leptospirosis outbreaks,
3. to promote innovative diagnostic tools, and
4. to improve the efficacy of leptospirosis prevention and control strategies through building country level capacity

Methodology

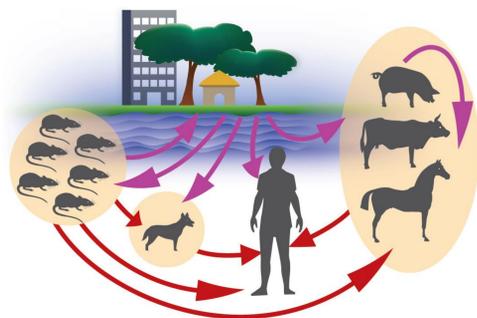
A systematic review of published and unpublished literature was performed that described studies of endemic leptospirosis incidence and mortality. The systematic literature review process and criteria complied with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and were developed during two consultative meetings of the LERG who reviewed and advised on the methods and results.

Modeling methods were developed to generate an estimate for the global and subregional incidence and mortality due to leptospirosis, adjusting for differences in the age and gender demographics of each country, and adjusting for estimated under-reporting bias due to laboratory confirmation.

GLEAN was developed with a five-year timeline, addressing four levels of intervention: predict, prevent, detect and response; to predict when/where the disease may occur, prevent the disease from occurring, detect all cases and develop effective interventions. This multi-disciplinary, multi-sectorial initiative includes medical clinicians, veterinarians, climatologists, statisticians, rodent specialists, biologists, anthropologists, ecologists, water and sanitation specialists, and economists.

GLEAN is governed through a steering committee, has four working groups aligned with the four levels of intervention, and holds an annual technical meeting.

Figure 1. Transmission cycle



Results

- Reported incidence ranged from 0.10 to 975.00 annual cases per 100,000 population.
- Reported case-fatality was 6-85% depending on prevalent serovars, healthcare and all-cause mortality.
- Multivariable prediction model including 4 variables related to geography, climate, health indicators and urbanization estimated globally 873,000 annual cases (95% CI, 299,000 – 1,460,000) and 48,600 annual deaths (95% CI, 19,000 – 79,900).
- The GBD sub regions with the highest predicted annual incidence and mortality are Oceania, the Caribbean, and South-East Asia
- The predicted burden of cases and deaths is highest among adult males with 44% of deaths occurring among males between 20 and 49 years old.
- Incidence is heavily influenced by climactic and geographic factors; with 87% of predicted cases worldwide located within the Tropics of Cancer and Capricorn.
- Average medical costs at a Thai community hospital: mild case ~45 €, severe case ~250 € per patient (excluding indirect or non-medical costs).
- The 2008 leptospirosis outbreak in New Caledonia resulted in 157 cases and cost 984,472€ (including diagnostic, prevention and control). The prevention and awareness programme cost an additional 52,077€.

Figure 2. Results of the systematic review process

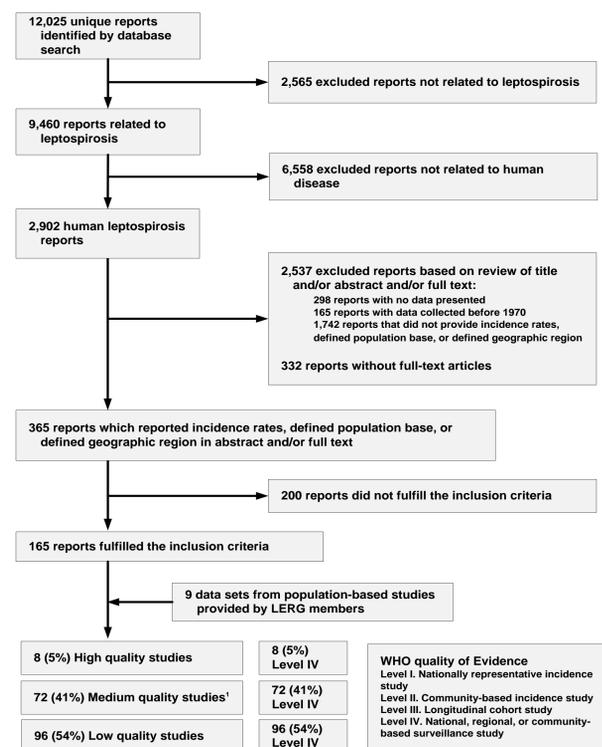
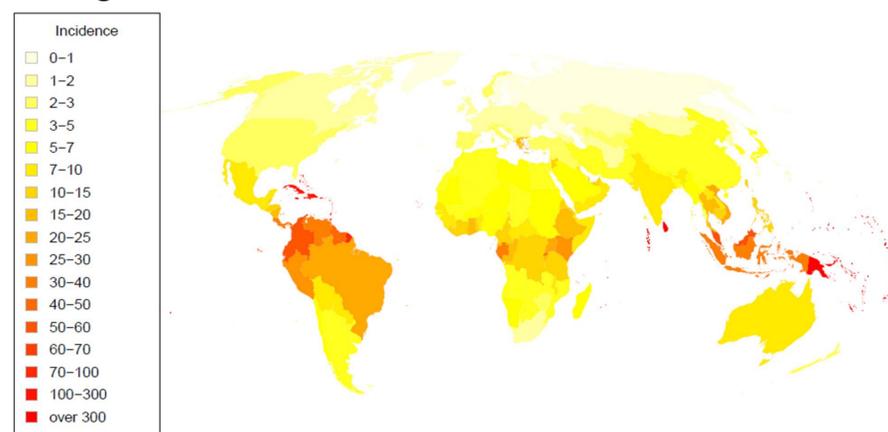


Figure 3. Estimated annual cases by Global Burden of Disease subregion



Conclusion

Leptospirosis is a significant global public health problem that disproportionately affects resource-poor areas of the world.

The true burden of this disease may be substantially higher than our estimates, due to the predominance of passively collected hospital-based data in our analysis, and due to the inherent infrastructural requirements and challenges of laboratory diagnosis and reporting. Continued efforts to improve surveillance and reporting, and to understand and mitigate the risk factors for leptospirosis should remain a priority, both in regions known to have a high burden, and in those identified by our analysis who may be at risk of significant unmeasured burden.

Utilizing the comprehensive findings from LERG, GLEAN was developed in partnership with international organizations and academic institutions, to provide direction and coordination to fill the many gaps in leptospirosis knowledge with the ultimate goal of translating the research findings into operational guidance for communities and countries affected by leptospirosis outbreaks.



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