GLOBAL RISK FORUM GRF DAVOS GRF
planet@risk
http://www.planet-risk.org

Towards a "One Health" Strategy against Leptospirosis[1]

JANCLOES, Michel[a], BERTHERAT, Eric[b], SCHNEIDER, Cristina[c], BELMAIN, Steve[d], MUNOZ-ZANZI, Claudia[e], HARTSKEERL, Rudy[f], COSTA, Federico[g], DENIS, Jerome[h], and BENSCHOP, Jackie[i]

[a] Health and Climate Foundation, Washington 20005 DC, USA, e-mail: michel.jancloes@gmail.com
[b] Epidemic Alert and Response, World Health Organization, Geneva, Switzerland, e-mail: bertherate@who.int
[c] Veterinary Public Health Unit, Pan American Health Organization, Washington 20037 DC, USA, e-mail: schneidc@paho.org
[d] Natural Resources Institute, Greenwich University, United Kingdom, e-mail: s.r.belmain@gre.ac.uk
[e] School of Public Health, University of Minnesota, USA, e-mail: munozzan@unm.edu
[f] KIT Biomedical Research, Royal Tropical Institute, Amsterdam, the Netherlands, e-mail: r.hartskeerl@kit.nl
[g] Oswaldo Cruz Foundation, Salvador, Bahia, Brazil, e-mail: fcosta2001@gmail.com
[h] Development Department, IMAXIO S.A., Lyon 6900, France, e-mail: jdenis@imaxio.com
[i] Institute of Vet, Animal and Biomedical Sciences,Massey University,New Zealand, e-mail: J.Benschop@massey.ac.nz

Abstract – Leptospirosis is an emerging disease; affecting animals, humans and the natural environment, it is a "one health threat". In spite of its global distribution, its epidemic potential due to climate/ environment changes, its high human mortality rate and socio economic burden, this zoonosis is neglected. For mobilizing more investments in its prevention and control, a global multi- disciplinary and multi-sector network called "Global Leptospirosis Environmental Action Network,"(GLEAN) has been established. This article reports recent expert's discussions on prevention and control strategies, based on a One Health concept. It provides an innovative agenda for operational research and for veterinary and public health cooperation.

Keywords – *leptospirosis; neglected disease; One Health; zoonosis; environment health*

1. Background

Despite being a largely widespread zoonosis in the world, affecting animals and humans, leptospirosis remains a relatively unknown disease. Clinical recognition and diagnosis is confounded by diverse common symptoms that are shared with other, well-known, diseases (e.g. malaria, dengue). Leptospirosis is an alarming public health threat because of its global distribution, especially in warm and humid areas, its epidemic potential linked with increasing natural disasters and floods and its almost omnipresence in animals and the natural environment.

A WHO expert group estimated its annual global incidence as 1.03 million human cases with 58,900 deaths (Hagan, Costa et al. 2013). If not properly treated, leptospirosis can have a high fatality rate of up to 29%. While not well measured, the overall economic impact is high due to the impact on both human and animal health. Health effects on livestock include reproductive failure and poor weight gain. In people, a wide range of clinical symptoms can be observed after infection, including potentially prolonged debilitating sequelae and inability to work, often for several months whilst recovering. Leptospirosis is often recognized as an occupational disease affecting slaughter and sewer workers, subsistence farmers and veterinarians; however, infection in other populations associated with daily activities and household exposures is increasingly being recognized.

This bacterial infection is a neglected disease because the transmission dynamics are poorly understood, symptoms are not specific, the laboratory diagnosis is complex (more than 250 sero-variants exist) and laboratory confirmation is often not available. This partly explains why leptospirosis has not received proper recognition and acknowledgement from public health authorities, the medical industry, the research community and investors as a threat to public health.

[1]This article is based on a presentation given during the 2nd GRF Davos One Health Summit 2013, held 17-20 November 2013 in Davos, Switzerland (http://onehealth.grforum.org/home/)

1.1. An integrated approach to "One Health"

The battle against leptospirosis can be considered an excellent example of "One Health", where the relationship between humans, animals and ecosystems needs be considered to better understand and manage the disease. Subsequently, any research and control effort requires a truly multi-disciplinary and coordinated approach. Exemplary is the case of the fight against leptospirosis, led in New Zealand (see annex 2)

To deal with this alarming challenge, the Health and Climate Foundation (HCF) and the World Health Organization (WHO) initiated a global network of experts from research institutions, international organizations, officials from affected countries and private companies involved in diagnostics and vaccine development. A technical framework was designed in 2011 as a foundation for novel partnerships, called the Global Leptospirosis Environmental Action Network (GLEAN). Its plan of work is multidisciplinary and involves several sectors and stakeholders. `www.glean-lepto.org`

At the recent Global Risk Forum, 19 November 2013 in Davos, GLEAN organized a special session on "An unrecognized One Health threat: Leptospirosis". The purpose was not only to recognize the full potential of a One Health Approach, but also to identify areas for new partnerships and finding cost-effective, applicable and sustainable solutions against human leptospirosis. The agenda of the session can be found in Annex 1, and on the conference site `www.conftool.pro/onehealth2013/sessions.php`

A key message emerged following this session's discussion and debate: A One Health vision applied to the prevention and control of human leptospirosis raises new interdisciplinary research avenues and partnerships, especially with veterinary scientists, practitioners and industry.

Looking to the interface between ecosystems, domestic and wild animals, humans and the environment has led to the following questions and implications:

1. What are the drivers of sero-variants distribution and diversity in specific environments? Which ones have more zoonotic or human infection potential or importance?
2. Could interventions to reduce leptospirosis in animals, such as livestock vaccination, have a positive impact on the incidence of human leptospirosis?
3. Could detection and surveillance of animal leptospirosis serve as risk indicator for human leptospirosis surveillance programs?
4. Should detection of human cases lead to interventions in domestic animals?
5. What is the predictive value of some drivers related to human epidemics, such as rodent density and factors stimulating their reproductive capacity? What is the role of other animals, particularly domestic animals?
6. Could the epidemiological knowledge on other zoonoses help in better managing undifferentiated symptoms, such as fever and making earlier diagnosis of leptospirosis, e.g. in pastoralist areas?
7. How do we maximize the impact of rodent management against animal and human leptospirosis?
8. Could community based interventions on environmental health prevent leptospirosis transmission?
9. How best to use laboratory animals for developing preliminary evidence of the efficacy of antibiotic chemoprophylaxis in pre and post exposure conditions?
10. Under which operational conditions, should joint veterinary and public health surveillance and detection services operate together?
11. To which extent does the development of vaccines against animal leptospirosis stimulate the development of human vaccines?
12. To get a more comprehensive knowledge of the economic impact of leptospirosis, would it be more appropriate to measure the cumulative burden for the populations of both animal and human leptospirosis?

2. Conclusion

An integrated vision within the animal-human-ecosystem interface is necessary in order to orient knowledge about the prediction, detection, prevention and response to outbreaks of leptospirosis. This vision guides the GLEAN framework to integrate expert efforts for translating research into operational tools to support affected communities and countries at risk of leptospirosis outbreaks.

To develop new technologies, strategies and operational guidelines against human leptospirosis, the key messages are:

- Leptospirosis is one disease affecting both animals and humans.
- Its transmission dynamics and main drivers needs better understanding.
- Scientists and decision makers from different sectors and disciplinary backgrounds should cooperate and be involved at all stages in the development of strategies.
- Veterinary and public health communities should design together research proposals, ensure an effective partnerships for joint surveillance and detection and create synergies in high risk areas.

References

Hagan,J.E., F.Costa, et al. (2013). Global morbidity and mortality of Leptospirosis: a systematic review. Scientific meeting of the International Leptospirosis Society. Fukuoka, Japan.

Marshall, R. B. and B. W. Manktelow (2002). "Fifty years of leptospirosis research in New Zealand: a perspective." New Zealand Veterinary Journal 50(3 Suppl): 61-63.

Citation

Jancloes, M.; Bertherat, E.; Schneider, C.; Belmain, S.; Munoz-Zanzi, C.; Hartskeerl, R.; Costa, F.; Denis, J.; Benschop, J. (2014): Towards a "One Health" Strategy against Leptospiro-

sis. In: Planet@Risk, 2(3), Special Issue on One Health (Part I/II): 204-206, Davos: Global Risk Forum GRF Davos.

Annex 1: Agenda of Davos

1. "*The Global Leptospirosis Environment Action Network: From a One Health Perspective*", Bertherat, E., WHO
2. *"Drivers of leptospirosis transmission at the animal-human interface in distinct community types".* Munoz- Zanzi, C., University of Minnesota
3. "*Can human incidence of leptospirosis be reduced through implementing Ecologically-based rodent management?*" Belmain, S.R. f, University of Greenwich
4. "*Leptospirosis outbreaks in Nicaragua: Identifying critical areas and exploring drivers for evidence-based-planning*". Schneider, C., Pan American Health Organization
5. "*Diagnosis of leptospirosis*". Hartskeerl R., The Royal Tropical Institute of Amsterdam
6. "*Overview of human vaccines against leptospirosis*". Denis, J., IMAXIO Company

Annex 2

In New Zealand, livestock vaccination to protect human health has a long history with dairy cattle and pigs being routinely vaccinated (Marshall and Manktelow 2002). This is in part feasible because the predominant serovariants found in human cases are few and these are maintained in domestic species. However, it is perhaps timely to propose that animal vaccination could work to prevent human cases more broadly, especially those associated with rodent-livestock interactions in developing countries. Of paramount importance is the reconsideration of the traditional reservoir/spill-over host model for leptospiral transmission and a deepening of our understanding of the host-pathogen dynamics gained through both phenotypic and genotypic characterisation. Livestock vaccination will not work in isolation and it is not without challenges. Vaccines must be available and efficacious (prevent shedding in naïve animals and reduce it in those previously exposed); ideally vaccination is supported by incentives (includes legislation, enforcement and proven benefits to animal owners, beyond human protection); vaccination is practical (timing fits in with animal production and movement cycles, the cold chain can be maintained and staff is trained to deliver it); and that animal vaccination is recognised by all as a long term prospect.