



## Agriculture-associated diseases research at ILRI: Neglected zoonoses

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*Neglected zoonoses thrive in neglected populations and impose burdens on both health and livelihoods. Integrated “One Health” approaches offer new promise in tackling these old diseases.*

### Key points

- Zoonotic diseases pass naturally from animals to humans;
- Around 60% of human pathogens are zoonotic;
- Around 75% of livestock pathogens are multi-host pathogens;
- Emerging diseases are more likely to be of zoonotic origin;
- The control of zoonotic diseases in humans may be most cost-effective if interventions are targeted at the animal reservoir.

### Why zoonoses matter

Zoonotic diseases are infections that are naturally transmitted between people and vertebrate animals, including wildlife, livestock or domestic pets. It is estimated that



such diseases represent 58% of all human pathogens and up to 75% of all emerging diseases<sup>1</sup>. In addition, 77% of livestock pathogens are multi-host pathogens<sup>2</sup>, meaning that they move between different hosts, which may include humans. Thus, zoonoses, and zoonoses that originate in livestock, constitute a significant threat to human health.

## The poor are most vulnerable

Over the last few years, a number of zoonotic diseases have emerged and hit the headlines, as they have caused, or threatened to cause, major pandemics (e.g. avian influenza). Such pandemic threats have focussed renewed attention on another set of zoonotic infections – those that are endemic and cause largely chronic morbidity in affected, poor populations, and yet receive much less international attention and funding than emerging diseases: the so-called “neglected zoonoses”<sup>3,4</sup>. Important neglected zoonoses, all widespread in Africa, include: anthrax, bovine tuberculosis, brucellosis, cysticercosis (pig tapeworm), echinococcosis (hydatid disease), leishmaniasis, rabies and zoonotic trypanosomiasis (sleeping sickness).

Neglected zoonoses persist in communities with complex development problems including: poverty, poor access to services, isolation, insecurity, political marginalisation, low literacy, gender inequality, lack of sanitation, degraded natural resources, and high dependence on livestock.

The poor, in developing countries, suffer a disproportionate burden of zoonotic disease because:

- Poor people are more at risk of acquiring zoonotic infections; this is partly because poorer groups are more likely to live in close proximity to their animals which are the reservoirs of zoonoses, and also because livestock products present a risk of zoonotic disease acquisition (eg meat infected by cysticercosis, milk infected with brucellosis). Livestock products consumed by poor people are more likely to have high levels of zoonotic pathogens.
- Sickness among poor people is always less likely to get a proper diagnosis and there is the added difficulty that diagnosis of zoonotic infections is often challenging (because zoonotic diseases are often confused with more common diseases such as malaria), leading to under-reporting – meaning that the affected people suffer for longer and decision-makers are unaware of the true extent of the problem.
- Zoonoses often inflict multiple burdens. Several zoonoses are constraints to livestock production, which translates to a constraint in realising the full market price of an animal. Livestock disease/death and sub-optimal production impacts directly on assets and income, worsening poverty.

Disease burden is also influenced by gender and culture. Women’s common role as primary care-givers for sick people and animals as well as preparers of food puts them at higher risk for some zoonoses. In other cases men may be more exposed because of gender roles (e.g. involvement in hunting, butchering and herding).

## What we have learned

At the International Livestock Research Institute (ILRI), research on neglected zoonoses has increased over the last decade. Early on, work focused on milk associated zoonoses, including brucellosis as part of smallholder dairy development. Several projects took place on different aspects of trypanosomiasis including community-based control, rational drug use to slow resistance development, and molecular epidemiology. While these focused on animal trypanosomiasis, implications for sleeping sickness were also explored.

The pig tapeworm, *Taenia solium*, is transmitted to humans from pigs through the consumption of infected pork. It is also the cause of neuro-cysticercosis, the single most important cause of acquired epilepsy in sub-Saharan Africa. ILRI supported development of the Cysticercosis Working Group East and Southern Africa and research with pigs as well as human epileptics in western Kenya.

ILRI hosted the Second World Health Organization meeting on the ‘Integrated Control of Neglected Zoonotic Diseases in Africa’ in 2007, advocating that changing livestock production and marketing systems in Africa were impacting on zoonotic disease risks and developed a joint programme on zoonoses with the Swiss Tropical and Public Health Institute.

ILRI research is in line with, and supports, an emerging consensus on zoonoses:

- Zoonotic diseases associated with livestock and livestock production are constraints to human health and economic development.
- Basic epidemiological data on zoonotic diseases are simply not available in many countries and regions and establishing systems for data collection is a priority
- Zoonoses can occur focally – they may have a significant and debilitating effect on some commu-

nities, but not on others. Understanding the spatial distribution of the burden of zoonoses is important to focus control efforts.

- There is a need for metrics that capture the societal burden of zoonoses, recognising the high dependency of the poor on livestock
- Cheap and efficient diagnostics are needed for this group of pathogens, in both the human and animal hosts.
- In general, zoonoses can be best tackled through interventions involving the livestock hosts – but a sound evidence base is lacking on costs, benefits, acceptability and scalability of interventions
- A significant constraint is the lack of collaboration between medical and veterinary authorities, such that institutionally, zoonoses find themselves homeless and ignored. There is a need for ‘One Health’ thinking and research to overcome inter-sectoral barriers to effective control.
- Policy frameworks are weak with respect to zoonotic diseases: their successful control requires a legal framework, a policy framework, institutional structures and an intervention implementation plan.
- The burden of neglected zoonoses falls heaviest on the poor, vulnerable and marginalised and differently on men and women. Assessment and intervention needs to specifically address the barriers disadvantaged groups have in managing diseases in animals and accessing services for themselves.

## ILRI and neglected zoonoses

Work on cysticercosis continues. With international academic and African industrial partners, prototype diagnostic tests have been produced and are under evaluation in the field, determining their sensitivity and specificity, together with work on how they might best be deployed to protect poor consumers.

A highly innovative research project, still at proof of concept stage, is investigating the introduction of genes for trypanosomosis resistance to cattle. Controlling trypanosomosis in livestock hosts could reduce the heavy burden of human sleeping sickness while protecting cattle from what is considered the most important disease in Africa.

ILRI and the University of Edinburgh and other partners, has established a field site in western Kenya for the study of zoonotic diseases. Scientists at the ILRI field laboratory are investigating several of the neglected zoonoses, concurrently in livestock and the families that keep them, and gathering the essential base line data about these infections and the populations affected by them that is so severely lacking. On the basis of this work, a platform is being created to undertake future studies that will include interventions to reduce the zoonotic burden. The research platform is also being used to develop and validate several diagnostic tests, and to investigate the transmission of certain zoonotic agents in the food chain.

Over 50% of the world’s population now lives in urban environments, and the need to feed this growing population means that a) rural hinterlands are increasingly connected to urban zones and b) agriculture and livestock production are increasingly taking place in urban and peri-urban areas. New opportunities for transmission are thus being created; an interdisciplinary approach, involving veterinarians, medical professionals, sociologists, urban planners, demographers, epidemiologists, ecologists and microbiologists has been brought together to describe and study these phenomena, with a view to informing the design and implementation of policy.

## Future plans and way forward

The CGIAR Research Programme on Agriculture for Enhanced Nutrition and Health has a component on Agriculture Associated Diseases led by ILRI. Neglected zoonoses are a major focus of activity along with emerging infectious disease and food safety in informal markets. The following research questions are key:

### *Risk prioritisation and systems understanding*

What are the priority zoonotic and emerging diseases that constrain pro-poor development?

- What is the prevalence and burden of zoonotic and emerging diseases?
- What are the risk factors and control points?
- What are the options for control?
- What are the likely risk-risk trade-offs, costs and benefits, and cost-effectiveness of control options?

## Risk management

How can agriculture-based interventions contribute to control of neglected zoonoses?

- How to build and test multi-sectoral, integrated zoonoses control packages?
- What is the added value and appropriate use of multi-sectoral, 'One Health' interventions?
- How to develop new technologies to meet current gaps in disease control?
- How to promote uptake, adoption, and transforming knowledge into use?
- What is the acceptability, scalability, transferability and sustainability of interventions?

## References

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*On 9 and 10 November 2011, the ILRI Board of Trustees hosted a 2-day 'liveSTOCK Exchange' to discuss and reflect on livestock research for development.*

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