

Institution: University of Edinburgh and SRUC, Scotland's Rural College
Unit of Assessment: 6
Title of case study: Eliminating trypanosome carriage in Ugandan cattle prevents sleeping sickness in humans, stimulating the formation of "Stamp Out Sleeping Sickness (SoS)" a Public Private Partnership that is eliminating the disease from Uganda.
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Impact: Economics, policy, animal and human health: In 2006, SoS (a Public Private Partnership-PPP) was established involving: University of Edinburgh, a pharmaceutical company, a charity, and the Govt. of Uganda to control sleeping sickness by eliminating Trypanosome carriage in cattle. The prevalence of trypanosomiasis has been reduced by 75% and sleeping sickness cases have fallen year on year since the PPP was established and Uganda has received a cost benefit between US\$125 and \$400M</p> <p>Beneficiaries: The Ugandan population, Ugandan Cattle population.</p> <p>Significance: Sleeping sickness, which is difficult to diagnose and treat in humans, is often fatal. Ten million Ugandans are at risk from sleeping sickness. SoS established a veterinary network in Uganda producing</p> <p>Attribution: Professor Welburn (University of Edinburgh, UoE) founded SoS and developed essential diagnostic techniques.</p> <p>Reach: SoS provides a model for the elimination of the disease across sub Saharan Africa in an economically sustainable fashion - with over 22 million people at risk.</p>
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>Sleeping sickness is a disease transmitted by tsetse flies in sub-Saharan Africa; it is expensive and difficult to diagnose and fatal if untreated. There are two forms of disease: acute Rhodesian caused by <i>Trypanosoma brucei rhodesiense</i> and chronic Gambian caused by <i>T. b. gambiense</i>. In Uganda, there are 32 high-risk districts with Rhodesian sleeping sickness threatening 9 million people, mostly in poor, rural areas. Nine districts currently account for 80% of all reported Rhodesian sleeping sickness cases in Uganda.</p> <p>Uganda is unique in having both disease forms that were historically widely separated. In 1999, the focus of the acute form began moving towards the chronic disease focus threatening established, distinct control measures. With > £10 million grants from DfID, Wellcome Trust, and The European Commission Seventh Framework Programme, Prof Welburn (Professor of Medical and Veterinary Molecular Epidemiology, University of Edinburgh, employed 1999-present) provided the evidence base for a new approach to control sleeping sickness in Uganda and established a public-private partnership (PPP) (Stamp Out Sleeping Sickness. SoS) - a unique One Health solution. A key collaborator has been The School of Veterinary Medicine and Animal Resources, Makerere University, Kampala, Uganda. Makerere veterinary school has been intimately involved in our research on zoonotic disease for more than 20 years contributing logistical and intellectual inputs.</p> <p>Key underpinning research outputs:</p> <ol style="list-style-type: none"> <u>Evidence that domestic cattle were the principal reservoir of human infective <i>Trypanosoma brucei rhodesiense</i> in Uganda (References 3.1-3.2)</u> <p>For 100 years it was impossible to assess the risk posed by livestock carrying both non-human-infective <i>T. b. brucei</i> and <i>T. b. rhodesiense</i> that were indistinguishable. In 1999, we identified and validated a robust molecular marker (<i>sra</i>) for human infectivity in trypanosomes and UoE work revealed that up to 40% of cattle in SE Uganda carried <i>T. b. rhodesiense</i>.</p>

Impact case study (REF3b)

2. Evidence to support a new approach to sleeping sickness control, by targeting the animal reservoir (References 3.1-3.3)

In 2001 our studies showed that outbreaks of sleeping sickness were caused by importation of cattle from endemic areas. Using mathematical modelling, we predicted that treating >86% of cattle would control the spread of disease. We tested the model in Uganda by (i) mass chemoprophylaxis of cattle to remove the parasites from the reservoir hosts and (ii) application of insecticide to cattle to prevent reinfection by tsetse. We showed that a single round of treatment could eliminate human trypanosomes in the cattle reservoir and that a monthly application of insecticide to cattle prevented reinfection.

3. References to the research (indicative maximum of six references)

- 3.1 Welburn, S.C, Picozzi, K., Fevre, E.M., Coleman, P.G., Odiit, M., Carrington, M. and I. Maudlin (2001). Identification of human infective trypanosomes in animal reservoir of sleeping sickness in Uganda by means of serum-resistance-associated (SRA) gene. *Lancet* 358: 2017-19. [http://dx.doi.org/10.1016/S0140-6736\(01\)07096-9](http://dx.doi.org/10.1016/S0140-6736(01)07096-9)
- 3.2 Fevre, E.M. Coleman, P.G., Odiit, M.D., Magona, J., Welburn, S.C., and M.E.J. Woolhouse (2001). The origins of a new sleeping sickness outbreak (caused by *Trypanosoma brucei* infection) in eastern Uganda. *Lancet* 358: 625-628. [http://dx.doi.org/10.1016/S0140-6736\(01\)05778-6](http://dx.doi.org/10.1016/S0140-6736(01)05778-6)
- 3.3 Fèvre, E.M., Picozzi, K., Fyfe, J., Waiswa, C., Odiit, M., Coleman, P.G. and S.C. Welburn (2005). A burgeoning epidemic of sleeping sickness in Uganda. *Lancet* 366: 747-747. [http://dx.doi.org/10.1016/S0140-6736\(05\)67179-6](http://dx.doi.org/10.1016/S0140-6736(05)67179-6)

4. Details of the impact (indicative maximum 750 words)**Impact on Health and Welfare:**

Based on our research findings, in 2006 we established a Public-Private-Partnership (PPP) (University of Edinburgh, CEVA Sante Animale (a global veterinary health company), IKARE (a UK-based charity) - and the Government of Uganda) called **Stamp Out Sleeping Sickness**. This was created to ensure:

- (i) Mass treatment of cattle in five districts in the disease-overlap zone
- (ii) Compliance with Govt. policy to treat cattle at markets (a legal obligation for the buyer, but not applied in practice)
- (iii) The establishment of veterinary businesses to deliver a cattle-spraying service and vet provision (where none was available in the post-privatised system)
- (iv) To tie in with Ministry of Health screening activities to coordinate human and animal treatments.

We tested the interventions in seven districts of Uganda, targeting 500,000 cattle in two phases. In phase I, 250,000 cattle were treated and in 2008, phase II, a further 150,000 cattle were treated. The clear impact of intervention was the finding that a 75% reduction in total trypanosome prevalence was achieved by mass treatment alone and sleeping sickness cases have fallen year on year since the PPP was established (it has been calculated that reported human cases have been reduced by 90%)[5.1]

To ensure the prevalence of the human infective parasite remains at a low level, 15–20% of the at-risk cattle population need to be treated monthly [5.2, 5.3, 5.6]. We are now involved with SoS in a three-year mass cattle treatment programme – injection and spraying– to quickly reduce human infective parasite prevalence in cattle [5.4; 5.9].

Impact on public policy

The model for sleeping sickness control we have developed is now promoted by WHO and donor agencies. [5.2; 5.6; 5.7; 5.8]. To eliminate sleeping sickness from SE Uganda a new approach to funding was needed to avoid the pitfalls associated with public goods (sustainability and accountability). Working with Social Finance (<http://www.socialfinanceus.org>) we have developed a novel partnership to leverage private investment to pay for sleeping sickness control by shifting

donor funding towards results based funding mechanisms (Development Impact Bonds) [5.9].

Impact on the economy

Human and animal health gains, as a result of reduced parasite prevalence, have been independently quantified in terms of: sleeping sickness cases averted; disability-adjusted life year (DALYs) averted (with \$ value) and care costs averted. Animal productivity gains as a result of reduced parasite prevalence can be quantified in terms of sleeping sickness parasite free cattle and Tick-free cattle – cattle treatment also controls tick-borne diseases providing additional economic impact. The economic benefit is estimated as \$100-400M in human health care costs plus an estimated \$25 per head of cattle per year increased productivity from improved animal health care provision in the poorest communities (in post conflict districts of Uganda). [5.3; 5.5, 5.10, 5.11].

5. Sources to corroborate the impact (indicative maximum of 10 references)

- 5.1. Christine Amongi PhD Thesis: Molecular Epidemiology Of *Rhodesian* And *Gambian* Human African Trypanosomiasis In Kaberamaido District, Uganda (University of Edinburgh). (Document available on request.)
- 5.2. Welburn S.C., Coleman, P.G., Fevre, E.M., Odiit, M., Maudlin, I and M.C. Eisler (2006). Crisis, what crisis? Control of *Rhodesian* sleeping sickness. *Trends in Parasitology* 22: 123-8. <http://dx.doi.org/10.1016/j.pt.2006.01.011>
- 5.3. Fèvre EM, Wissmann BV, Welburn SC, Lutumba P (2008) The burden of human African trypanosomiasis. *PLoS Neglected Tropical Diseases* 2:e333. <http://dx.doi.org/10.1371/journal.pntd.0000333>
- 5.4. World Health Organisation (2012): 'Accelerating work to overcome the global impact of neglected tropical diseases - A roadmap for implementation'. Specific reference to the elimination of zoonotic sleeping sickness in East Africa, WHO recommends targeting interventions at the intermediate hosts (cattle) citing the DFID-RNSS research findings as evidence supporting this strategy. <http://tinyurl.com/ptqj7k6>
- 5.5. Shaw, APM et al., (2013), Estimating the costs of tsetse control options: An example for Uganda. *Preventive Veterinary Medicine* 110 (2013) 290– 303. Shows economic benefit of \$100- 400 million in human health care costs - plus an estimated 25\$ per head of cattle per year in increased productivity from improved animal health care provision in post conflict districts of Uganda. <http://dx.doi.org/10.1016/j.prevetmed.2012.12.014>
- 5.6. Bardosh, K Charles Waiswa, C. and Welburn, S.C. (2013) Conflict of interest: use of pyrethroids and amidines against tsetse and ticks in zoonotic sleeping sickness endemic areas of Uganda. *Parasites & Vectors*, 6:204. <http://dx.doi.org/10.1186/1756-3305-6-204>
- 5.7. The disease control model we have used in Uganda was developed with Prof Hargrove (University of Stellenbosc) and simulates the effect of interventions in terms of changes in parasite prevalence in cattle, reduction in human health burden and improvement in animal health (expressed as \$). (Hargrove et al (2012) Modeling the control of trypanosomiasis using Trypanocides or insecticide-treated livestock. *PLoS Neglected Tropical Diseases*, 6 (5). E1615. <http://dx.doi.org/10.1371/journal.pntd.0001615>).
- 5.8. 2012 - SOS - One Health approach for securing health and livelihoods in developing countries Risk Forum One Health Summit 2012, One Health: Public health and livelihoods Control of "Neglected" Zoonoses: 19th – 23rd February Davos. <http://tinyurl.com/o4ag4fr>
- 5.9. Zoonotic HAT targeted for elimination using SOS Model. Report of the Interagency meeting on planning the prevention and control of neglected zoonoses diseases, WHO, Geneva 5 -6 July 2011. <http://tinyurl.com/ox6hp7l>

In 2011, the WHO Strategic and Technical Advisory Group for Neglected Tropical Diseases and partners adopted a roadmap for control, elimination and eradication. The roadmap sets targets for the period 2012–2020. WHO believes that despite the complexity of neglected tropical diseases, the targets are achievable.

Impact case study (REF3b)

Organized by the Department of Neglected Tropical Diseases (NTD) of the World Health Organization (WHO) with UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), the Food and Agriculture Organization of the United Nations (FAO) and the World Animal Health Organization (OIE).
<http://tinyurl.com/or5u635>

- 5.10. SoS Featured at three WHO/EU/DfID policy meetings on Neglected Zoonoses. Flagship NZ project at the 3rd Neglected Zoonoses Conference November 2010. Report of the NZD3 conference <http://tinyurl.com/qfa3pyk>
- 5.11. Center for Global Development and Social Finance June 2013. Development Impact Bond Working Group Report. An Investment Strategy in the Human Interest: <http://tinyurl.com/ou62qzq>