INTERGRATED CONTROL OF NEGLECTED ZOONOSES:
Improving Human Health and Animal Production Through Scientific Innovation and Public Engagement

BY

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Improving Human Health and Animal Production Through Scientific Innovation and Public Engagement
Origins of ICONZ

Two major WHO international meetings held in 2005 and 2007.

These focussed on endemic zoonoses which affect poverty: anthrax, bovine TB, brucellosis, cystic echinococcosis, cysticercosis and neurocysticercosis, rabies and zoonotic Human African trypanosomiasis

Realisation that these were neglected diseases with a huge dual impact on lives and livelihoods. 3rd NZD meeting in 2010 in Geneva, Switzerland.
Major neglected zoonotic diseases - Hot Spots?

Open-ended List of "NZDs"
- Anthrax
- Bovine tuberculosis
- Brucellosis
- Cysticercosis/taeniosis
- Echinococcosis/Hydatidosis
- Zoonotic trypanosomiasis
- Zoonotic leishmaniasis
- Rabies

AMR
- Rabies
- Echinococcosis
- Cysticercosis
- Leptospirosis
- Brucellosis
- B.Tuberculosis

SEAR/WPR
- Rabies
- Echinococcosis
- Trematodoses
- Cysticercosis
- Leptospirosis

EUR
- Rabies
- Echinococcosis
- Cysticercosis
- Brucellosis
- B.Tuberculosis

EMR
- Echinococcosis
- Brucellosis
- Rabies
- Zoonotic trypanosomiasis
- Zoonotic leishmaniasis
- Rabies
A Disproportionate Burden is Borne by the Poor

- Living in isolated rural areas or urban slums
- Close contact with animals
- No services

- Reliance on family members
- Livestock income becomes critical as part of coping strategy

- Poor prognosis once infected
- More risk of acquiring a zoonosis
- Greater Burden borne

- More vulnerable to illness

- Difficulties in getting a diagnosis
- Expensive treatments
- Cost of seeking health care
- Parallel difficulties in getting animals treated

- Death, Disfigurement, Morbidity, Loss of Livelihood, Poverty
Origins of ‘Neglect’

- **Donor prioritization:** Unintended consequence of adoption of a system of prioritization scoring system (GBD - DALYs)
- **Funding based on GBD DALY** while logical, is not universally accepted as being either fair or sensible.
- **Gross under-reporting**
- **Morbidity:** rarely comes to clinical attention
- **Fund Provider interest:** When a disease is perceived to be a threat to wealthier nations or donors and investors are more likely to pay attention e.g. SARS, H5N1, ‘Swine flu’ etc
- **Trade and industrial interests:** when pharmaceutical firms see the disease as a source of potential sales. NZD offer negligible marketable opportunities.
Where are the Neglected Zoonotic Diseases in Africa?

Evidence patchy

Everywhere?  Nowhere?
Successful NZ interventions

All founded on 3 principles

1. On the ground properly designed epidemiological field work with empirical data collection feeding into

2. Robust theoretical models of complex multi host systems

3. Using 1 and 2 as a platform for designing, evaluating and implementing successful interventions

But **Model is only as good as data going into it!**

Animal targeted vector control Interventions

RAP SS Uganda, Collars on dogs - Leish in Brazil and Iran
Specific Needs

• Assessment of the burden borne by individuals (human and animal) and societal impacts on affected communities.
• Assessment of the cost of the disease to livestock production
• Identification of risk factors in both people and animals – identify at-risk groups for high priority intervention
• Fully understand the life cycle of the disease(s) circulating
• Methodology for quantifying the rate of disease under-reporting in humans and animals
• Assessment of the efficacy of disease control tools
• Assessment of the efficacy of control and prevention strategies (appropriateness for the communities)
• Calculate cost benefits (single, multiple disease approaches)
• Sell it to Governments concerned and integrate with NTD lobby.
‘Integrated’

- **An integrated approach to disease control:** Multi-disease and multi-host strategy
- **One Health approach:** Holistic
- **Multi-disciplinary approach:** Professionals of different disciplines - veterinarians, medical doctors, basic scientists, epidemiologists, social scientists etc.
- **Cost-benefit approaches:** Combining health and economic benefits, allow the health sector to present arguments to policy makers based on the rate of return on investment rather than tables of DALYs.
ICONZ – Basic Facts

- ICONZ is a large collaborative project funded by the European Commission under its seventh Framework Programme (FP7).
- It began in April 2009 and will continue for 5 years to April 2014.
- It has 21 partners!(26 initially)
- Its focus in on Africa, where the cluster of neglected zoonoses identified has a particularly severe impact.
ICONZ – Aims

1. Mapping and reviewing research activities
2. Surveying and assessing the global burden
3. Improving / developing disease control tools
4. Developing cost-effective control & prevention strategies
5. Capacity building
6. Empowerment of communities and policy makers to make effective and appropriate use of control and prevention strategies
<table>
<thead>
<tr>
<th>Participant No.</th>
<th>Participant Organization Name</th>
<th>Country</th>
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<tbody>
<tr>
<td>14</td>
<td>Laboratoire Central Vétérinaire, Bamako</td>
<td>Mali</td>
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<tr>
<td>15</td>
<td>National Veterinary Research Institute, Vom</td>
<td>Nigeria</td>
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<td>16</td>
<td>Eduardo Mondlane University, Maputo</td>
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<td>17</td>
<td>Institut Agronomique et Vétérinaire Hassan II, Rabat</td>
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<td>Makerere University, Kampala</td>
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<td>SACEMA, University of Stellenbosch</td>
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<td>Sokoine University of Agriculture</td>
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<td>21</td>
<td>University of Zambia, Lusaka</td>
<td>Zambia</td>
</tr>
<tr>
<td>26</td>
<td>International Livestock Research Institute, Nairobi</td>
<td>Kenya</td>
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Nine partners,
Case studies in 8 countries
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<td>1</td>
<td>University of Edinburgh</td>
<td>UK (Scotland)</td>
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<td>2</td>
<td>Institute of Tropical Medicine</td>
<td>Belgium</td>
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<td>3</td>
<td>University of Copenhagen</td>
<td>Denmark</td>
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<td>4</td>
<td>Agence Française de Sécurité des Aliments</td>
<td>France</td>
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<td>5</td>
<td>University of Lyon</td>
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<td>6</td>
<td>Friedrich Loeffler Institute</td>
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<td>7</td>
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<td>9</td>
<td>Karolinska Institute</td>
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<td>10</td>
<td>Swiss Tropical Institute</td>
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<td>11</td>
<td>University of Liverpool</td>
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<td>12</td>
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<td>13</td>
<td>Uniformed Services University Medical School</td>
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Project Full Title: **Integrated Control of Neglected Zoonoses: Improving Human Health and Animal Production Through Scientific Innovation and Public Engagement**

**Project Acronym:** ICONZ

**Type of funding scheme:** Large Collaborative Project - SICA

**Work Programme:** KBBE-2007-1-3-09:

**Topics Addressed:** Neglected Zoonoses in Developing Countries: Integrated Approach for the Improvement of their Control in Animals

**Name of the Coordinating Person:** Prof. Sue Welburn
Calculation of budget is based on Lump Sum method

Based on country income group

- Low-income: €8,000 (Nigeria)
- Lower middle income: €9,800
- Upper middle income: €20,700

Payments are made based on actual effort involved. Payments are released based on Periodic Reporting but it is only the time devoted to the project that is reported not the actual costs incurred.

Total Budget Allocation to Nigeria: €248,000

75% provided by the EU
25% provided by Nigeria
Financial Reporting:

- **Lump-Sums** are calculated on the basis of researches/year.

- The reports submitted by the ICPC beneficiary will include the financial Form C.

- Time sheets to prove time on project by researchers.

- As the beneficiaries are paid on the basis of **Lump-Sums**, there is no requirement to submit certificates on Financial Statements.
Structure of ICONZ

WP1: Project Management and Coordination

WP2: Mapping global neglected zoonoses research

WP3: Knowledge & information on neglected zoonoses

WP4: Disease control tools

Control and prevention strategies: integrated intervention packages

WP5: Bacterial zoonoses cluster

WP6: Small ruminant / dog cluster

WP7: Pig-associated diseases cluster

WP8: Vector-borne diseases cluster

Overarching support packages

WP9: Socio-economic and institutional aspects

WP10: Cultural aspects and messaging

WP11: Technology transfer and training

WP12: Communication and dissemination
WP1 Project Management & Coordination
- Management: administration, meetings and feedback
- Networking and liaison within the consortium
- Promote international partnerships

WP2 Mapping global neglected zoonoses research
- Gain global overview and produce database
- Map research activities and identify gaps
- Promote networking outside consortium

WP3 Knowledge and information on neglected zoonoses
- Estimate incidence and prevalence
- Assess under-reporting
- Map disease risk (GIS)
- Assess total societal burden of NZs

WP4 Disease control tools
- Review diagnostic tools
- Review control and prevention tools
- Review messaging and awareness tools
- Identify research gaps
- Validate new and improved tools

WP5 Bacterial zoonoses cluster
- Anthrax
- Bovine tuberculosis
- Brucellosis

WP6 Small ruminant/dog cluster
- Cystic echinococcosis
- Leishmaniasis
- Rabies

WP7 Pig-associated disease cluster
- Cysticercosis
- Neuro-cysticercosis
- Taeniasis

WP8 Vector-borne disease cluster
- Zoonotic trypanosomiasis
- Tick-borne animal diseases
- Malaria in some areas

Control and prevention strategies: integrated intervention packages
- Review of strategies, site-specific studies, technical validation
**ICONZ Details II**

### WP9 Socio-economic and Institutional Aspects
- Cost-effectiveness
- Medical-veterinary collaboration
- Cost sharing
- Advocacy

### WP10 Cultural Aspects and Messaging
- Gender issues
- Traditional knowledge
- Appropriate interventions
- Appropriate messages in all media

### WP11 Technology Transfer and Training
- Support build up of diagnostic and control capacities and facilities
- Train scientists, doctors, veterinarians and others working on NZ control
- Produce community training packages for livestock keepers and householders, especially women

### WP12 Communication and Dissemination
- Secure government commitment to NZ control
- Ensure effective communication among stakeholders
- Promote establishment and support activities of Scientific Advisory Committee for NZ
- Make available information on all aspects of NZ covered by project
Work Package 5

Improve and Develop Control and Prevention Strategies Through Integrated Intervention Packages For Bacterial Zoonoses

• **Country Project:** Case Study

• **Participating Country:** International Cooperation Partner Country (ICPC)

• **Work Package Leader:** Prof. Ignacio Moriyon
WP5 Neglected Bacterial Zoonoses

Bacterial Zoonoses:
- Brucellosis.
- Bovine tuberculosis.
- Anthrax

Objectives:
1. To improve and develop control and prevention strategies for Neglected Bacterial Zoonoses (NBZ) cluster in endemic developing countries, taking into account economic, sociological and cultural aspects related to the diseases as well as traditional knowledge.

2. To develop cost-effective disease control strategies for NBZ.

3. To develop integrated disease control packages for NBZ.

4. To provide information for WP11 to be used in training and capacity building activities.

5. To provide information for advocacy, and strategic options for control and prevention of NZ to be disseminated (WP12) to governments, WHO, FAO, etc.
Nigeria Case Study

Goal of the study:
• To determine the socioeconomic impact of brucellosis in settled Fulani cattle herds and the efficacy of prophylactic tools.

Specific Objectives:
• To determine brucellosis sero-prevalence in cattle, sheep and goats in settled Fulani herds in the Kachia Grazing Reserve.
• To determine brucellosis sero-prevalence in Fulani households in the Kachia Grazing Reserve.
• To isolate and characterize *Brucella* from these herds and from local dairy products.
Research Team

- Dr. R. A. Ocholi (Vet. Bacteriologist; PI);
- Dr. W. J. Bertu (Vet. Bacteriologist; Ph.D. student).
- Dr. A. M. Gusi (Vet Bacteriologist; MSc. Student).
- Dr. S. S. Ngulukun (Vet Bacteriologist; Researcher).
- Dr. I. Luka (Public Health (Med.Doct; Researcher)
- Dr. P. Ekong (Vet. Epidemiologist; Researcher);
- Dr. O. Owolodun (Molecular Biologist; Researcher)
- Mrs. E Mwankon (Laboratory Scientist; Researcher)
- Mr. A. Ardo (Vet. Extension; Researcher)
- Mr. A. Hassan (Laboratory Scientist; Researcher)
- Marie Ducrotoy (DVM. PhD Student).

- Prof. Ignacio Moriyón
Study Site

- Kachia Grazing Reserve (KGR)
- Tropical sub-humid.
- Established 1970.
- Fulani settled herds

Location of the Kachia Grazing Reserve in Nigeria (map by Ward Bryssinckx)
**Case Study Site**

**Name**  
Kachia Grazing Reserve, Kaduna State, Nigeria; Size 31,000 ha

**Demography**  
6 Blocks (Administrative Units)  
Several small health facilities  
Two slaughter slabs  
Human population: 18,000.

**Relevant Animal Population**  
Cattle 42,000, Sheep 11,000, Goats 5,000

**Epidemiology**  
Mixed cattle sheep goat extensive breeding  
Animal brucellosis present (preliminary serological survey)

**Geography, Topology, Climate**  
Tropical sub-humid climate  
Typical Guinea Savannah- Trees and shrubs with under growth grassland.  
Annual rainfall: 1000-1200mm  
Rain season: April–October  
Temp: avr:28°, min: 19°(Jan), max 39°(April)
Study Population

• Fulani cattle herdsmen
• Pastoralists and agro-pastoralists
• Manage 90% of total Nigerian livestock population
Public Engagement

The Team visited the area three times before starting the field work
• Four workshops/meetings with Fulani leaders, Imams, and cattle owners
• Contacts/Discussions with State Government officials, Resident Doctor, Co-operatives / organisations for men/women, Cattle Traders, Teachers and other stakeholders to sensitize the community for the field works and to map out strategies for sample collection.
Other Activities:

• Population census of the animals in the Grazing Reserve

• GSP Co-ordinates of every household sampled were taken for mapping.

• Ethical Clearance obtained from the State Ministry of Health

• Contrasting the results with those of Jos Plateau nomadic Fulanis
Phase 1
Baseline survey

March & June & 2011

Household animal productivity questionnaire & interviews with vets and livestock marketers

Baseline
Animal (BTB, brucellosis) survey

Baseline
Human brucellosis seroprevalence survey

Patient questionnaire & interviews with health providers

Phase 2
Intervention

VACCINATION, STAKEHOLDER ENGAGEMENT & EDUCATION

Phase 3a
Estimating impact of intervention

POST-INTERVENTION Animal (BTB??, brucellosis) survey

Repeat questionnaires & interviews

POST-INTERVENTION Human brucellosis seroprevalence survey

Repeat questionnaires & interviews

Phase 3b
Demonstrate Cost-effectiveness

(1) Animal production losses

(2) Money spent on animal health

(3) DALYs

(4) Money spent on human health

(5) TOTAL SOCIETAL BENEFITS OF THE DISEASE CONTROL INTERVENTION

(6) TOTAL SOCIETAL COST OF THE INTERVENTION

(Diagram created by Alex Shaw)
Results

ANIMAL BRUCELLOSIS
Cattle
(March 2011 study: official census unreliable; cattle on migrations; study stopped)
(June 2011 study)
• 10/1963 RBT positive cattle  
  0.5 % individual sero-prevalence
• 7/40 herds with at least one RBT positive animal
  17.5 % herd sero-prevalence
Small ruminants
Sheep: 2/717 = 0.23%
Goats: 0/752 = 0%

HUMAN BRUCELLOSIS
0/1124 RBT positives
0.0 % individual seroprevalence

BOVINE TUBERCULOSIS
• Applied most restrictive cut-offs (severe single tuberculin test) for interpretation
• 77/1944 animals with reactor readings
  4 % individual prevalence
• 27/40 herds with at least one reactor
  67.5 % herd prevalence

Low individual prevalence, higher herd prevalence
### Brucella Culture and Typing:

<table>
<thead>
<tr>
<th>Sample (cattle)</th>
<th>Total No. Samples</th>
<th>Brucella Isolate</th>
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</thead>
<tbody>
<tr>
<td>Vaginal Swab</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Milk</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Hygroma Fluid</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Aborted Fetus</td>
<td>1</td>
<td>1</td>
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</tbody>
</table>

Classical typing shows *B. abortus* biovar 3
Molecular typing of isolates at CITA, Zaragoza, Spain
Livestock Losses

Livestock productivity
• Herd composition
• Fertility
• Mortality
• Other exist and entries
• Carcase value
• Body condition scores
• Disease history
• Cost of dealing with disease

Participatory research methods: FGDs and KII
• Discussions with veterinary service staff about monetary expenditure on animal health
  o Project Office (State government)
  o NLDP (Federal government)
  o Local private veterinary clinics
• Discussions with people in marketing chain (butchers, traders, abattoir workers, marketers).
Other data collected

• **Human burden**
  - Human health questionnaire
  - KII with healthcare providers to determine cost to health services

• **KAP**
  - FGDs to capture sociocultural factors with regards to presence, transmission factors, impact and control of brucellosis
Benefits From Training and Capacity Building

• Training Workshops
• Student Training:
  1. PhD (Livestock Economics) – University of Edinburgh, UK
  2. PhD (Sociology) – University of Edinburgh, UK
  3. PhD (Molecular Epidemiology) – ABU, Zaria
  4. PhD (Vet. Epidemiology) – UI
  5. MSc. (Vet. Microbiology) – UNN
  6. MSc. (Med. Microbiology) – University of Jos
Thank you