Strengthening Collaboration in Research

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Research Collaborations: Scope of Engagement

• Zoonoses – emerging and neglected zoonoses
• Food safety
• Food security and livelihoods, sustainable development
• Antimicrobial resistance
• Comparative medicine
• Conservation medicine
• Ecosystem approaches to health
• Non-communicable diseases
• Mental health and interactions with animals and nature
“One Health”
What drives inter-disciplinary research collaborations?

• Mutual interests
• Funding support
• Publication outputs
• Much of the momentum, funding and high-profile publications relate to global concerns about emerging infectious diseases
....but interest and support for endemic and neglected zoonoses still limited

- Tend to affect rural poor with poor access to health services

**Estimated annual deaths**

- Rabies
- Leptospirosis
- Leishmaniasis
- Trypanosomiasis
- Chagas Disease
- Japanese Encephalitis
- SARS
- Influenza A H1N1
- Nipah
- RVF
- Ebola

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_One World, One Health => One Wealth?_

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Additional data: Leptospirosis - WHO (2006); Ebola – WHO (2013)
Endemic zoonoses: reversing the cycle of neglect

- Limited data on disease burden
- Widespread under-diagnosis and misdiagnosis
- Veterinary services often have responsibility for control, but neither the economic incentives nor societal resource allocation to fulfill this role
Infectious disease research in Africa dominated by HIV/AIDS, TB and malaria

Trends in global malaria deaths

Surveillance of human febrile illness, northern Tanzania

Bacterial zoonoses cause 33% cases of febrile illness among hospital admissions in northern Tanzania

15 x the number of cases of febrile illness as malaria

Frequently mis-diagnosed as malaria

Spotted fever group Q fever (7.9%)
rickettsiosis (8.7%)
Leptospirosis (10.1%)
Brucellosis (5.3%)

Malaria (7.1%) – Overall 1.9%

Fungal (18.8%)

Bacterial (61.6%)

Mycobacterial (12.5%)

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Bloodstream infections (27.8%)

No diagnosis (33.2%)

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Patients admitted to 10 hospitals with diagnosis of malaria over one year by outcome, presence of any *P falciparum* asexual parasites on the research blood slide, and case fatality.

Reyburn H et al. BMJ 2004;329:1212

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Opportunities for strengthening collaboration:

(A) Zoonotic causes of common human disease syndromes

- **Non-malaria febrile illness** (e.g. leptospirosis, brucellosis, Q fever, rickettsioses, Crump et al., 2013)
  
  - *Identified as a priority by the zoonoses working group of the WHO Strategic and Technical Advisory Group for Neglected Tropical Diseases*

- **Epilepsy** (e.g. neurocysticercosis is a major cause of epilepsy in Africa, Asia and Latin America, Carpio, 2013)

- **Neurological disease** (e.g. rabies confirmed in 10% of fatal CNS infections in children, Mallewa et al., 2007 )

- **Respiratory syndromes** (e.g. Q fever confirmed as cause of 3% acute lower respiratory infections in Kenya, Knobel et al., 2013)

- **Joint pain** (e.g. brucellosis?)
Priorities for research (and education)

*Needs:*

• Improved awareness among medical clinicians about possible zoonotic aetiologies of common human disease syndromes

• Improved diagnostic tools for effective clinical management

• Linked human-animal health studies to quantify impact, identify risk factors and critical points for targeting interventions

• More effective measures for reducing infection in animals and preventing zoonotic transmission to people
Changing livestock systems

- Exposure to pathogen
- Vulnerability to disease

Livestock management, movements, and contact networks

Animal handling, slaughter, food preparation and consumption

Disease in people

Zoonotic disease impacts

Infection in people

Health and livelihoods

Infection in livestock

Disease in livestock

DRIVERS OF CHANGE

- Livestock policy (and provision)
- Wildlife policy
- Climate change
- Markets and regulation
- Communication technology
- Population movement and change
- Health policy (and provision)
- Land rights
- Changing socio-economic status and gender relations
- Knowledge and education
- Social sciences – participatory studies, policy and institutional analyses
- Climate models/remote-sensing
- Ecosystem studies

DESIGNING INTERVENTIONS:

- Cluster randomized trials, cost-effectiveness studies, willingness-to-pay, qualitative social sciences, integrative models (incorporating human behaviour and economics)

Ecosystem studies

- Technology
- Climate change

Livelihoods analyses, macroeconomic analyses, qualitative social sciences

Human-animal infection/disease studies

Qualitative social sciences

Linked transmission models

Participatory studies, value chains, network models, movement data/analyses
Opportunities for research collaboration:
(B) Interweaving qualitative and quantitative sciences

Which animal species are contributing most to human infection and disease?

Which pathways of zoonotic transmission are most important?

What are the critical points that can be targeted for interventions?
- Livestock vaccination?
- Milk supply chains?
- Household preparation and consumption practices?
- Livestock handling practices?
Epidemiological tools - risk factor and attribution studies, transmission models

But we also need to understand **social, cultural and economic context** in which interventions operate.

**Efficacy** x **Coverage** = **Effectiveness**

- **Efficacy**: 80%
- **Access**: 80%
- **Targeting accuracy**: 80%
- **Provider compliance**: 75%
- **Consumer adherence**: 75%

**Issues of availability, accessibility, affordability, acceptability**

**Zinsstag J. et al. Towards equity effectiveness in health interventions**
Opportunities for strengthening collaboration: (C)Animal intervention studies for human health benefits

• Efficacy studies for veterinary interventions do not capture variation that occurs under field conditions

• Evaluation of **effectiveness** of interventions largely limited to human health research
  – Increasingly involve an integrated *process evaluation* to document contextual factors affecting the success of different approaches

• **Cluster randomized trials** accepted as “gold standard” for evaluating human health interventions at population level
  – Rarely carried out for veterinary interventions

• Intervention studies not only generate valuable research outputs but also deliver **impact**
Intervention studies: generating research insights and human health benefits

Mass dog vaccination to control and eliminate canine rabies
The Feasibility of Canine Rabies Elimination in Africa: Dispelling Doubts with Data

Tiziana Lembo1,2, Katie Hampson3, Magai T. Kaare4, Eblate Ernest4, Darryn Knobel1, Rudovick R. Kazwala5, Daniel T. Haydon1, Sarah Cleaveland1

• Although most dogs are free-roaming, no evidence for substantial ‘stray’ (ownerless) dog population

• Most dogs are accessible for parenteral vaccination

• Canine rabies in Tanzania maintained only by domestic dogs, even in wildlife-rich areas

• Mass dog vaccination can result in elimination of rabies in dogs, human and wildlife populations
Dog vaccination can result in rapid decline in demand for costly human vaccine for PEP

Protects vulnerable communities unable to access life-saving PEP promptly

70% coverage optimal scenario at ‘very cost-effective’ levels of investment

Fitzpatrick M. et al. (in press) Annals of Internal Medicine

Cleaveland et al., 2003, Vaccine
Opportunities for strengthening collaborations: (E) Impact on livelihoods and well-being

- Need for quantitative metrics and qualitative insights
  ➔ Collaborations with public health and agricultural economists, development scientists, social scientists

  ➔ Understanding and quantifying that capture dual impact of zoonotic diseases, and relationships between livestock heath human health and other household assets

  ➔ Understanding the social “costs” of illness to the household, the strategies adopted to mitigate these costs and the understandings of health and well-being that underlie these perspectives
Establishing successful collaborations

• Mutual interests and benefits
• Equitable partnerships
• Recognising and acknowledging expertise, roles and responsibilities
• Building trust and confidence
• Communication
  – Adopting accessible language
  – Respect for different perspectives and insights
  – Training together (and socialising together)
Washington State University
Antimicrobial resistance

KCMC-Duke University collaboration
Tropical infectious diseases, medical diagnostics

University of Glasgow
Epidemiology, social sciences

University of Glasgow
Veterinary pathology, diagnostics
Challenges of One Health Research

• Different priorities and concerns
  – Upstream nature of prevention activities and temporal and causal distance from human consequences

• Complex intersectoral professional structures and institutional environments
  – Different ‘languages’, issues of trust, control and influence

• Extensive, multidisciplinary expertise for complex analyses

• Large teams – communication challenges, transaction costs

• Funding – usually requires consortium of funding agencies (NIH/BBSRC, DfID-BBSRC-Wellcome Trust)

• Ethical review processes – needs streamlining

• Institutional barriers – sharing resources
Sharing resources and facilities

• **Sharing of resources** widely promoted
  - Sharing expertise (e.g. diagnostics) and data
  - Optimizing use of limited resources (e.g. combined delivery of polio and livestock vaccinations in Chad, Schelling et al. 2007)
  - Building relations, genuine partnerships

• **Widely held perceptions** about the need for separation of laboratory facilities for processing and analysis of human and animal samples
  - Level of laboratory containment needs to be appropriate for the *pathogen* not the origin of the sample
Research Ethics Committees

Linked human-animal research on brucellosis, Q fever and leptospirosis in Tanzania - NIH/BBSRC funded study

- University of Glasgow: College of Medical, Veterinary and Life Sciences
- University of Glasgow: School of Veterinary Medicine (animal studies)
- University of Glasgow: School of Geographical and Earth Sciences (social sciences)
- Duke University Medical Center: Institutional Review Board
- Duke University Medical Center: Animal Care and Use Committee
- Tanzania Commission for Science and Technology (research in Tanzania)
- National Institute of Medical Research, Tanzania Research Ethics Committee
- Kilimanjaro Christian Medical Centre Research Ethics Committee
- Tanzania Wildlife Research Institute (wildlife research – wild rodents, wild ungulates)
Ethical issues reflect conventional medical research perspectives and some important practical and cultural issues not well recognised.

Animal care/Handler training
- e.g. focus on laboratory animals for experimental research not field-based livestock research.

Western perceptions dominate in scientific ethical review processes:
- e.g. perceptions of animals very different in different cultures.

Social issues
- e.g. Insistence on written consent can stigmatize illiterate people, and cause considerable anxiety and suspicion.
- e.g. Peer-pressure from involvement of community leaders.
Conclusions

• There is a clearly a need for strengthening interdisciplinary research to address complex human and animal health problems

• But….the problems that require a One Health approach are invariably complex and challenging, and often costly

• We need to recognise the contributions from across the medical, veterinary, biological sciences, and social sciences
  – Excellent science can be carried out doing impactful research

• We need to develop integrative research methodologies that allow a tighter weaving of quantitative and qualitative approaches, and greater participation of stakeholders
Recent ‘One Health’ Funding Initiatives:

- BBSRC – DfID - Wellcome Trust - ESRC: Zoonoses and Emerging Livestock Systems
- National Institutes of Health - National Science Foundation - BBSRC: Ecology and Evolution of Infectious Diseases
- BBSRC – DfID – Scottish Government: Combating Infectious Diseases of Livestock for International Development