

Vaccines and diagnostics—The case for regional One Health centres of excellence

Delia Grace, Phil Toye, Shirley Tarawali and Vish Nene

One Health Colloquium: Sustainable livestock and disease control - exploring the links to climate change, improving human nutrition and the refugee crisis, London, 31 May – 1 June 2016



ILRI
INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE


CGIAR

Overview

- **One health**
 - Definitions
 - ILRI working in a OH paradigm
 - OH addressing vaccine delivery and use
- **Case studies**
 - East Coast Fever vaccine
 - Newcastle disease vaccine
 - Diagnostics for TBD
- **Conclusions**

Health and One Health

Health is “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (World Health Organisation).

One Health “the collaborative effort of **multiple disciplines** — working locally, nationally, and globally — to attain optimal health for people, animals and the environment” (One Health Commission).

Ecohealth “recognizes complex biophysical, **social, cultural, political and economic relationships** between the ecosystem and human health” (National Council for Science and the Environment).

ONE HEALTH

Human health

Vet
Pub
Health

Animal Health

**Societies, cultures,
Economies, institutions
Policies**

One
medicine

Wildlife health

Plant health

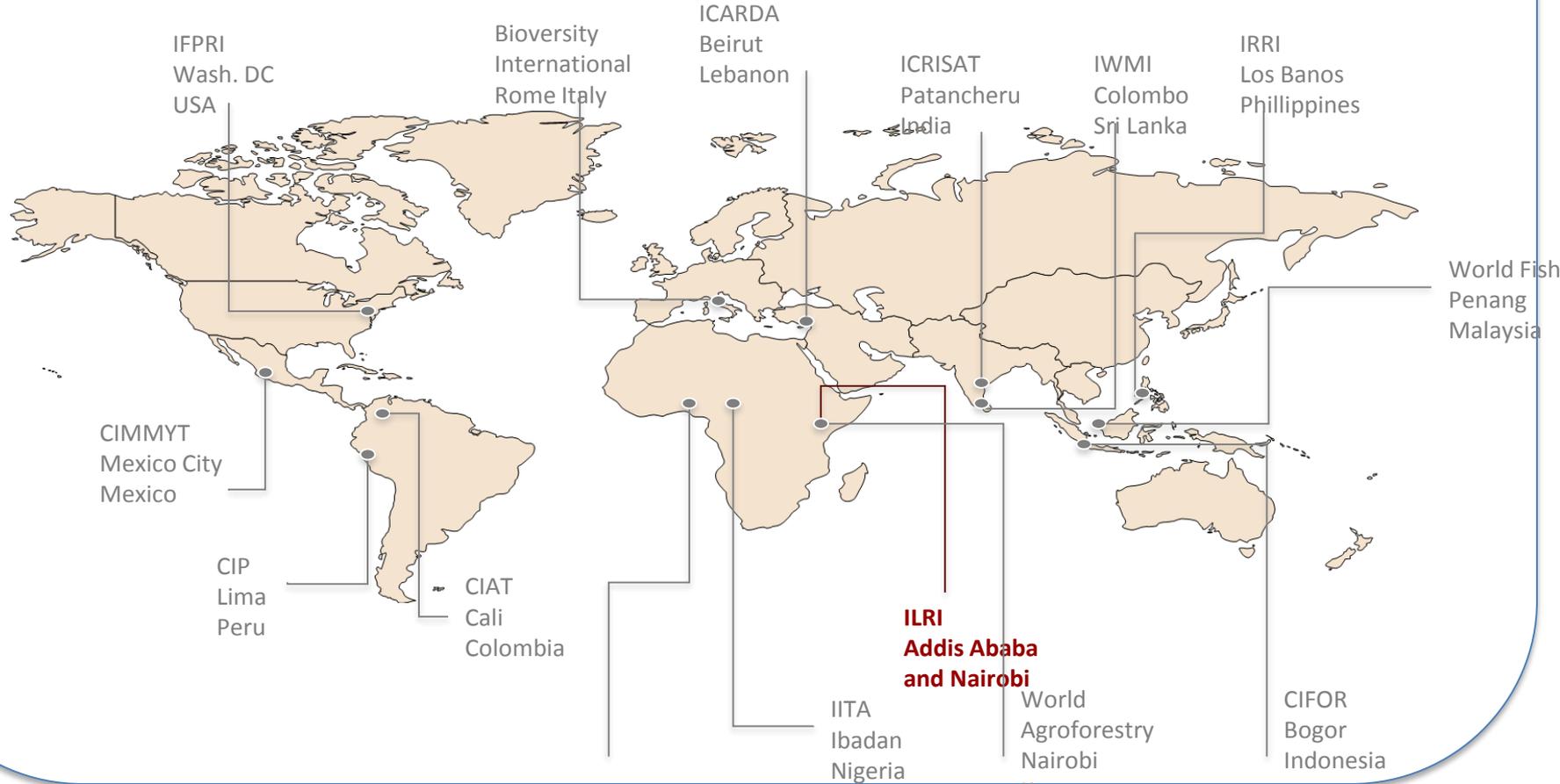
Agroecosystem health

EcoHealth

International Livestock Research Institute

• a member of the **CGIAR Consortium**, ILRI conducts livestock, food and environmental research

- ❖ to help alleviate poverty
- ❖ and improve food security, health & nutrition,
- ❖ while protecting the natural resource base.



International Livestock Research Institute

- **Founded in 1974**
- **Budget: around US\$80 million**
- **Staff: 750: Senior scientists from 39 countries: >half from developing countries**
- **34% of internationally recruited staff are women --and 50% of the senior leadership team**
- **Main campuses in Kenya and Ethiopia, and offices in 16 other countries around the world**



ILRI experiences: Knowledge transfer, disease control and innovation in vaccines and diagnostics

- **East Coast fever vaccine:** ILRI involved development, manufactured and transferred vaccine use to northern Tanzania and manufacturing to CTTBD in Malawi
- **Newcastle disease vaccine for village poultry:** ACIAR led development, widely promoted, recently evaluated by ILRI in Tanzania
- **Tick borne disease diagnostics:** ILRI developed and runs diagnostics

East Coast fever (ECF)



- ECF present in 12 countries; it could spread to 8 more
- Caused by a tick-transmitted protozoan – *Theileria parva*
- ~28 million cattle at risk; ~1million deaths/year; losses > 300 \$ million a year
- Small-holder farmers who would benefit from control: ~ 20 million
- Not zoonotic: affects food supply, livelihoods, and vulnerable groups

Infection and treat method



The Cow-Pock — or — the Wonderful Effects of the New Inoculation! — Vide... the Publications of y^e Anti-Vaccin^e Society.

Control milestones

- 1911-14: 283,000 cattle vaccinated in S. Africa, low success rate
- 1911-1940: “T” brand oxen Kenya- exposed & immune
- 1980: DANIDA projects in Malawi, Zambia, Zimbabwe, Kenya
- 1983: Field use endorsed by FAO expert panel
- 1996: First commercial vaccine batch produced at ILRAD
- 2012: Authorized for dairy cattle in Kenya
- 2014: CTTB Malawi launched
- 2016: vaccine used Malawi, Kenya, Tanzania, Uganda



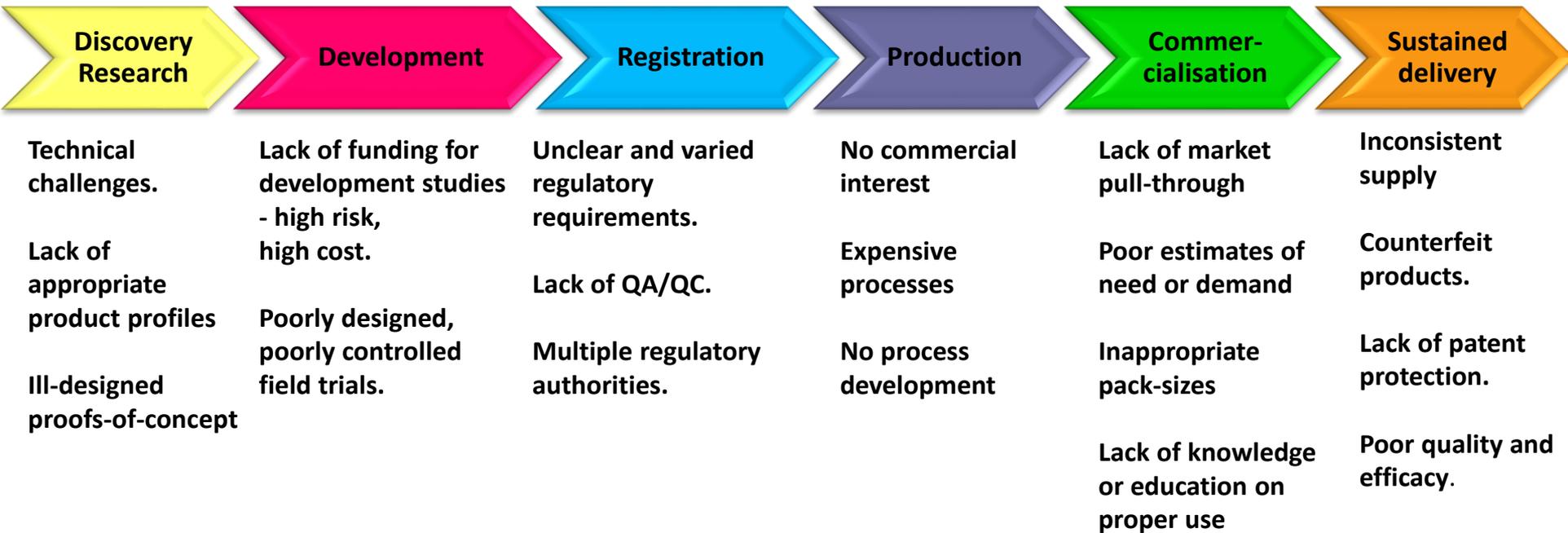
Research contributions

- 1928: Tick homogenates produce immunity and can be stored (Theiler & du Toit)
- 1953: OTC prevent reactions after vaccination (Neitz in S Africa)
- 1954-57: Cocktail method developed in the Congo and Rwanda (Jeziarski et al)
- 1973: Sporozoite stabilates (Cunningham in Kenya)
- 1975: Muguga cocktail
- 1993: 30% solution

Donor investments

- 1967: UNDP funded tick program at EAVRO develops ITM: continues at KARI and ILRAD
- 1980: DANIDA projects in Malawi, Zambia, Zimbabwe, Kenya
- 1996: First commercial vaccine batch produced at ILRAD
- 2004: GALVmed founded – ECF a disease of focus
- 2014: CTTB Malawi launched
- 2016: vaccine used Malawi, Kenya, Tanzania, Uganda

A technical and market-based approach to delivery



Challenges to availability of appropriate new products

Success of ITM in Zambia and Tanzania

Since 1990s around 1.5 million cattle vaccinated – 1% of cattle at risk during that time
Most in Zambia and Tanzania

1982-2002 Belgian veterinary support project

- Local Katete strain
- Calf mortality reduced from 33% to 3%. Cost \$10
- First year of charging: only 10% of farmers brought calves

2008-2014 IFAD project \$15 million

- 300,000 vaccinated – around 20% of the at risk population
- Farmers pay 15% cost – revolving fund – unlikely to be sustainable



Success of ITM in Zambia and Tanzania

Since 1990s around 1.5 million cattle vaccinated – 1% of cattle at risk during that time
Most in Zambia and Tanzania

1995- 1998 ITTBD in Northern Tanzania

- 10-20,000 a year vaccinated
- Pastoral areas

2004-16 VetAgro private sector,

- Around 80,000 a year, up to 80% of calves
- full cost recovery (\$10 a calf)
- 2006 FAO subsidy, 2012-13 GALVMed, 2014 USAID



Transfer, impact and challenges

- MC produced on commercial basis by CTTBD
- GALVmed targets 2 million doses a year

Technology

- Live vaccine
- Production demanding
- Breakthrough infections
- Liquid nitrogen cold chain

Delivery

- Relatively high cost \$9-17
- Distribution has high financial risk
- Production and much delivery outside private sector



Newcastle disease



- Worldwide distribution; caused by virus; emergence potential
- Major poultry disease: 30-80% of village chickens die each year
- Minor zoonoses; impacts on livelihoods and food & nutrition security
- Strong gender dimension: most owned by women
- Epidemic disease and hence communal action important

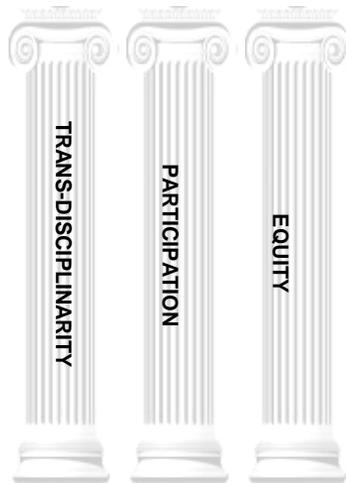
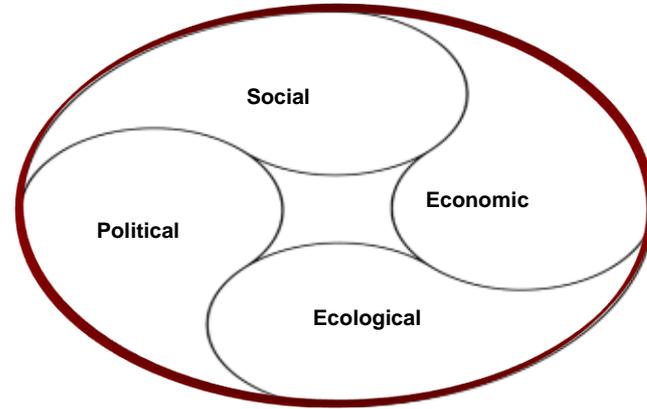
History of Newcastle disease vaccination

- 1927 virus isolated from outbreak in Newcastle
- Spread rapidly in Asia and more slowly to rest of the world
- Second pandemic in late 1960s, devastated poultry industries
- Brought under control using live vaccines
- 1984 ACIAR started to fund research into ND in village poultry
- A new strain I-2 developed at the University of Queensland for village poultry

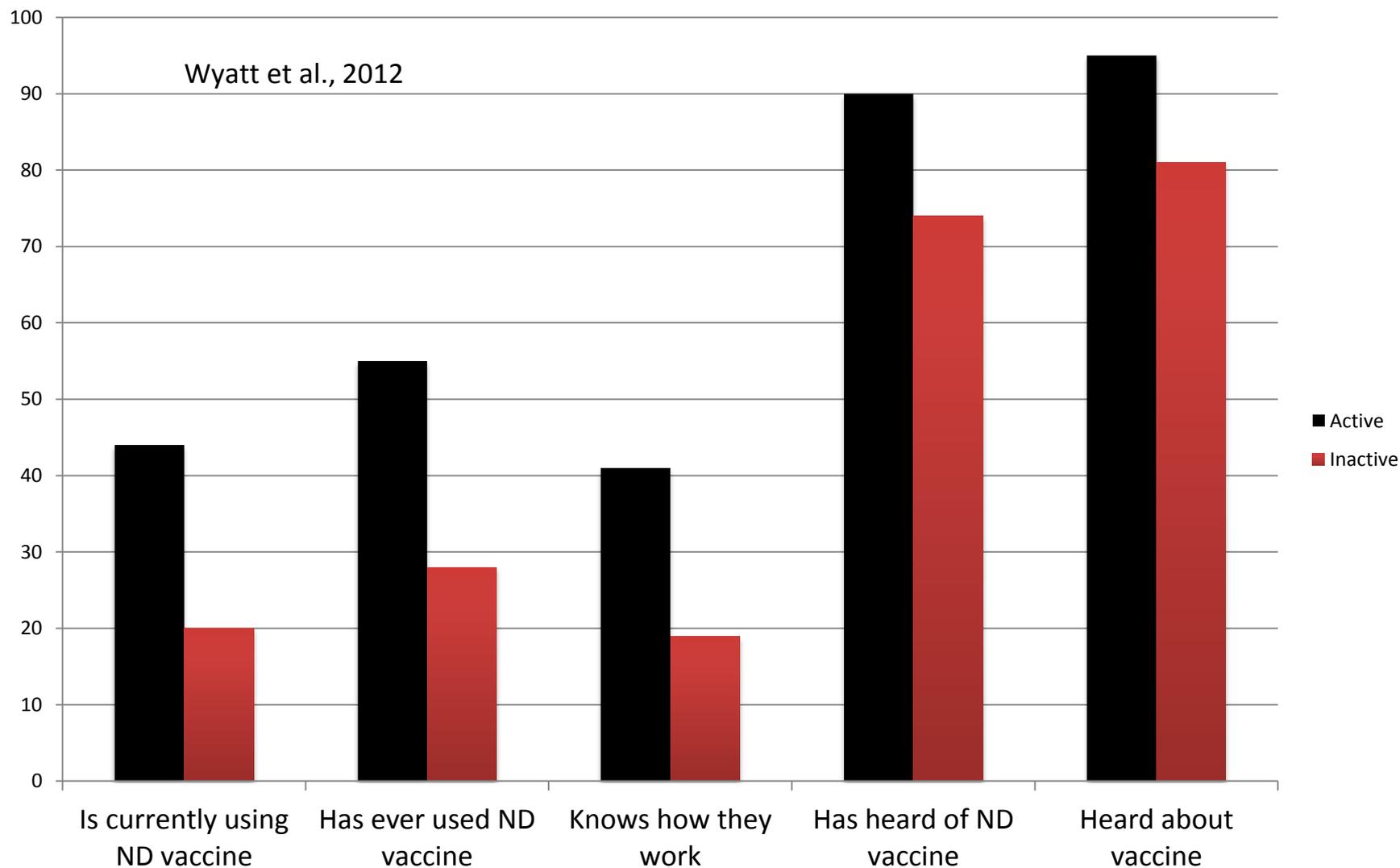
2003-2005 SANDCP project funded by Australia

- Mozambique, Malawi and Tanzania
- Participatory, gender-responsive, sustainable, approach
 - Informed by one health thinking
- With support from production to end use and cost recovery

A one health approach to delivery



Farmer knowledge and practice



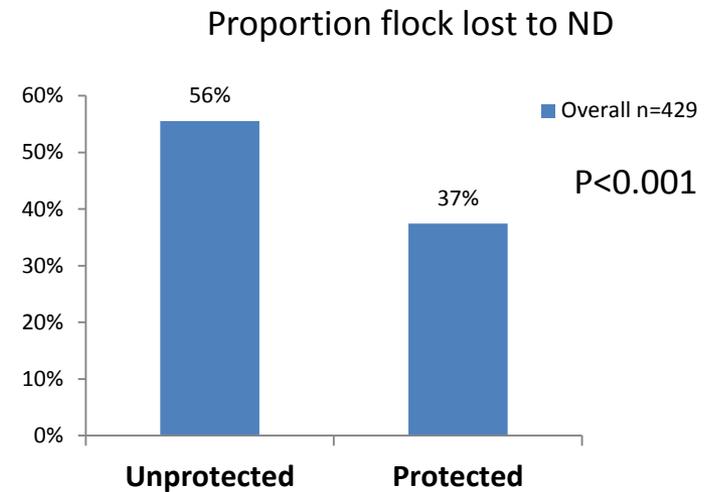
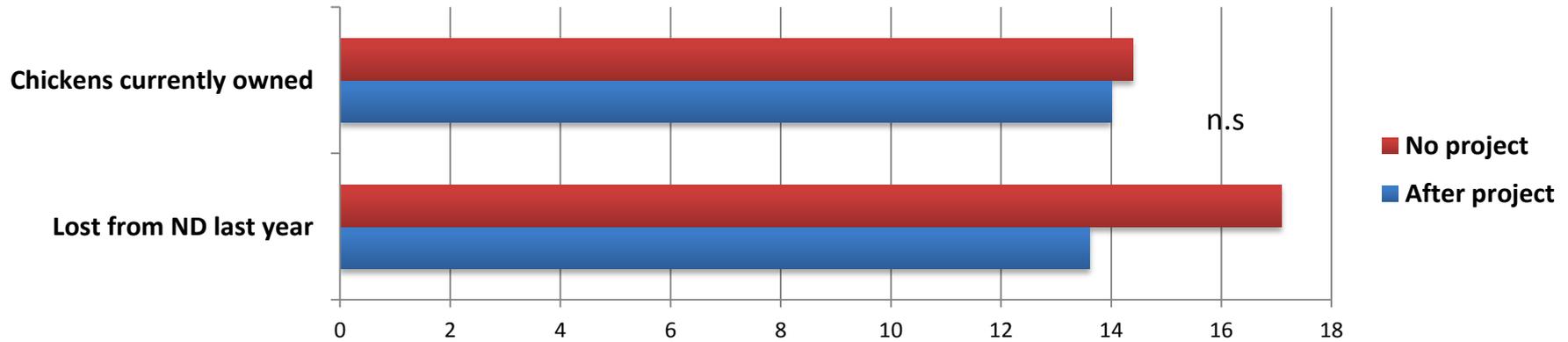
EO: *Farmers lie about diseased chicken to get them vaccinated....
I train the vaccinators on handling, giving injections, side affects*

Some sell vaccine to rich households and use water to vaccinate the birds of the poor households to make money

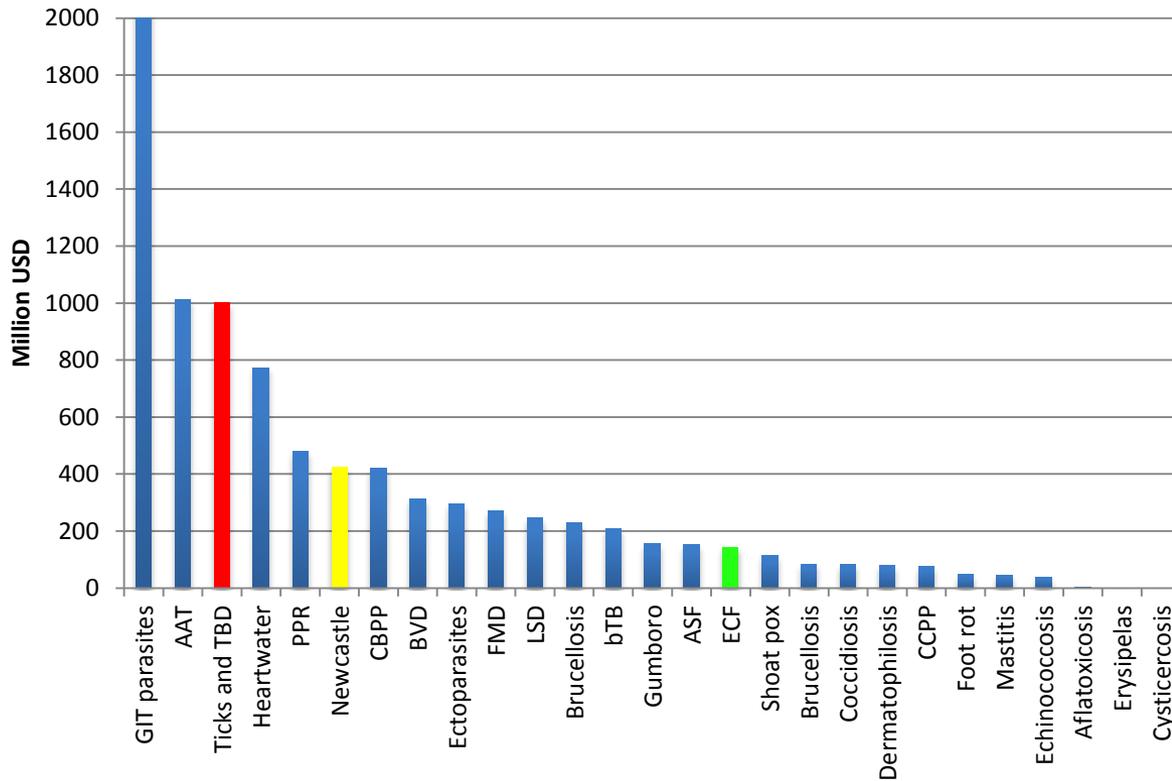
Vx: People complain about the amount charged....
3 out of 10 don't pay....
I have received no training...

FGD: We are willing to pay 100 TSH
(twice the price currently charged)

Best case: losses still high



Tick-borne diseases diagnostics



- Ticks and tick-borne disease
- Important cattle disease; zoonotic potential

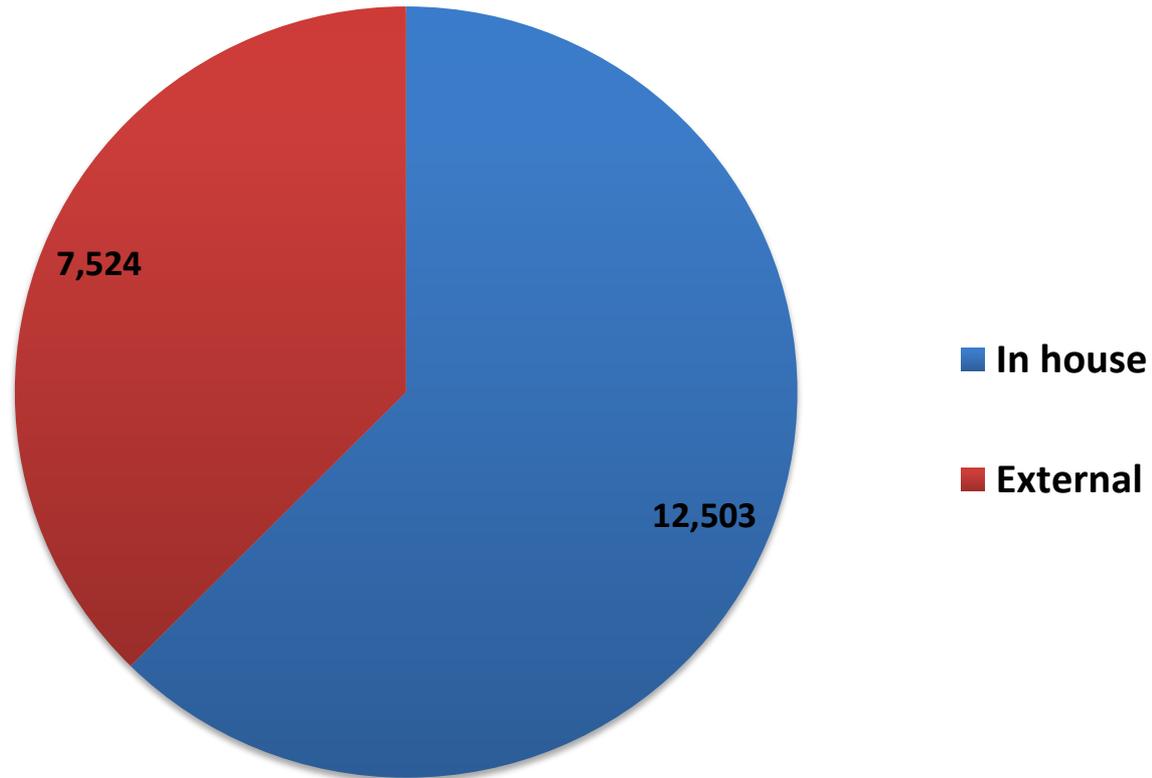
ILRI diagnostics for ticks and tick-borne disease

- ELISA for: *Theileria parva*, *Theileria mutans*, *Babesia bigemina*, *B. bovis*, *trypanosomes*, *Anaplasma marginale*
- ELISA tests for 4 major TBDs – developed ~ 20 years ago
 - Used mainly for research
 - Anaplasma and Babesia tests offered commercially
- Point-of-care assays (lateral flow) for human trypanosomiasis (with FIND), cysticercosis (ASARECA) and PPR (Pirbright)
 - Development proof of concept
 - Business plan developed for cysticercosis tests but not funded

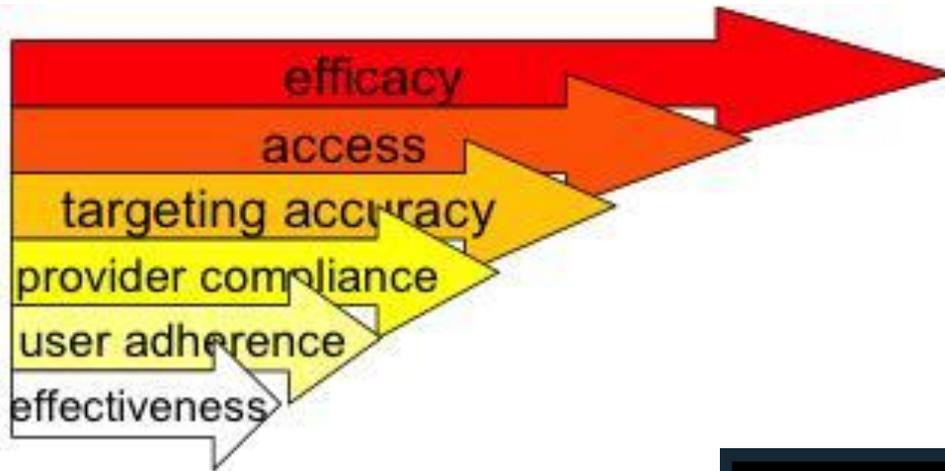
Use of tick borne diagnostics

- Explored commercial production but not viable

2012-2014



Vaccines: good efficacy but (so far) less impact,
Dx: high *impact factors*, hard to attribute impacts



Science Advances

[Home](#)

[News](#)

[Journals](#)

[Topics](#)

[Careers](#)

[Science](#)

[Science Advances](#)

[Science Immunology](#)

[Science Robotics](#)

[Science Signaling](#)

[Science Translational Medicine](#)

SHARE

RESEARCH ARTICLE | PARASITOLOGY



8

Co-infections determine patterns of mortality in a population exposed to parasite infection

Conclusions

- **Impact that scales:**
 - Vaccines intuitively enormously attractive
 - Adoption by smallholders and pastoralists challenging
- **Evidence that counts:**
 - Insights into disease require investments into infrastructure

better lives through livestock

ilri.org

Patron: Professor Peter C Doherty AC, FAA, FRS

Animal scientist, Nobel Prize Laureate for Physiology or Medicine—1996

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock

ILRI is a member of the CGIAR Consortium

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

ILRI has offices in East Africa • South Asia • Southeast and East Asia • Southern Africa • West Africa



This presentation is licensed for use under the Creative Commons Attribution 4.0 International Licence.