ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international

PUBLIC HEALTH FOUNDATION OF INDIA

CGIAR
RESEARCH PROGRAM ON Agriculture for Nutrition and Health
Led by IFPRI

EcoHealth
INTERNATIONAL ASSOCIATION FOR ECOLOGY & HEALTH

International Conference
Intensifying Food Systems and Health: Emphasis on Antimicrobial Use in Agricultural Systems

Jaipur (India), 4-6 April 2018

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Introduction

Background

Agriculture produces food and food is essential to lives and livelihoods, nutrition, incomes and the environment. Food systems include all activities involving production, processing, transport, consumption and disposing of food. In low and middle-income countries, food systems operate largely in unregulated spaces and are rapidly intensifying and diversifying in response to growing demand. This brings both challenges and opportunities.

The CGIAR is a global partnership that unites organizations engaged in research for a food and health secure future. The CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) brings an innovative perspective on the relationship between agriculture, nutrition, and health through research that strengthens the knowledge base and new partnerships leading to real outcomes. A4NH places emphasis on integrating gender and equity, as well as evaluation and impact assessment into research, offering specific methods to support research and development by others.

A4NH has been active in South and Southeast Asia since its launch in 2012. Major bilateral projects have been aligned with this program including a project on Peri-Urban dairies led by the Public Health Foundation of India (PHFI) and projects on antimicrobial resistance (AMR) and zoonoses led by the Indian Council for Agricultural Research (ICAR). These have been supported by a number of donors, with the International Development Research Centre of Canada (IDRC) a key donor.

Under the afore-mentioned projects, the international conference 'Intensifying Food Systems and Health: Emphasis on Antimicrobial Use in Agricultural Systems' is organized to strengthen long-term partnerships of regional relevance, grounded on joint-work, between the CGIAR, Indian and other Asian institutes working on agriculture and health.

This conference is co-organised by the International Livestock Research Institute (ILRI), in partnership with International Development Research Centre (IDRC) of Canada, the Public Health Foundation of India (PHFI), CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) and International Association for Ecology and Health (IAEH). The meeting will consist of two days presenting of research findings, identifying key learnings, and research gaps followed by half day engagement with policymakers and public. It will be an opportunity to validate the CGIAR strategic approach to research for better management of agriculture associated antimicrobial resistance.

Objectives:

The purpose of the meeting is to:

- Share cutting edge findings from food system and health projects from India and the region with an emphasis on antimicrobial use, antimicrobial resistance, and foodborne disease
- Build regionally relevant partnerships around intensifying food safety systems and health
- Develop action-oriented recommendations and outline ways forward
- Engage with policy makers and public

Date and location

Location: Hotel Jaipur Marriott, Jaipur, Rajasthan, India

Date: 4-6 April 2018

Agenda

Day 1: 4 April 2018, Wednesday

09.00 – 09.30	**Registration**	
09.30 – 10.30	**Inaugural session**	**Facilitator: Dr. Rajeshwari Shome, ICAR-NIVEDI / Ms. Roma Oli, ILRI**
	Welcome Address	Dr. H Rahman, Regional Representative for South Asia, ILRI
	Brief about the conference	Dr. Delia Grace Randolph, ILRI
	Address by partners	▪ Dr. Suresh S. Honnappagol, Animal Husbandry Commissioner, DADF, Ministry of Agriculture, Govt. of India ▪ Dr. Arlyne Beeche, IDRC ▪ Dr. J. K. Jena, Deputy Director General (AS), ICAR
	Address by the Chief Guest	Dr. Sh. Ajitabh Sharma, IAS, Secretary, AH, Gopalan, Dairy & Fisheries, Govt. of Rajasthan
	Vote of Thanks	Dr. Johanna Lindahl, ILRI
10.30 – 11.00	**Tea break**	
11.00 - 12.30	**Session 1: Introduction**	
	▪ Keynote 1: Why food systems? ▪ Keynote 2: What have we learned from studying peri-urban dairy systems? ▪ Keynote 3: One Health and EcoHealth	▪ Dr. Arlyne Beeche, IDRC ▪ Dr. Manish Kakkar, PHFI ▪ Dr. Johanna Lindahl, ILRI
12.30 – 13.30	**Lunch break**	
13.30 – 15.00	**Session 2: Assessing AMR and AMU in agricultural food system**	
	▪ Technical 1: AMR in livestock – Indian perspective ▪ Technical 2: IVRI work on AMR- what have we learned and what are the major knowledge gaps ▪ Technical 3: AMR issues in SAARC region ▪ Technical 4: WHO Initiative for AMR Surveillance at Human and Animal Interface ▪ Technical 5: The experience from Vietnam	▪ Dr, BR Shome, ICAR-NIVEDI ▪ Dr. Samiran Bandyopadhyay, ICAR-IVRI ▪ Dr. Nure Alam Siddiky, SAARC ▪ Dr. G. N. Gongal, WHO ▪ Dr. Hung Nguyen, ILRI
15.00 - 15.30	**Tea Break**	
15.30 – 17.00	**Group work**: What have we learned? What are the major gaps?	All participants
19.00-21.00	**Cocktail dinner by pool with traditional music**	

Day 2: 5 April 2018, Thursday

9.00 – 11.15	**Session 3: Interventions to Improve AMU in Food Systems**	
	Short presentation ▪ How do we do successful interventions? ▪ Results from the WHO meta-analysis and the experiences from an African intervention ▪ One Health Approach to Tackle AMR Issues: Our Experience from WHO Indian Grants	 ▪ Dr. Johanna Lindahl, ILRI ▪ Dr. Delia Grace Randolph, ILRI ▪ Dr. Neelam Taneja, WHO
	Group work: What have we learned? What are the major gaps?	All participants
11.15 - 11.30	**Tea Break**	
11.30 – 13.00	**Session 4: Implications of agriculture associated AMU for human health, nutrition and livelihoods**	
	Short presentation ▪ NCDC work on AMR and AMU ▪ FAO Activities in India on antimicrobial use and resistance ▪ The current situation from a human health perspective ▪ Antimicrobial stewardship in Vietnam's smallholder sector: untangling complexity ▪ CSE Perspectives on Animal and Environmental Aspects of Antimicrobial Resistance ▪ Network program on AMR in Fisheries	 ▪ Dr. Naveen Gupta, NCDC ▪ Sh. Rajesh Dubey, FAO ▪ Dr. G N Gongal, WHO ▪ Dr. Tarni Cooper, ILRI ▪ Dr. Rajeshwari Sinha, CSE ▪ Dr. Gaurav Rathore, ICAR-NBFGR
13.00 – 14.00	**Lunch break**	
14.00 – 15.30	**Policy to support AMU**	
	Presentation National Action Plan on AMR of India AMR and AMU policy management in livestock sector in Vietnam	 Dr. Naveen Gupta, NCDC Dr. Do Van Hoan, Department of Livestock Production, Vietnam
	Group work What have we learned? What are the major gaps? (for Session 4 and 5)	All participants
15.30 – 16.00	**Tea break**	
16.00 – 17.00	**Session 6: Towards a CGIAR strategy for AMR**	
	Presentation CGIAR strategy on AMR	 Dr. Fred Unger, ILRI
	Group work: Advice for adapting and implementing the CGIAR strategy in South and Southeast Asia?	All participants

Day 3: 6 April 2018, Friday

10.00 – 11.30	**Engagement with policymakers**	
	Short presentations from all working on the national action plans on AMR (10 minutes each)	
	Group work: What does the health community need from the agricultural community and vice versa?	All participants
11.30 -11.45	**Tea break**	
11.45 – 13.00	**Concluding session**	
	CGIAR and the future work on food systems and AMR in Asia	Dr. H. Rahman, ILRI
13:00-14:00	**Lunch break**	

Abstracts

Agriculture associated antimicrobial resistance in LMICs

The brief/document sets out the position of the International Livestock Research Institute ILRI on how to tackle antimicrobial resistance[1] (AMR) in agriculture, incl. livestock and aquaculture, and its implications for human health in LMICs.

Antimicrobials (AM) are amongst the most important tools for medical and veterinary professionals for curing disease and improving welfare; however, these tools are threatened by the emergence of AMR. The resulting lack of treatment options for infectious diseases in people and livestock jeopardises human health as well as animal health, food and nutrition security and livelihoods. The World Bank estimates that increasing drug resistance could reduce global livestock production by 7.5%. The main driver of AMR emergence is the selection of resistant bacteria following use of antibacterial compounds. AMR in human pathogens is largely due to medical use, however agricultural use has also been linked to AMR emergence. Misuse is of growing concern and engenders negative consequences without health benefits.

In many high-income countries, stringent regulations on antimicrobial use in livestock agriculture have been put in place, and increasingly antibiotic consumption is being carefully monitored. These countries demonstrate that with good husbandry and herd health practices, antibiotic use can be reduced without any undue effects on productivity.

In LMICs, little is known about antimicrobial use in agriculture or how close interactions of livestock and people in smallholder production systems relates to the emergence of AMR. Other challenges are the presence of counterfeit drugs, lack of regulations and poor observance of withdrawal periods. This is compounded by poor knowledge amongst actors involved, from livestock keepers to veterinary professionals and government officials, highlighting the need for capacity building at all levels. The lack of capacity is also apparent when discussing solutions, such as establishing surveillance and early warning systems, which require laboratory capacities to detect new resistance patterns and to be able to process a large number of samples to monitor AMR in livestock and livestock products.

In order to tackle agriculture associated AMR, a number of measures are recommended:

- Collect data on the use, quality and governance of antimicrobials in animals and humans, and data on the extent of antimicrobial resistant bacteria found in animals, humans, the environment and food.
- Conduct research to understand the transmission and genetic mechanisms of resistance in agriculture and the implications for human and animal health.
- Generate evidence to promote good practices in the governance, supply, use and disposal of agriculture-associated antimicrobials and incentives for their adoption.
- Generate evidence to promote good practices in the management of food and agricultural wastes containing antimicrobials and incentives for their adoption.
- Develop and test pest and pathogen control to better manage livestock and fish diseases and so reduce the use of antimicrobials.

- Jointly convene agriculture and health stakeholders in order to support One Health solutions.
- Support capacity building and increase awareness on AMR in the agricultural sector.
- Pilot and evaluate approaches for surveillance of use of AMs, treatment failure, and AMR.
- Understand the costs and benefits of interventions to tackle AMR and their differential impacts on poor farmers, vulnerable groups and address other societal objectives such at attaining nutrition security.

CGIAR's endeavors to solve the problem

The CGIAR with its mandate to improve livelihoods of poor farmers is ideally placed to tackle agriculture related AMR risks in LMICs. As a result, the related research portfolio has been steadily growing over recent years with a focus on AMR in several CGIAR Research Programs (CRP Livestock and CRP A4NH, and to a lesser extent PIM and Fish, GMO markers) and various bilateral projects focusing on AM use and on AMR emergence in risk hot spots.

CRP Livestock and the CRP A4NH contribute to research on the complexity around AMR. While the two CRPs approach the topic from different perspectives, respectively livestock and human health, both start with the use of AMs in livestock production in LMICs.

For the CRP Livestock, the focus is on AM use and productivity since AMR will lead to treatment failure in livestock. Thus, the CRP aims to promote rational and efficient use of antimicrobials and more explicitly how rational use can be promoted when integrated into herd health packages. This will be achieved through building capacity and creating incentive to refine use of AMs. The outputs of the different studies provide evidence and winning arguments to engage policy makers in the AMR discussion, and the CRP Livestock aims to support countries in setting up appropriate strategies. A4NH focusses on understanding the drivers of AMR emergence in livestock systems and transmission in animal and human health systems. The CRP will map existing and project future use of antimicrobials in agriculture. To better understand AMR risks for humans due to antimicrobial use in agriculture, studies into the biology, ecology, and epidemiology of microbes will be conducted in specific sites. Whole genome sequencing will help identify the drivers of AMR emergence and transmission. To test how these drivers can be mitigated, intervention studies will be conducted in hotspot sites. Insights gained in these studies will then be used in discussions with policy makers.

Through ongoing research, ILRI has established strong partnerships with other key players in AMR research, in the CRPs with SLU and LSHTM and is in an exchange with OIE, FAO and WHO and other international platforms. Both CRPs use findings to engage policymakers in discussions about AMR and to inform the development of AMR control strategies.

1) WHO Definitions:

ANTIBIOTIC: A synonym for antibacterials used to treat bacterial infections in both people and animals.
ANTIMICROBIAL: Any substance of natural, synthetic or semi-synthetic origin which at low concentrations kills or inhibits the growth of micro-organisms.

The term antimicrobial is a collective for anti-virals, anti-bacterials, anti-fungals and anti-protozoals[1], here mainly used as AMR in bacteria…… Therefore, AMR is part of a broader challenge of pathogen resistance and the effects of resistance to e.g. parasites (including worms, insects, and trypanosomes) have been described as well as solutions developed. But in discussions around AMR, it refers mainly to the capacity of bacteria to select for resistance to antibiotics. Almost exclusively now, when people talk about antimicrobial resistance, they are talking about antibacterial resistance.

List of participants

Ref.	Organization	Invited representative		
	Organization name	Full name	Title/ Position	Email
1.	Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Govt. of India	Dr. Suresh Honnappagol	Animal Husbandry Commissioner	ahc-dadf@nic.in
2.	ICAR	Dr. J K Jena	DDG (AS & Fy)	ddgas.icar@nic.in; ddgfs.icar@gov.in
3.	ICAR	Dr. R K Singh	Director, IVRI	directorivri@gmail.com; dirivri@ivri.res.in
4.	ICAR	Dr. Ashok Kumar	ADG (AH)	ashokkr.icar@gov.in
5.	ICAR	Dr. B R Shome	PS, NIVEDI	brshome@gmail.com
6.	ICAR	Dr. Rajeswari Shome	PS, NIVEDI	rajeswarishome@gmail.com
7.	ICAR	Dr. S Bandyopadhyay	Scientist, IVRI	samiranvet@gmail.com
8.	ICAR	Dr. Naresh Goyal	PS, NDRI	nrshgoyal@yahoo.com; nkg6825@gmail.com
9.	AAU	Dr. R A Hazarika	Professor & Head	rah1962@rediffmail.com
10.	GADVASU	Dr. Jasbir Bedi,	Assistant Professor	bedijasbir78@gmail.com
11.	FAO	Sh. Rajesh Kr. Dubey	Operations Officer	rajesh.dubey@fao.org
12.	FSSAI	Dr. Vijay Pal Singh	Deputy Director (RARD)	vp.singh@fssai.gov.in
13.	CSE	Dr. Rajeshwari Sinha	Program Officer-Food Safety and Toxins Programme	S_rajeshwari@cseindia.org
14.	NCDC	Dr. Naveen Gupta	Joint Director, Zoonosis Division	nicdnaveen@gmail.com
15.	WHO	Dr. G N Gongal		gongalg@who.int
16.	IFPRI	Dr. Manika Sharma	Program Manager	Manika.sharma@cgiar.org
17.	NBFGR	Dr. Gaurav Rathore	Head of Department	grathore69@gmail.com
18.	KVAFSU	Prof. Fairoze Nadeem	Director, PGS	prof.nadeem@gmail.com; dipgskvafsu@gmail.com
19.		Dr. Neelam Taneja		drneelampgi@yahoo.com
20.	PHFI	Dr. Manish Kakkar		manish.kakkar@phfi.org
21.	MM POWER	Dr. B K Dwivedi		mpower.raj@gmail.com

22.	USAID India, Health Office, Division of Tuberculosis & Infectious Diseases	Dr. Umesh Alavadi	Project Management Specialist	ualavadi@usaid.gov
23.	CDC	Dr. Mohan Papanna	Public Health Specialist (AFI and One Health)	moi1@cdc.gov
24.	CDC India	Dr. Kayla Laserson	Country Director, CDC India	kel4@cdc.gov; klaserson@cdc.gov
25.	CDC	Dr. Valan Siromany	Public Health Specialist (AMR)	
26.	CDC	Dr. Indranil Roy	Public Health Specialist and Laboratory advisor	
27.	IDRC	Dr. Arlyne A Beeche		abeeche@idrc.ca
28.	ILRI	Dr. Delia Grace	Program Manager, (joint) Animal and Human Health	D.GRACE@CGIAR.ORG
29.	ILRI	Dr. Johanna Lindahl	Scientist	j.lindahl@cgiar.org
30.	CENPHER/ HUPH	Dr Pham Duc Phuc	Deputy director of CENPHER/ HUPH; Coordinator of VOHUN	pdp@huph.edu.vn)
31.	ILRI	Dr. Hung Nguyen	Regional Representative, ILRI, VIETNAM	H.Nguyen@cgiar.org
32.	ILRI Hanoi	Dr Fred Unger,	senior scientist	F.Unger@cgiar.org
33.	ILRI Hanoi	Ms Chi Nguyen	communication officer	C.Nguyen@cgiar.org
34.	Ministry of Agriculture and Rural Development, Vietnam	Dr. Do Van Hoan	Deputy Director-Poultry and Small Livestock Division	dovanhoan01@yahoo.com
35.	Center for Public Health and Ecosystem Research (CENPHER)-Hanoi University of Public Health	Dr. Dang Xuan Sinh		xuansinhck@gmail.com
36.	BLRI	Dr. Mohd. Abdus Samad	Senior Scientific Officer	samad_blri@yahoo.co.nz; sarkernr62@yahoo.com
37.	SAARC	Dr. Md. Nure Alam Siddiky	SO, SAC	nasiddiky.saarc@gmail.com
38.	NARC	Dr. Luma Pandey	Senior Researcher	luma.pandey@yahoo.com
39.	School of Veterinary Science, The University	Dr. Tarni Cooper		t.cooper@uq.edu.au

	of Queensland, Australia			
40.	Programme for Emerging Infections, ICDDRB	Dr. Sukanta Chowdhury	Assistant Scientist	sukanta@icddrb.org
41.	Infectious Diseases Division	Prof. Iqbal Rouf Mamun	Member	iqbalrouf@yahoo.com
42.	Centre for Global Health Policy, University of Sussex.	Dr. Anne-Sophie Jung	Research Fellow	A.Jung@sussex.ac.uk
43.	Department of Biochemistry and Molecular Biology, Faculty of Medicine, Colombo, Sri Lanka	Dr. Tharanga Thoradeniya	Senior Lecturer	tharanga@bmb.cmb.ac.lk
44.	ILRI	Dr. H Rahman	Regional Represetative for South Asia	r.habibar@cgiar.org
45.	ILRI	Ms. Roma Oli	Administration Officer	r.oli@cgiar.org
46.	ILRI	Ms. Rini Prabhakar	Accountant	rini.prabhakar@gmal.com
47.	RAJUVAS	Dr. A. K. Gahlot	Former Vice Chancellor, RAJUVAS	ajeygahlot@hotmail.com
48.	Rajasthan	Dr. A. K. Tomar	Director, ICAR-CSWRI	cswriavikanagar@yahoo.com
49.	Rajasthan	Dr. S S Misra	Senior Scientist	mssppcunit@gmail.com
50.	Govt. of Rajasthan	Dr. Lal Singh	Director, Gopalan	lalsinghjsm@yahoo.com
51.	Govt. of Rajasthan	Dr. Sandip Agrawal	Veterinary Officer	Sandip.agrawal67@gmail.com

Animal and Human Health program

Capacity development, partnerships, networking and communication

Capacity development

- **Graduate fellowships**: Through the International Livestock Research Institute (ILRI) graduate fellowship program, MSc and PhD students from universities around the world are attached to the program to carry out their thesis research on topics such as veterinary epidemiology, food safety, animal health, zoonotic diseases and ecohealth.
- **Field Epidemiology and Laboratory Training Program (FELTP)**: FELTP was set up to strengthen Kenya's capacity in epidemiology and laboratory management. Through the Urban Zoo and ZooLinK projects, the program hosts graduate students to carry out their Masters research on veterinary epidemiology.
- **Training workshops**: We organize training workshops for various groups including dairy producers, milk traders, veterinary officers, meat inspectors, academicians, graduate students and laboratory technicians. Topics include qualitative risk assessment, laboratory analytical methods, participatory epidemiology, food safety and hygienic milk and meat handling. Various training approaches are used such as lectures, practical exercises, group discussions, demonstrations and field visits.

Partnerships

We work in partnership with diverse institutions (https://aghealth.wordpress.com/partners). Our partners are grouped into seven broad categories: CGIAR centres; global initiatives; government departments and ministries; non-governmental organizations, private-sector organizations and development actors; regional initiatives; research institutes; and universities.

Networking

Our scientists are involved in a number of research and policy networks through which they provide evidence to inform policymaking on issues of global concern such as antimicrobial resistance, food safety and environmental management. These networks include Agrilinks, Chatham House, the Department for International Development, Food and Agriculture Organization of the United Nations, Lancet, Leverhulme Centre for Integrative Research on Agriculture and Health, Livestock Global Alliance, United Nations Environment Program, the World Bank, the World Organisation for Animal Health and the World Health Organization.

Communication

Program and project updates are posted on the AgHealth blog (http://aghealth.wordpress.com), ILVAC blog (http://ilvac.net) and Zoonotic Diseases website (http://www.zoonotic-diseases.org). Research outputs are indexed in the Open Access CGSpace repository (http://cgspace.cgiar.org). We also share our research through ILRI's corporate social media channels and the ILRI and CGIAR websites.

Contact

Delia Grace, d.grace@cgiar.org
http://aghealth.wordpress.com

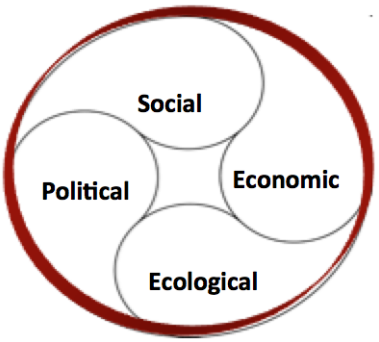
Animal and Human Health program

One Health

One Health/Ecohealth (OH) is a broad movement that recognises the fact that human, animal and ecosystem health are interdependent and that multidisciplinary collaborations are often necessary in order to attain optimum health solutions. It is particularly suited to addressing intractable, imminent and existential threats to humanity. Globalization, urbanization, population growth and climate change are just some of the new factors driving disease dynamics. OH not only improves understanding of complex problems but also adds value in terms of solutions, beyond what can be achieved by working in sectors.

One Health problems and solutions

- Climate sensitive diseases
- Emerging infectious disease
- Diseases with wildlife hosts
- Food borne disease
- Vector borne disease
- Waste management
- Neglected zoonoses
- Urban agriculture
- Antimicrobial resistance
- Livestock and nutrition
- Equity, gender and ethics



One Health partnerships

ILRI helped establish two Ecohealth/One Health resource centers in Southeast Asia and other southern centers of One Health excellence through capacity building and collaborative research. These include: Centre for Public Health and Ecosystem Research, Vietnam; the Zoonotic Disease Unit, Kenya; and Centre Suisse de Recherches Scientifiques en Côte d'Ivoire. We are a member of a number of OH networks including the Network for Evaluation of One Health and the Participatory Epidemiology Network for Animal and Public Health and the Lancet Commission for Health and Climate change.

One Health research highlights

- Several research firsts including: the first detection of Middle East respiratory syndrome in camels and people in Kenya; the first risk assessment for Ebola in Uganda; the first identification of *Trichinella* and erysipelas also in Uganda.
- A project in Southeast Asia worked with more than 100 researchers from multiple disciplines in six countries – many of them were introduced to the concept of OH by the project. Outcomes included: policymakers in Bali convinced to extend the project model of community workers to the entire island; a policy brief published in the Thai government journal influencing how small slaughterhouses were managed, EcoHealth curricula in place in two universities; extension of student community work in Indonesia.

Contact

Delia Grace, d.grace@cgiar.org
http://aghealth.wordpress.com

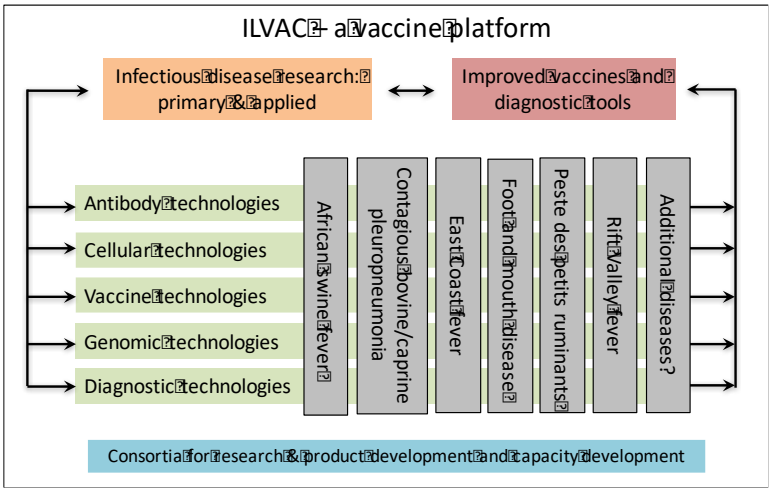
ILRI vaccine biosciences and ILVAC

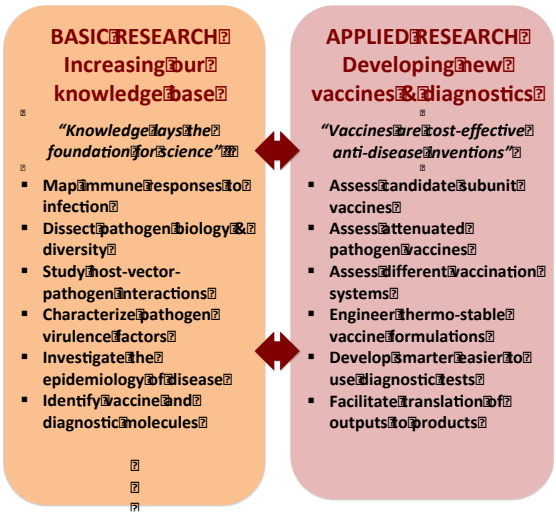
Vaccines are one of the most effective inventions for disease control, especially in under-resourced agricultural systems. Our vision is to build through a vaccine platform (ILVAC) a hub for research excellence dedicated to developing vaccine-based solutions to reduce disease burdens that limit livestock productivity in smallholder and pastoral farming systems. We also work to improve diagnostic tests, as they play a key role in disease control.

New vaccine science, new opportunities: Underpinned by genome sequence data, high throughput screening methods, systems approaches and cross-learning arising from human and veterinary research have resulted in paradigm shifts in vaccinology. This has accelerated the pace of basic and applied research enabling a multi-disciplinary approach to development of vaccines. The three key areas include:

1. Monitoring of immune responses to infection and immunization.
2. Methods for candidate vaccine antigen identification.
3. Re-design of vaccine antigens and vaccination methods to increase their efficacy.

A focussed approach: ILVAC with partners focuses on a set of priority diseases; African swine fever (ASF), contagious bovine/caprine pleuropneumonia (CBPP/CCPP), East Coast fever (ECF), peste des petits ruminants (PPR) and Rift Valley fever (RVF). A suite of crosscutting technologies, robust pathogen challenge models and generic approaches are implemented under ILVAC to tackle these diseases, and lays the foundation for research on other diseases. Through the ILRI Tick Unit we include research on vectors of disease. The BecA-ILRI hub supports high-end laboratory research, the ILRI Farm supports enhanced BLS-2 vaccine trials, the Kapiti Ranch permits contained field trials and ILRI's extensive links with local partners permits clinical field studies.





Estimates of some disease burdens

- African swine fever: threatens the global $150 billion/year pig industry.
- Contagious bovine pleuropneumonia: eastern Africa losses > $60 million/year.
- East Coast fever: sub-Saharan Africa regional losses exceed $300 million/year; kills ~ 1 million cattle/year.
- Rift Valley fever: 2006/7 outbreak in Kenya cost ~ $30 million; 140 human deaths in eastern Africa.

A risky but high-reward venture: This research is complex in nature and requires long-term investments. ILVAC's comparative advantage is mainly in the discovery phase to proof-of-concept under laboratory and early field trials, with different entry points depending on the disease. Several lead vaccine molecules for CBPP and ECF have been identified. Research on RVF has reached contained field trials, that on ASF and CCPP is just starting, while research on PPR is through delivery of thermostable formulations of the existing attenuated live vaccine.

Partnering for impact: To meet its objectives and achieve impact ILVAC works with the CGIAR Research Programs, as well as national, regional and international academic, public, private and development sectors.

Contact: Vish Nene; ilri-vaccines@cgiar.org; ilvac.net.

ILRI Tick Unit

A unique resource and one of a few such remaining units in the world

Unit built in 1979 to support research on development of vaccines against East Coast fever (ECF) and conduct research on ticks and other tick-borne diseases (TBDs).

A secure building with BSL2 level fly/tick proof animal isolation rooms (16 cattle and 48 rabbits) with upgraded BSL1 laboratory space, equipment and tick rearing rooms.

Tick species maintained: *Rhipicephalus appendiculatus* (7 different stocks from eastern and southern Africa); *R. zambeziensis; R. evertsi; Amblyomma variegatum; R. boophilus decoloratus; R. b. microplus; Hyalomma anatolicum, Ornithodoros moubata.*

Current activities

- Breed and maintain clean tick species and stocks
- Provide training in tick identification and dissections
- Provide bulk antigen for the live ECF-ITM vaccine
- Provide animal facilities for vaccine and acaricide trials
- Provide parasite material for ECF subunit vaccine research

Future opportunities

- Studies on vector biology and vector-pathogen interactions
- Tick population studies to examine genetic diversity
- Epidemiology of tick and TBDs, including zoonoses
- Map acaricide resistance
- Development of anti-tick vaccines and chemicals
- Predict effects of climate change on ticks and TBDs
- Integrated control of ticks and TBDs

Contact: Naftaly Githaka; ilri-vaccines@cgiar.org

RESEARCH PROGRAM ON
Agriculture for Nutrition and Health
Led by IFPRI

A4NH

FLAGSHIP 5
Improving Human Health

About A4NH

The CGIAR Research Program on Agriculture for Nutrition and Health (A4NH), led by the International Food Policy Research Institute (IFPRI), is built on the notion that agriculture has the potential to do much more than reduce hunger and poverty. Our high-quality research and evidence from Phase I (2012–2016) confirmed that agricultural development has enormous potential to make significant contributions to improving the nutrition and health of people. In Phase II (2017–2022), our focus is expanding to address challenges related to food system transformation, the rising burden of foodborne disease, and emerging health risks, like antimicrobial resistance. Our work continues to recognize that addressing inequality related to gender or other social categories is a development objective in its own right and an important condition for achieving other development objectives, particularly improved nutrition and health.

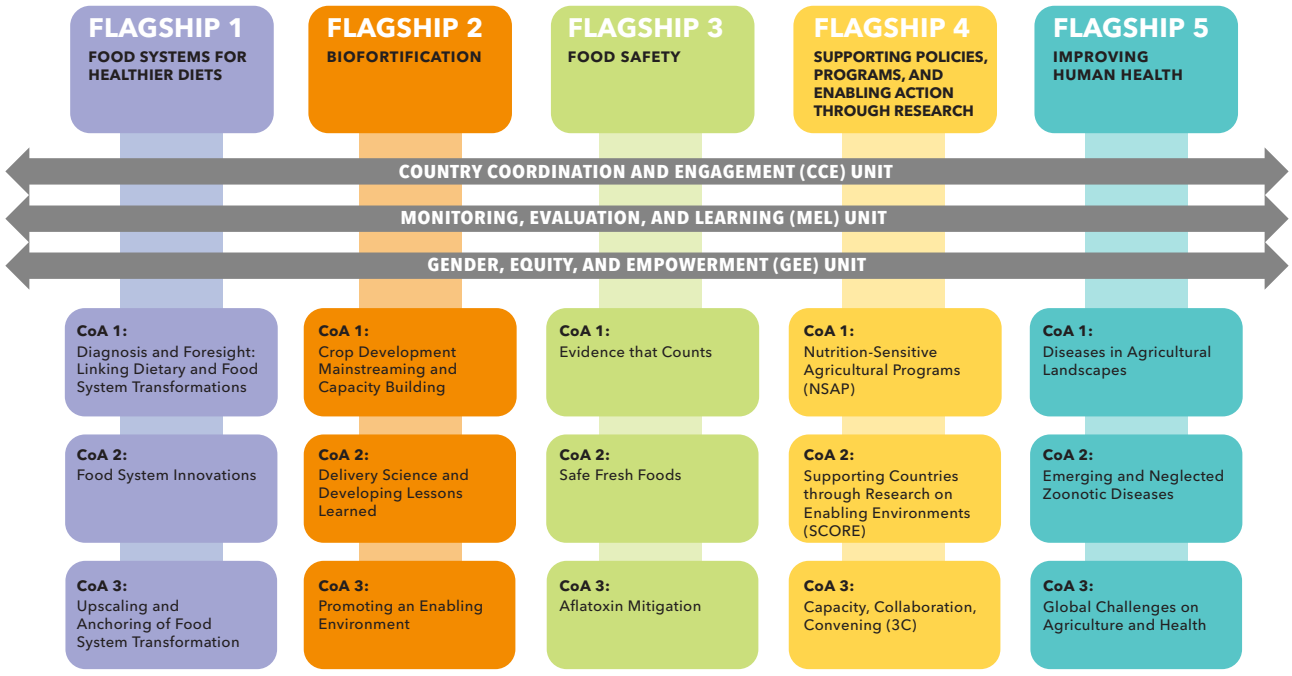
As CGIAR's only research program on nutrition and health, A4NH makes a unique contribution to three specific CGIAR targets related to reduced poverty and improved food and nutrition security for health.

Recognizing this is a major task, A4NH brings together 5 CGIAR Centers and 2 academic institutions plus the talents and resources of a wide range of partners. Together, we carry out research activities through five unique, yet complementary, flagship programs and three cross-cutting units in at least 30 countries.

Flagship 5 Rationale and Objectives

Agriculture enhances access to food and improves livelihoods, but in some cases, may also be linked with increased risks of disease transmission. Historically, CGIAR research has explored agriculture and health interactions related to irrigation and vector-borne diseases, use of wastewater in agriculture, integrated pest management (IPM), and emerging and neglected zoonotic diseases. Research that bridges disciplinary divisions and enhances links between agriculture and health

FIGURE 1 A4NH Program Structure



Stevie Mann/ILRI

provides a largely untapped opportunity to improve the health and livelihoods of poor people, especially in rural areas where ill health may be the most critical pathway for staying or becoming poor, and undermines the benefits of agricultural development.

Clusters of Activities

Flagship 5 is an innovative collaboration between public health and agricultural researchers aimed at mitigating health risks and optimizing benefits in agricultural systems. This flagship is led by a joint partnership arrangement designed to bridge agriculture and public health research to deliver high-quality scientific outputs and to identify new key opportunities for integrated actions that improve human health.

CONNECT WITH FLAGSHIP 5

To engage with A4NH directly on Improving Human Health, please contact the Flagship 5 leader:

Eric Fèvre
Chair of Veterinary Infectious Disease
International Livestock Research Institute (ILRI) and Institute of Infection and Global Health, University of Liverpool
Email: Eric.Fevre@liverpool.ac.uk

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

Flagship 5 also hosts a platform for public health and agriculture research collaboration, convened by the London School of Hygiene and Tropical Medicine, which will serve as a resource for CGIAR partners looking to collaborate on agriculture and health. Flagship 5 is co-led by the International Livestock Research Institute (ILRI) and the London School of Hygiene and Tropical Medicine (LSHTM) and combines resources from the International Institute of Tropical Agriculture (IITA) along with several strategic partners. Our research priorities fall into three main clusters of activities:

1. **Diseases in Agricultural Landscapes** concentrates on understanding the health effects of agricultural intensification, including changes in water use. This evidence is shared in ways that leads to an increase in agricultural research initiatives measuring health risks and benefits.
2. **Emerging and Neglected Zoonotic Diseases** studies shared human and animal disease risks and explores the impacts of co-locating and aligning health and agricultural interventions. Study results help both agricultural and public health policymakers and implementers deliver coordinated and effective solutions to zoonotic threats, in particular, cysticercosis.
3. **Global Challenges on Agriculture and Health** coordinates research and engagement activities that tackle emerging, common problems for health and agriculture, such as antimicrobial resistance and pesticide resistance. Our efforts are intended to help public and private sector policymakers implement measures to reduce health risks from these global challenges, like antimicrobial resistance in hotspot livestock systems.

Yousuf Tushar/WorldFish

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1201 Eye Street NW, 12th floor, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-467-4439 | Email: ifpri@cgiar.org | www.ifpri.org

For more information, please contact:
John McDermott, A4NH director | j.mcdermott@cgiar.org
www.a4nh.cgiar.org

Partners

The International Livestock Research Institute (ILRI), in partnership with International Development Research Centre (IDRC) of Canada, the Public Health Foundation of India (PHFI), CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) and International Association for Ecology and Health (IAEH) organize this event.

The **International Livestock Research Institute (ILRI)**
ILRI's mission is to improve food and nutritional security and to reduce poverty in developing countries through research for efficient, safe and sustainable use of livestock- ensuring *better lives through livestock*. www.ilri.org

The **CGIAR Research Program on Agriculture for Nutrition and Health**, or A4NH, led by the International Food Policy Research Institute (IFPRI), helps realize the potential of agricultural development to deliver gender-equitable health and nutritional benefits to the poor. http://a4nh.cgiar.org/

The **International Development Research Centre (IDRC)** funds research in developing countries to promote growth, reduce poverty, and drive large-scale positive change. https://www.idrc.ca/

The **Public Health Foundation of India (PHFI)** is a public private initiative that has collaboratively evolved through consultations with multiple constituencies including Indian and international academia, state and central governments, multi & bi-lateral agencies and civil society groups. PHFI is a response to redress the limited institutional capacity in India for strengthening training, research and policy development in Public Health. https://www.phfi.org

The **International Association for Ecology and Health** or the IAEH is a scholarly organization with members from all continents. The IAEH is committed to fostering the health of humans, animals and ecosystems and to conducting research which recognizes the inextricable linkages between the health of all species and their environments. http://ecohealthinternational.org/