Policy brief

RESEARCH PROGRAM ON Livestock

CGIAR

Photo: ILRI / K Dhanji

PROMOTING MEDICALLY RATIONAL AND RESPONSIBLE USE OF ANTIMICROBIALS for healthy and productive livestock

KEY MESSAGES

- Growing global anti-microbial resistance is a looming threat that could lead to devastating health consequences and scale back food security, economic and development gains.
- Most livestock farmers across LMICs and production systems practice improper use of antimicrobials, resulting in high occurrence of anti-microbial resistance (AMR) in animals and animal source foods.
- Livestock keepers and drug retailers in LMICs have limited awareness on AMR, often due to a combined lack of access to knowledge and affordable tools to guide the proper use of antimicrobials.
- Reinforced legislation alone is insufficient to promote medically rational and responsible anti-microbial use in livestock and to address the rise of AMR.
- Incentives on the ground are imperative for change and should focus on supporting disease prevention as a means to reduce the need for antimicrobials. This requires increased access by farmers to professional animal health services and affordable veterinary medicines of adequate type and quality.

This policy brief is intended to guide policymakers, funders and other development and health practitioners who want to invest in measures to curb antimicrobial resistance (AMR) by refining antimicrobial use (AMU) in livestock in low- and middle-income countries (LMICs). It proposes actions based on evidence from multi-year research and capacity development projects in sub-Saharan Africa and Southeast Asia.

INTRODUCTION

Rising occurrence of anti-microbial use (AMR) is making infections in humans and animals harder or impossible to treat and is threatening gains in key areas of global health, food security, economic growth and development (World Bank, 2019). The global livestock sector is a major user of antimicrobials and contributes significantly to the emergence of AMR (Tiseao et al., 2020). Improper use of antibiotics, such as use for disease prevention, as growth promoters or without a proper diagnosis, drives AMR development, particularly in low- and middle-income countries (LMICs) (IACG, 2019). Legislation is one tool to address inappropriate AMU but is more effective when combined with capacity for enforcement and strong incentives on the ground to bring about sustainable change.

In 2015, the Global Action Plan on AMR (GAP) was endorsed by the World Health Assembly and provides a framework for developing national action plans (WHO, 2019). By 2021, most LMICs have developed multi-sectoral National Action Plans (NAP) to tackle emerging AMR in human and animal health, food production, food safety and the environment. However, knowledge gaps, such as knowing which interventions to implement, prioritization of actions and practical examples on what works, are hampering progress on implementing the NAPs in LMICs.

Our work addressed some of these knowledge gaps, drawing on all the five strategic objectives in the GAP, by improving the understanding of rationales for AMU and AMR situation in livestock in selected LMICs in Sub Saharan Africa and Southeast Asia and on designing and implementing locally adapted manuals, trainings, and tools to change the improper antibiotic use.

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Did you know? *Antimicrobials* are drugs that act on a range of microbes (bacteria, fungi, viruses and protozoa) that cause disease. *Antibiotics*, on the other hand, specifically target bacteria and are only effective against bacterial infections.

APPROACHES AND RESULTS

From 2018 to 2021, the Animal Health Flagship under the CGIAR Research Program on Livestock conducted research on how to promote medically rational and responsible use of antibiotics to curb the emergence of antimicrobial resistance in support of the program's goal to provide research-based solutions to drive the transition to sustainable, resilient livelihoods and to productive small-scale enterprises that will help feed future generations.

The work contributed to the development of several tools and outputs:

1. **AMUSE** is a tool to measure antimicrobial use that consists of a core set of questions for **attempting a harmonised approach to data collection on AMU in various livestock systems**, which was applied in Benin, Ethiopia, Kenya, Vietnam and Uganda (Gemeda et al., 2020; Wieland et al. 2019). The tool was developed to better understand how antimicrobials are accessed, used and by whom, and how these factors contribute to misuse of antimicrobials. It was designed to enable collation and comparison of data from different production systems and species in diverse countries.

Piloting of AMUSE revealed that most farmers regularly use antimicrobials in livestock including drugs intended for human use. Differences were reported between locations and production systems in terms of 1) access, 2) types of antimicrobials used and 3) when they were used. Antimicrobials were most commonly accessed by livestock owners from veterinarians and private suppliers, and in some locations, almost half of the respondents reported problems with drug access. Improper use of antimicrobials, mostly use without a proper diagnosis, was observed among 70-80% of livestock keepers and a majority were unaware of withdrawal periods of milk and meat after antibiotic treatment to avoid antibiotic residues in food intended for human consumption.

In Ethiopia, **AMUSE was followed-up with community conversations** as a training approach which addresses perceptions and gender differences in AMU and together with communities agreed on action points to prevent AMR. Agreed actions included to consult a veterinarian before buying and using drugs, improve disease prevention practices and to stop using human drugs for animals (Lemma et al 2019; Alemu et al., 2019).

2. **Assessments of the antimicrobial drug supply chain and AMR occurrence in livestock** was done in Benin, Ethiopia and Uganda. These studies found low levels of training on veterinary medicine amongst antimicrobial supply chain actors, particularly the drug retailers. Additionally, high overall AMR occurrence were detected in food handlers, live animals and food of animal origin (Gemeda et al 2020; Gemeda et al. 2021; Dione et al 2020 ; Dion et al 2021).

3. In Uganda, **interactive trainings for animal health professionals, farmers and traders on livestock production with low antibiotic use** were developed and implemented. The trainings combined teaching with social learning, using mixed group discussions to deliberate on local knowledge. The trainings resulted in piloting of interventions for disease prevention to reduce the need for antibiotics. Measures involved record keeping, stringent farm biosecurity, vaccination, and batchwise raising of animals. Lessons learned were captured in manuals on prudent AMU targeting farmers and veterinary professionals.

4. In a pilot study, a laboratory team developed a **diagnostic assay using biomarkers in pigs to discriminate between viral and bacterial infections**. This assay has the potential to be used to guide a more precise and medically rational use of antibiotics in animals by differentiating between bacterial infections that may be susceptible to antibiotics, and viral infections that can't be cured with antibiotics. The method is a starting point, paving the way for further development of a rapid field test or point of care test (Hjertner et al 2021).

Training a group of farmers on responsible antibiotic use.
Photo by Justine Alinaitwe

Category	Gene	Viral mimics			Bacterial mimics			Inactivated microbes	
		ODN 2216 (TLR9)	R848 (TLR7/8)	poly (I:C) (TLR3)	Pam3CSK4 (TLR2/1)	LPS (TLR4)	FLiC (TLR5)	Split Influenza	*A. pleuro* (HI)
Putative viral markers	*IFNα*	3.4	0	1.0	0.2	0.3	0.3	1.7	0.4
	IFNβ	409.2	1.8	1992.0	3.0	0.5	1.7	70.9	1.4
	IFITM3	19.9	11.9	5.7	2.7	0.9	1.3	22.5	0.7
	STING	0.6	0.2	0.6	0.5	0.5	0.7	1.3	0.4
	IFI44L	7.5	3.4	3.3	1.4	0.7	1.1	8.0	0.5
	IFIT3	41.7	12.4	7.0	1.5	46.2	0.7	95.9	0.2
	MxA	72.6	39.5	17.7	7.9	0.5	1.0	63.0	0.7
	RSAD2	206.7	73.3	30.7	7.6	0.8	1.5	113.5	0,5
Putative Bacterial markers	*FAM89A*	0.6	0.1	0.5	0.5	0.8	0.8	0.6	0.6
	S100PBP	0.6	0.2	0.7	0.6	0.5	0.6	0.7	0.4
	SLPI	72.6	5.3	28.1	5.0	0.2	2.0	233.8	0.3
	UPB1	25.5	78.5	5.9	66.5	38.8	20.1	2.2	30.8
Pro-inflam-matory cytokines	*IL-1β*	1.0	1.8	10.3	67.2	40.7	30.0	0.7	17.7
	IL-6	20.7	96.7	19.7	72.3	51.7	24.5	3.7	12.2
	IL-8	1.9	9.0	44.0	119.8	66.6	32.0	0.3	24.3
	TNF-α	2.6	0.9	2.3	1.9	2.4	2.5	2.1	1.6

≤ 0.0625	> 0.0625 – 0.125	> 0.125 – 0.25	> 0.25 – 0.5	> 0.5 – < 2	2 to < 4	4 to < 8	8 to < 16	≥16

The gene expression was calculated as fold change in relation to the geometric average expression of three reference genes and calibrated to a medium control, using the average of duplicate reactions for each cDNA. Color denotes fold change expression range. Light to dark green denotes up-regulated and pink to orange denotes down-regulated genes.

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Development of diagnostic test to discriminate between viral and bacterial infections will guide a more precise and medical rational use of antibiotics.

Medical rational use of antibiotics supports the production of safe animal source foods. Photo ILRI/Paul Karaimu

A veterinarian discuss with a farmer how to use an antibiotic appropriately. Photo ILRI/Biruk Gemeda

CONCLUSION

The work within the CRP Livestock highlighted several pressing issues on AMU in livestock that can serve as guidance in prioritizing actions to curb AMR in LMIC.

- Most livestock farmers across countries and production systems practice improper use of antimicrobials
- Livestock keepers and drug retailers have limited awareness and knowledge on AMR
- The occurrence of AMR is high in animals and animal source foods
- Veterinary practitioners are only occasionally consulted by farmers on disease prevention and treatment
- Actors along the livestock value chain lack affordable and accessible tools to guide proper use of antimicrobials

RECOMMENDATIONS

The AMR agenda requires effective governance and commitments from local, on-the-ground practitioners, to central level policymakers. This may be achieved by combining bottom-up and top-down approaches. The following recommendations have come forward as key to tackle emerging AMR in the livestock sector in LMICs:

- Support farmers with disease prevention and improved herd health as means to reduce the need for AMU
- Strengthen the capacity of animal health services in disease prevention and on treating diseased animals in a medically correct way
- Improve farmers' access to antimicrobials of adequate type and quality and to affordable professional animal health services for guiding diagnosis and treatment of diseased animals
- Involve farmers, animal health professionals and other relevant stakeholders in defining locally feasible interventions and targets to refine AMU in livestock
- Develop affordable and field-adopted assays and tools to guide treatment of animals and evaluate AMU interventions

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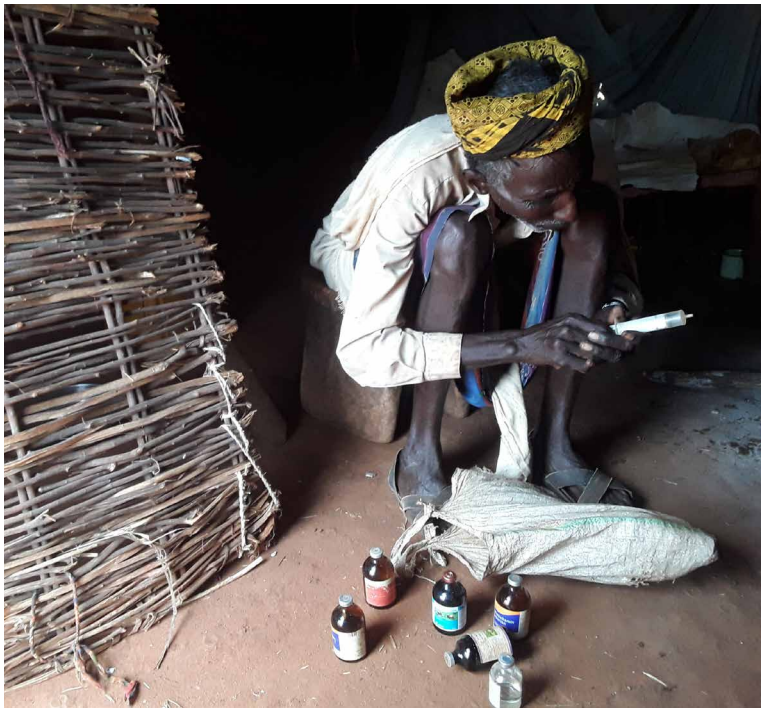

Poor knowledge on how to use antibiotics responsibly is common among farmers in low- and middle-income countries. Photo ILRI/Biruk Gemeda