



Unregulated Antimicrobial Use in Rural Veterinary Practice: Field Insights and Stewardship Challenges

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Abstract

Antimicrobial resistance (AMR) is a global health crisis, with veterinary misuse contributing significantly to its spread. Off-label drug use, particularly in rural veterinary practice, is common due to limited access to licensed veterinary medicines, economic constraints, and farmer expectations. This short communication presents field observations from rural dairy and small ruminant farms in India, documenting patterns of off-label antimicrobial use, associated risks, and implications for antimicrobial stewardship. Findings reveal frequent reliance on human antibiotics, empirical dosing without diagnostics, and poor adherence to withdrawal periods. These practices pose risks for food safety, animal welfare, and public health. Strengthening veterinary drug availability, farmer education, and stewardship programs is urgently required.

KEYWORDS: Off-label drug use; antimicrobial resistance; veterinary medicine; rural practice; stewardship; India.

INTRODUCTION

Antimicrobial resistance (AMR) is recognized as one of the greatest threats to global health, food security, and development (World Health Organization [WHO], 2019). Veterinary medicine plays a critical role in this crisis, as misuse of antimicrobials in animals contributes to resistant pathogens that can spread to humans through direct contact or food chains (Holmes et al., 2016).

In rural veterinary practice, particularly in low- and middle-income countries, veterinarians often resort to off-label drug use administering drugs outside their approved species, dosage, or indication due to limited access to veterinary-specific formulations (Mutua et al., 2020). While off-label use may provide immediate therapeutic solutions, it raises concerns about drug residues, treatment failures, and AMR development (Rajagunalan et al., 2023).

This short communication reports field observations of off-label antimicrobial use in rural India and discusses their implications for antimicrobial stewardship.

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FIELD OBSERVATIONS

Between June and September 2025, field visits were conducted across dairy and goat farms in Maharashtra, India. Interviews with veterinarians and farmers, combined with direct observation, revealed several recurring patterns:

Use of human antibiotics in livestock: Ciprofloxacin and doxycycline, intended for human use, were frequently administered to cattle and goats when veterinary formulations were unavailable (Mutua et al., 2020).

Extra-label dosing of oxytetracycline: Farmers often administered higher doses for mastitis treatment, disregarding withdrawal periods, leading to potential residues in milk (Kumar et al., 2020).

Empirical broad-spectrum use: Antibiotics such as ceftiofur and enrofloxacin were used empirically without diagnostic confirmation, reflecting gaps in laboratory support (Singh et al., 2021).

Farmer-driven administration: In many cases, farmers administered drugs without veterinary supervision, relying on peer advice or local pharmacy recommendations (Jayanthi et al., 2025).

These practices highlight systemic challenges in rural veterinary healthcare, including inadequate drug regulation, poor farmer awareness, and limited extension services.

IMPLICATIONS FOR ANTIMICROBIAL STEWARDSHIP

The indiscriminate off-label use of antimicrobials in rural veterinary practice has profound implications for antimicrobial stewardship. One of the most critical concerns is the acceleration of antimicrobial resistance (AMR). Pathogens such as *Escherichia coli* and *Staphylococcus aureus*, which are leading causes of bovine mastitis and zoonotic infections, are particularly vulnerable to developing resistance when exposed to inappropriate dosing regimens (Sharma et al., 2022). Off-label practices often involve extrapolating human drug dosages to animals without considering species-specific pharmacokinetics, resulting in sub-therapeutic concentrations that allow partially resistant strains to survive and proliferate. These resistant organisms can spread within herds and across communities, posing risks not only to animal health but also to public health through direct transmission or contaminated food products (Holmes et al., 2016).

Another major implication relates to food safety risks. Failure to observe withdrawal periods following antimicrobial administration leads to residues in milk and meat. Studies have documented the presence of tetracyclines, fluoroquinolones, and beta-lactams in dairy products when withdrawal guidelines are ignored (Kumar et al., 2020). Such residues can trigger allergic reactions, disrupt gut microbiota, and contribute to chronic low-dose exposure in humans, which fosters resistance in commensal bacteria. Beyond health risks, these residues violate food safety standards, undermining consumer confidence and potentially affecting market access for smallholder farmers (Sharma et al., 2022).

Underlying these challenges are regulatory gaps. Rural areas often lack access to veterinary-specific drugs, forcing reliance on human formulations (OIE, 2021). Weak enforcement of prescription requirements and inadequate pharmacovigilance systems exacerbate misuse. Addressing these issues requires robust stewardship programs, including training veterinarians in judicious antimicrobial use, farmer education on withdrawal periods and risks, and strengthening drug regulation to restrict over-the-counter sales (Costin, 2024). Integrating these measures into a One Health framework is essential to safeguard animal productivity, food safety, and public health.

CONCLUSION

Field observations underscore that off-label drug use in rural veterinary practice is widespread and poses significant challenges to antimicrobial stewardship. Addressing these issues requires a multi-pronged approach: improving veterinary drug availability, enforcing withdrawal periods, enhancing diagnostic support, and implementing stewardship programs. Such measures are essential to safeguard animal health, farmer livelihoods, and public health.

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