

Review article



Silent Drivers of AMR: The Forgotten Role of Substandard Veterinary Antibiotics in Nigeria's One Health Landscape

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ABSTRACT

Antimicrobial resistance poses an escalating threat to public health in Nigeria, where infectious diseases remain prevalent and antimicrobial use in livestock production is extensive. While misuse of antibiotics is widely acknowledged, the impact of poor-quality veterinary drugs on resistance development has received limited attention. This commentary examines substandard veterinary antibiotics as an overlooked driver of resistance within a One Health framework. A narrative synthesis of scientific literature, regulatory documents, and contextual field insights was undertaken to explore how poor-quality antimicrobials contribute to resistance emergence. Evidence reveals systemic weaknesses in regulatory oversight, supply chain integrity, and pharmacovigilance, alongside biological pathways through which degraded or falsified antibiotics accelerate resistance transmission across animal, human, and environmental interfaces. Substandard veterinary antimicrobials represent a silent yet potent catalyst of resistance in Nigeria. Addressing this requires stringent regulation, quality surveillance, stewardship education, and stronger integration within national One Health strategies.

Keywords: Antimicrobial resistance; Veterinary antibiotics; Substandard medicines; One Health; Nigeria

Introduction

Antimicrobial resistance (AMR) has become a profound public health and economic challenge in Nigeria and other low- and middle-income countries, where infectious diseases remain pervasive and health systems are fragile¹. The veterinary sector accounts for a substantial proportion of antimicrobial consumption, particularly in poultry and aquaculture, with weak regulatory oversight and widespread non-prescription access^{2,3}. While global AMR discourse often centres on misuse and overuse, the equally critical dimension of drug quality has received limited attention. Recent World Health Organization assessments reveal a high prevalence of falsified and substandard antimicrobials across Africa, intensifying the risk of resistance selection^{4,5}. This commentary highlights substandard veterinary antibiotics as an overlooked yet potent driver of AMR in Nigeria. By adopting a One Health lens, it offers a novel perspective that links poor-quality veterinary drugs, human exposure, and environmental contamination within the country's unique regulatory and livestock context^{6,7}.

Substandard Veterinary Antibiotics as an Overlooked AMR Driver

Understanding Substandard Veterinary Antimicrobials

Substandard veterinary antibiotics encompass products that contain incorrect concentrations of active pharmaceutical ingredients, degraded formulations, or falsified compositions that fail to meet established pharmacopeial standards⁸. In Nigeria and other low- and middle-income countries, such products are widespread in informal pharmaceutical markets where weak enforcement allows the sale of unregistered and illegally imported veterinary drugs⁹. Evidence from regulatory seizure reports and the World Organisation for Animal Health indicates that these poor-quality products are not only prevalent but also systematically overlooked within antimicrobial resistance (AMR) discourse. Their use in livestock production undermines therapeutic efficacy and accelerates bacterial adaptation in species such as *Escherichia coli*, *Salmonella enterica*, and *Campylobacter jejuni*, which are common zoonotic agents in Nigeria¹⁰.

Mechanistic Pathways of Resistance Development

The biological pathways through which substandard antibiotics drive AMR are multifaceted. Exposure of pathogens to sub-therapeutic concentrations allows partial bacterial killing and survival of resistant subpopulations, while degraded formulations alter pharmacokinetics, prolong infection, and increase the frequency of treatment cycles^{2,3}. This recurrent exposure to inadequate drug levels in poultry and aquaculture—sectors characterized by intensive production and limited veterinary oversight—creates ideal conditions for the emergence of multidrug-resistant organisms. Farmers often respond to treatment failures by escalating doses or combining multiple antimicrobials, inadvertently compounding selective pressure and propagating resistance across microbial communities¹⁰.

Nigeria's Vulnerability Landscape

Nigeria's vulnerability to this silent driver of AMR is heightened by its unregulated veterinary drug markets, climatic conditions, and systemic weaknesses in quality assurance^{9,11}. The country's high temperatures and humidity degrade drug potency during transport and storage, particularly in rural areas lacking cold-chain infrastructure. Antimicrobial use decisions are frequently made by farmers without veterinary supervision, reflecting low awareness of drug quality indicators and limited access to professional guidance³. Post-market quality surveillance and pharmacovigilance remain minimal, as there is no routine chemical analysis of veterinary antimicrobials and few laboratories possess the capacity to test product authenticity⁹. Consequently, treatment failures are rarely reported, and substandard products continue to circulate unchecked.

One Health Consequences

The implications of these quality failures extend beyond animal health into the broader One Health ecosystem. Resistant bacteria originating in livestock can transfer to humans through contaminated food, occupational contact, or environmental dissemination⁴. Manure and wastewater from farms carry both resistant microbes and residual antimicrobials into soil and water systems, creating persistent reservoirs that sustain resistance genes in the community^{5,11}. High-risk production systems such as poultry and aquaculture amplify these pathways, facilitating the exchange of resistance determinants across species and

ecological compartments¹⁰.

Systemic Gaps and Policy Weaknesses

At the policy level, weak regulatory oversight and fragmented AMR governance frameworks perpetuate these vulnerabilities. The National Agency for Food and Drug Administration and Control struggles with porous borders and limited inspection capacity⁹, while the National Action Plan on AMR insufficiently integrates veterinary drug quality control into its operational priorities^{6,7,12}. Without robust pre-market verification and traceability mechanisms, substandard products continue to erode the effectiveness of stewardship interventions.

Actionable One Health Recommendations

Addressing these gaps requires a coordinated One Health response that embeds drug quality assurance within AMR control strategies. Strengthening import regulation and registration systems through mandatory pre-market testing and digital traceability is essential^{8,9}. Establishing veterinary pharmacovigilance networks involving universities and diagnostic laboratories can enable routine field testing and reporting of treatment failures¹². Farmer education programs should emphasize drug quality literacy and responsible antimicrobial use, supported by agricultural extension

systems^{2,3}. Finally, Nigeria should leverage regional and global mechanisms, including the African Medicines Agency and the frameworks of the World Organisation for Animal Health, the Food and Agriculture Organization, and the World Health Organization, to harmonize veterinary drug regulation and sustain cross-sector collaboration^{8,12}. By confronting the silent threat of substandard veterinary antibiotics, Nigeria can advance toward a resilient, evidence-based AMR response that safeguards animal, human, and environmental health.

Conclusion

Substandard veterinary antibiotics constitute a silent yet powerful driver of antimicrobial resistance in Nigeria, undermining therapeutic effectiveness and accelerating the spread of resistant pathogens across humans, animals, and the environment. Addressing misuse alone will not suffice without embedding drug quality control within the national AMR response. Strengthened regulatory enforcement, systematic surveillance, and veterinary pharmacovigilance, supported by farmer education and stewardship initiatives, are imperative. Integrating veterinary drug quality into One Health strategies will enhance Nigeria's capacity to mitigate AMR and safeguard public, animal, and environmental health for the future.

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