

# Addressing Antibiotic Resistance Through Antimicrobial Stewardship in Developing Countries: A Minireview of Strategies and Outcomes

Mini Review

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## Abstract

Antibiotic resistance poses a significant challenge to global healthcare systems, affecting both human and animal welfare. Developing countries face additional obstacles due to inadequate sanitation, nutritional deficiencies, and limited access to quality medical care, resulting in a rise in drug-resistant microorganisms. Antimicrobial stewardship (AMS) has emerged as a key strategy to optimize antibiotic prescription and mitigate resistance. This mini-review explores ongoing programs and initiatives related to AMS in developing countries, focusing on their impact and feasibility.

**Keywords:** Antibiotic resistance, Antimicrobial stewardship, Developing countries

## Introduction

Antibiotic resistance refers to the ability of microorganisms, including bacteria, viruses, parasites, and fungi, to withstand treatments that were previously effective against them. It is a major global challenge, impacting human and animal health. Developing countries face additional hurdles such as poor sanitation, nutritional deficiencies, and limited access to quality healthcare, leading to a concerning increase in drug-resistant microorganisms [1]. While the severity of this issue must be acknowledged, it is crucial to avoid painting an apocalyptic scenario [2]. Recent estimates show that drug-resistant infections caused 1.27 million deaths globally in 2019, predominantly in sub-Saharan Africa and South Asia [3]. Antimicrobial stewardship (AMS) programs have emerged as an approach to optimize antibiotic use and reduce resistance [4]. This minireview aims to examine existing programs and initiatives related to AMS in developing countries and evaluate their impact.

## Methods

This review utilized Scopus and Web of Science databases to conduct a search from 2010 to 2023. The search focused on systematic reviews, literature reviews, prospective, retrospective, and descriptive studies related to antibiotic stewardship in developing countries, using keywords such as “Antibiotic resistance,” “Antibiotic stewardship,” and “Developing countries.” A total of 76 articles were obtained, after removing duplicates, 63 unique articles were included for further evaluation. After a thorough review, 13 articles meeting the selection criteria were included in the review.

## Discussion

AMS initiatives have proven effective in raising awareness among healthcare providers and patients regarding antibiotic resistance. These initiatives are particularly crucial in both developing and de-



veloped countries. Developing countries have implemented various strategies to integrate AMS in diverse healthcare settings, including intensive care units, primary care centers, and hospitals. Implementing AMS programs has been effective in various scenarios, improving awareness, compliance with good practices, and reducing costs. For example, in a tertiary care hospital in South India, stewardship pharmacists engaged in discussions with clinicians to address inappropriate antibiotic prescriptions. This intervention led to a significant increase in appropriate antibiotic usage from 64% to 95%. The most recommended course of action was drug withdrawal (52% of the time), followed by therapy changes (16%) and the switch from intravenous to oral administration (5%). This comprehensive approach involving diverse healthcare professionals resulted in improved antibiotic utilization and patient care [5].

In a tertiary care neonatal intensive unit in India, a Quality Improvement project utilizing the Plan-Do-Study-Act cycle successfully reduced inappropriate antibiotic use from 61% to 27%. This project involved creating awareness, educating on antibiotic stewardship, and requiring justification for antibiotic use. Such projects demonstrate the power of quality improvement initiatives in reducing antibiotic misuse and can be replicated in different settings [6]. In an emergency ICU unit in Egypt, an AMS team was composed of various healthcare professionals, including the ICU medical director, intensivist, microbiologist, infection control consultant and pharmacist. They implemented educational programs, created guidelines, and emphasized the use of microbiology tests for accurate diagnosis and treatment. This approach showed promising outcomes in terms of antibiotic utilization and infection prevention [7].

In a neonatal ICU in Shanghai, China, the execution of a Smart Use of Antibiotics program improved AMS without adverse effects on patient care or outcomes, while significantly decreasing the length of hospitalization, and reducing multidrug-resistant organisms [8]. AMS programs also decreased the antibiotic and hospitalization cost considerably in a hospital in Jordan, including the decline in the prescription of broad-spectrum agents [9].

However, lack of adequate resources for AMS programs poses challenges in developing countries. For instance, primary healthcare facilities in Namibia struggled to implement adequate AMS programs due to a lack of necessary divisions and resources [10]. In most hospitals in Kenya, as in most developing countries, antimicrobial sensitivity tests are lacking, making it more challenging to optimize treatment selection and duration [11]. Despite these challenges, even minimal actions can have a substantial impact.

## Next Steps

Molecular methods offer valuable tools for enhancing diagnostic accuracy and treatment efficacy, especially for prevalent diseases like respiratory infections and *H. pylori*, commonly encountered in developing countries. These methods can reduce empirical antibiotic use, shorten hospitalization durations, and expedite the diagnostic process, leading to cost savings. For instance, molecular methods can accurately diagnose *H. pylori* infection, including detecting resistance genes, enabling effective treatment regimens [12]. Also, prompt identification of viral infections using rapid molecular methods can prevent unnecessary initiation of antibiotics and facilitate their timely discontinuation when no longer required [13].

Implementing molecular diagnostic methods and AMS programs requires significant investment, which may be lacking in resource poor countries. As antimicrobial resistance is a global problem, and drug resistant pathogens can spread easily in an increasingly interconnected world, global investment in AMS in developing countries should be a priority. For example, Global Bridges (<http://www.globalbridges.org>), a non-profit educational initiative based at Mayo Clinic, has partnered with Pfizer Inc.'s Global Medical Grants program (<https://www.pfizer.com/about/programs-policies/grants>) to fund eleven quality

improvement programs in AMS in resource limited settings in nine countries around the world. These QI programs range from capacity building in AMS to implementation of novel diagnostic and informatics technologies to improve antimicrobial prescribing and reduce health disparities in antimicrobial resistance. While these QI projects are ongoing and their potential impact has not yet been fully assessed and reported, this type of public and private partnership and investment in AMS in resource limited settings is an example of one way to address the increased burden of antimicrobial resistance in developing countries.

## Conclusion

Antibiotic resistance is a significant concern, particularly in developing countries where resources and antibiotic stewardship practices are limited. Implementing multidisciplinary antibiotic stewardship teams, creating awareness among healthcare practitioners, educating on appropriate antibiotic prescription, involving community pharmacists, and establishing local susceptibility testing are crucial steps to address this issue. The reviewed strategies have demonstrated significant reductions in hospitalization costs and drug-resistant organisms. Replicating these or developing new strategies in developing countries can help control antibiotic resistance and improve patient care.

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