ECRONICON OPEN ACCESS

EC MICROBIOLOGY
Review Article

Antimicrobial Resistance in Low and Middle Income Countries: The Impact of Poor Antibiotic Stewardship and Public Awareness

Oludairo Esther*

Department of Microbiology, Faculty of Science, University of Lagos, Akoka, Lagos, Nigeria

***Corresponding Author:** Oludairo Esther, Department of Microbiology, Faculty of Science, University of Lagos, Akoka, Lagos, Nigeria.

Received: December 19, 2025; **Published:** November 03 , 2026

Abstract

Antimicrobial resistance (AMR) is an increasing global public health concern that threatens the effective treatment of infectious diseases. Although antimicrobial resistance is a worldwide problem, its impact is disproportionately higher in low and middle income countries (LMICs), where limitations in healthcare infrastructure, regulation, and surveillance persist. These constraints contribute significantly to inappropriate antibiotic use and the rapid emergence of resistant microorganisms.

Poor antibiotic stewardship remains a major driver of antimicrobial resistance in LMICs. Inappropriate prescribing practices, widespread self medication, over the counter access to antibiotics, and failure to complete prescribed treatment courses create selective pressure that promotes the development and spread of resistant pathogens. In addition, limited public awareness regarding the appropriate use of antibiotics and the consequences of antimicrobial resistance further exacerbates misuse, particularly in settings where access to professional healthcare services is constrained.

This review examines antimicrobial resistance in low and middle income countries, with emphasis on the roles of inadequate antibiotic stewardship and insufficient public awareness. Structural, regulatory, and behavioral factors influencing antibiotic use are discussed, alongside the challenges associated with implementing effective stewardship programs in resource limited settings. Potential mitigation strategies, including strengthening stewardship initiatives, improving public education, enhancing diagnostic capacity, and reinforcing policy enforcement, are also highlighted.

Addressing antimicrobial resistance in LMICs requires coordinated and sustained efforts across healthcare systems, policy frameworks, and community engagement to reduce inappropriate antibiotic use and limit the spread of resistant microorganisms.

Keywords: *Antimicrobial Resistance (AMR); Antibiotic Stewardship; Antibiotic Misuse; Public Awareness; Low and Middle Income Countries (LMICs); Public Health*

Introduction

Antimicrobial resistance (AMR) has emerged as one of the most significant threats to global public health in recent decades. The increasing ability of microorganisms to withstand antimicrobial agents that were once effective has compromised the management of infectious diseases and contributed to increased morbidity, mortality, and healthcare costs worldwide [1]. While antimicrobial resistance affects both high and low income regions, its consequences are particularly severe in low and middle income countries (LMICs), where health systems often face persistent structural and resource related challenges.

The misuse and overuse of antibiotics have been widely recognized as key factors driving the development and spread of antimicrobial resistance. In many LMICs, antibiotics are frequently obtained without prescription, used inappropriately for non bacterial infections, or taken in incorrect doses and durations [2]. Limited access to diagnostic facilities further encourages empirical antibiotic use, often without laboratory confirmation of infection or susceptibility testing [3]. These practices create an environment that favors the selection and persistence of resistant strains within communities.

Antibiotic stewardship refers to coordinated interventions aimed at promoting the appropriate use of antimicrobial agents to improve patient outcomes and reduce resistance development. Although stewardship programs have demonstrated effectiveness in reducing inappropriate antibiotic use in high income settings, their implementation in LMICs remains limited [4]. Challenges such as weak regulatory enforcement, inadequate healthcare infrastructure, and shortages of trained personnel hinder the successful adoption of stewardship strategies.

Public awareness also plays a critical role in shaping antibiotic use behaviors. In many low resource settings, limited knowledge about antimicrobial resistance contributes to self medication, premature discontinuation of treatment, and the sharing of antibiotics among individuals [5]. Socioeconomic factors, cultural beliefs, and barriers to healthcare access further influence health seeking behaviors, reinforcing practices that accelerate resistance development.

This review focuses on antimicrobial resistance in low and middle income countries, emphasizing the impact of poor antibiotic stewardship and limited public awareness. By examining the key drivers and challenges associated with antimicrobial resistance, this article aims to highlight the need for strengthened stewardship frameworks, improved public education, and coordinated policy actions to curb the growing burden of antimicrobial resistance.

Antibiotic misuse and poor stewardship in low and middle income countries

Antibiotic misuse is widely recognized as a major contributor to the development and spread of antimicrobial resistance, particularly in low and middle income countries. In many of these settings, antibiotics are frequently used without proper medical indication, often for viral or self-limiting infections where antimicrobial therapy offers no benefit [6]. This inappropriate use creates sustained selective pressure that encourages the survival and proliferation of resistant microorganisms.

One of the most significant challenges affecting antibiotic stewardship in LMICs is the ease of access to antibiotics without prescription. Weak regulatory enforcement allows antimicrobial agents to be purchased over the counter from pharmacies, informal drug vendors, and street markets [7]. As a result, individuals often self medicate based on prior experience, advice from non professionals, or economic considerations, rather than seeking formal medical evaluation. Such practices increase the likelihood of incorrect drug selection, inappropriate dosing, and shortened treatment duration.

In healthcare settings, antibiotic misuse is also influenced by limited diagnostic capacity. In many LMICs, laboratory infrastructure for microbiological culture and antimicrobial susceptibility testing is inadequate or unavailable [8]. Consequently, clinicians frequently rely on empirical treatment, often prescribing broad spectrum antibiotics as a precautionary measure. While this approach may be necessary in some circumstances, repeated empirical use without diagnostic confirmation contributes to unnecessary exposure to antimicrobials and accelerates resistance development.

Antibiotic stewardship programs are designed to promote the rational use of antimicrobials through coordinated interventions, including guideline-based prescribing, monitoring of antibiotic consumption, and education of healthcare professionals. However, the implementation of such programs in LMICs remains inconsistent [9]. Challenges such as shortages of trained personnel, limited

institutional support, lack of surveillance data, and competing healthcare priorities hinder the sustainability of stewardship efforts. Without structured stewardship frameworks, inappropriate antibiotic use continues largely unchecked.

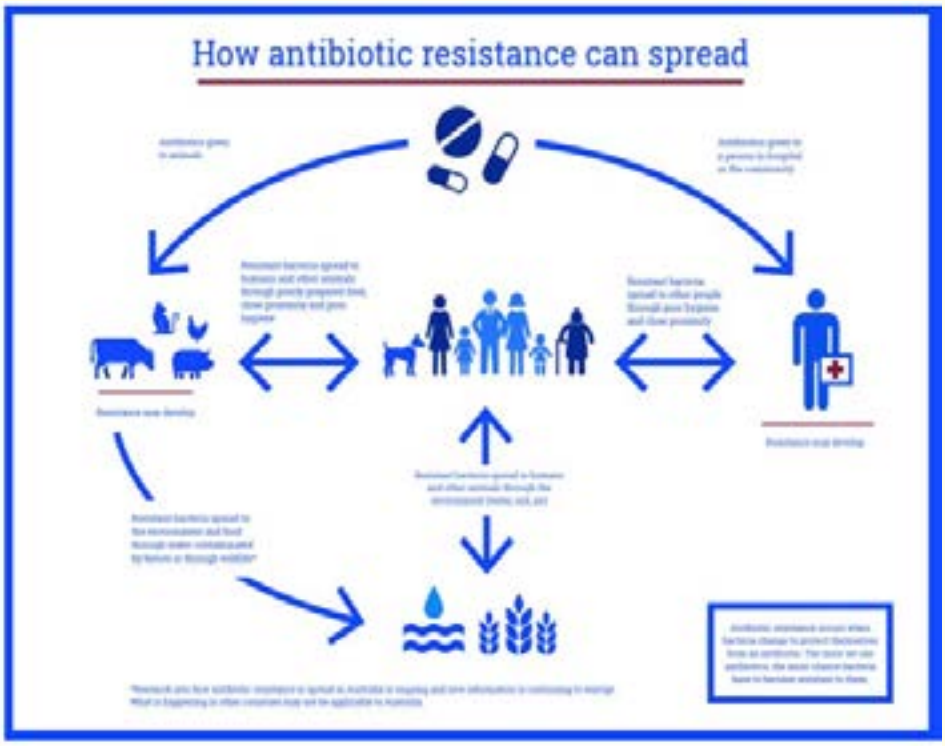


Figure 1: *Diagram showing pathways through which antibiotic resistance develops and spreads (Australian Government Department of Health and Aged Care, 2022) [20].*

Role of public awareness and behavioral factors

Public awareness plays a critical role in influencing antibiotic use patterns and, by extension, the progression of antimicrobial resistance. In many low and middle income countries, gaps in knowledge regarding the appropriate use of antibiotics contribute significantly to misuse [10]. Misconceptions, such as the belief that antibiotics are effective for all infections or that symptoms alone justify antimicrobial treatment, are common and often reinforced through community practices.

Socioeconomic factors strongly shape health seeking behavior in LMICs. Financial constraints, long waiting times in healthcare facilities, and limited access to qualified healthcare professionals may discourage individuals from seeking formal medical care [11]. As a result, self-medication becomes a practical alternative, even when it poses long-term public health risks. The sharing of leftover antibiotics among family members and premature discontinuation of treatment once symptoms improve further exacerbate resistance development.

Cultural beliefs and informal sources of health information also influence antibiotic use. Advice from family members, community leaders, or untrained drug vendors may outweigh professional medical guidance, particularly in rural or underserved areas [12]. In the absence of targeted public education, these practices persist and undermine efforts to promote rational antibiotic use.

Improving public awareness is therefore a crucial component of antimicrobial resistance control. Educational interventions that emphasize the dangers of misuse, the importance of completing prescribed courses, and the distinction between bacterial and non bacterial infections have been shown to improve antibiotic related knowledge and attitudes [13]. However, for such interventions to be effective in LMICs, they must be context specific, culturally sensitive, and integrated into broader public health strategies.

Challenges to implementing effective stewardship programs

Despite growing recognition of the importance of antimicrobial stewardship, several barriers limit its effective implementation in low and middle income countries. Weak regulatory frameworks and insufficient enforcement mechanisms allow inappropriate antibiotic distribution and use to persist [14]. Even where policies exist, limited resources and governance challenges often prevent consistent application.

Healthcare infrastructure constraints also pose significant challenges. Many LMICs lack adequate laboratory facilities, surveillance systems, and data management tools needed to monitor antimicrobial resistance trends and antibiotic consumption [15]. Without reliable data, it becomes difficult to evaluate the effectiveness of stewardship interventions or guide evidence based policy decisions.

Additionally, competing public health priorities, such as infectious disease outbreaks and limited healthcare funding, may reduce the attention given to long term resistance control strategies. These challenges highlight the need for adaptable stewardship models that align with local healthcare capacities and priorities.

Role of microbiologists in combating antimicrobial resistance

Microbiologists play a critical role in addressing antimicrobial resistance, particularly in low and middle income countries where diagnostic and surveillance gaps remain significant. Through laboratory based identification of pathogens and antimicrobial susceptibility testing, microbiologists provide essential evidence that guides appropriate antibiotic selection and supports rational prescribing practices [16]. Accurate and timely laboratory data reduce reliance on empirical treatment and help limit unnecessary exposure to broad-spectrum antimicrobial agents.

Surveillance of antimicrobial resistance patterns is another key responsibility of microbiologists. The systematic collection, analysis, and reporting of resistance data enable the detection of emerging resistant strains and inform local, national, and regional treatment guidelines [17]. In LMICs, where resistance trends are often underreported, strengthening microbiology laboratories and surveillance networks is essential for understanding the true burden of antimicrobial resistance and guiding effective public health interventions.

Microbiologists also contribute significantly to antimicrobial stewardship programs. By collaborating with clinicians, pharmacists, and infection control teams, microbiologists help interpret laboratory results, advise on appropriate antimicrobial therapy, and support the development of evidence based prescribing guidelines [18]. Their expertise is particularly valuable in healthcare settings with limited diagnostic capacity, where informed decision making can significantly reduce inappropriate antibiotic use.

In addition to clinical and laboratory roles, microbiologists play an important part in public education and policy development. Through research dissemination, training of healthcare workers, and engagement with policymakers, microbiologists help translate scientific evidence into practical strategies for antimicrobial resistance control [19]. Their involvement in advocacy and capacity building initiatives supports the integration of laboratory data into national action plans and strengthens the overall response to antimicrobial resistance.

Enhancing the role of microbiologists in LMICs requires sustained investment in laboratory infrastructure, workforce training, and interdisciplinary collaboration. Empowering microbiologists to actively participate in stewardship initiatives, surveillance systems, and public health education is essential for reducing inappropriate antimicrobial use and limiting the spread of resistant microorganisms.

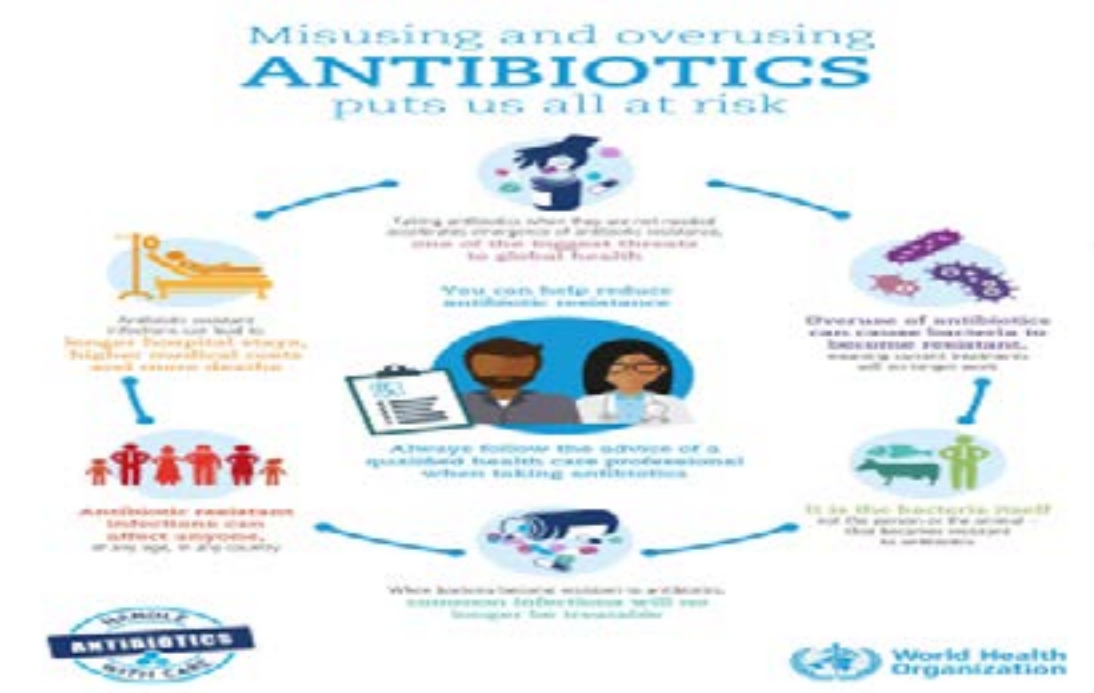


Figure 2: *Infographic illustrating how misuse and overuse of antibiotics contribute to antimicrobial resistance in communities (PAHO, 2017) [21].*

Conclusion

Antimicrobial resistance remains a significant and escalating public health challenge in low and middle income countries, driven largely by poor antibiotic stewardship and limited public awareness. Inappropriate antibiotic use, facilitated by weak regulatory systems, inadequate diagnostic capacity, and socio-behavioral factors, continues to promote the emergence and spread of resistant microorganisms. These challenges place considerable strain on already vulnerable healthcare systems and compromise the effective management of infectious diseases.

Addressing antimicrobial resistance in LMICs requires a coordinated and multifaceted approach that combines strengthened antibiotic stewardship, improved public education, and supportive policy frameworks. Within this context, microbiologists play a central role in guiding rational antimicrobial use through accurate pathogen identification, antimicrobial susceptibility testing, and resistance surveillance. Their contributions provide the evidence base necessary for informed clinical decision making and the development of context specific treatment guidelines.

Beyond the laboratory, microbiologists contribute to antimicrobial stewardship programs through interdisciplinary collaboration with clinicians, pharmacists, and infection control teams. Their involvement supports the interpretation of diagnostic data, promotes appropriate antibiotic selection, and reduces reliance on empirical therapy. Additionally, microbiologists are well positioned to contribute to public awareness initiatives, healthcare worker training, and policy development by translating scientific evidence into practical and sustainable interventions.

Strengthening the role of microbiologists through investment in laboratory infrastructure, workforce development, and surveillance systems is essential for effective antimicrobial resistance control in resource limited settings. Sustainable efforts that integrate scientific expertise, public engagement, and policy enforcement are critical to reducing inappropriate antimicrobial use and mitigating the growing threat of antimicrobial resistance in low and middle income countries.

Bibliography

1. World Health Organization. "Antimicrobial Resistance Fact Sheet". Geneva: WHO (2023).
2. Sulis G., *et al*. "Antimicrobial resistance in low and middle income countries". *International Journal of Infectious Diseases* 114 (2022): 131-138.
3. Iskandar K., *et al*. "Surveillance of antimicrobial resistance in low and middle income countries: a scattered picture". *Antimicrobial Resistance and Infection Control* 10.1 (2021): 63.
4. Mambiya M., *et al*. "Protocols, policies and practices for antimicrobial stewardship in hospitalized patients in least developed and low income countries: a systematic review". *Antimicrobial Resistance and Infection Control* 12.1 (2023): 131.
5. Fuller W., *et al*. "Education and awareness on antimicrobial resistance in the WHO African region: A systematic review". *Antibiotics* 12.11 (2023): 1613.
6. Akande Sholabi W and Oyesiji E. "Antimicrobial stewardship: knowledge, perceptions, and factors associated with antibiotic misuse among pharmacy consumers in Nigeria". *Journal of Pharmaceutical Policy and Practice* 16.1 (2023): 120.
7. Ya KZ., *et al*. "Coverage of policies to improve antimicrobial stewardship in human medicine in low and middle income countries". *BMC Public Health* 24.1 (2024): 2297.
8. Gandra S., *et al*. "Antimicrobial resistance surveillance in low and middle income countries: progress and challenges in eight south Asian and southeast Asian countries". *Journal of Infection and Public Health* 13.12 (2020): 1826-1834.
9. Majumder MAA. "Antimicrobial stewardship: scale, strategies, and impact". *Infection and Drug Resistance* 13 (2020): 3321-3332.
10. Gilham EL., *et al*. "Assessment of global antimicrobial resistance campaigns conducted to improve public awareness and antimicrobial use behaviours: a rapid systematic review". *BMC Public Health* 24.1 (2024): 396.
11. Akande Sholabi W., *et al*. "Socioeconomic determinants of self medication with antibiotics in low-resource settings". *Journal of Pharmaceutical Policy and Practice* 16 (2023): 122.
12. Sulis G., *et al*. "Cultural and behavioral factors contributing to antimicrobial resistance in LMICs". *International Journal of Infectious Diseases* 114 (2022): 139-146.
13. Fuller W., *et al*. "Impact of educational interventions on public knowledge of antibiotic use in Africa: systematic review". *Antibiotics* 12.11 (2023): 1625.
14. Tang KWK., *et al*. "Global challenges to implementing antimicrobial stewardship programs". *British Journal of Biomedical Science* 80.2 (2023): 98-107.
15. Murray CJL., *et al*. "Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis". *Lancet* 399.10325 (2022): 629-655.

16. Iskandar K., *et al*. "Role of microbiologists in addressing antimicrobial resistance in LMICs". *Antimicrobial Resistance and Infection Control* 10 (2021): 64.

17. Sulis G., *et al*. "Surveillance of antimicrobial resistance patterns: importance of microbiologist led systems in LMICs". *International Journal of Infectious Diseases* 115 (2022): 145-153.

18. Mambiya M., *et al*. "Microbiologists and stewardship programs in low resource settings". *Antimicrobial Resistance and Infection Control* 12 (2023): 132.

19. Fuller W., *et al*. "Microbiologists' roles in public education and policy development to combat AMR". *Antibiotics* 12.12 (2023): 1650.

20. Pan American Health Organization. World Antibiotic Awareness Week 2017: Infographic "Misusing and overusing antibiotics puts us all at risk". Washington, DC: PAHO (2017).

21. Australian Government Department of Health and Aged Care. "Infographic: How antibiotic resistance can spread". AMR.gov.au. (2022).

Volume 22 Issue 11 November 2026
©All rights reserved by Oludairo Esther.