



# Healthcare challenges in LMICs: addressing antibiotic resistance threats, a call for comprehensive global solutions: an editorial

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## Introduction

Considered one of the most significant medical discoveries of the 20th century, antibiotics have transformed healthcare by preventing countless deaths caused by bacterial infections. However, antibiotic resistance is a powerful foe that has emerged because of antibiotic overuse and misuse. Antimicrobial resistance poses an immediate threat to public health around the world, accounting for at least 1.27 million deaths globally and about 5 million fatalities in 2019<sup>[1]</sup>. The efficacy of antibiotics is seriously threatened by the current global health crisis, endangering our capacity to treat common diseases. Antibiotic resistance is one of the main risks to modern development, food security, and global health, and it is an increasing global concern<sup>[2]</sup>. Anyone, anywhere in the world, at any age, can become resistant to antibiotics<sup>[2]</sup>. Worldwide, the prevalence of antibiotic resistance is increasing to dangerously high levels<sup>[2]</sup>. Every year, around 2.8 million antibiotic-resistant diseases happen in the United States<sup>[1]</sup>. The CDC (Centers for Disease Control and Prevention) estimates that, as a result, more than 35 000 people pass away<sup>[1]</sup>. More than \$4.6 billion is spent on the treatment of infections each year in the United States due to six multidrug-resistant bacteria that are commonly identified in medical settings<sup>[1]</sup>. Our capacity to treat common infectious diseases is under threat from new resistance mechanisms that are emerging and spreading globally<sup>[2,3]</sup>. Given the urgency of the problem, a thorough grasp of the epidemiology, local dynamics, and mechanisms influencing the emergence of

antibiotic resistance is necessary. Antibiotics used to treat an increasing array of diseases, including gonorrhoea, pneumonia, TB (tuberculosis), and salmonellosis, are losing their effectiveness<sup>[2]</sup>. Dedicated prevention and infection control initiatives in the United States decreased mortality from antimicrobial-resistant infections by 18% nationwide and by nearly 30% in hospitals, according to the CDC's 2019 AR Threats Report<sup>[1]</sup>. However, according to the CDC's 2022 special report on the impact of COVID-19 on antibiotic resistance in the United States, a significant portion of that advancement was lost because of the global epidemic<sup>[1]</sup>. In 2020, the pandemic drove towns, health departments, and healthcare facilities to the brink of collapse, making it extremely difficult to continue the progress being made in the fight against antibiotic resistance<sup>[1]</sup>. Although the United States is a developed country, antibiotic resistance poses much more challenging problems for low- and middle-income nations. In these resource-poor environments, frontline healthcare personnel face particular challenges in their quest to deliver high-quality treatment while negotiating the murky waters of antibiotic resistance. This article analyzes the tactics that can enable healthcare professionals to tackle antibiotic resistance effectively and preserve the effectiveness of antibiotics for future generations. It also digs into the nuances of these difficulties.

## Urgent challenges and complexities in managing antibiotic resistance

Low- and middle-income countries (LMICs) are more affected than high-income countries due to widespread antibiotic misuse, antibiotic use in agriculture, poor drug quality, inadequate surveillance, and other factors related to inadequate medical standards, malnutrition, chronic and recurrent infections, and the inability to afford more expensive and effective drugs<sup>[4]</sup>. Due to inadequate systems and knowledge, all of these are becoming more common in LMICs on a daily basis. In environments with limited resources, frontline healthcare providers are crucial to the healthcare system in LMICs and must deal with the difficult problem of antibiotic resistance. The stability of healthcare systems and the adequacy of necessary treatments are imperiled by antibiotic resistance. Antibiotic resistance is a worldwide health epidemic with far-reaching effects, and it presents a tough challenge in an already demanding situation. The global issue of antibiotic resistance is becoming increasingly pressing, and frontline healthcare professionals in LMICs encounter difficulties in managing this problem in environments with inadequate resources. These difficulties include a lack of finances, inadequate infrastructure,

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restricted access to diagnostic equipment, and a lack of knowledge and training<sup>[5]</sup>. When deciding whether antibiotics are needed, an accurate diagnosis is essential, but in LMICs, healthcare facilities usually lack the required diagnostic equipment and skilled staff. While balancing the requirements of varied populations in healthcare is a universal problem, LMICs face unique challenges. The frequency of empirical treatment in LMICs, which is influenced by things like a high patient load and a shortage of medical staff, diagnostic tools, and pharmaceuticals, is an important topic that needs more research. Relying too much on empirical treatment may have the unintended consequence of breeding microorganisms that are resistant to drugs. Due to the conservative approach brought forth by this deficiency, antibiotics are often provided as a first resort, which exacerbates antibiotic resistance and misuse. To effectively combat antibiotic resistance, frontline healthcare professionals must strike a careful balance between meeting patients' needs, prescribing and administering antibiotics in accordance with best practices, and giving proper care. In addition to maintaining this delicate balance, frontline healthcare workers in LMICs frequently struggle with the application and ignorance of the World Health Organization's AwaRe framework<sup>[6]</sup>. Antibiotic resistance can be made worse by improper antibiotic prescription and distribution, which is a result of a lack of understanding and execution of the framework<sup>[6]</sup>. Patients who become colonized with multidrug-resistant organisms (MDROs) have a markedly increased risk of infection, regardless of whether the infections occur in medical institutions or the community. This higher risk can then result in insufficient treatment or even therapy failure, which can raise death rates in the end.

Furthermore, resistance rates are made worse, and healthcare systems are severely constrained by the larger socioeconomic issues that are common in areas with limited resources<sup>[7]</sup>. The livelihoods and general well-being of the impacted communities are adversely affected by these problems, which have a knock-on effect. To lessen the severe effects of antibiotic resistance in these susceptible environments, it is essential to address these interconnected challenges in their entirety. Furthermore, the impact of health emergencies like COVID-19 has brought to light the fragility of healthcare systems in LMICs<sup>[8]</sup>. These crises, whether they are past, present, or perhaps future occurrences, could put additional demand on frontline healthcare professionals' abilities, making the difficulties they already confront managing antibiotic resistance even more severe. The combination of ongoing antibiotic resistance and health concerns creates a complex challenge. Healthcare workers must strike a balance between several opposing needs, such as continuing to use antibiotics appropriately while ensuring accurate diagnosis and concurrent infection management.

### Strategies to tackle antibiotic resistance

In LMICs, combating antibiotic resistance necessitates a comprehensive and multidimensional strategy. First and foremost, there should be a focus on expanding healthcare access and encouraging good hygiene habits to stave off diseases. Healthcare systems must be strengthened, which includes making infrastructural investments, hiring qualified medical staff, and guaranteeing that necessary medications are available. To solve the problems caused by antibiotic resistance, cooperation between governmental bodies, non-governmental groups, and international organizations is

crucial. Governments and other relevant organizations should make investments to fortify healthcare systems by enhancing the facilities, hiring more medical personnel, and guaranteeing the supply of necessary medications. Campaigns for public awareness can be extremely important in educating communities about the proper use of antibiotics and the negative effects of improper use. ChatGPT can also be extremely helpful in tackling antibiotic resistance in LMICs by giving patients, healthcare providers, and the general public easily accessible and customized information. The applicability, dependability, and influence of ChatGPT in the field of travel medicine were documented by Choudhary and Priyanka<sup>[9]</sup> in their article. When it comes to advice on proper prescriptions for antibiotics, dosing schedules, and the significance of finishing antibiotic courses, ChatGPT can be a dependable and accessible resource. Antibiotic sales should be regulated, with prescription drugs the only way to obtain them in order to prevent over-the-counter availability.

Moreover, Priyanka et al. reported that nano vaccines have proven their ability to boost the immune system to combat diseases and halt the spread of diseases<sup>[10]</sup>. With nano vaccines, the growing threat of antibiotic resistance in *Mycobacterium tuberculosis*, the bacteria that causes tuberculosis, and other infections caused by bacteria can be controlled<sup>[11]</sup>. As research in this sector advances, nano vaccines have the potential to transform our approach to infectious diseases and address the worrying development in antibiotic resistance. Although attenuated or inactivated microorganisms or viruses were previously used to create vaccinations, a revolutionary method of developing vaccines has recently been found that relies on a molecule known as messenger RNA (mRNA) rather than live bacteria or viruses<sup>[10]</sup>. mRNA vaccinations can activate the body's immune system to mount a focused defense against infections, in contrast to antibiotics, which can lead to the emergence of resistance while only targeting particular bacteria. The need of the hour is to create and modify efficient mRNA-based vaccine candidates against major infectious diseases, as the global scientific community is keeping an eye on the vaccines' stability, delivery, and associated adverse effects<sup>[10]</sup>. Encouraging research and development of novel antibiotics, diagnostics, and vaccines is necessary to guarantee an ongoing supply of potent instruments for fighting diseases. Moreover, international collaboration is essential to halting the cross-border spread of germs resistant to antibiotics. Combining these approaches will enable LMICs to reduce antibiotic resistance and ensure that these life-saving drugs remain effective for future generations.

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### References

- [1] CDC. National Infection & Death Estimates for AR. Centers for Disease Control and Prevention, 2022.
- [2] World Health Organization. Antibiotic resistance. Antibiotic Resistance 2020 <https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance>[Accessed 1 November 2023].
- [3] Frontiers. Antimicrobial Resistance in Foodborne Pathogens: ecology, epidemiology, and mechanisms Accessed 1 November, 2023. <https://www.frontiersin.org/research-topics/23547>
- [4] Haroon RMD, Rahman MdM, Sultana H, *et al.* Antibacterial resistance patterns of bacteria isolated from clinical specimens at Uttara IbnSina Diagnostic Centre, Dhaka. *Afr J Microbiol Res* 2020; 14:175–81.
- [5] Naal H, Daou T, Brome D, *et al.* Evaluating a research training programme for frontline health workers in conflict-affected and fragile settings in the middle east. *BMC Med Educ* 2023;23:1–6.
- [6] Mudenda S, Daka V, Matafwali SK. World Health Organization AWaRe framework for antibiotic stewardship: Where are we now and where do we need to go? An expert viewpoint. *Antimicrob Steward Healthc Epidemiol* 2023;3:e84.
- [7] Saliba R, Zahar JR, Dabar G, *et al.* Limiting the spread of multidrug-resistant bacteria in low-to-middle-income countries: one size does not fit all. *Pathogens* 2023;12:144.
- [8] Rodríguez-Baño J, Rossolini GM, Schultsz C, *et al.* Antimicrobial resistance research in a post-pandemic world: insights on antimicrobial resistance research in the COVID-19 pandemic. *J Glob Antimicrob Resist* 2021;25:5–7.
- [9] Choudhary OP, Priyanka. ChatGPT in travel medicine: a friend or foe? *Travel Med Infect Dis* 2023;54:102615.
- [10] Chopra H, Choudhary OP. mRNA vaccines as an armor to combat the infectious diseases. *Travel Med Infect Dis* 2023;52:102550.
- [11] Abusalah MA, Chopra H, Sharma A, *et al.* Nanovaccines: a game changing approach in the fight against infectious diseases. *Biomed Pharmacother* 2023;167:115597.