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The global threat of drug resistance: Are we prepared?

Thomas Regan*

Department of Medicine, University of Alabama at Birmingham, USA

*Correspondence to: Thomas Regan, Department of Medicine, University of Alabama at Birmingham, USA, E-mail: Thomasregan7@gmail.com

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Introduction

Drug resistance is one of the most pressing global health threats of the 21st century. From antibiotic-resistant bacteria to antiviral-resistant strains and multidrug-resistant parasites, the rise of drug resistance undermines decades of medical progress. The World Health Organization (WHO) warns that without urgent action, common infections and minor injuries could once again become fatal. As resistance spreads across borders and pathogens evolve faster than our ability to counter them, the question looms large: are we truly prepared? Drug resistance occurs when pathogens—bacteria, viruses, fungi, or parasites—develop the ability to survive exposure to medications designed to kill them. This phenomenon is driven by genetic mutations, horizontal gene transfer, and selective pressure from overuse or misuse of drugs. Antibiotic resistance is the most well-known form, but resistance is also rising in antivirals (e.g., HIV, influenza), antifungals (e.g., *Candida auris*), and antimalarials (e.g., *Plasmodium falciparum*) [1].

The consequences are severe: longer hospital stays, higher medical costs, increased mortality, and limited treatment options. Drug resistance threatens not only individual patients but also the effectiveness of entire healthcare systems. According to the WHO, antimicrobial resistance (AMR) causes an estimated 1.27 million deaths annually, with projections suggesting up to 10 million deaths per year by 2050 if current trends continue. The economic impact is equally staggering, with potential losses of $100 trillion globally over the next three decades [2].

Drug resistance is not confined to hospitals. It affects agriculture, veterinary medicine, and the environment. Resistant pathogens can spread through food, water, and international travel, making AMR a truly global issue. Antibiotics are often prescribed unnecessarily or used incorrectly, accelerating resistance. Antibiotics are widely used in livestock to promote growth, contributing to resistant strains in the food chain. Inadequate hygiene and sanitation in healthcare settings facilitate the spread of resistant organisms. The pharmaceutical pipeline for antimicrobials has dried up, with few new classes of antibiotics developed in recent decades [3].

Low- and middle-income countries often lack access to diagnostics, surveillance, and stewardship programs. Effective surveillance is critical to understanding and combating drug resistance. Initiatives like the Global Antimicrobial Resistance Surveillance System (GLASS) aim to collect standardized data across countries. However, many regions still lack robust monitoring systems, leading to underreporting and delayed responses. Genomic surveillance, which tracks resistance genes and mutations, offers powerful insights but requires significant investment in infrastructure and expertise. Without accurate data, policymakers and clinicians are left navigating blind spots [4].

Despite growing awareness, global preparedness remains uneven. High-income countries have implemented national action plans, antimicrobial stewardship programs, and research funding. Yet many low-resource settings struggle with basic access to clean water, diagnostics, and trained personnel. The COVID-19 pandemic further strained healthcare systems and disrupted AMR efforts. Increased use of antibiotics during the pandemic, often without clear indications, may have accelerated resistance. Moreover, the diversion of resources away from AMR surveillance and research has created gaps in preparedness. Programs that promote responsible prescribing and use of antimicrobials have shown success in reducing resistance rates. Point-of-care tests can distinguish between bacterial and viral infections, reducing unnecessary antibiotic use. Bacteriophages—viruses that infect bacteria—are

being explored as alternatives to antibiotics, especially for multidrug-resistant infections. Global cooperation is essential to address drug resistance. The WHO's Global Action Plan on AMR provides a framework for coordinated efforts, including surveillance, stewardship, and research investment. Regional initiatives, such as the European One Health Action Plan, integrate human, animal, and environmental health perspectives. Policy interventions must also address access and equity. Ensuring that all countries have the tools to detect, prevent, and treat resistant infections is vital. Intellectual property reforms, tiered pricing, and technology transfer can help bridge gaps between high- and low-income nations [5].

Conclusion

The global threat of drug resistance is real, urgent, and multifaceted. While progress has been made, preparedness remains uneven and fragile. Combating drug resistance requires a holistic approach—integrating science, policy, public awareness, and international collaboration. The time to act is now. If we fail to prepare, we risk entering a post-antibiotic era where even minor infections become deadly. But with sustained commitment and innovation, we can turn the tide and safeguard the future of medicine.

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