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Antimicrobial Resistance: A Silent Pandemic

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Abstract

Antimicrobial resistance (AMR) is a growing global health threat that impedes the effective treatment of infectious diseases. Drug-resistant microorganisms have emerged more quickly as a result of the excessive use of antibiotics in aquaculture, agriculture, animals, and humans. AMR causes prolonged illness, higher mortality rates, rising healthcare costs, and compromises food security and environmental sustainability. The importance of the "One Health" approach and national initiatives such as India's National Action Plan on Antimicrobial Resistance (NAP-AMR 2.0) is emphasized as a coordinated strategy to contain AMR and preserve antimicrobial efficacy for future generations.

Keywords: Antimicrobial resistance (AMR), Human & Animal Health

Introduction

Antimicrobial resistance (AMR) has emerged as one of the most serious public health concerns of the twenty-first century. AMR, which is frequently referred to as a "silent pandemic," happens when bacteria, viruses, fungi, and parasites develop defence mechanisms that make antimicrobial medications ineffective. As a result, infections that were previously treatable are becoming more challenging, costly, and occasionally untreatable. The World Health Organization (WHO) has repeatedly stated that AMR poses a threat to the foundations of modern medicine, such as safe surgery, cancer chemotherapy, and infectious disease management.

Antimicrobial overuse and misuse in human health, veterinary care, agriculture, and aquaculture have accelerated the emergence and spread of resistant microorganisms worldwide. The issue is made worse in low- and middle-income nations by insufficient infection prevention, illogical prescription practices, and restricted access to diagnostics. Without urgent and coordinated action, AMR could reverse decades of progress in health and development.

Understanding Antimicrobial Resistance

Over time, genetic mutations in microorganisms lead to the natural development of antimicrobial resistance. However, human activities have significantly accelerated this process. Excessive or improper use of antimicrobials kills susceptible microorganisms while permitting resistant organisms to develop and survive. Through direct contact, food chains, water systems, and waste, these resistant microbes can spread among people, animals, and the environment. Bacteria employ several mechanisms to resist antimicrobials. These include altering drug targets, producing enzymes that deactivate antibiotics, reducing drug uptake, and actively pumping drugs out of the cell. AMR is a complicated and quickly growing issue because, in addition to mutations, bacteria can pick up resistance genes from other bacteria through horizontal gene transfer.

AMR and the Environment

The environment plays a vital role in the development and spread of antimicrobial resistance (AMR). Antibiotics and resistant bacteria enter the environment through hospital wastewater, pharmaceutical waste, agricultural runoff, and improper medicine disposal. Studies have detected antibiotic residues and resistance genes in soil, surface water, groundwater, and even drinking water sources.

In agriculture and animal husbandry, people commonly use antimicrobials not just to treat diseases but also to prevent them and promote growth. This practice places selective pressure on bacteria in animals, leading to the rise of resistant strains that can pass to humans through food, direct contact, or environmental contamination. In aquaculture systems, antibiotics are often added directly to the water, which further spreads resistance genes in aquatic ecosystems.

Impact on Human and Animal Health

The effects of AMR are serious for both human and animal health. In human, resistant infections cause longer illnesses, extended hospital stays, higher healthcare costs, and increased death rates. Common germs like *Escherichia coli*, *Staphylococcus aureus*,

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Klebsiella pneumoniae, and *Pseudomonas aeruginosa* have become resistant to several types of antibiotics, which limits treatment options significantly.

In veterinary medicine, AMR makes it harder to effectively treat infectious diseases in livestock and pets. This not only harms animal welfare but also poses a risk to food security and farmers' income. Resistant infections in animals can lower productivity, raise treatment costs, and help spread resistant germs to humans, showing how connected AMR is across different areas.

Economic and Developmental Consequences

Beyond health impacts, AMR poses a significant economic burden. Resistant infections reduce workforce productivity due to prolonged illness and caregiving demands. Health systems face increased costs from the need for more expensive drugs, longer hospitalizations, and advanced diagnostic tests. At a national level, AMR can slow economic growth and strain already limited healthcare resources.

AMR also threatens the achievement of the United Nations Sustainable Development Goals (SDGs). It directly affects goals related to health and well-being, poverty reduction, food security, clean water, and economic growth. If left unaddressed, rising AMR levels could push millions of people into extreme poverty and undermine sustainable development efforts worldwide.

Global and National Response to AMR

Recognizing the seriousness of the problem, the WHO and its partners have called for a coordinated global response to combat AMR. The Global Action Plan on Antimicrobial Resistance emphasizes five key objectives: improving awareness and understanding, strengthening surveillance and research, reducing infection incidence, optimizing antimicrobial use, and ensuring sustainable investment in counter-AMR activities.

In line of AMR mitigation, India has developed and implemented the National Action Plan on Antimicrobial Resistance (NAP-AMR) 2.0. This plan adopts a One Health approach, recognizing the interconnection between human health, animal health, and the environment. It focuses on strengthening surveillance systems, promoting rational antimicrobial use, enhancing infection prevention and control, and supporting research and innovation.

Conclusion

Antimicrobial resistance is a complex, multifaceted challenge that threatens global health, food security, and sustainable development. While the problem is daunting, it is not insurmountable. Coordinated action guided by scientific evidence, strong policies, and the One Health approach can significantly slow the spread of AMR. Addressing AMR today is

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an investment in the future of humanity. By preserving the effectiveness of existing antimicrobials and promoting responsible practices across sectors, we can safeguard the achievements of modern medicine and ensure a healthier, more sustainable world for generations to come.

References

World Health Organization (WHO). *Global Action Plan on Antimicrobial Resistance*. WHO, Geneva.

Government of India. *National Action Plan on Antimicrobial Resistance (NAP-AMR) 2.0*.

Sharma S. et al. (2024). Emerging challenges in antimicrobial resistance: implications for pathogenic microorganisms, novel antibiotics, and their impact on sustainability. *Frontiers in Microbiology*, 15:1403168.

World Health Organization. *Antimicrobial resistance: Key facts and global response*.