

## Anti-Microbial Resistance (AMR) – A Rising Global Concern & Ways of Mitigating Its Risks

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Antimicrobials – including antibiotics, antivirals, antifungals and antiparasitic – are medicines used to prevent and treat infections in humans, animals and plants.

In the battlefield of biology, a shadowy adversary known as Antimicrobial Resistance (AMR) lurks in the shadows, plotting its nefarious schemes. It's when bacteria, viruses, fungi, and parasites undergo enigmatic transformations, rendering our medicinal arsenal powerless. This metamorphosis turns once-treatable infections into formidable foes, spawning dread and despair. As the ancient shields of antibiotics and their antimicrobial brethren shatter under the onslaught of resistance, the spectre of untreatable infections looms ever larger. Among the ranks of these formidable microbial foes stands MRSA, a common bearer of antibiotic-resistant fortitude.

### Important examples are:

- The indomitable vancomycin-defying Enterococcus (VRE)
- The relentless multi-drug-resistant Mycobacterium tuberculosis (MDR-TB)
- The formidable carbapenem-resistant Enterobacteriaceae (CRE) intestinal inhabitants.

### What causes antimicrobial resistance?

At the heart of the antimicrobial resistance conundrum lies the formidable culprit: antibiotic consumption. When we unleash antibiotics upon the microbial world, a grim battle unfolds. Some bacteria succumb to their mighty force, but lurking among them, resistant strains emerge, resilient and cunning. These tenacious foes not only endure but thrive, perpetuating their lineage.

In the grand theatre of overuse, a sinister transformation takes place. The overindulgence in antibiotics fosters a breeding ground for these defiant bacteria, elevating their presence from rarity to ubiquity. With each dose of antibiotics, we unwittingly furnish the evolutionary stage for bacteria to refine their resistance. It's a perilous dance between medicine and microbe, where the more antibiotics we employ, the greater the opportunity for bacteria to shroud themselves in resistance, rendering our once-mighty weapons increasingly impotent.

**Antimicrobial resistance** mechanisms fall into four main categories:

- (1) Limiting uptake of a drug;
- (2) Modifying a drug target;
- (3) Inactivating a drug;
- (4) Active drug efflux.

### **How can we prevent antimicrobial resistance?**

Numerous approaches exist to prevent drug-resistant infections, encompassing immunization, safe food handling, proper hand hygiene, and the prudent use of antibiotics, reserving them solely for when medically necessary. Furthermore, it's worth noting that averting infections also serves as a potent deterrent against the proliferation of resistant bacteria.

To actively contribute to the battle against antibiotic resistance and fortify your own defences against infection, consider the following recommendations:

- (1) Don't take antibiotics unless you're certain you need them. An estimated 30% of the millions of prescriptions written each year are not needed. ...
- (2) Finish your pills. ...
- (3) Get vaccinated. ...
- (4) Stay safe in the hospital.

### **Why AMR is rising global concern?**

The relentless emergence and dissemination of drug-resistant pathogens armed with novel resistance mechanisms continue to cast a menacing shadow over our ability to combat commonplace infections. What is particularly disconcerting is the alarming global proliferation of multi- and pan-resistant bacteria, colloquially known as "superbugs." These formidable adversaries instigate infections that defy treatment with our existing antimicrobial arsenal, including antibiotics.

Adding to the gravity of the situation is the disheartening aridity in the pipeline of new antimicrobial drugs. As of 2019, the World Health Organization (WHO) identified a mere 32 antibiotics in various stages of clinical development, all aimed at tackling the WHO's

list of priority pathogens. Regrettably, a mere six of this exhibited true innovation.

Compounding these challenges is the pervasive issue of limited access to high-quality antimicrobial medications. Antibiotic shortages afflict nations across the spectrum of development, disproportionately affecting healthcare systems.

As drug resistance sweeps across the globe, antibiotics are gradually losing their efficacy, leading to more arduous battles against infections and, tragically, increased mortality. The clamorous call for new antibacterial agents, particularly for addressing carbapenem-resistant gram-negative bacterial infections identified in the WHO's priority pathogen list, is undeniable. However, it is imperative that we alter our current practices in antibiotic use. Failure to do so will result in a bleak fate for these novel antibiotics, mirroring the impotence that plagues their predecessors.

### **Ways to mitigate Anti-microbial resistance (AMR) includes the following**

1. Fortifying Infection Control within Healthcare Facilities
2. Raising Awareness on the Prudent Use and Misuse of Antibiotics
3. Harnessing the Power of Vaccination to Combat Drug Resistance
4. Enhancing Surveillance for Resistant Infections: A Data-Driven Approach
5. Discouraging Self-Medication: A Vital Health Precept
6. Prescribed Precision: Antibiotics as Directed by Healthcare Professionals
7. The Art of Antibiotics: Choosing Wisely, Completing Fully
8. Investing in the Quest for Novel Antibiotics and Advanced Diagnostic Tools

## 9. The Imperative of Coordinated Action: Uniting Against Antimicrobial Resistance

### **Four Core Actions to Prevent Antibiotic Resistance**

#### **1. Preventing Infections, Preventing the Spread of Resistance**

Preventing infections in the initial stages not only diminishes the necessity for antibiotic usage but also curbs the potential for resistance to manifest during treatment. Countless avenues exist for averting drug-resistant infections, including immunization, meticulous food handling practices, vigilant hand hygiene, and the judicious utilization of antibiotics, adhering strictly to medical guidance. Furthermore, this proactive stance against infections serves as a potent deterrent against the proliferation of drug-resistant bacteria, championing a healthier and more resilient world.

#### **2. Tracking**

The CDC diligently collects information regarding antibiotic-resistant infections, their underlying causes, and the identification of potential risk factors that may have contributed to individuals contracting such infections. Armed with this invaluable data, experts can craft targeted strategies aimed at preventing these infections and curbing the dissemination of antibiotic-resistant bacteria.

#### **3. Improving Antibiotic Prescribing/ Stewardship**

Arguably, the most pivotal step in significantly decelerating the emergence and dissemination of antibiotic-resistant infections is a fundamental shift in the way antibiotics are employed. Shockingly, up to half of antibiotic consumption in humans and a substantial portion in animals is deemed unnecessary and improper, thereby jeopardizing collective safety. Halting even a fraction of these misguided practices, both in people and animals, would constitute a significant stride in retarding the proliferation of resistant bacteria.

This unwavering commitment to employing antibiotics judiciously and responsibly, reserving their usage solely when warranted to treat illness, while also selecting the appropriate antibiotics and administering them correctly in every instance, is encapsulated in the concept of antibiotic stewardship.

#### **4. Developing New Drugs and Diagnostic Tests**

Antibiotic resistance is an inherent outcome of the natural evolutionary process in which bacteria adapt and evolve. While we can indeed take measures to slow its progression, it remains a relentless force that cannot be entirely halted. Consequently, the perpetual need for fresh antibiotics to counteract resistant bacterial strains, along with advanced diagnostic tools to monitor the evolution of resistance, becomes imperative to stay one step ahead in the ongoing battle against drug-resistant infections.

**In conclusion**, the escalating challenge of antibiotic resistance presents a formidable threat to public health worldwide. While we may not be able to completely halt the natural evolutionary processes that give rise to resistance, our collective efforts in antibiotic stewardship, infection prevention, and judicious antibiotic use offer a glimmer of hope in mitigating its impact. However, it is clear that the quest for novel antibiotics and advanced diagnostic tools must remain a top priority, as they are essential weapons in our ongoing fight against the relentless tide of drug-resistant infections. By embracing a multifaceted approach that includes prudent antibiotic practices, vigilance in infection control, and sustained investment in research and development, we can aspire to preserve the efficacy of antibiotics and safeguard the health of generations to come.