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# Misuse of Antibiotics Among the Population

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**Abstract:**

This article examines the problem of antibiotic resistance that develops in bacteria as a result of the improper use of antibiotics. It provides a detailed analysis of the main causes of misuse, the mechanisms of resistance development in bacteria, specific examples, and their impact on human health. Furthermore, particular attention is given to effective measures for reducing and preventing antibiotic resistance, including rational drug use, vaccination, hygiene, and the development of new treatment methods. The article aims to raise awareness among students, healthcare professionals, and the general public about the importance of the rational use of antibiotics.

**Keywords:** Antibiotics, Resistance, MRSA, MDR-TB, VRE, Rational Use, Infections.

## Introduction

### The Role of Antibiotics in Medicine

Antibiotics are substances that inhibit the activity of microorganisms or destroy them, and they are among the most important drugs in modern medicine [1]. They are widely used in the treatment of bacterial infections, prevention of postoperative complications, and protection of immunocompromised patients. Since their discovery in the mid-20th century, antibiotics have revolutionized human health and made it possible to control many dangerous diseases [2].

### Their Importance in Saving Lives

Thanks to antibiotics, diseases that were once fatal—such as pneumonia, tuberculosis, sepsis, meningitis, and many other infectious diseases—have become treatable. Moreover, antibiotics play a crucial role in ensuring the safety of procedures such as organ transplantation, complex surgical operations, and chemotherapy. Without antibiotics, even minor injuries or infections could pose serious, life-threatening risks. Therefore, antibiotics are often referred to as "life-saving drugs" [3].

### Causes of Misuse of Antibiotics

The misuse of antibiotics poses a threat not only to individual patients but also to society as a whole. The growing issue of antibiotic resistance in recent years is largely associated with their irrational and uncontrolled use [4]. The main causes include:

### Self-medication

Many individuals take antibiotics independently for viral illnesses such as the common cold or influenza. However, antibiotics are ineffective against viruses and are only useful in treating bacterial infections. Self-medication disrupts beneficial microflora and promotes the development of resistant bacteria [5].

## Methodology

### Use Without Medical Prescription

The widespread availability of antibiotics without a prescription leads to their unsupervised use. This results in improper treatment, reduced drug effectiveness, and increased bacterial resistance.

**Failure to Complete the Treatment Course**

Patients often discontinue antibiotic use once they feel better. At this stage, some bacteria may survive. These surviving bacteria adapt to the antibiotic and can later cause more severe infections. This not only complicates treatment but also contributes to the spread of resistant strains.

**Incorrect Dosage**

Taking antibiotics at doses lower than prescribed prevents complete eradication of bacteria and promotes resistance. Conversely, excessively high doses can cause toxic effects on organs, particularly the liver and kidneys. Therefore, antibiotics should only be taken according to a physician's prescription.

**Concept of Antibiotic Resistance**

Antibiotic resistance is the process by which bacteria adapt to the effects of antibiotics and become resistant to them. In simple terms, diseases that were once easily treatable with certain antibiotics gradually lose their sensitivity to these drugs. As a result, treatment becomes more difficult, prolonged, and associated with severe complications. Today, antibiotic resistance is one of the most significant global public health challenges.

## Result and Discussion

**Mechanisms of Resistance Development in Bacteria**

Bacteria develop resistance to antibiotics through several mechanisms:

- **Production of antibiotic-degrading enzymes**
  For example, β-lactamase enzymes inactivate penicillin and similar antibiotics.
- **Prevention of antibiotic entry into the cell**
  Some bacteria modify their cell walls to block drug penetration.
- **Efflux pumps**
  Bacteria produce proteins that actively expel antibiotics from the cell.
- **Modification of target sites**
  Structural changes occur in proteins or ribosomes targeted by antibiotics, rendering the drugs ineffective [6].

**Genetic Mutation and Gene Transfer (via Plasmids)**

Antibiotic resistance develops through two primary pathways:

1. **Genetic mutations**
   Naturally occurring small genetic changes enable bacteria to adapt to antibiotics. These bacteria rapidly multiply and pass resistance traits to future generations.
2. **Horizontal gene transfer (via plasmids)**
   Resistance genes can be transferred from one bacterium to another through plasmids or transposons. This process allows resistance to spread rapidly across different bacterial species. As a result, resistance is not confined to clinical settings but also распространяется in the environment [7], [8], [9].

**Examples of Resistant Bacteria**

**MRSA (Methicillin-resistant Staphylococcus aureus)**

MRSA is a strain of *Staphylococcus aureus* resistant to methicillin, commonly found in hospital settings. It can cause infections of the skin, respiratory tract, and bloodstream. MRSA infections are difficult to treat due to resistance to many penicillin-like antibiotics, requiring specialized treatment regimens.

**MDR-TB (Multidrug-resistant Tuberculosis)**

MDR-TB is a form of tuberculosis resistant to several key antibiotics. It does not respond to standard treatments and requires significantly longer therapy. It poses a serious public health risk due to its high transmissibility [10].

**VRE (Vancomycin-resistant Enterococcus)**

VRE refers to strains of *Enterococcus* resistant to vancomycin. These bacteria commonly cause intestinal and hospital-acquired infections. Treatment is challenging due to resistance, particularly in immunocompromised patients [11].

## Consequences of Antibiotic Resistance

### Increased Difficulty of Treatment

Resistant bacteria make the treatment of common infections more complicated. Standard antibiotics become ineffective, forcing clinicians to use stronger, less conventional, or combination therapies. This prolongs treatment duration and increases patient burden.

### Higher Mortality Rates

Infections caused by resistant organisms such as MRSA, MDR-TB, and VRE are associated with increased mortality. Delayed or ineffective treatment can lead to rapid deterioration, especially in vulnerable populations [12].

### Economic Burden

Treating resistant infections often requires expensive medications and complex medical interventions. Prolonged hospitalization and loss of productivity impose high economic costs on both individuals and society. Globally, antibiotic resistance is estimated to cause billions of dollars in losses annually.

## Prevention Measures

### Rational Use of Antibiotics (Antibiotic Stewardship)

Antibiotics should only be used under medical supervision and strictly according to prescribed dosage and duration. Antibiotic stewardship programs help ensure appropriate use, prevent resistance, and improve treatment outcomes [13].

### Vaccination

Vaccination is one of the most effective ways to prevent infectious diseases. Immunization against illnesses such as influenza and pneumonia reduces bacterial infections and decreases the need for antibiotics.

### Hygiene and Sanitation

Maintaining personal hygiene and environmental sanitation plays a crucial role in reducing infections. Handwashing, safe food and water consumption, and adherence to sterilization protocols in healthcare settings help limit the spread of resistant bacteria [14].

### Development of New Antibiotics and Alternative Therapies

The development of new antibiotics and alternative treatments is essential in combating resistant bacteria. These include bacteriophages, probiotics, and innovative drugs, which offer promising approaches to managing infections [15].

## Conclusion

Antibiotics are among the most essential drugs in modern medicine, playing a critical role in treating bacterial infections and saving lives. However, their misuse and uncontrolled application contribute to the development of antibiotic resistance. Practices such as self-medication, using antibiotics without medical supervision, failing to complete treatment courses, and incorrect dosing significantly accelerate resistance. Resistant bacteria such as MRSA, MDR-TB, and VRE complicate treatment, increase mortality, and cause economic losses. Therefore, rational antibiotic use, vaccination, adherence to hygiene and sanitation practices, and the development of new therapeutic approaches are key strategies for combating antibiotic resistance and ensuring the sustainability of global healthcare systems.

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