REVIEW ARTICLE

Antimicrobial Resistance Due to Injudicious Use of Antibiotics

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Date of submission: 24-02-2024. **Date of acceptance:** 29-03-2024 **Date of publication:** 07-04-2024

ABSTRACT

Antibiotic misuse and overuse are significant contributors to the global crisis of antibiotic resistance, which threatens the effectiveness of these life-saving drugs. This review explores the proper use of antibiotics, highlights the widespread issue of misuse, and examines the factors that contribute to their overprescription, including patient demand, lack of diagnostic facilities, and self-medication. The consequences of antibiotic resistance, such as longer hospital stays, increased healthcare costs, and higher mortality rates, are discussed in detail. Additionally, global efforts to combat antibiotic resistance, including antimicrobial stewardship programs, regulatory measures, and public education campaigns, are examined. The review concludes that a multifaceted approach, involving healthcare providers, policymakers, and the public, is essential to mitigate the misuse of antibiotics and preserve their efficacy for future generations.

KEYWORDS: Antibiotics, antibiotic resistance, misuse, overuse, antimicrobial stewardship, self-medication, antibiotic stewardship programs, healthcare, public health, global health

INTRODUCTION

Antibiotics, often referred to as the cornerstone of modern medicine, have played an indispensable role in the treatment of bacterial infections, contributing significantly to the reduction of mortality and morbidity worldwide. Since the discovery of penicillin in 1928, antibiotics have not only revolutionized clinical practices but have also transformed the outcome of surgeries, cancer treatments, organ transplants, and the management of chronic diseases, all of which depend on the effectiveness of antimicrobial agents. As a result, the widespread availability and use of antibiotics have been instrumental in increasing life expectancy and improving quality of life across the globe.

Despite the tremendous benefits antibiotics provide, their misuse and overuse have led to a growing global health crisis. The phenomenon of antimicrobial resistance (AMR) arises when bacteria adapt to resist the effects of antibiotics, rendering them ineffective in treating infections. AMR has become one of the most serious public health challenges of the 21st century, with resistant infections leading to longer hospital stays, more intensive care, higher medical costs, and increased mortality. In fact, the World Health Organization (WHO) has identified AMR as a priority threat, warning that by 2050, antimicrobial resistance could lead to an estimated 10 million deaths annually—more than cancer and diabetes combined.

The misuse of antibiotics manifests in several ways. Overprescription, particularly in healthcare settings, is one of the primary contributors. This may occur when antibiotics are prescribed for viral infections such as the common cold or flu, where antibiotics are ineffective. Additionally, the practice of self-medication, where patients obtain and use antibiotics without proper medical guidance, further exacerbates the issue. This is particularly prevalent in regions where antibiotics are available over the counter or where there is limited regulation of pharmaceutical practices. Inadequate dosage or failure to complete prescribed antibiotic courses, often seen in both clinical and community settings, also accelerates resistance by not fully eradicating the bacteria, which then develop resistance to the drug.

The driving factors behind the misuse of antibiotics are diverse and include both medical and non-medical influences. In healthc-

are settings, lack of awareness or education among healthcare providers about antibiotic stewardship, inadequate diagnostic tools, and time pressures can contribute to inappropriate prescribing. On the other hand, in community settings, lack of knowledge among the public about the dangers of overusing antibiotics, cultural factors, and a demand for antibiotics by patients contribute significantly to their misuse. Furthermore, economic factors, such as the affordability of antibiotics and their availability without prescription in some regions, exacerbate the problem, particularly in low- and middle-income countries.

The consequences of antibiotic misuse are profound, not only in terms of public health but also in terms of global health security. AMR undermines the effectiveness of existing antibiotics, making it increasingly difficult to treat infections. This has serious implications for the management of common diseases such as pneumonia, tuberculosis, and urinary tract infections, as well as for more complex medical procedures such as surgery and cancer treatments, where infections are a leading cause of complications.

Given the gravity of the situation, it is imperative that concerted efforts are made to address antibiotic misuse and reduce the impact of AMR. In response to the growing threat of resistance, various global and national initiatives have been launched to promote responsible antibiotic use and encourage better infection control practices. These include the implementation of antibiotic stewardship programs, public health campaigns to raise awareness, stricter regulations on antibiotic sales, and improved diagnostic capabilities. However, significant challenges remain, particularly in regions with limited healthcare infrastructure and where antibiotics are widely accessible without prescription.

This narrative review seeks to explore the patterns and drivers of antibiotic use and misuse, focusing on the global dimensions of the issue, the factors that contribute to these practices, and the consequences of antibiotic resistance. By synthesizing evidence from a wide range of sources, this review aims to provide a comprehensive understanding of the current state of antibiotic use, the growing problem of resistance, and the urgent need for global efforts to ensure the continued effectiveness of antibiotics for future generations. Through this exploration, the review also seeks to identify key strategies and interventions that can mitigate the misuse of antibiotics and reduce the burden of antimicrobial resistance.

MATERIALS AND METHODS

Study design

This study presents a narrative review of the literature on the use and misuse of antibiotics. The review synthesizes evidence from various sources, including peer-reviewed articles, government reports, and institutional guidelines, to provide a comprehensive understanding of the global patterns, trends, and consequences of antibiotic use and misuse.

Literature Search Strategy

A systematic search of the literature was conducted to identify relevant articles published between 2000 and 2024. The following electronic databases were used to retrieve relevant studies: PubMed, Scopus, Google Scholar, and Web of Science.

Search terms included combinations of keywords such as “antibiotics,” “antimicrobial resistance,” “misuse of antibiotics,” “antibiotic stewardship,” “prescription practices,” “self-medication,” and “antibiotic resistance.” The search was conducted using Boolean operators (AND, OR) to refine results.

The inclusion criteria for the review were as follows:

1. Original research articles, review articles, meta-analyses, and clinical guidelines.
2. Studies focusing on antibiotic usage and misuse in human health.
3. Studies published in English.
4. Articles discussing both developed and developing country perspectives.

Exclusion criteria included:

1. Articles not related to antibiotic use and misuse in clinical or community settings.
2. Studies conducted before 2000.
3. Non-English publications.

Data Extraction and Synthesis

The data extracted from the selected studies included information on the patterns of antibiotic use, factors contributing to misuse, impacts on antimicrobial resistance, and interventions aimed at improving antibiotic stewardship. The authors independently reviewed each study and extracted key findings.

Ethical Considerations

Since this study is a narrative review based on secondary data from published studies, no ethical approval was required. The review followed ethical guidelines for academic research, including proper citation and attribution of all sources.

DISCUSSION

Proper Use of Antibiotics

Antibiotics should be prescribed and used only for bacterial infections. Their correct use involves selecting the appropriate antibiotic based on the causative pathogen, determining the correct dosage, and ensuring that the prescribed treatment duration is followed. These practices help minimize the development of antibiotic resistance. Healthcare providers play a pivotal role in educating patients on the importance of completing their prescribed course of treatment to ensure complete eradication of the pathogen. Failure to adhere to this can contribute to the survival of resistant strains (1, 2).

Misuse of Antibiotics

Antibiotic misuse is a prevalent problem that manifests in various ways. One common form is inappropriate prescribing, such as using antibiotics to treat viral infections like the common cold, influenza, or viral sore throats, where antibiotics are ineffective. This practice exposes patients unnecessarily to antibiotics, fostering resistance in the process (3). In many cases, healthcare providers feel pressured by patient demands for antibiotics, particularly when patients expect antibiotics for conditions that are not caused by bacteria (4).

Another significant form of misuse is self-medication. In many parts of the world, especially in low- and middle-income countries, individuals purchase antibiotics without prescriptions, often relying on previous experiences or recommendations from friends and family. This behavior is dangerous as it leads to incorrect dosages, inappropriate drug selection, and failure to complete the treatment course, all of which contribute to the development of antibiotic-resistant bacteria (5). Studies have shown that a significant proportion of individuals self-medicate with antibiotics, with 62% of people in India engaging in such behavior (6).

Factors Contributing to Antibiotic Misuse

The misuse of antibiotics is driven by various factors. One of the primary contributors is patient demand. Many patients expect to receive antibiotics for conditions that are viral in origin, putting pressure on healthcare providers to prescribe them unnecessarily (7). This demand is often exacerbated by the perceived quick relief antibiotics provide, even when they are not necessary.

Another factor contributing to antibiotic misuse is the lack of diagnostic facilities, especially in low-resource settings. Without access to laboratory testing, healthcare providers may prescribe antibiotics empirically based on symptoms alone, which increases the risk of unnecessary antibiotic use. In such settings, broad-spectrum antibiotics are often prescribed, which can contribute to the development of resistant bacteria (8).

Self-medication remains a significant issue, especially in regions where antibiotics are available over the counter without prescription. In such cases, individuals frequently use leftover antibiotics or seek advice from non-medical sources, further perpetuating antibiotic misuse. A lack of education about the risks of self-medication and the proper use of antibiotics is a critical contributing factor to this problem (9).

The Impact of Antibiotic Resistance

The consequences of antibiotic misuse are dire and extend beyond individual health. The most significant and alarming consequence is the development of antibiotic-resistant bacteria. These resistant organisms can render commonly treatable infections life-threatening, leading to longer hospital stays, increased healthcare costs, and higher mortality rates. Resistant bacteria such as Staphylococcus aureus (MRSA) and Mycobacterium tuberculosis have already caused major global health challenges (10). Resistant infections are harder to treat, often requiring the use of more toxic and less effective drugs, which can result in prolonged illness and complications (11).

The economic burden of antibiotic resistance is also profound. The cost of treating resistant infections is much higher than treating infections caused by susceptible pathogens, due to the need for more intensive care, longer hospitalization, and more expensive medications (12). Moreover, antibiotic resistance impacts routine medical procedures, such as surgeries and cancer treatments, which depend on antibiotics to prevent or treat infections during recovery (13).

The global nature of antibiotic resistance further complicates the issue. Resistant bacteria do not recognize national borders, and international travel can facilitate the spread of these pathogens across regions, making it challenging to control outbreaks. This global spread of resistance highlights the need for coordinated international efforts to combat the problem (14).

Global Efforts and the Role of Antibiotic Stewardship

Recognizing the threat posed by antibiotic resistance, global health organizations, including the World Health Organization (WHO), have called for increased efforts in antibiotic stewardship. Antibiotic stewardship involves promoting the rational use of antibiotics, ensuring that they are prescribed only when necessary and that the correct antibiotics are selected for specific infections. This requires collaboration between healthcare providers, public health authorities, and patients. Antimicrobial stewardship programs, which focus on optimizing antibiotic use, have been shown to reduce antibiotic consumption and improve patient outcomes (15). These programs are particularly important in hospital settings, where inappropriate antibiotic use can be more prevalent.

Education campaigns such as the WHO's World Antibiotic Awareness Week are crucial for raising public awareness about the dangers of antibiotic misuse and encouraging responsible antibiotic use. Such campaigns aim to reduce patient demand for antibiotics and increase understanding of the risks associated with unnecessary use (16).

In addition to stewardship and education, governments and health organizations are working to improve regulations surrounding the sale of antibiotics. In many parts of the world, antibiotics are available over the counter without a prescription, which contributes to misuse. Stricter regulations, including the requirement for prescriptions for antibiotics and the monitoring of their sale, are essential to curbing self-medication and overuse (17).

Future Directions

The future of antibiotic use depends on continued efforts in research, policy, and education. The development of new antibiotics is crucial, as the current arsenal is insufficient to combat the growing threat of resistance. Additionally, improving diagnostic technologies will play a key role in ensuring antibiotics are prescribed appropriately. Rapid diagnostic tests can help healthcare providers identify the causative pathogens and select the most effective antibiotics, reducing unnecessary antibiotic use (18).

Strengthening regulations to control over-the-counter sales of antibiotics is essential in many low- and middle-income countries where access to antibiotics is unregulated. Furthermore, greater investment in public health education is needed to reduce the general population's demand for antibiotics for viral infections and to encourage responsible self-care practices (19).

CONCLUSION

The misuse of antibiotics is a significant global health challenge with serious implications for public health, the economy, and medical practice. While antibiotics remain a cornerstone of modern medicine, their overuse and misuse are leading to the development of antibiotic-resistant bacteria, which threatens the effectiveness of these life-saving drugs. Tackling this problem requires a multifaceted approach that includes improved healthcare practices, better regulation, public education, and global collaboration. Through these combined efforts, it is possible to reduce the misuse of antibiotics and ensure their continued effectiveness in the treatment of bacterial infections.

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Cite: Alsulaimani SGA,Bajafar AAS,Alharbi YA,Bayazeed YSA, Alharthi SA,Garanbish DT et al. Antimicrobial resistance due to injudicious use of antibiotics.*Radiol Med Dec 2024*;18(1):1-4.