Review Article

https://doi.org/10.3329/cbmj.v15i1.87647

Antibiotic Resistance in Bangladesh: The Silent Epidemic

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Abstract

Bangladesh is experiencing a silent but genuinely antibiotic resistance epidemic. Since it makes many infections more difficult or impossible to treat, it is becoming a bigger hazard to public health. In this review, the present status of antibiotic resistance in Bangladesh is discussed. It draws attention to the fact that germs that were formerly easily treated are now developing resistance to numerous conventional antibiotics. *Staphylococcus aureus*, *Salmonella species*, *Pseudomonas aeruginosa*, *Escherichia coli,* and *Klebsiella pneumoniae* are significant resistant bacteria in Bangladesh. These bacteria can be found in the environment, in communities, in hospitals, and in animals. The abuse and overuse of antibiotics is one of the primary causes of antibiotic resistance in Bangladesh. Antibiotics are frequently taken without a doctor's prescription. Pharmacies sell a lot of medications without a prescription. In order to accelerate animal growth and avoid sickness, farmers provide antibiotics to livestock and poultry. This contributes to the spread of resistance in people and animals. In hospitals, the issue is exacerbated by inadequate infection control, poor cleanliness, and a shortage of clean water. The absence of effective surveillance mechanisms is another significant problem. Many labs and hospitals are unable to accurately identify resistant microorganisms. Programs for antibiotic stewardship are extremely rare. There is also extremely little public knowledge on the proper usage of antibiotics. There are policies, but they are not adequately implemented. According to this review, Bangladesh's antibiotic resistance requires immediate intervention. Better legislation, enhanced monitoring, public awareness campaigns, and appropriate use of antibiotics in humans and animals are all urgently needed. Connecting the health of humans, animals, and the environment requires a 'One Health' strategy. If nothing is done right now, antibiotic resistance will keep growing and might eventually make minor diseases fatal. To combat this silent epidemic, strong collaboration between the health sectors, stringent enforcement of policies, and ongoing research are essential.

CBMJ 2026 January: vol. 15 no. 01 P: 253-259

Keywords: Antibiotic resistance, Bangladesh, Epidemic, Multidrug resistant bacteria, Surveillance

Introduction

Antibiotic resistance is an important global health concern that reduces the efficacy of treatments for infectious diseases, leading to increased costs for medical care, longer hospital stays, and a higher death rate.[1] According to the World Health Organization (WHO), antibiotic resistance poses an urgent threat to global food security, development, and health.[2] This issue is especially problematic in low- and middle-income countries, where infectious diseases are prevalent, and healthcare systems often lack enough funding.[3] Due to overcrowding, uncontrolled antibiotic usage, and restricted access to diagnostic resources, Bangladesh's antibiotic resistance problem is getting worse. The nation's healthcare system is under stress due to the high incidence of infectious diseases, and wide-ranging antibiotic usage exacerbates the situation.[4] Antibiotics are frequently abused and overused in Bangladesh because they are easily obtained over the counter without a prescription.[5] Furthermore, the spread of resistant bacteria is facilitated by poor sanitation and insufficient infection control procedures in healthcare environments.[6] The public health in Bangladesh is seriously threatened by the rise of microorganisms resistant to antibiotics. Previously curable with antibiotics, common bacterial infections are becoming more challenging to control, leading to increased

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rates of morbidity and mortality.[7] Antibiotic resistance has a significant economic impact as well since it raises healthcare costs and reduces productivity.[8] This review will address the issue of antibiotic resistance in Bangladesh in more detail, focusing on the prevalence of the problem and the most resistant bacterial species. It will also look at the reasons behind resistance, such as misuse of antibiotics, insufficient controls, and medical practices. Additionally, it will discuss international relationships and promote government actions. The goal of these initiatives is to solve the problem. However, there are a number of challenges, such as little funding, limited public awareness, and lax enforcement of laws.

Overview of Antibiotic Resistance

Globally, antibiotic resistance poses a serious and expanding hazard to public health. It happens when bacteria develop defenses against antibiotics, making them less effective or even ineffective. This behavior may result in more disease transmission, chronic illnesses, and a greater strain on healthcare systems. There are various ways that bacteria might become resistant to antibiotics: Some produce enzymes, such as beta-lactamase, that break down the drug. Certain bacteria, such as *E. coli* and *P. aeruginosa*, use pumps to push the drug out of the cell. Furthermore, bacteria have the ability to change the areas they target, which reduces the efficiency of antibiotics, or they can learn to evade the drug's effects. Additionally, by transferring resistance genes, bacteria can quickly spread resistance.[9,10]

Antibiotic resistance is a widespread problem that impacts people everywhere. Several bacteria, such as Carbapenem-resistant Enterobacteriaceae (CRE), Methicillin-resistant *Staphylococcus aureus* (MRSA), and Multidrug-resistant *Mycobacterium tuberculosis* (MDR-TB), have been identified by the World Health Organization (WHO) as being particularly dangerous because of their resistance to multiple antibiotics.[11] According to recent research, antibiotic resistance causes at least 700,000 fatalities worldwide each year; if nothing is done, estimates show that this number might increase to 10 million deaths annually by 2050.[12] In middle- and low-income countries, where healthcare infrastructure is frequently insufficient to manage and prevent the development of resistant diseases, the situation is more critical.[13] Despite Southeast Asia's highest AMR risk, measures are not being adopted due to the region's weak rules and regulations.

Bangladesh Scenario

Bangladesh was found to have a high level of antibiotic resistance compared to other developing countries in Southeast Asia, which raises concerns both internationally and regionally. Bacteria resistant to antibiotics are becoming more common in Bangladesh. Because of the nation's dense population, poor healthcare system, and widespread antibiotic abuse, resistant bacteria are spreading quickly throughout the country. Bacteria resistant to antibiotics are becoming more common in Bangladesh.[14] The prevalence of antibiotic-resistant microorganisms in Bangladesh, their causes, and how the local healthcare system exacerbates issues are examined in the following sections:

Research indicated that *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Escherichia coli* are among major microorganisms that showed significant prevalence of resistance.[15] There have been concerning reports of antibiotic resistance among prevalent bacterial infections in several parts of Bangladesh. Studies conducted at tertiary hospitals in Chittagong and Dhaka found that multidrug-resistant (MDR) bacteria were significantly present.[16]

According to a study conducted at Dhaka Medical College Hospital, 65% of the strains of *Escherichia coli* that were recovered from UTIs were resistant to several medicines, including fluoroquinolones and third-generation cephalosporins.[17] Another study found that more than 63% of *K. pneumoniae* isolates from bloodstream infections were resistant to carbapenems, indicating significant rates of resistance.[18] In addition, *Staphylococcus aureus* (MRSA) is frequent and has strong resistance to conventional medicines such erythromycin and penicillin.[14] Rising resistance to first-line antibiotics in Salmonella infections, especially *Salmonella Typhi*, has made treating typhoid fever more difficult.[19]

Factors Associated with Antibiotic Resistance

The high rates of antibiotic resistance in Bangladesh are caused by the following factors:

i) Availability of antibiotics as over the counter (OTC) drugs: In Bangladesh, antibiotics are easily obtained without a prescription, which encourages abuse and overuse. According to a study, more than 70% of antibiotics were bought in rural areas without a prescription, which greatly accelerated the emergence of resistance.[20]

ii) Inadequate law enforcement and regulation: The laws controlling the use and sale of antibiotics are not well-defined, and they are not always enforced. Antibiotics can be distributed and consumed unregulated due to this absence of regulation.[21]

iii) Ineffective infection control procedures: Due to frequently insufficient infection control procedures, resistant microorganisms proliferate in healthcare environments. A research conducted in Bangladesh's government hospitals found significant weaknesses in infection control protocols, including hand cleanliness and the usage of personal protective equipment.[22]

iv) Resource-poor healthcare infrastructure: Bangladesh's healthcare system lacks adequate resources, and there is restricted access to diagnostic centers that can help determine the proper usage of antibiotics. As a result, empirical and frequently incorrect antibiotic prescribing strategies are used.[23]

Impact on Public Health

Antibiotic resistance has a significant influence on Bangladesh. Longer hospital stays, more costly medications, and longer treatment periods are frequently necessary for patients with resistant illnesses.[24] This burden has serious effects on society and the economy and strains the already overloaded healthcare system.[12] According to a World Bank analysis, antibiotic resistance may cause up to 28 million individuals globally to fall into poverty by 2050 as a result of higher medical costs and lower incomes[25], and naturally low- and middle-income countries like Bangladesh will suffer badly.

Antibiotic resistance makes common diseases harder to treat, which raises rates of morbidity and mortality.[1] Infections can worsen when first-line antibiotics are ineffective, necessitating stronger and frequently more toxic substitutes that may still be less effective.[14] Multidrug-resistant organism outbreaks are common in Bangladeshi hospitals, requiring expensive infection control procedures and taking funds away from other critical health services.[26] Limited healthcare resources are further taxed by the growing need for isolation facilities and sophisticated care for patients with resistant illnesses.[27]

Antibiotic resistance has serious financial consequences that impact both direct medical expenses and overall economic output. Because resistant infections require higher-cost medications and longer-term care, treating them is considerably more costly than treating non-resistant ones.[8]

Additionally, antibiotic resistance has important societal implications. Family finances may be strained by the increased burden of illness, which could result in lower household income and greater individual medical costs.[28,29] This has the potential to worsen social injustices and poverty, especially in rural places where access to healthcare is already scarce. Families in rural Bangladesh frequently sell assets or suffer loans to cover medical bills for diseases that are resistant to treatment, which promotes poverty cycles.[30]

Plan of Actions for Combating Antibiotic Resistance

The National Action Plan on Antimicrobial Resistance 2017-2022 is one of the significant measures taken by our Ministry of Health and Family Welfare in this regard. This comprehensive plan described methods for enhancing infection prevention and control procedures, optimizing the use of antibiotics, and enhancing surveillance. Additionally, the plan prioritizes education and public awareness of antimicrobial resistance (AMR).[31] Besides, to combat the development of antibiotic resistance, government has launched several initiatives in collaboration with several UN and other partner organizations. These initiatives include raising public awareness, improving rules controlling the sale of antibiotics, and enhancing infection control procedures in medical facilities.[32] However, More cross-sector collaboration like implementation of 'One Health' approach is required.[33,34] Regarding regulatory procedure, policies to limit the selling of antibiotics over the counter (OTC) have been put in place by the Directorate General of Drug Administration (DGDA), but implementation is still difficult.[35]

Infection prevention and control (IPC) programmes in public and private hospitals are undergoing and being supervised by the Ministry of Health and Family Welfare to stop the spread of bacteria in hospital and community settings that are resistant to treatment. Healthcare personnel are taught how to utilize personal protection equipment and maintain good hygiene as part of these programs.[36] Fighting antibiotic resistance requires both education and public awareness. In Bangladesh, numerous initiatives have been started to inform the general population and medical professionals about the responsible use of antibiotics.[37] As part of the global awareness initiatives, Bangladesh actively takes part in the World Antibiotic Awareness Week, launching national programmes to increase public knowledge of antibiotic resistance and the significance of using antibiotics appropriately.

To monitor resistance trends and create successful interventions, research and surveillance ability must be improved. Bangladesh has set up the Antibiotic Resistance Surveillance System (ARSS) to track patterns of antibiotic resistance in medical environments. This method aids in pinpointing areas of resistance and directing policy choices.[38] Bangladesh's attempts to fight antibiotic resistance are greatly aided by international collaborations.[4]

Challenges

However, the fight against antibiotic resistance is slowed by a number of obstacles, which demand

strong public health initiatives. Insufficient surveillance systems to track patterns of resistance, low level of public knowledge regarding the responsible use of antibiotics and inadequate infection control protocols in medical facilities are some of them.[4] Inadequate law enforcement makes it simple to obtain antibiotics without a prescription, which encourages abuse. Doctors administer antibiotics without conducting testing because many medical facilities, particularly those in rural areas, lack the necessary equipment and labs. Programs related to AMR, such as awareness campaigns and tracking systems, are limited by funding. Antibiotic resistance is not well known, especially in rural regions. Due to inadequate training, some medical professionals write unnecessary prescriptions. Although drug-resistant germs are spreading swiftly, prompt actions are challenging due to slow tracking systems.[39]

Recommendations

Antimicrobial resistance (AMR) needs to be addressed with a coordinated, multidimensional strategy. The sale of antibiotics without a prescription must be stopped by strengthening regulatory structures and enforcing them strictly. Improving the healthcare system, especially the diagnostic services in underprivileged areas, is necessary to enable early and precise infection detection. More funding is required to support AMR-related projects, public education campaigns, and surveillance systems. It is recommended that all healthcare facilities develop antimicrobial stewardship programs to guarantee appropriate prescribing practices. Prioritizing research on resistance mechanisms and the creation of novel antimicrobial drugs is also necessary. Addressing more general socioeconomic issues and advancing international efforts to limit AMR also require international cooperation.

Conclusion

A silent crisis with broad consequences is the resistance to antibiotics in Bangladesh. To counter this expanding threat, immediate and persistent action is required. The impact of antibiotic resistance can be lessened, and public health can be protected by putting comprehensive strategies into place and encouraging cooperation.

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