

Understanding the Invisible Threat: The Progressive Escalation of Antibiotic Resistance in Pakistan

Antibiotic resistance is a global health problem and is quickly becoming a growing health concern in Pakistan. Rapidly increasing resistance to antibiotics in recent years has significant implications for the public health and the healthcare systems. Resistance develops when bacteria acquire certain characteristics which render antibiotics previously effective, obsolete. The primary cause of antibiotic resistance is the excessive and oftentimes inappropriate use of antibiotics. Antibiotics are often prescribed by healthcare workers without proper diagnostic tests and this misuse is contributing to the development of resistant strains. Lack of awareness and lack of access to healthcare in some regions of Pakistan prompt patients to search for quick solutions to their various illnesses. Antibiotic resistance has the potential to become a health crisis for the already crippling healthcare system of Pakistan. Therefore, a multifaceted approach must be adapted quickly to mitigate this issue. The distribution and sale of antibiotics should be controlled through implementation of strict regulations. Proper public awareness campaigns should be used as targeted interventions, to create a sense of responsibility in the general public about the prudent use of antibiotics.

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Antibiotic resistance is a silent global crisis which is intensifying and becoming an invisible threat to the public health of Pakistan. It is steadily gaining momentum and is rapidly spreading within our borders, leaving us apprehensive about what it means for the future of healthcare in our country. The discovery of penicillin was an unprecedented advancement in medicine which opened a floodgate for the development of antibiotics. This discovery which revolutionized the world of medicine, however, came with a host of side effects. Penicillin was sold over the counter in pharmacies for years which eventually led to the establishment of a population of resistant strains. The situation today is similar on a grander scale leaving us defenseless against life-threatening infections, when our most powerful and trusted weapons against bacteria become futile.¹

For instance, recently an article which evaluated the susceptibility of microbes to various antibiotics in Pakistan was published.² One key finding which was highlighted by the study was that multidrug resistance is rampant in Pakistan. The study also emphasized on the fact that antimicrobial treatment is very limited and that there are restrictions on the use of antibiotics which is a significant concern for the field of healthcare and medicine. This finding has great implications for a country like Pakistan which is home to more than two hundred million people and is currently grappling with the menace of antibiotic resistance which has deeply penetrated the country.³ The influx of low-quality antibiotic strains and their unchecked consumption is associated with the lack of clinical acumen as medications are sold without a prescription and worse due to a lack of standard treatment guidelines, the health workers are inclined to overprescribe antibiotics. Lack of awareness and education of the general public are major contributing factors to the rising resistance because of the lack of information about the consequences of the uncontrolled and unsupervised use of antibiotics. The general public is unaware of the hazardous effects of incomplete therapeutic courses and self-medication. The inadequate regulation and unchecked proliferation of antibiotics as over-the-counter medications are contributing to the formation of new resistant strains of bacteria.⁴

In Pakistan, the country with the highest rate of unnecessary antibiotic prescriptions, untreatable infections due to resistant bacteria have become a significant burden on the already crippling healthcare system. For example, *M. tuberculosis*, a pathogen that has plagued Pakistan for decades and is endemic in

the region, is an example of a superbug with multi-drug resistance. Pakistan ranks fifth among the TB high burden countries worldwide and reports more than five hundred thousand new cases of tuberculosis every year. The ramifications of this alarming number are further worsening due to the emergence of more than fifteen thousand drug-resistant cases of tuberculosis every year. The drug-resistant cases are exceptionally difficult to treat and require more expensive alternative treatments. This leads to inadequate control and cure of the disease leading to prolonged stay in the hospital further increasing the burden on the healthcare system.⁵

Antibiotic resistance is a complex problem that occurs when bacteria acquire the ability to continue to proliferate and survive even in the presence of agents designed to kill or inhibit their growth. The overuse of antibiotics puts a higher selection pressure on the bacteria to filter out the most resistant strains which leads to the diversification of the bacterial genome. This resistance to antibiotics develops through various mechanisms and it's imperative to understand them to develop strategies to combat this issue. One such mechanism is spontaneous mutations in the genetic material of bacteria which render the antibiotic ineffective against it. In addition, some bacteria produce enzymes which actively break down the antibiotics. This includes the enzyme β lactamase which is the leading cause of resistance against the pioneer antibiotic i.e. penicillin. Other mechanisms of resistance are efflux pumps which actively pump the drug out of the cell, modification in the target sites of the drug and the formation of biofilms which make the bacteria about one thousand times more resistant to antibiotics. One exceptionally important mechanism of antibiotic resistance which is becoming increasingly prevalent in the resistant strains is horizontal gene transfer (HGT) which is the exchange of genetic material within species without any sexual contact⁵. This exchange promotes collaboration among the bacterial population in the development of multi-drug resistance which leads to "superbugs" which can tolerate almost all antibiotics.

Antibiotic resistance is on track to becoming a large-scale medical issue and it is essential to adopt a multifaceted approach and to implement appropriate control measures to mitigate this rising threat. The most important tool to counter the situation that is proliferating out of control so rapidly is monitoring the usage of antibiotics which needs to be done at both a personal level and a national level. This can be achieved

by the implementation of regulatory measures that restrict the availability of antibiotics without prescription. Healthcare professionals including pharmacists should be properly educated about their role in the irrational use of antibiotics. Doctors should be strictly advised to not over-prescribe drugs and pharmacists should be in particular made vigilant to not provide antibiotics which require a prescription. A universal treatment guideline should be drafted by WHO to be followed

as a global prescription plan for antibiotics which all healthcare physicians must adhere to. In addition, targeted interventions should also be done at the national level and the government should play its role responsibly and effectively in mitigating this issue. The government should establish an antibiotic resistance surveillance and tracking system to monitor and track the emergence of new resistant strains to prevent this situation from getting out of control.

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