Research Article

THE STATE OF ANTIBIOTIC RESISTANCE IN NIGERIA; CHALLENGES, AND THE WAY FORWARD: A NARRATIVE REVIEW

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Abstract

This narrative review examines the prevalence of antibiotic resistance and underlying factors contributing to antibiotic resistance (AR) in Nigeria, highlighting its growing public health threat. Antibiotic Resistance occurs when bacteria develop mechanisms to resist the effects of antibiotics, limiting treatment options for infectious diseases. The review explores key factors driving AR in Nigeria, including over-prescribing, self-medication, inadequate regulations, lack of awareness, and inadequate healthcare infrastructure. It also outlines the role of healthcare providers, pharmacies, and patients in the misuse of antibiotics, contributing to the spread of resistant bacteria. The review emphasizes the need for stronger antibiotic stewardship programs, improved diagnostic services, public education on responsible antibiotic use, and regulation of antibiotic sales. Recommendations are made for healthcare policies and strategies to mitigate AR and improve infection control in hospital and community settings. The findings underscore the urgency of addressing AR to prevent a post-antibiotic era where even minor infections could become fatal

INTRODUCTION

Antibiotic resistance (AR) is a worldwide health crisis and is reported annually to cause the death of 10 million by the year 2050 if the current trend of misuse and overuse continues.[1, 2, 3] Antibiotic resistance is defined as the capability of microorganisms to curb the action of antimicrobial agents, and this approach happens when an antibiotic loses its efficiency to interfere with bacterial growth.[2, 4] The World Health Organization (WHO) has reported a warning stating the world is "using up all of its antibiotics," increasing terror about global antibiotic resistance reaching a new peak.[3] Many species of bacteria had developed the capability to withstand antibiotics long before humans began mass-producing them to prevent and treat infectious diseases[1] additionally, specimens from environments that have been isolated from anthropogenic bacterial pollution can provide insights into the resistance mechanisms that prevailed during the pre-antibiotic era.[1, 5] New resistance mechanisms have emerged and spread globally, reducing the ability to treat prevalent infectious diseases in peril, because of its capacity to spread across nations and the resulting to low treatment options, antibiotic resistancebecomesaserioushealthcareconcern.[6] As antibiotics become less potent, diseases such as tuberculosis, pneumonia, blood poisoning, food-borne diseases, and gonorrhea are becoming difficult, if not impossible, to cure.[7] Decades after the first patients received antibiotic treatment, bacterial infections have become a serious threat.[3] We are rapidly approaching a post-antibiotic era where common infectious diseases and minor injuries could become fatal unless immediate and proactive measures are taken.[7] In 2021, the WHO stated that antimicrobial resistance was among humanity's 10 global public health threats.[7] Antibiotic-resistant diseases are calculated to cost the global economy about $100 trillion annually.[8]

Antibiotic resistances build up at both the hospital and community levels. Although the acquiring and spreading of resistance genes take time, the evolution of bacterial resistance has remarkably increased due to the unnecessary use and misuse of antibiotics.[3, 7] This narrative review aims to highlight the status quo of antibiotic resistance and the challenges associated with the prevalence of antibiotic use. The available literature and research indicate potential antibiotic misuse and overuse in Nigeria. The objectives are to ascertain;

- The prevalence and pattern of antibiotic utilization in Nigeria.
- The contributing factors to antibiotic resistance in Nigeria.

METHODS

This narrative review utilized PubMed, Google Scholar, Medline, and ResearchGate databases, covering a specified date window from 2020 to 2025. The search terms included "Antibiotic Resistance," "Prevalence," "Drug Misuse," and "Drug Overuse." Boolean operators such as AND and OR were applied to refine the search results. However, free text and Medical Subject Headings (MeSH) were not used. The review focused on antibiotic resistance in Nigeria, particularly among the general population. Studies from other countries were included only for comparative discussion. The inclusion criteria comprised peer-reviewed journal articles published between 2020 and 2025, studies conducted on human populations that reported on antibiotic resistance, prevalence of antibiotic use, contributing factors, or mitigation strategies, and research articles available in full text and written in English. The exclusion criteria included studies published in languages other than English, non-research papers such as books, conference proceedings, magazines, and policy briefs, and studies on antibiotic resistance in veterinary medicine or agricultural settings.

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Table 1. Summary of search strategy

Authors & Year	Type of Study	Geopolitical Zone	Most Used Antibiotics	Prevalence Rate (%)	Conclusion
Mohammed et al. (2021)	Questionnaire-based cross-sectional study	North-East, North-West, North-Central	Amoxicillin (71.7%) and Ampicillin/Cloxacillin (70.1%)	98.2%	The study revealed a high level of antibiotic use for wrong indications.
Chukwu et al. (2020).	Cross-sectional study	North Central, North East, North West, South East, South-South, and South West	Ampicillin/Cloxacillin (54.4%), Ampicillin (41.7%), Ciprofloxacin (39.4%)	66.8%	There is a low knowledge of antibiotic resistance and stewardship.
AkandeSholabi and Oyesiji (2023)	Cross-sectional study	South West	Amoxicillin (42.4%)	72.5%	The study highlighted inadequate knowledge about rational antibiotic application, leading to its misuse.
Nwafia et al. (2024)	Cross-sectional study	South-East	Beta lactam antibiotics (35.5%)	50.6%	The study reported a poor prescribing habit due to a high rate of empirical treatment.
Akintan et al. (2024)	Cross-sectional study	South-West	Third-generation cephalosporins and aminoglycosides	68.8%	The study emphasized that there is still a high level of antibiotic usage and multiple antibiotics reserved for children.
Sekoni, Oreagba, and Farouk (2022)	Retrospective study	South-West	Amoxicillin and clavulanic acid, ciprofloxacin, amoxicillin	Hospitalized patients had a consumption rate of 260.9 DDD/100 bed-days, outpatients 72.3 DDD/1000 inhabitants per day	The study revealed high levels of antibiotic misuse, overuse, and abuse.
Popoola et al. (2024)	Online cross-sectional survey	All regions	Amoxicillin (54.2%), Metronidazole (48.2%), Ciprofloxacin (45.6%)	71.5%	Despite high awareness of antibiotic resistance, it did not translate into proper antibiotic use, highlighting the need for more stringent antibiotic dispensing and prescribing regulations.
SalihuDadari (2020).	Questionnaire-based study	North	Penicillin antibiotics (65.53%)	61.02%	Maternal use and misuse of antibiotics during breastfeeding could contribute to the transfer of antibiotic-resistant genes to infants.
Ogoina et al. (2021).	Cross-sectional study	South-South, South-East, South-West, North-East, North-West, and North Central	Amoxicillin-clavulanate (98%), Fluoroquinolones (97%), Ceftriaxone (96.8%)	100%	The study emphasized the lack of implementation of antibiotic stewardship among tertiary hospitals in Nigeria.
Akpan, Udoh, Akpan, &Ozuluoha (2021)	Questionnaire-based study	South-South	Metronidazole (82%), Azithromycin (43%), Amoxicillin/Clavulanic Acid (24%), Sulphamethoxazole/Trimethoprim (20%)	68%	The study reveals an increased rate of inappropriate antibiotic dispensing among community pharmacists.
Abubakar (2020)	Point-prevalence survey	North	Metronidazole (30.5%), Ciprofloxacin (17.1%), Ceftriaxone (16.8%), Amoxicillin-Clavulanate (12.5%), Gentamicin (11.8%)	80.1%	There was an indication of high levels of antibiotic use among hospitalized patient prescriptions.

Antibiotics Resistance

Antibiotic resistance arises through the selective adaptation of bacteria to certain compounds based on their toxic exposure.[8] The outcome of the process is that bacteria cannot withstand antibiotics that usually kill or stop their growth.[8] It is somewhat relevant to understand the reason for the rise in antibiotic resistance than identify it, as it is often highlighted that by the time a resistant trait is recognized, it may have spread throughout nature.[8] Mohammed *et al.* reported that antibiotic resistance globally is connected with the overprescribing of antibiotics, and therefore, developing nations such as Nigeria have the likelihood of containing antibiotic resistance based on inappropriate prescribing, dispensing, and regulations.[9] Unnecessary use of antibiotics, especially in cases where treatment is self-administered, contributes to antibiotic resistance.[10]

The appearance and increase of antibiotic resistance among infectious bacteria have become a growing problem for public health in recent years. It is growing increasingly that not only the resistant genes (ARGs) observed in clinical studies are relevant but also the infectious commensals, environmental bacteria, and bacteriophages create this reservoir of ARGs known as resistome from which the infectious bacteria produces its resistance through the process of horizontal gene transfer (HGT).[8] Antibiotic resistance happens in both community and hospital settings, creating the existence of resistant infectious bacteria.[3] The community-acquired pathogens are known as an important point of morbidity and mortality.[3,8] Some problematic resistant antibiotic bacteria include *Acinetobacterbaumannii*,[11]*Pseudomonas aeruginosa,*[12] *Staphylococcus aureus*,[13]*Klebsiella pneumonia*,[14]*EnterobacterSpp*,[15]Enterococci.[16]

Table 2. Summary of the prevalence of antibiotics utilized in Nigeria

Search elements	Specification
Databases Used	PubMed, Google Scholar, Medline, ResearchGate
Date Range	2020 to 2025
Search Terms	"Antibiotic Resistance," "Prevalence," "Drug Misuse," "Drug Overuse"
Boolean Operators	AND, OR (used to combine search terms)
Inclusion Criteria	Peer-reviewed journal articles, full text, published in English, studies on human populations
Exclusion Criteria	Studies not in English, non-research papers (books, conference proceedings, magazines), veterinary/agriculture studies

Thus, the knowledge of bacterial resistance mechanism is a valuable tool in managing resistant pathogens and providing a solution to reducing the impact of bacterial resistance.

The extent of antibiotic resistance in Nigeria

Reports on antibiotic resistance have spread across different states in Nigeria. A study by Akande-Sholabi and Oyesiji[17] cited past studies revealed incidences of *Staphylococcus aureus*, a methicillin-resistant, and Escherichia coli, a fluoroquinolone-resistant in Nigerian communities. In addition, the high prevalence of antibiotic resistance has been alarming among clinical specimens in tertiary hospitals. Akande-Sholabi and Ajamu[18] reported a very low percentage of rational dispensing of antibiotics in community pharmacies across Nigeria. Several studies indicated that antibiotic resistance is common among patients admitted in pediatric, intensive care units, and other specialized units in tertiary hospitals. [19] It further revealed that the main drivers of antibiotic resistance were heavy antibiotics and cross-infection within the hospital staff and the environment. Hospitals are known to be the breeding grounds for the spread of antibiotic-resistant pathogens in Nigeria. [19, 20] A study by Sekoni *et al.* revealed that *Clostridioides (Clostridium) difficile*, a bacterium transferred by an infected patient to hospital staff through improper hand cleansing methods, causes antibiotic resistance. This further highlighted the high flow of antibiotic resistance through community and hospital-acquired infections that lead to high utilization of antibiotics. [21] Also, the study revealed that prescribers knew that overprescribing antibiotics to their patients could cause antibiotic resistance. Yet, they remained adamant about the overuse of antibiotics and prescribed them even in the absence of a bacterial infection. [21] Popoola *et al.* revealed that in Nigeria, self-medication played a notable role in the inappropriate use of antibiotics, which in turn contributes to antibiotic resistance. [22] The study also revealed that internet use by over 108 million Nigerians is a source of knowledge for the misuse of antibiotics, leading to antibiotic resistance. [22] Iheanacho and Eze reported in their study that the range of antibiotics prescribed for hospitalized patients in Nigeria is 65-79%, and there is a lack of national antibiotic guidelines in which 4 out of 5 patients receive at least an antibiotic per day, therefore, encouraging more spread of resistant pathogens. [23] Thus, the menace of antibiotic resistance in Nigeria will require conscious efforts by the pharmacists and other stakeholders for its control.

Factors contributing to antibiotic resistance in Nigeria

Several factors contribute to antibiotic resistance, particularly in Nigeria. Manga *et al.* reported that antibiotic prescribing by non-physicians (CHEWs), limited knowledge of multidrug-resistant (MDR) pathogens, and non-adherence to prescribing guidelines are key contributors to the rise of antibiotic resistance.[9] Akpan *et al.* identified additional factors, including inappropriate use of antibiotics for self-limiting infections,

decreased bacterial sensitivity due to overuse, and selection pressure from widespread antibiotic use.[10] According to Akande-Sholabi and Eunice Oyesiji, antibiotic resistance is primarily driven by misuse. Their study highlighted several contributing factors. It spans from the concept of its misuse. The study highlighted delays in receiving laboratory reports as individuals resort to self-medication due to the waiting period for test results, a belief that antibiotics provide rapid symptom relief, a misconception that antibiotics are potent and effective for any illness, even when not needed, influence of healthcare providers; some patients use antibiotics based on previous prescriptions without consulting a doctor again, easy access to pharmacies, fear of injections while some individuals prefer oral antibiotics over injectable medications due to a phobia of injections, avoidance of consultation fees; people opt for antibiotics instead of paying for a doctor's consultation, prioritizing cost savings and belief in self-treatment for minor illnesses.[17]

Akintan *et al.* highlighted factors contributing to the increased misuse of antibiotics in neonatal wards that may lead to resistance were advancements in medical facilities, increased referrals of preterm infants, high rates of neonatal sepsis, lack of access to affordable diagnostic tools and use of prophylactic antibiotics in high-risk newborns. [20] Sekoni, Oreagba, and Oladoja reported irrational prescribing of antibiotics in hospitalized patients, often in cases where antibiotics were not required, thereby failing to meet the National Standard Treatment Guidelines. For instance, some prescribers irrationally used third-generation cephalosporins for malaria despite their lack of clinical indication for the disease.[21]

In addition, Popoola *et al.* self-medication encouraged convenience, limited access to doctors, financial constraints and misconceptions, and risky practices such as the belief that antibiotics kill viruses; they immediately stop taking antibiotics once they feel relieved of symptoms and reduce their antibiotic dosage when they feel better among others.[22]
Nwafia *et al.* identified additional factors that promote antibiotic resistance, including; prolonged antibiotic use, which increases bacterial adaptation and resistance; empirical prescribing without laboratory confirmation, leading to inappropriate antibiotic use and selection pressure for resistant bacteria; high antibiotic use in intensive care units (ICUS), encouraging the development of multidrug-resistant organisms (MDROs). Weakened immune systems in ICU patients make them more susceptible to resistant infections and the use of invasive medical devices, which facilitate hospital-acquired infections caused by resistant bacteria.[24]

Way Forward in Combating Antibiotic Resistance in Nigeria

This review suggests that, based on the identified factors contributing to antibiotic resistance, the following recommendations are necessary to mitigate its rise in Nigeria.

Figure 1. Factors contributing to Antibiotic Resistance in Nigeria

1. Strengthening Antibiotic Stewardship Programs by implementing strict prescribing patterns and guidelines while enforcing compliance among healthcare providers. It also requires educating and regulating non-physician prescribers (CHEWs) and creating antibiotic stewardship awareness among professionals such as pharmacists and nurses to ensure appropriate antibiotic use. Over-the-counter sales of antibiotics should also be restricted to prevent misuse, and adherence to the National Standard Treatment Guidelines should be enforced.

2. Improving laboratory capacity and diagnostic services is essential. Reducing delays in laboratory test results will help discourage empirical prescribing and self-medication. Investing in affordable and accessible diagnostic tools will ensure laboratory confirmation before prescribing antibiotics.

3. Promoting public awareness and implementing health education through community-based campaigns is necessary to correct misconceptions such as the belief that antibiotics treat viral infections, the importance of completing the entire course of prescribed antibiotics, and the need to avoid sharing or reusing antibiotics. Educating the public on the dangers of self-medication and encouraging consultation with healthcare professionals will further help mitigate antibiotic resistance.

4. There is an urgent need to regulate pharmacy operations and antibiotic dispensing. Formulating policies to restrict easy access to antibiotics in pharmacies without valid prescriptions, monitoring and penalizing pharmacies selling antibiotics without proper documentation, and ensuring proper oversight of drug distribution will help control antibiotic misuse.

5. Encouraging rational use of antibiotics in hospitals requires implementing hospital-based antibiotic prescribing audits to track irrational use. Developing neonatal and ICU antibiotic use guidelines is necessary to ensure that only essential prescriptions are given. Furthermore, infection prevention strategies, such as improved hygiene and sanitation in healthcare facilities, should be promoted to reduce the risk of antibiotic-resistant infections.

6. Expanding research and surveillance on antibiotic resistance is critical. Establishing national antibiotic resistance monitoring programs will help track resistance trends and guide policymaking. Encouraging vaccination programs will reduce infections that lead to unnecessary antibiotic use. Additionally, supporting research on alternative therapies and new antibiotics will help address the growing challenge of antibiotic resistance.

Conclusion

The widespread and concerning issue of antibiotic use, misuse, and overuse in Nigeria contributes significantly to the growing problem of antibiotic resistance.Despite widespread knowledge of antibiotic resistance, there is a stark disconnect between awareness and proper antibiotic use, with many individuals opting for self-medication and healthcare providers sometimes failing to adhere to standard treatment guidelines.The review calls for immediate action to address these challenges through strengthening antibiotic stewardship programs, improving public awareness, and regulating antibiotic sales and prescriptions. Further investment in diagnostic services and stricter enforcement of existing treatment guidelines is also necessary to curb antibiotic misuse and mitigate the rise of antibiotic-resistant pathogens in Nigeria. (10)

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