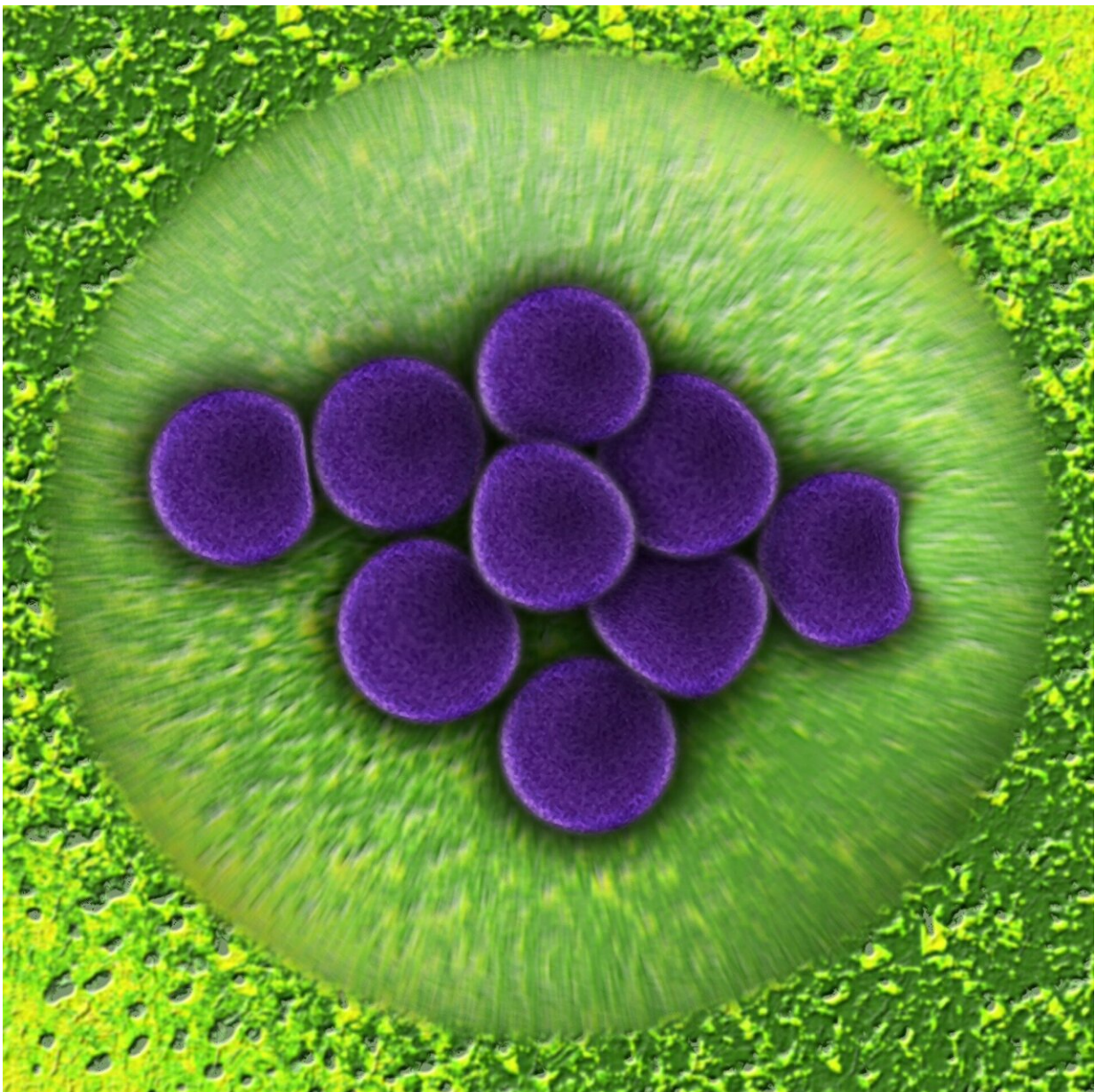


# Resistance to antibiotics in northern Nigeria: What bacteria are prevalent, and which drugs work against them

September 18 2023, by Fred C. Tenover and Nubwa Medugu

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Antimicrobial resistance—the ability of microorganisms to resist drugs that have been developed to control them—is a [severe problem in African countries](#). The continent has the [highest global burden](#) of antimicrobial-resistant infections, with 114.8 deaths per 100,000 people.

One of the causes of resistance is inappropriate use of antibiotics. Using the wrong antibiotic to treat an [infection](#) enables resistant [bacteria](#) to flourish and spread. It's [challenging](#) to address the resistance problem when there are gaps in three areas:

- access to effective antimicrobial agents
- [laboratory](#) capacity to identify the source of infections
- funding to carry out planned solutions.

It's essential to identify the type of infection present so that the right antimicrobial agent can be selected. [Treatment guidelines](#) stress the importance of using laboratory data to guide treatment. Physicians need laboratory data to choose the right antibiotic, at the right dose, for the right period of time. This is known as antimicrobial stewardship.

But in low- and [middle-income countries](#), [hospital budgets don't include much funding for laboratories](#). So laboratory data to create local treatment [guidelines](#) for doctors are scarce. Treatment choices become "empiric"—the doctor's best guess based on the patient's signs and symptoms and the doctor's experience. This can lead to choosing ineffective antibiotics, which can lead to increases in resistant bacteria.

[Our combined experience](#) in understanding and [addressing](#) the spread of antimicrobial resistant organisms in African countries, and Nigeria in particular, spans 40 years. Over this time, we have noted how the lack of laboratory data hinders the effective treatment of patients with infections. We have also observed that the cost of producing quality laboratory data is high and rising.

One way forward is to pool laboratory data from other hospitals in the region to guide therapeutic choices. In other words, to develop a list of what bacteria are prevalent in the region and which drugs work against them.

To accomplish this, we recently conducted [a study](#) of multidrug-resistant bacteria obtained from patients in six hospitals in northern Nigeria. Our goal was to determine which antimicrobial agents might still be effective therapies in this region.

The results indicate that the mechanisms by which bacteria have become resistant in the region are complex. But there may be ways to support antimicrobial stewardship efforts in local hospitals.

## **Drug-resistant bacteria in Nigeria**

We chose to analyze bacteria that are resistant to more than one drug because they are the biggest challenge when treating infections. We focused primarily on bacteria from blood and urinary tract infections.

We found that about 85% of the bacteria isolated from infections were resistant to the most commonly used antibiotics. So, without laboratory data, the most frequent choices of antibiotics would probably be ineffective.

In addition, 65% of the bacteria analyzed were resistant to the

"antibiotics of last resort". Those are antibiotics reserved for treating the most difficult infections. This result was higher than anticipated. It underscored the need for laboratory data to indicate where [antibiotic resistance](#) was becoming a serious problem.

The good news was that two antibiotics, tigecycline and fosfomycin, remained very active even against highly resistant strains of bacteria. The bad news was that these antibiotics are expensive and not readily available in many hospitals in Africa.

Nevertheless, this data on the resistance patterns of multidrug resistant infections supports the value of regional guidelines. It points to strategies of antimicrobial stewardship that might work specifically in Nigeria. Such strategies could include judicious use of tigecycline or fosfomycin for serious infections when guided by laboratory data.

## **Genetic mechanisms**

Our study went beyond the use of routine testing methods and included whole genome sequencing of the resistant bacteria. This was done to understand what made these organisms so resistant to antibiotics at the molecular level.

The data revealed an astonishingly high number of genetic mechanisms making the microorganisms resistant. This shows that the choice of agents to treat infections has not been optimal in the past.

Genes which inactivated some classes of antimicrobial agents such as beta-lactams, aminoglycosides, tetracyclines and fluoroquinolones were present.

In some cases, the [genetic information](#) encoding resistance was capable of being shared among other microorganisms. This increases the

potential for spread of the resistance problem.

Additionally, among the isolates studied, several belonged to newly emerging "high-risk" bacterial clones. These are bacterial species of high virulence that are easily spread among patient populations. Hospitals need to pay closer attention to infections caused by [resistant bacteria](#) to ensure infections do not spread to other patients.

## **The need for antimicrobial stewardship**

Some of the [resistance genes](#) were capable of moving from one microorganism to another (mobile resistance genes). Other genes were embedded within the bacterial chromosome. Unlike the mobile genes, which can be unstable and lost, the ones in the chromosome are often stable. This mix of mobile and embedded resistance genes suggests that resistance will not go away any time soon.

However, there is hope for decreasing the impact of resistance through effective antibiotic prescribing. Antimicrobial stewardship based on laboratory data is effective especially if done locally, regionally and nationally.

## **Antimicrobial resistance is everyone's concern**

Four points are important for the public to note.

First, similar multidrug-resistant strains of bacteria have been [detected](#) in the United States, Europe, Asia and Australia. This is a global issue.

Second, the data could have been much worse. We did identify antibiotics that are still effective even against the most resistant bacterial strains we studied.

Third, there are efforts in place in [Nigeria](#) and other [African countries](#) to limit the spread of resistant microorganisms.

Fourth, there are things that everyone can do to help bring antibiotic resistance under control. For example, the US Centers for Disease Control and Prevention list [five things](#) that everyone should know about drug resistance and [10 activities](#) to protect yourself and your family against [resistance](#).

This is a global battle that we need to win.

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