# Wastewater is a valuable source of information—Africa's scientists need to use it to find drug-resistant bacteria

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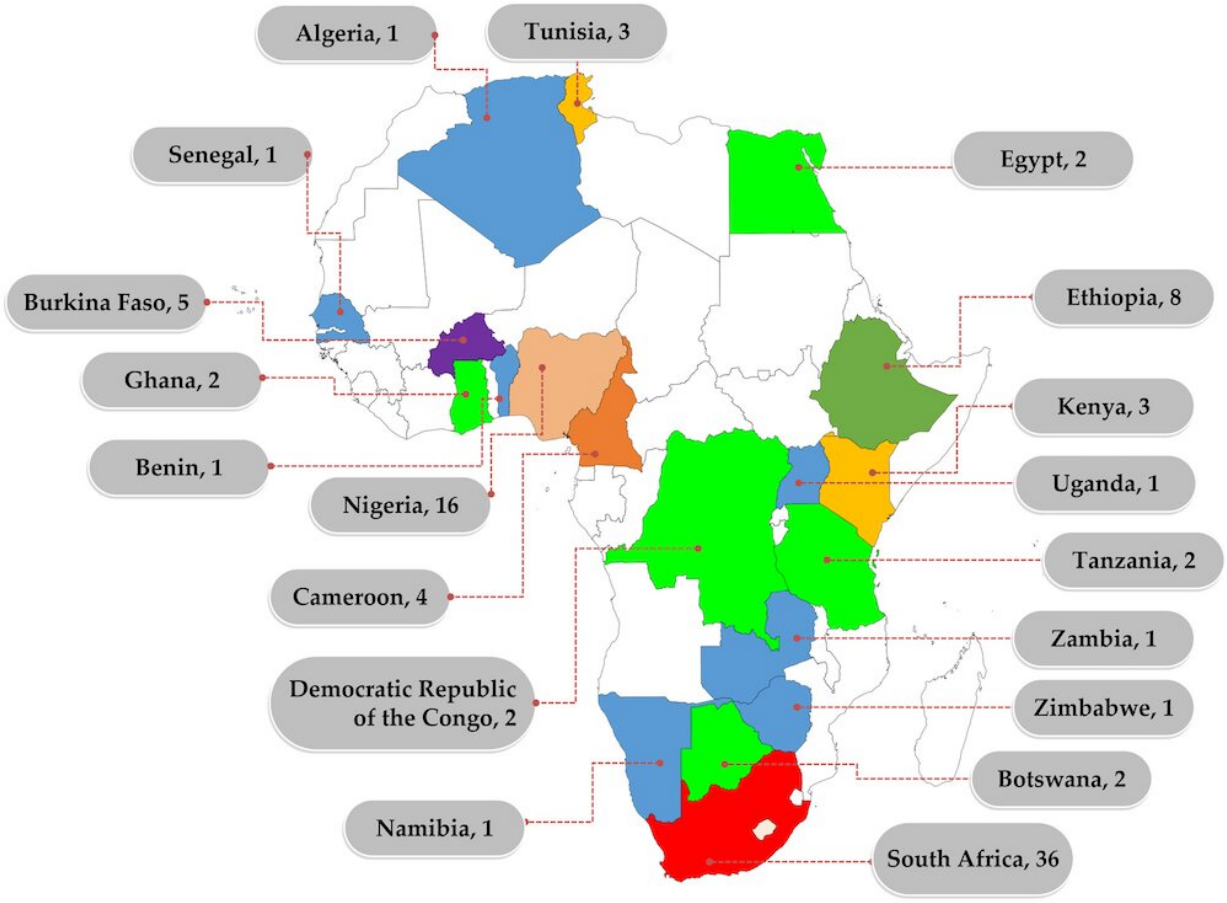


Distribution of African studies on antimicrobial resistance in wastewater between 2012 and 2022. Numbers represent the number of studies identified within the reviewed period. Only counties that reported at least one study in the review period are labelled. Credit: The Conversation

People often think of wastewater as serving no purpose. But it can be a valuable source of information. Wastewater is increasingly recognized as a significant environmental reservoir for antimicrobial resistance—a growing global public health threat.

Antimicrobials are medicines, including antibiotics and antivirals, used to treat infections in humans, animals and plants. But the excessive use of antimicrobials has resulted in many microorganisms becoming resistant to these important medicines. This, in turn, has led to the development of complicated and sometimes untreatable diseases.

Antimicrobial resistance is expected to kill over 10 million people annually by 2050 if nothing is done to stop it. In sub-Saharan Africa, 23.5 deaths out of every 100,000 are attributed to diseases such as lower respiratory, chest, bloodstream and intra-abdominal infection caused by antimicrobial-resistant organisms.

These organisms are all around us. For instance, research done on pigs in South Africa found resistant bacteria at all the stages of sampling, from the farm to the final packaged meat. Another South African study found that manure from a poultry farm transferred antibiotic-resistant bacteria to the soil. Heavy rainfall could wash these bacteria into nearby rivers. As a result, people who use water from these rivers for drinking and household purposes could get sick.

Wastewater treatment plants receive wastewater from a variety of sources: hospitals, households, industries and farms. This makes the plants useful proxies for determining the burden of antimicrobial resistance in communities. By monitoring wastewater, scientists can determine the types of resistant bacteria circulating in a given population. This approach is becoming the global gold standard for

tracking antimicrobial resistance.

But it doesn't seem to have been adopted in many African countries yet. Our recent research looked at studies done on wastewater in African countries between 2012 and 2022. We wanted to identify the challenges in using wastewater surveillance to determine the prevalence of antimicrobial resistance.

We found that using wastewater to study antimicrobial resistance was increasing on the continent. But not in all countries. In most of the studies we found samples were only collected once. This is not sufficient to draw strong conclusions. Furthermore, many studies used only one method to identify resistance in the wastewater. Depending on the method, this either overestimated or underestimated the rate of resistance. With these gaps, studies within the continent could be presenting a false picture of the antimicrobial resistance problem, which could have severe health implications.

## Case studies

We reviewed studies on wastewater-based surveillance of antimicrobial resistance in sub-Saharan Africa. Our study showed that most countries lacked the necessary skills to conduct this research. The lack of skills affected the methods that the studies used, hence the results presented.

Most of the research was done in South Africa. That's largely because most sub-Saharan countries simply do not have enough wastewater treatment plants. Many treat less than 5% of the wastewater they generate. Only a few countries, among them South Africa and neighboring Botswana, treat 25% to 50% of their wastewater. This means there is more to be learned from these countries.

In South Africa, studies on antimicrobial resistance in wastewater were

done in only a few of the provinces. Also, not all the studies were done on wastewater treatment plants. This means the source of the resistance could not be traced. In addition, there were differences in the methods used and the results reported.

We found monitoring challenging even where wastewater treatment plants were available because of the lack of technical skills needed for genomic sequencing. Genomic approaches study the DNA of all the microrganisms in the wastewater, instead of focusing on only a few. Furthermore, there are no standardized approaches to these studies. So, it was difficult to compare findings from different locations.

## Recommendations

The absence of wastewater treatment plants in many African countries means that it will be hard for them to actively implement wastewater-based antimicrobial resistance surveillance. Governments must invest in connecting their populations to sewer networks to address this problem. This is crucial for overall hygiene and health. And it will offer important sources of information for researchers trying to detect resistant microorganisms in communities.

Once sewer networks are in place, standardized protocols for assessing antimicrobial resistance in wastewater treatment plants must be established. The protocols should consider the sampling regime and frequency, the organisms targeted, what antibiotics need to be tested, and what methods should be used.

There is also a need to build capacity in sequencing technologies and bioinformatics. This will ensure that there are enough people with the knowledge required to analyze the large volumes of data generated in these studies. Funding bodies must finance researchers in sub-Saharan countries as sequencing technologies are not yet widespread, and the cost

of using these facilities is still high.

People may consider wastewater as something undesirable that just needs to be flushed away. But studying this valuable resource could provide early warning about potential disease outbreaks, especially those involving antimicrobial-resistant microorganisms.



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