

Brief summary

July, 2021

High levels of antibiotic resistant organisms in two rivers in Ghana - a need to improve waste disposal

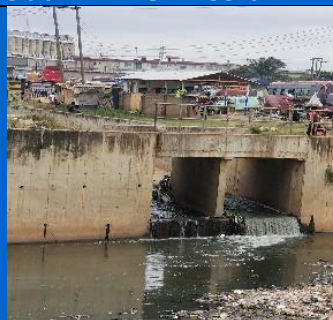
Banu et al. 2021

<https://doi.org/10.3390/tropicalmed6020105>

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**Fig.1a Upstream
Odaw River Accra**



**Fig.1b Downstream
Odaw River Accra**

Key Messages

- This study showcases outcomes from a survey of antibiotic resistant bacteria in two rivers in Ghana located in - Accra and Kasoa - using the WHO Tricycle protocol.
- Majority of water from both cities (98%) was positive for the antibiotic resistant bacteria called Extended Spectrum Betalactamase *E. coli* (ESBL-Ec).
- Contamination of the rivers took place by waste water as they flowed from upstream to downstream through the cities. On average there was an 80-170 times increase in the concentration of ESBL-Ec as the rivers moved downstream.
- ESBL-Ec can cause difficult-to-treat infections in human and animals, and therefore urgent action is needed to reduce contamination of rivers and to educate people of the safe use of water from affected rivers.

What is the problem and why is it important?

Resistance to antibiotics is mainly driven by antibiotic misuse in humans and animals. The environment is known to play a role in the development and spread of resistant bacteria, however this role is relatively unidentified especially in low- and-middle income settings. *E. coli* resistant to third generation cephalosporins causes infections which are difficult to treat in humans and are known to be on the increase in Ghana. In this study we report on ESBL-Ec concentrations in two rivers in Accra and Kasoa, Ghana.

How did we measure it?

A total of 96 surface river water samples were taken. Water samples were collected from a source with little pre-city influence (upstream)(Figs.1a & 2a), and a downstream point (Figs.1b & 2b) further away (20kilometers: Avenor and 10Kilometers :Kasoa) from the upstream point of the Odaw River in Accra and the Okurudu River in Kasoa. In addition, two other samples on human and animal waste water were taken from a downstream point in both rivers. Water samples were taken monthly over 12-months and analysed at the water research institute microbiology laboratory. Concentrations of ESBL-Ec were determined per 100ml (half glass) of river water. We used the WHO-recommended Tricycle Protocol in our study.



**Fig.2a Upstream
Okurudu River Kasoa**



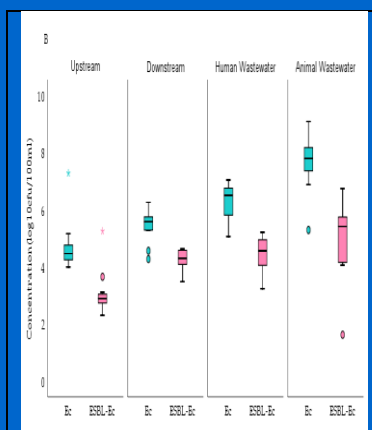
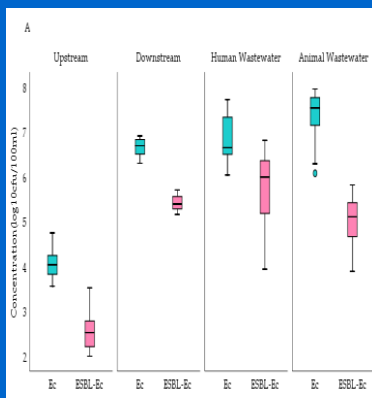
**Fig.2b Downstream
Okurudu River Kasoa**

What did we find?

- High concentrations of *E.coli* resistant to 3rd generation cephalosporins also known as ESBL-Ec were found in the two rivers. On average every 100mls contained between 3,000 to 230,000 counts of resistant bacteria. The sources of this contamination contribute to the spread of antibiotic resistant bacteria among humans and animals in Accra and Kasoa.
- In downstream river waters ESBL-Ec were 10 times greater in Accra compared to Kasoa(Fig.3).
- Levels of *E. coli* detected were between 10 and 100 times above WHO guideline thresholds for irrigation of crops.
- Our study also shows that it is feasible to use WHO Tricycle Protocol to survey antibiotic resistant bacteria in water even in low resource settings.

Implications

- This study suggests that river water may be contributing to the spread of antibiotic resistance among humans and animals through contaminated food and direct contact.
- Carriage of ESBL among the human population could result in difficult-to-treat infections such as urinary tract and bloodstream infections.
- High fecal contamination of rivers is likely a result of poor disposal of untreated wastewater into the environment.
- Environmental contamination can be reduced through strict enforcement of by-laws on wastewater disposal by the Environmental Protection Agency and the Ministry of Sanitation and Water resources
- Immediate action is required to educate people living around the rivers on the safe use of the river water and proper waste disposal practices.



**Fig.3 *E. coli* and ESBL-Ec
in Accra (A) and Kasoa
(B) for the periods**

