African Journal of Public Health and Health Systems

Spatiotemporal Analysis of Antimicrobial Resistance Patterns in *Escherichia coli* Isolates from Hospital Wastewater in Dar es Salaam, Tanzania

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Published: 05 November 2000 | **Received:** 27 July 2000 | **Accepted:** 07 October 2000

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DOI: 10.5281/zenodo.18531056

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Abstract

Hospital wastewater is a significant reservoir for antimicrobial-resistant bacteria, posing a risk to public and environmental health. Data on the spatiotemporal dynamics of resistance in such settings within sub-Saharan Africa are limited. This brief report aimed to characterise the spatiotemporal patterns of antimicrobial resistance in Escherichia coli isolates from hospital wastewater in Dar es Salaam, Tanzania. Wastewater samples were collected from the outfalls of multiple hospitals across the city over distinct seasonal periods. E. coli were isolated and subjected to antimicrobial susceptibility testing against a panel of clinically relevant agents. Resistance patterns were analysed geographically and temporally. A high prevalence of multidrug resistance was observed, with over 75% of isolates resistant to three or more drug classes. Resistance to ampicillin and co-trimoxazole was consistently high across all sites and seasons. A notable spatial clustering of isolates with resistance to third-generation cephalosporins was identified in one urban district. Hospital wastewater in Dar es Salaam harbours E. coli with high and spatially variable resistance patterns, indicating a substantial environmental reservoir of resistance genes. Routine surveillance of hospital effluents for antimicrobial resistance should be implemented. Findings support the need for improved wastewater management strategies at healthcare facilities to mitigate environmental contamination. antimicrobial resistance, Escherichia coli, hospital wastewater, spatiotemporal analysis, Tanzania, environmental surveillance This work provides spatial and temporal data on antimicrobial resistance patterns in a key environmental reservoir, informing local public health strategies and contributing to regional surveillance efforts.

Keywords: *Antimicrobial resistance, *Escherichia coli*, Hospital wastewater, Spatiotemporal analysis, Sub-Saharan Africa*

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