# Community Exposure Assessment to Anti-microbial Resistance (AMR); case study of Malawi


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## I. Background

- Anti-microbial resistance is currently one of the greatest global health threat (CDC, 2020, WHO, 2020).
- Efforts have previously focused on the healthcare sector through antibiotic stewardship and surveillance (Cueni, 2020)
- Poor water, sanitation and hygiene (WASH) practices and infrastructure contribute to the transmission of resistant bacteria (Iskandar et al., 2020)
- Low-and middle-income countries (LMICs) such as Malawi have pre-existing WASH challenges, which increase the risk of population exposure to AMR (Cassivi et al., 2020).
- There is an existing knowledge gap regarding the prevalence of AMR in the wider community environment (Ahammad et al., 2018)

## II. Study Objectives

**Main study objective**

- Examine potential human and animal exposure to AMR in public spaces in both urban and rural settings in Southern Malawi

**Specific objectives**

- Understand contributing practices to environmental contamination and exposure.
- Identify potential risk pathways of exposure in the environment
- Determine the presence of resistant ESBL *E. coli* and *K. pneumoniae* in the exposure pathways

## III. Methods

- Data collected monthly from September 2020-April 2021
- Method based on the principles of the Sanipath tool (https://www.sanipath.net)
- Conducted in 3 study sites; Ndirande (Urban), Chileka (Peri-urban) and Chikwawa (Rural)
- In-depth Interviews with community leaders (n=9) selected purposively to understand the WASH status in the study sites
- Transect walks in 3 sections of each study site to identify potential transmission pathways
- 40 environmental samples from potential transmission pathways collected every month at each study site (n=120/month)
- Thematic analysis was used to generate themes from the interviews
- Samples were pre-processed (filtration, enrichment) and then grown on ESBL CHROMagar™ media to identify ESBL *E.coli* and ESBL *K. Pneumoniae* isolates.
- Univariate analysis conducted using Stata 14.0 (College Station, TX: StataCorp LP) to describe the data.

Figure 1: Data collection team

Figure 2: Sample collection from a drain

## IV. Results: Interviews & transect walks

**Infrastructure:**

- Poor bathrooms and latrines leading to open drains

**WASH practices:**

- Poor solid waste disposal in the urban and peri-urban
- Poor animal waste management and disposal.

**Perceived Risk:**

- Open wells and rivers perceived as safe sources of water for household chores but not for drinking.

**Identified transmission pathways**:

- Drains
- Standing water
- Areas of frequent hand contact (e.g. borehole handles)
- Soil (dumping sites and playing areas).

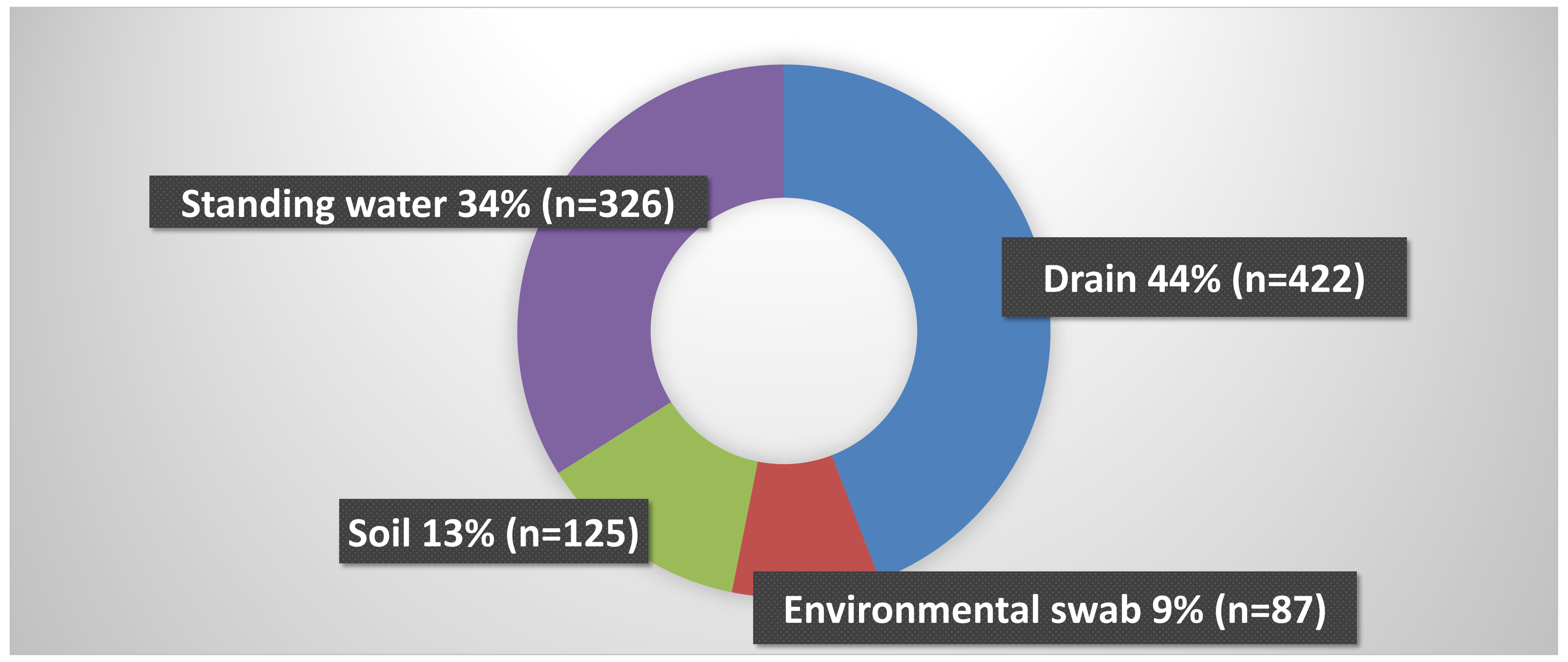
(Examples of transmission pathways shown in **Figure 4**)

| Pathway | Type of exposure |
| --- | --- |
| Drain water | Contact/ingestion |
| Standing water | Contact/ingestion |
| Bathing water | Contact/ingestion |
| Public taps | Contact |
| Waste disposal sites | Contact/ingestion |
| Broken pipes | Contact/ingestion |
| Soil | Contact/ingestion |
| Animals | Contact |

## IV Results: Transmission pathways


**Figure 4:** Transmission pathways: **(a)** Standing water **(b)** Drain **(c)** Soil-Dumping site **(d)** Soil-Animal slaughter area **(e)** Environmental swab-Borehole handle)

## IV. Results: Microbiological samples




**Environmental swabs collected from areas of frequent communal contact e.g. borehole handle

**Figure 5: Sample distribution per type**

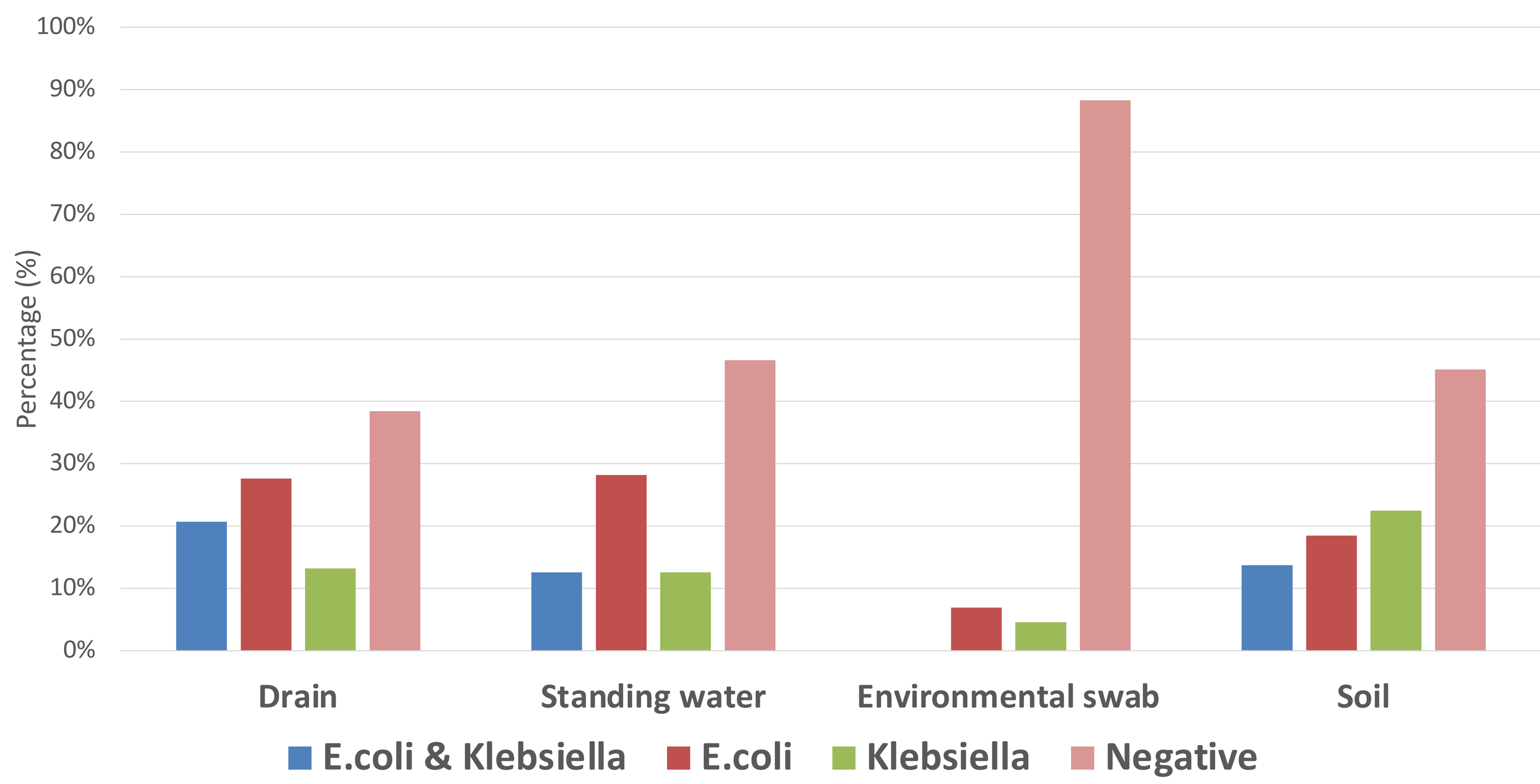



**Figure 6: ESBL Positivity per sample type, stratified by bacterial species**

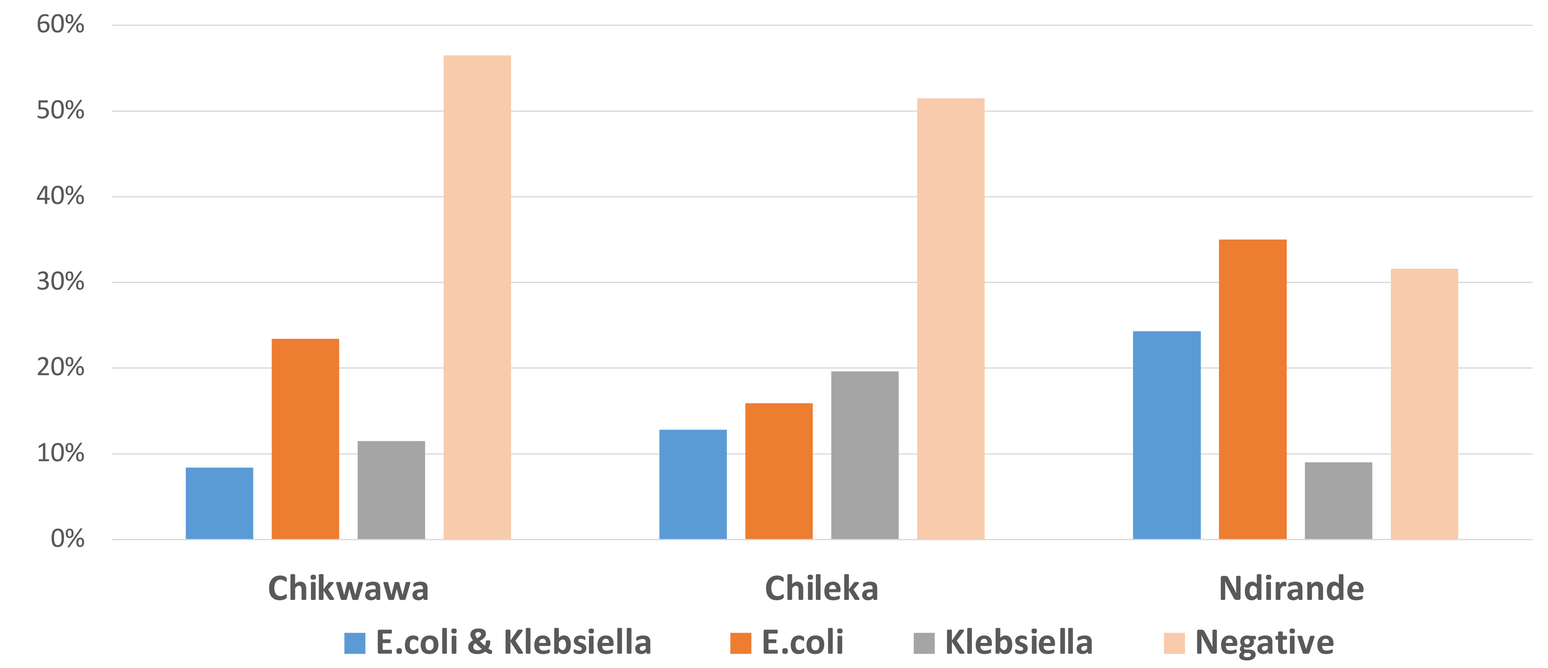



**Figure 7: ESBL Positivity per site, stratified by bacterial species**

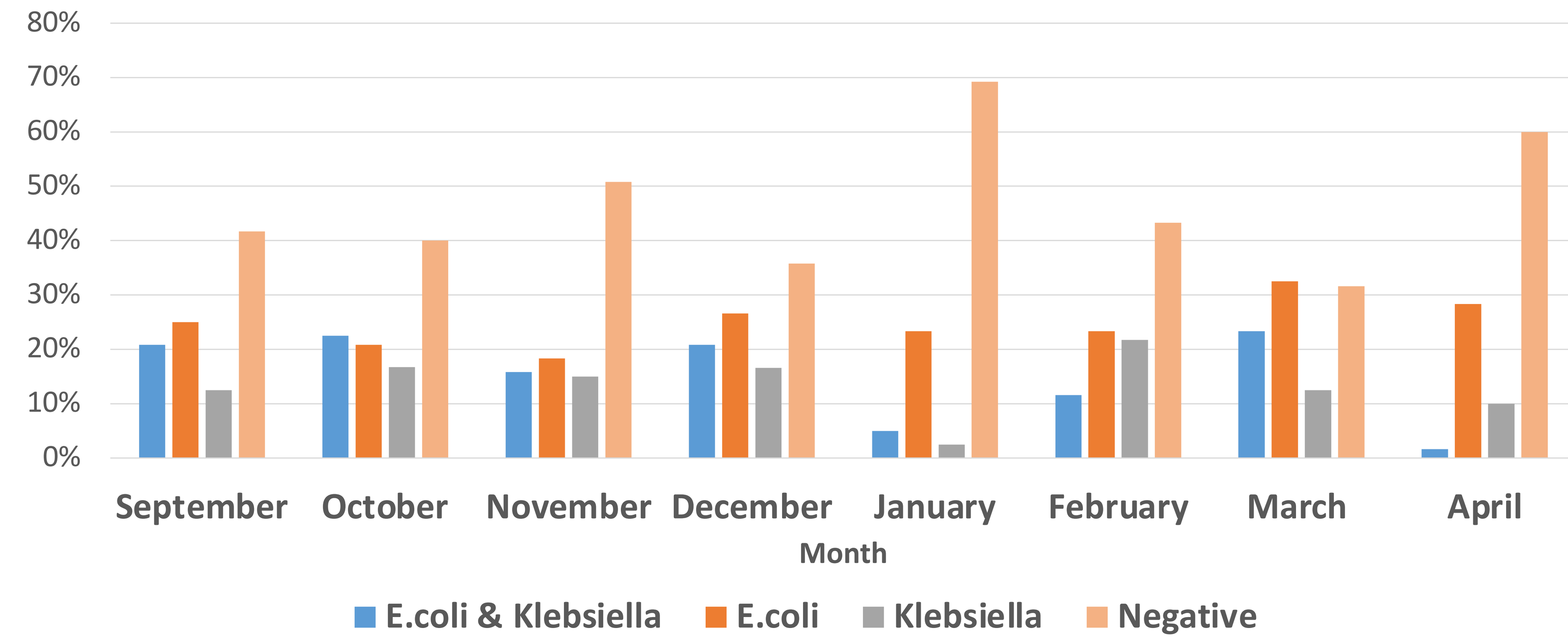



**Figure 8 : ESBL positivity per site each month, stratified by bacterial species**

## V. Conclusions

- Poor hygiene practices & infrastructure in communities, lead to contaminated environments which are potential transmission pathways for AMR.
- Drains and standing water are the major transmission pathways in community environments.
- Presence of ESBL *E.coli* & *K. pneumoniae* in over half of the transmission pathways in the urban site indicates a greater exposure of the urban population to ESBL *E.coli* & *K. pneumoniae.*
- The persistence and high levels of ESBL bacteria throughout both wet and dry seasons point towards a continued and ongoing risk within the broader environment
- Environmental water, sanitation and hygiene conditions need to be improved to reduce transmission of resistant bacteria.

## VI. Citation


Ahammad, S., Arduino, M., Husman, A. M. de R., Durso, L., Edge, T., (2018). *Initiatives for Addressing Antimicrobial Resistance in the Environment: Current Situation and Challenges*. https://wellcome.org/sites/default/files/antimicrobial-resistance-environment-report.pdf

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