

Drivers of Resistance in Uganda and Malawi: The DRUM Consortium



DRUM

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A One Health approach to understanding how water, sanitation and hygiene practices interact with antimicrobial usage to facilitate the transmission of AMR-bacteria in Uganda & Malawi

The growing threat of **antimicrobial resistance (AMR)** is well recognised. Low- and middle-income countries are likely to be more severely affected due to overstretched health systems and poor access to alternative antibiotic regimes.

Despite this, there is much that is not understood about:

1 How antimicrobial resistance (AMR) transmission occurs

2 How microbes evolve to develop resistance

3 How human use of antibiotics and WASH practices contribute to AMR transmission

4 How AMR effects the cost of healthcare

5 How AMR policy is developed and implemented

The DRUM consortium will take a One Health approach to understanding how water, sanitation and hygiene practices interact with antimicrobial usage to facilitate the transmission of AMR-bacteria in Uganda & Malawi.

We will address how human behaviour and antibacterial usage in urban and rural Africa leads to the transmission of AMR amongst *E. coli* and *K. pneumoniae* in humans, animals and the environment. DRUM seeks to develop agent-based models that will enable the prediction of how these transmission pathways can be interrupted in order to design interventions to reduce AMR spread.



DRUM is a consortium of researchers working across the One Health spectrum to understand pathways of AMR within communities. We will then create a model which allows us to test hypothetical methods of disrupting those pathways to prevent AMR.



DRUM is comprised of 5 packages of work (see reverse of sheet):

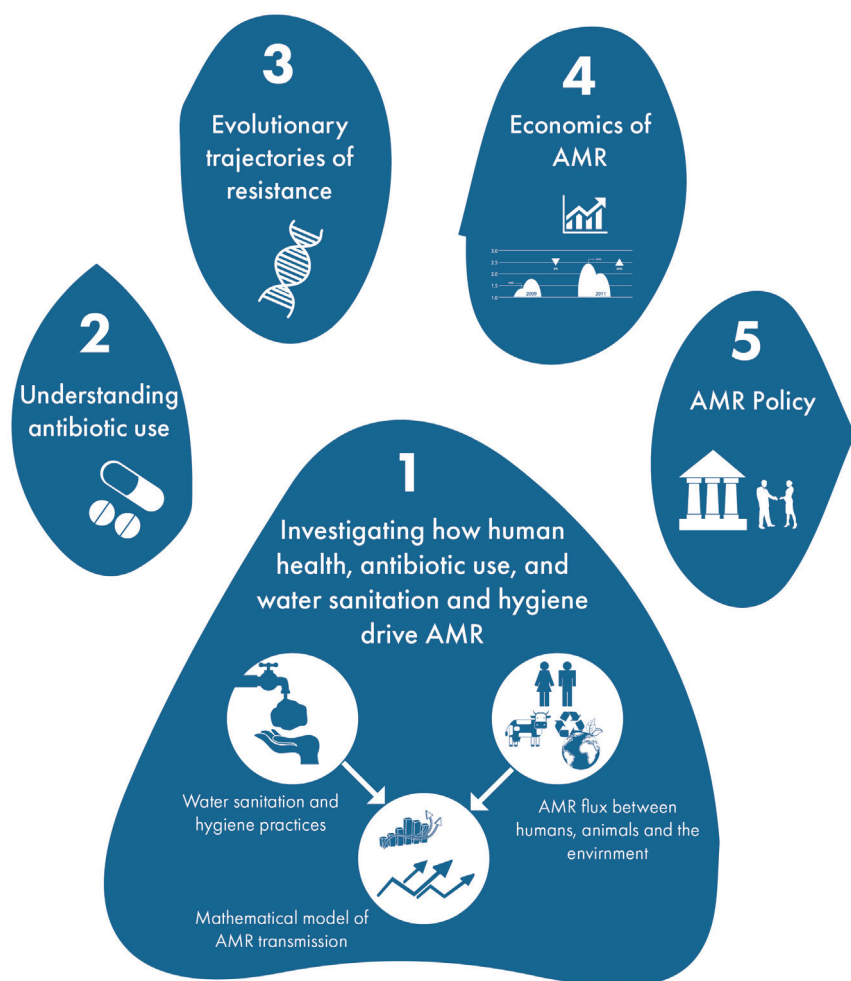
1. Investigating how human health, antibiotic use, and water sanitation and hygiene drive AMR
2. Understanding antibiotic use
3. Evolutionary trajectories of resistance
4. Economics of AMR
5. AMR Policy

Partners:

- African Institute for Development Policy (AFIDEP)
- Centre for Ecology and Hydrology (CEH)
- Infectious Diseases Institute (IDI)
- Lancaster University
- Liverpool School of Tropical Medicine (LSTM)
- Makerere University College of Health Sciences
- Malawi Liverpool Wellcome Trust (MLW)
- Ministry of Health of Malawi
- University of Liverpool
- University of Strathclyde
- Wellcome Sanger Institute



DRUM work packages



1. Investigating how human health, antibiotic use, and WASH drive AMR

We will work in households in urban and rural Uganda and Malawi, to look for AMR in people, animals and the environment. These findings will be related to antibiotic use and people's exposure to the environment. This is because AMR has been found in water, faeces, and wastewater in low-income countries, and is compounded by a lack of faeces management, multiple uses of water and poor hygiene practices. Using both qualitative and quantitative methods, our study will examine the potential pathways for faecal-oral transmission, including infrastructure, current WASH practices and the drivers of these practices.

These data will then be incorporated into a mathematical model of AMR-

bacteria transmission to untangle the real-world complexity of transmission and uncover the general principles of what makes some people more susceptible to AMR than others. This "agent-based" approach will allow us to explore the efficacy of community-level responses to health interventions.

2. Understanding antibiotic use

Globally, AMR has often been framed as a problem caused by the way individuals use or 'misuse' antibiotics, particularly in low- and middle-income countries where there are weak regulatory frameworks. Responding to this framing, the Global Health focus has often been on ways to change individual behaviour through awareness raising campaigns. In contrast, there has been less attention paid to the context in which antibiotic use is enacted. Our work seeks to understand how and why

medicines are used and the ways in which antibiotics are embedded in different contexts.

3. Evolutionary trajectories of resistance

The evolutionary pathways to antibiotic resistance and their overall effects on bacteria are varied. Becoming resistant to antibiotics normally comes at a cost to bacteria, but resistance can emerge in multiple ways, sometimes resulting in extensively resistant bacteria that are stronger or "fitter" even in the absence of antibiotic selection pressure. We will use a combination of molecular and microbiology to determine how our target bacteria evolve in response to different antibiotics.

4. Economics of AMR

AMR impacts health, but little is known about how this translates into the cost of providing healthcare in Africa. Resistance to commonly used antimicrobial agents in the region is likely to result in more costly or intensive use of healthcare services by those affected. To better understand this, we aim to explore the impact of AMR on the costs of providing inpatient medical care to estimate the current and future economic burden of AMR at national levels.

5. AMR policy

Understanding the policy process for AMR in Malawi and Uganda at national and district level will help to identify structural barriers between the two countries and within the political and regulatory sectors. Using an ethnographic approach, we have already conducted interviews with key individuals involved in the formulation of policy and regulation related to combating AMR in Malawi and will replicate this in Uganda. One output of this research has been to identify key governmental structures where AMR policy is developed and monitored.