

Attributing the source of antimicrobial resistant diarrheal pathogens in African children

Supervisory team:

Main supervisor: Prof Samuel Sheppard (University of Bath)

Second supervisor: Prof Andrew Dowsey (University of Bristol)

Dr Jahangir Hossain (MRC Unit, the Gambia @ the London School of Hygiene and Tropical Medicine), Dr Ben Pascoe (University of Bath)

Collaborators: Prof Martin Maiden (University of Oxford)

Host institution: University of Bath

Project description:

Diarrhoeal disease is a major cause of mortality among children in low-income countries. Joining a large MRC funded program you will collect and sequence metagenome samples to quantify the relative contribution of different antimicrobial resistant pathogens to human infection. Time spent in Bath, Bristol and The Gambia will help understand transmission networks, and bioinformatics and machine learning risk models will identify effective interventions.

House crowding, cohabitation with animals and poor sanitation/food safety are all potential risk factors, but effective interventions depend upon quantitative estimates of infection sources. Genome sequencing technologies and bioinformatics analyses provide a means for explaining these cryptic disease networks by identifying differences between strains and tracking transmission.

Building on an established collaborative network in the UK and The Gambia, we will develop a program of globalized enteropathogen surveillance. Specifically, we will: (i) sample and genome sequence thousands of isolates from multiple sources; (ii) develop databases and novel analysis pipelines (machine learning) to identify source attribution markers; (iii) quantify the relative contribution of different human infection sources; (iv) use a cost-benefit risk models to identify the most effective interventions in the transmission network. This evidence-based approach will enable effective local interventions and reduce the burden of diarrhoeal disease.

This interdisciplinary project provides an ideal context for a student to tailor their PhD towards their own interests. From the outset, the project builds on established international collaborative network, substantial MRC funding (>£1.2M) and a detailed project plan. Far from being restrictive, this gives the student the opportunity to focus their efforts towards their preferred specialism(s). In the initial 3 months you will experience all aspects of the project. Commencing with a visit to The Gambia, you will take part in environmental and cross-sectional sampling with patients and local clinical leads. Next, you will work with microbiologists in the MRC Unit (The Gambia) to culture isolates, differentiate species, conduct antimicrobial resistance assays, and extract DNA (including metagenomes). In Bath you will conduct genome sequencing and be trained in genome assembly, QC, archiving and primary bioinformatic analyses – including phylogenetics and identification of putative AMR genes. Finally, study in Bristol will teach AI analyses and machine learning.

You will have a multidisciplinary supervisory team and a supportive and stimulating training environment to guide you through the challenges and rewards of this project – the results of which will have a profound impact on children's health in Africa.