Antimicrobial resistance (AMR) is a growing concern. It threatens the effectiveness of existing treatments against many infectious diseases. Low- and middle-income countries are at most risk, particularly as local and national healthcare approaches are often not set up to tackle the problem. Makeda Semret, Cédric Yansouni, and colleagues at McGill University, Canada, partnered with Addis Ababa University, Ethiopia, to develop a sustainable clinical bacteriology sector at the Tikur Anbessa Specialised Hospital in Addis Ababa. The project’s success demonstrates that local interventions can lead to sustainable improvements in approaches to AMR.

AMR threatens the effectiveness of existing treatments against very common infectious illnesses like urinary tract infections, appendicitis, or infected wounds. Treatments then become costly or even impossible for previously curable diseases, leading to prolonged illness or death in susceptible patients. Without effective antimicrobials, medical procedures, such as surgeries and cancer chemotherapy become risky, as the risk of infections increases.

Even though there are innovative antimicrobials in clinical development, their development is not fast enough to combat the exponentially growing threat of AMR. If no significant measures are taken to curb the rising threat of AMR, it is estimated that the burden of AMR will increase to 10 million deaths per year by 2050. This dwarfs the number of fatalities caused by malaria, tuberculosis, and HIV combined.

Currently, the highest rates of AMR are reported from low- and middle-income countries (LMIC). Of those, sub-Saharan African countries are the least prepared to face the socioeconomic costs of AMR due to a lack of health infrastructure in place, particularly diagnostic testing capacity. Among other factors, the focus on single- disease control programmes instead of overall health systems has led to many aspects of patient care being neglected.

The WHO’s Global Strategy for Containment of Antimicrobial Resistance recognises that clinical microbiology diagnosis is essential to combat AMR. This is because identifying the exact cause of infections and identifying only the patient populations that require antimicrobials ensure the appropriate use of antimicrobials, which then prevents overuse. The committee addresses three strategies for data surveillance, appropriate use of antimicrobials (antibiotic stewardship), and infection control. Sub-Saharan Africa, however, has almost no clinical hospital laboratories that provide bacteriology diagnostics services to international standards.

DIAGNOSTIC TESTING IN ETHIOPIA

Let’s explore a case study in sub-Saharan Africa: Ethiopia. With 110 million inhabitants, Ethiopia is the second most populous country in Africa. Access to basic health care services has improved over the past two decades, but advanced therapies are only available in specialised hospitals in urban areas. Even in urban referral centres, there is little access to bacteriology diagnostic testing. The lack of diagnostic results means healthcare providers are working with a blindfold, unable to identify the specific infection a patient may be suffering from and unable to determine whether patients would benefit from antibiotics. As a result, patients are often put on multiple, broad-spectrum antibiotics or prescribed antibiotics unnecessarily. This has led to significant overuse, in Ethiopia, up to 85% of hospitalised patients are on antibiotics on any given day.

Ethiopia also lacks the infrastructure and institutional capacity to monitor trends of AMR, as data collection is limited to local hospitals and small cohort studies. Consequently there are large gaps in understanding the actual burden of AMR in the community, making it difficult to formulate effective treatment strategies.

THE IMPORTANCE OF DIAGNOSTIC TESTING

Cédric Yansouni from McGill University, along with researchers from institutions across the United States and Canada, have allowed more effective treatment by detecting these resistant bacteria. Being able to target treatment is key to controlling AMR and has knock-on effects, as correct diagnoses can minimise the patient’s stay in hospital and the resources needed for treatment. Using bacteriology testing to guide treatment, also known as culture-guided therapy, can significantly decrease mortality in conditions like severe sepsis, as inappropriate antimicrobial use has been recognised as a major contributor to deaths.

LABORATORY STRENGTHENING IN ETHIOPIA

Despite international recognition of AMR and the value of diagnostic testing, solutions are not straightforward. High-level recommendations from WHO on AMR containment are frequently in direct conflict with local institutional priorities.

The lack of diagnostic results means healthcare providers are working with a blindfold, unable to determine whether patients would benefit from antibiotics.
and with the attitudes and experience of individual healthcare providers in LMICs. Makeda Semret, Cedric Yansouni, and a team from McGill University worked with researchers from Addis Ababa University to understand the factors needed to ensure sustainable change.

They established the Addis Ababa–McGill Partnership in Infectious Diseases to address training gaps, provide opportunities for innovative research and, importantly, focus on measures that would improve the quality of care and safety of patients in LMICs. They conducted a project to strengthen the clinical bacteriology service at the Tikur Anbessa Specialised Hospital (TASH), the largest referral hospital in Ethiopia with approximately 20,000 admissions annually.

Before this project, TASH had few quality measures in place, communication between clinicians and laboratory staff members as well as credibility of the laboratory results were weak. Protocols from the McGill University Health Centre (MUHC) were adapted for healthcare professionals at TASH, with local realities including availability of reagents and equipment in Ethiopia, level of training and language proficiency of personnel in mind. Three microbiologists from MUHC (Semret, Yansouni, and Michael Libman) visited TASH on a regular basis to provide direct supervision and formal training sessions with local technologists, instilling a SOP culture in TASH healthcare professionals. The Ethiopian Public Health Institute assisted in a collaborative effort and urgency from local and ministerial levels, as well as prioritization of bacteriology diagnostics for AMR containment.

The team's short-term success at TASH demonstrates that local interventions to strengthen clinical bacteriology laboratories are feasible in low income countries. However, it also highlights the importance of having a holistic approach and gaining support from organisational leadership to ensure the changes in culture and practice are sustainable. For example, providing the clinical and financial impact of this work to policymakers yields the information they need to provide the appropriate budget and support to diagnostic bacteriology laboratories, so they can adopt routine quality-assured bacteriology testing as essential to AMR containment. If clinical microbiology is recognised as a specialty in sub-Saharan Africa, expertise in this area can be fostered to produce a new generation of skilled microbiologists.

The major factors that contribute to widespread AMR still remain in Ethiopia and across sub-Saharan Africa. Weak supply chains for bacteriology reagents, lack of comprehensive policies that address regulatory and fiscal obstacles for the diagnostic sector outside the laboratory, and a perennial lack of practical application of quality assurance measures in place to provide direct supervision and formal training sessions with local technologists, instilling a SOP culture in TASH healthcare professionals. The Ethiopian Public Health Institute assisted in a collaborative effort and urgency from local and ministerial levels, as well as prioritization of bacteriology diagnostics for AMR containment.

SCALING-UP BACTERIOLOGY AS THE CORNERSTONE OF AMR CONTAINMENT

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Within 18 months of implementing these interventions, bacteriology laboratory use increased from an average of 15 to 75 samples per day. Standardised automated blood cultures and antimicrobial susceptibility testing are now routine procedures, with up to 50 blood culture specimens processed every day. Data from these routine tests were recorded and submitted for national and global AMR surveillance, as part of the Global Antimicrobial Surveillance System. Following the success at TASH, efforts are underway to scale-up versions of this intervention in other large hospitals in Ethiopia.

As well as strengthening the laboratory, the team implemented a number of new initiatives, such as antimicrobial stewardship to steer clinicians towards evidence-based prescribing of antimicrobials. Taken together, all these measures resulted in a 50% reduction in antibiotic use in hospitalized patients. Strikingly, the savings resulting from lower antimicrobial use were slightly greater than the annual cost of laboratory reagents, making the intervention financially feasible in addition to being clinically beneficial.

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