# Tackling the Threats of Antimicrobial Resistance (AMR) through Building Capacity in Laboratory Services in the Pacific Region

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## Keywords

*antimicrobial resistance, laboratory service, Pacific*

## Abbreviations

*AMR = antimicrobial resistance*
*AST = antimicrobial susceptibility test*
*ATCC = American type culture collection*
*CLSI = Clinical Laboratory Standards Institute*
*EUCAST = European Committee on Antimicrobial Susceptibility Testing*
*MROs = multi resistant organisms*
*PICTs = Pacific island countries and territories*
*SPC = The Pacific Community*

## Introduction

Globally, antimicrobial resistance (AMR) is among the top 10 global public health and development threats that require urgent and comprehensive multisectoral actions.[1,2] In 2019, it was estimated that AMR was directly responsible for 1.27 million deaths and associated with 4.95 million deaths worldwide.[3] It is predicted that AMR could kill 10 million people per year by 2050.[4] AMR poses significant threats to the most vulnerable countries that are affected by natural disasters and climate change.[5] Antimicrobials are increasingly ineffective, thus making it harder to treat infections, and consequently causing severe illness. For example, the number of antibiotic resistant tuberculosis strains are increasing and threatening to tackle the tuberculosis epidemic. It is well recognized that the economic impact of AMR is substantial due to prolonged illness, disability, and death.[2] For example, AMR affects the productivity of patients and their families through prolonged hospital stays, intensive care treatment, and/or expensive medications. This compounds the challenges for nations' health care systems and economic development, particularly in the Pacific island countries and territories (PICTs) where resources are limited to effectively address AMR. Of the several drivers contributing to the increase in AMR, this article focuses on the key issues related to laboratory services in the Pacific, countries' efforts in addressing them, and the call for more targeted investment and actions to address AMR in a holistic multisectoral approach.

## Key Issues Related to Laboratory Services that are Contributing to the Development of AMR in the Pacific

Evidence has shown that the misuse and overuse of antimicrobials, including antibiotics, antivirals, antifungals, and antiparasitics, are the main drivers of drug resistance.[1,2] In the Pacific, these issues are compounded by the challenges faced in providing quality laboratory services.[5] For example, PICTs have limited: (1) laboratory surveillance systems to properly monitor and generate data on AMR; (2) capacity and skills in testing quality-assured antimicrobial resistance and susceptibility; (3) knowledge on the importance of quality control testing process and resources to detect multi-resistant organisms (MROs); and (4) regulations and guidelines on antimicrobial use among humans and animals.[5] These challenges can lead to poor quality AMR reports and unreliable antibiograms, resulting in the use of inappropriate antibiotics and further worsening AMR in the region.

The development of an accurate and reliable antibiogram at a national level can only be achieved if microbiologists are properly trained, have the required resources to perform a quality antimicrobial susceptibility testing (AST), and implement quality assurance in all processes. These include the pre-analytical phase (eg, collection of samples and transportation to laboratories), the analytical phase (eg, processing of samples in which organisms are grown, identified, and undergo antibiotic testing ), and the post analytical phase (eg, reporting of AST results following approved international guidelines, such as from the Clinical and Laboratory Standards Institute [CLSI] and the European Committee on Antimicrobial Susceptibility Testing [EUCAST].[6]

Quality-assured ASTs are critical given that the use of appropriate antimicrobials against specific pathogens is guided

through AST results. ASTs need to be done properly to yield timely, accurate, and reliable results to guide clinicians in the selection of effective antimicrobial agents to properly treat patients. However, the capacity and capability of microbiology testing in low resourced small island developing states across the Pacific region have been a major concern[5] and there is an urgent need to upskill laboratory services. For example, most of the laboratories in PICTs do not have qualified microbiologists and there has been little attention from respective governments and donor agencies to invest in building laboratory capacity to improve services.[5]

## Efforts in Addressing AMR through Building Capacity on Laboratory Services

Recognizing the challenges, the Pacific Community (SPC)'s Public Health Division collaborated with Fiji National University, Pacific Islands Health Officers Associations, Pacific Pathology Training Centre, and World Health Organization to develop a training program. The aim of the training program was to build capacity among health workers in PICTs and strengthen microbiology diagnostic capacity to obtain accurate and reliable AST results. This would, in turn, guide informed decisions and the appropriate use of antimicrobials, thereby protecting nations' health care systems against the threat of AMR.

The training program consisted of both theory and practical components and focused on clinical and diagnostic microbiology. This included laboratory methods of conducting ASTs to detect MROs and strengthen AMR surveillance in Biosafety Level 1 laboratories (ie, the lowest level laboratories which work with agents that usually pose a minimal potential threat to laboratory workers and the environment, and do not consistently cause disease in healthy adults). Between 2019 and 2022 the program expanded to multiple PICTs, including Kiribati, Samoa, Cook Islands, Vanuatu, Nauru, Fiji, Tonga, Solomon Islands, Tuvalu, and Vanuatu. A pre and post knowledge test was conducted, and it was reported that both laboratory staff and health care professionals were fully engaged, actively participated, and improved knowledge through the program. The program also provided funding to PICTs for the purchase of necessary equipment and consumables, such as semi-automated urine analysers (to assist microbiology staff in the selection of urine samples that should be cultured for detection of urinary tract infections) and American Type Culture Collection (ATCC) control strains. In addition, the program supported the establishment of a database system and development of design for laboratory antibiogram databases that would allow to monitor AMR patterns and trigger prompt actions on AMR.

Through these regional and national efforts, some positive outcomes have been observed. For example, based on a program evaluation survey carried out 6 months after the training program, the preliminary findings showed that laboratory technicians and microbiology scientists improved their knowledge and acquired practical skills in complying with laboratory protocol in detection of MROs, using proper microbiology procedures to identify AMR strains, testing antimicrobial susceptibility of microorganisms in a quality assured manner, and developing antibiogram that would guide clinicians to the appropriate use of antimicrobials. This would thereby strengthen the nation's health care system.

## The Need for More Targeted Investment to Address AMR in a Holistic Multisectoral Approach

AMR is a complex problem that requires a holistic multisectoral approach. Insufficient clean water, lack of proper sanitation and personal hygiene, and inadequate infection control can also lead to the spread of antimicrobial resistant pathogens.[7] The lack of knowledge and the misuse of antimicrobials among the general population could accelerate antimicrobial resistance. The misuse or overuse of antimicrobials in agriculture and animal farms is also major concern, as this could increase the risk of antimicrobial resistant pathogens transmitted from animals to humans.[2] The lack of political leadership and effective governance at the national level to address AMR more effectively also contributes to the growing burden of drug resistant strains.[8]

Therefore, building up laboratory capacity alone will not be sufficient to address the problem of AMR in the Pacific. There is an urgent need to bring relevant sectors and stakeholders together to plan and implement AMR prevention and control programs for better public health outcomes, including the development of effective policies, legislations, education, awareness, behaviour change, monitoring, and evaluation. Targeted investments are required for the research and development of effective antimicrobial medicines and diagnostic methods in all health care settings. It is of utmost importance to ensure all stakeholders are fully aware of the substantial burden of AMR and to address this in a whole-of-government and whole-of-society approach. Addressing AMR in a comprehensive approach will lead to positive health outcomes and contribute to achieving the Healthy Island Vision[9] and United Nations' Sustainable Development Goal 3[10] on good health and well-being.

## Conclusion

AMR is a critical development threat, particularly in the low-resourced small island nations in the Pacific. Of the several factors contributing to the increase in AMR, this article highlights the key issues of surveillance and monitoring of AMR, and current efforts in building up laboratory capacity and services in PICTs. Despite recent efforts that have been made, including the creation of a training program, there is still a need to scale up actions that address AMR to attain better health outcomes in the Pacific. Targeted investment and accelerated actions to tackle AMR in a holistic multisectoral approach is urgently needed.

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