Curbing antimicrobial resistance

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ABSTRACT

The discovery of antimicrobial agents for treatment of diseases in humans, animals and plants was one of the most significant events of the 20th century. Notwithstanding their importance, acquired resistance has become increasingly evident and this pattern has followed the introduction of each new antimicrobial agent. Antimicrobial resistance (AMR) has not only led to unwarranted mortality rates in humans, but also presents a major economic burden to farmers, governments and the rest of society. Hence, the alarming worldwide escalation of AMR poses a serious threat to public health, agricultural production and food security, and can cause major disruption globally. Whilst there has been progress in understanding the causes of AMR, there is a dearth of knowledge on how to empirically mitigate it using the One Health approach in low resource settings. Furthermore, the occurrence of AMR in the Pacific region is poorly understood. Using Fiji as a case study and through the Enhancing the Management of Antimicrobial Resistance (EMAR) project, we illustrate how systems thinking can be applied in the context of AMR. We also describe the impact of AMR on agricultural systems, and demonstrate how we are tackling the problem of resistance in Fiji to improve health, agricultural production, and ecosystem outcomes in a sustainable and cost-effective manner. We envisage that the approach used in Fiji, including the lessons learnt, will be scaled out to other low resource settings to reduce the spread of AMR.

Antimicrobial resistance (AMR) adds to the already long list of biosecurity threats that have been discussed today. It is a problem that involves the complex interaction of microorganisms, people, animals and the environment. It will cause 10 million deaths by 2050, surpassing cancer and diabetes as the major cause of mortality. Antimicrobial resistance will also cause many disruptions in health care, livestock production and the global economy (Figure 1). For

Figure 1. The global problem of AMR.

This record has been prepared from a transcript and the slides of the presentation.

example, in the Western Pacific region alone it is estimated that AMR will cost $1.35 trillion over the next 10 years. Therefore the spread of AMR, just like the COVID-19 pandemic, presents a major economic burden to most governments and communities in most countries of the world, requiring it to be mitigated as a regional and global public good. That means all countries in a region, and globally, need to come together to tackle the problem. No country can tackle this problem alone.

Since the COVID-19 pandemic began there is greater recognition that human, animal and environment systems are only as strong as the weakest link. But how do we strengthen such systems to tackle problems such as AMR and COVID-19?

The One Health approach, which has been mentioned throughout this conference, is a very important operational mechanism for bringing together agri-food systems, health systems and ecosystems, to optimise the health of people, animals and the environment. From an economic perspective, a One Health approach is also a good mechanism for reducing the negative externality of AMR, resulting in the optimal use of antibiotics – rather than overuse, which is the major cause of problem.

Therefore, from an economic point of view, we need to make sure that we optimise and get the best value from using antibiotics in human health as well as in animal health.

The causes of antimicrobial resistance are well known, but in developing countries the One Health approach has not been applied as a way of mitigating the problem (Figure 2). Suitable resources are limited in developing countries,

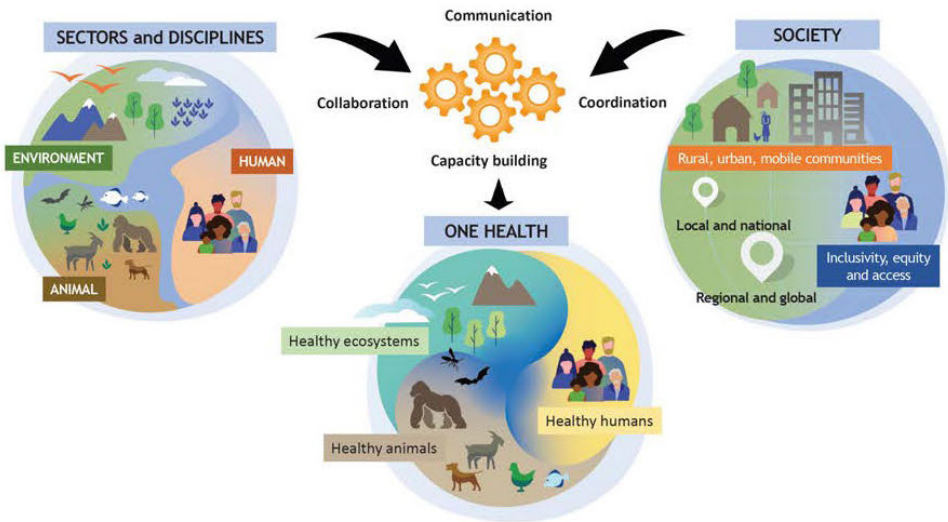

Figure 2. Systems thinking: One Health approach.

* One Health approach provides an operational mechanism for bringing agrifood systems, health systems and ecosystems together to optimise health of people, animals and ecosystems.

* There is insufficient knowledge on how to mitigate AMR using the required One Health approach in low resource settings.

* How do we develop an integrated surveillance system and a business case for each sector to participate in the management of AMR, given the limited resources in developing countries?

so the question arises: How do we build a business case for each sector to participate in the management of antimicrobial resistance, when each sector has its own roles and expectations? (Figure 2).

The project: Fiji

To answer this question we first conducted a scoping study which was funded by ACIAR and the Indo-Pacific Centre for Health Security (an Australian Government Health Security initiative) between 2018 and 2019. We found that Fiji is the best place to tackle the problem of AMR, because it has a National Antimicrobial Resistance Committee, commonly known as NARC, which is a multisectoral platform for coordinating AMR activities. The study also showed the need to enhance research and lab capacity, and the need to strengthen animal health systems, among other needs.

Consequently, working with the NARC members we co-designed a project known as Enhancing the Management of Antimicrobial Resistance (EMAR). All the stakeholders came together to develop the project to tackle some of the challenges that were identified during the scoping study (Figure 3).

As part of the project design we incorporated the One Health approach into what we call the Driver Pressure State Impact Responses Framework. This framework is commonly used in the environmental sciences to tackle emerging or complex issues such as climate change. That is, we are trying to bring that framework into the management of antimicrobial resistance. Such an application has been proposed previously but has not been done before.

Specifically, it means that some of the project activities in the livestock sector will include economic analysis of the impact of AMR, sample collection, lab capacity building, and conducting surveys on farmers' knowledge, attitudes and practices towards antimicrobial use.

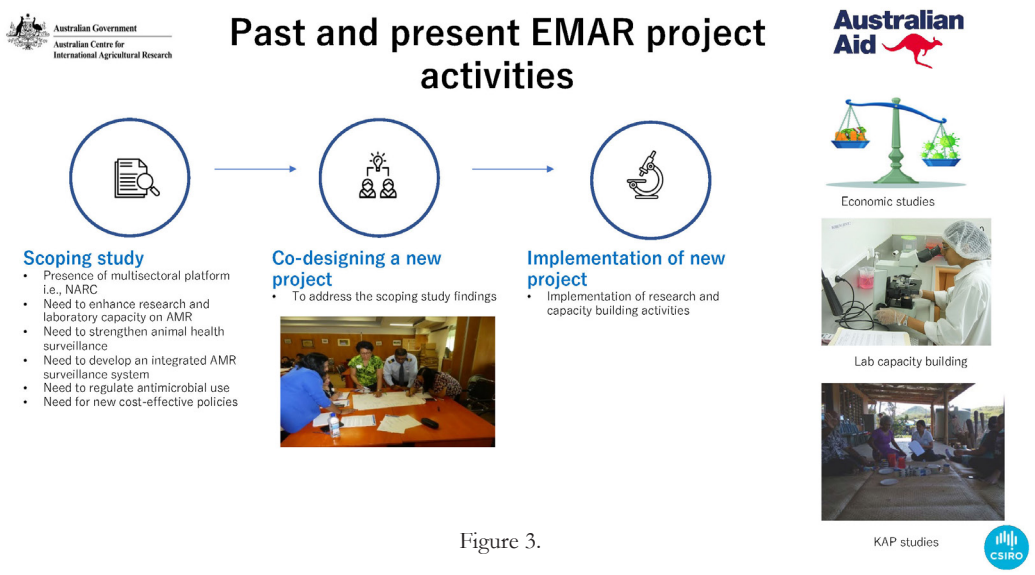

Figure 3.

Outcomes so far, and acknowledgements

So far this project has increased lab and research capacity in Fiji, particularly in the animal health sector where there had been very little or no investment in the past. For example, for the first time, the Fiji National University staff are conducting their research through our project. We have also improved the regulations around antimicrobial use, among other outcomes (Figure 4).

Our aim is to improve food security, health outcomes, and water quality, as stipulated in Fiji's National Development Plan. It is important that we communicate what we are doing and that we link it up with what the Fiji Government is trying to achieve, so that the Fiji Government wants to be part of this project.

In Fiji we have learned that multisectoral platforms and strong partnerships, capturing the interest of each sector, and providing economic evidence, are all essential factors in tackling acquired resistance, as well as developing the business case for each sector and strengthening Fiji's human, animal and environment systems. We envisage that the approach used and lessons learnt in Fiji will be scaled out to other low resource settings to reduce the impacts of acquired resistance, plus other zoonotic diseases, in the Pacifc region including Australia.

I would like to thank our partners, including (Figure 4) University of Technology Sydney, University of South Australia, Fiji National University, The University of the South Pacific, the Fiji Ministry of Agriculture and the Fiji Ministry of Health & Medical Services, and the many, many, many other stakeholders that we are working with in Fiji.

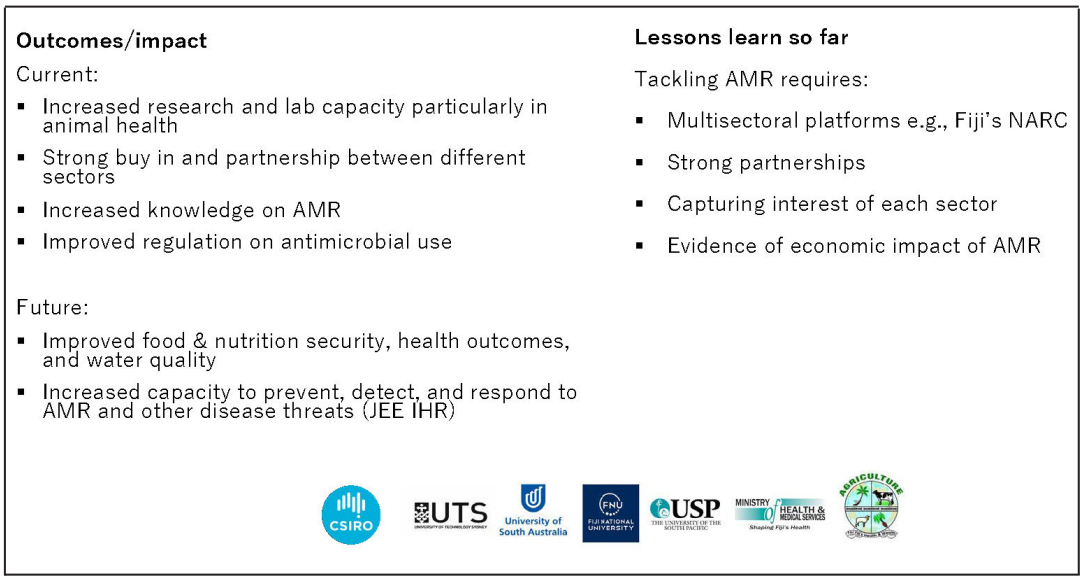

Figure 4. Outcomes/impacts and lessons learnt, and the logos of the partner organisations involved.

Dr Walter Okelo is a research scientist at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and his current research involves quantifying economic impact of biosecurity risks at the human–animal–environment interface. Also, Walter currently leads an interdisciplinary project focusing on sustainable management of antimicrobial resistance in Fiji, among other projects. Walter's research interests include biosecurity economics, resource economics, disaster risk management, One Health, and techno-economics. Walter holds a PhD in economics from The University of Edinburgh and postgraduate certificates in applied econometrics and epidemiology (from Utrecht University) and health economics (from the World Bank). Walter is a veterinarian by background and has over six years' experience in designing and evaluating biosecurity projects in Asia, Africa, Australia and the Pacific region. Walter is a Commonwealth Scholar and enjoys nature and playing basketball.