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Towards Integrated Monitoring of Antimicrobial Resistance and Usage in horticulture, water, and wine sectors in Australia

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Background: Antimicrobial resistance (AMR) is a growing concern in agribusiness sectors with serious consequences to productivity and public health. A data centric approach is needed to support Australian agribusinesses and water sectors to understand the impact of antimicrobial usage on the emergence of resistance for diseases that farmers are faced on a daily basis. The SAAFE CRC Analytics Program has partnered with the Australian Research Data Commons (ARDC) to co-design the SAAFE Data Code that promotes responsible and ethical data sharing across sectors and SAAFE CRC project partners in managing the AMR data. Furthermore, to alleviate the problem of siloed data, we developed SAAFE Data Dictionary, an ontology-based and relational schema-based framework to standardise and enable FAIR (Findable, Accessible, Interoperable, Reusable) data practices for AMR data across the agribusiness and water sector in Australia.

Method: This study will lay the foundation for data centric approach to AMR monitoring in the agribusiness and water sectors and has the following distinct yet connected milestones:

- SAAFE Data Code (governance): To co-design a framework for responsible and trusted data access between sectors, project partners, key stakeholders and collaborators. The Code promotes and encourages best practices on data sharing and accessibility to ensure emerging challenges, such as AMR data, are managed in an ethical manner. In this regard, we have conducted workshops with partnered sectors based on specific "what-if"scenarios and have elicited from the participants the risks involved and then the guiding principles to mitigate those risks. The risks and guiding principles covered, existing data, future and new data that will be generated, and cross-sectoral data.
- SAAFE Data Dictionary: To address heterogeneity and promote FAIR (Findable, Accessible, Interoperable, and Reusable) data principles of antimicrobials in Agribusiness across Australia, we developed a standardised ontology-based framework. In the first phase, we compiled a dictionary of domain-specific terms related to antimicrobials, pathogens, sample types, and more, across concerned sectors such as water, wine, and horticulture. These terms were sourced from authoritative international bodies like the FAO and WOAH, which monitor antimicrobial usage and resistance globally. Building on this, we designed a relational data schema to capture laboratory test results, focusing on four key data types: antimicrobial usage, AST testing, antimicrobial residue, and minimum inhibitory concentration (MIC). This schema supports standardised recording and interoperability of laboratory findings across organisations. Finally, we developed a user-friendly standardised data submission framework that allows partner sectors to upload their datasets and respond to a guided questionnaire. This input is automatically mapped through a backend ontology, enabling consistent data integration across the horticulture, water, and wine sectors.

Results: Overall, the SAAFE Data code and Data dictionary provide for ethical, interoperable and standardised data practices, and strengthen cross-sectoral collaboration in order to establish effective surveillance integrated AMR monitoring in agribusiness and water sectors in Australia. We will show the SAAFE data Code and the working AMR standardisation framework for the horticulture, water and wine sectors.

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