Public Support for Next-Generation Antimicrobial Resistance Surveillance

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The World Health Organisation's *Global Action Plan on Antimicrobial Resistance* calls upon countries to strengthen antimicrobial resistance (AMR) surveillance.

Australian governments have responded with a plan to implement a nationally coordinated, technologically enhanced surveillance program that takes a One Health approach – recognising that human, animal, and environmental health systems are closely interconnected, so monitoring AMR and the use of antibiotics must take place across all systems.

Introducing Artificial Intelligence (AI) and Machine Learning (ML) technologies to healthcare will necessitate new forms of governance and regulation.

While regulatory mechanisms for these technologies are rapidly evolving, they are not yet fit for purpose in healthcare-related applications. We conducted in-depth qualitative research with members of the Australian public to understand their knowledge, attitudes, and behaviours around the use of technologically enhanced monitoring systems for antimicrobial resistance (AMR). We showed them a hypothetical example of such a system, which we called OUTBREAK.

Australian residents who participated in our research demonstrated that there is a willingness to allow AI- and ML-enabled monitoring systems for AMR to:

- guide the actions of trusted decision makers;
- shape the workflow of healthcare systems; and
- trigger and guide effective action to reduce AMR-producing activities in human, animal, and environmental contexts.

However, the public's support for these next-generation monitoring systems was contingent on addressing certain challenges and risks, namely 'data sources and data safety' and 'quality and reliability of insights'.

Further in-depth engagement revealed the system must deliver for the 'common good' by:

- tightly governing and regulating data use and safety;
- generating high-quality, reliable insights that can guide clinical and policy action; and
- making those insights available to trusted decision makers in healthcare.

Where these factors are present, the public are willing to trust the developers and operators of these technologies and to let their findings guide action in healthcare.

Public support for next-generation AMR surveillance systems is dependent not only on data safety but also on effective production of high-quality, reliable insights

Policy Implications

- Active and sustained engagement with the public is essential for the success of any AMR surveillance activity.
- Earning and enjoying the trust of the general public requires delivering more benefit than burden.
- AMR surveillance must benefit individuals as well as the community at large, as opposed to benefitting the latter over the former – a condition we call serving ‘the common good’.
- Key areas for success include the safety and reliability of data sources, the quality of insights generated by the system, and the rigour of regulatory and governance frameworks.

Background

Antimicrobial resistance (AMR) occurs when bacteria and other microbes become resistant to the antibiotics, antifungals and other medicines that had earlier been effective treatments. This resistance allows these bacteria and other microbes to spread and cause life-threatening infections that are difficult to treat.

If left unchecked, AMR is forecast to cause 10 million deaths annually by 2050 and add a burden of US$100 trillion to health systems worldwide.

The first step to tackling this problem is understanding what causes this problem. To date, the focus of research and biomedical investment has primarily been on the development and spread of AMR in hospitals and human health systems. However, with mounting evidence that resistance developed in animal or environmental systems can lead to resistance in human systems, it is now time to expand this focus to antimicrobial use across human, animal, and environmental systems to give a true picture of the threat of AMR.

This kind of One Health monitoring presents significant challenges. It requires bringing together the necessary data streams across diverse areas of human, animal, and environmental systems. It requires new ways of processing and analysing these data. Finally, it requires new ways of working across these systems to effectively track, trace and tackle antibiotic resistance.

The result will be a system that helps to predict and prevent AMR outbreaks before they occur; identify with high precision the origin of outbreaks that do occur; and simulate (and cost) the outcomes of potential AMR interventions and other decisions that might impact AMR evolution, propagation, and population exposure.

The Challenge

In addition to the many practical and technical challenges involved in developing a next-generation, technologically enhanced One Health monitoring system, there will also be a series of important ethical, legal, and social implications to address as this new capability pushes the boundaries of current practice.

We believe that a system like this should be operated for the common good, and so we asked members of the Australian public about their attitudes towards the system in a series of in-depth qualitative engagements.

The Evidence

Participants had varied knowledge levels about – and attitudes towards – AMR and antimicrobial usage in human, animal, and environmental systems.

While knowledge of AMR generally came from interactions with health practitioners, two participants detailed a personal experience with AMR. Dave_29 named a recent personal experience of antibiotic usage as being affected by AMR: 'So, I have had, like, an infection in the past. That had to do with my tooth… the first antibiotic didn't work. So, that was upgraded to a second antibiotic. Eventually the infection did dissolve. Whether or not it was due to the antibiotic or not, I'm not too sure.'

All participants were supportive of a system like OUTBREAK as a response to AMR. This support ranged from guarded but positive through to enthusiastic, but all participants stated the conditions upon which their support would be gained and maintained, and expressed caution related to those conditions.

Participants stated a relatively homogenous set of requirements for a system like OUTBREAK to gain and maintain social licence, namely (a) that it demonstrates strong efficacy and (b) that all aspects of the system, from governance practices and data security to choice of collaborators, serve what we call the common good. These requirements were stated even by those participants who were most fully in support of OUTBREAK and who reported the most permissive attitudes to contentious issues like consent, privacy, and public access to OUTBREAK data and results. For example, Robert_38 was among the most enthusiastic supporters ('no issues at all…If someone can be benefited from, you know, from my health history, by all means…no concern whatsoever…with consent or without consent'), but, when pressed, indicated certain conditions for their support – 'as long as my privacy's not getting compromised'. They suggested that there should be a central agency to control data, strong governance controls on access, and a suspicion of pharmaceutical company involvement and access to data.

The Implications

Even with formal evaluation and certification processes, technology can fail in the absence of acceptance and use by key stakeholders. Therefore, it is essential to build and maintain social licence to operate an AMR surveillance system like OUTBREAK, which requires an understanding of the public's existing knowledge, attitudes, and behaviours.

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Appendix: Method

In mid-2020, a series of focus groups and in-depth interviews were hosted by the OUTBREAK ELSI team. There were five participants in each of the two focus groups, and two participants in each of the two interviews, for a total of 14 participants. This fieldwork was convened to ascertain the Australian public's knowledge, attitude, and practices (KAP)[1] regarding both antimicrobial resistance (AMR) and technologically enhanced AMR management systems like OUTBREAK.

This qualitative fieldwork was supported by Telmy, an experienced Australian social and market research company. Telmy provided recruitment and logistical support including advertising, screening, scheduling, and distributing stimulus material. A gift card to the value of AUD$50 was offered to each participant in recognition of their significant time investment (screening processes, engagement with stimulus material, an interview of approximately 90 minutes and follow-up work as required). Where participants accepted this offer, the gift cards were processed by Telmy. The research was funded by the Australian Government through the Medical Research Future Fund. Ethics approval was granted for the research by the University of Technology Sydney Human Research Ethics Committee as part of the Centre for Health Economics Research and Evaluation Program Approval (ETH18-2507).

One participant was a registered pharmacist currently working in a community pharmacy practice in an urban setting. No other participants were health practitioners, nor had they worked in the healthcare sector. Participants varied in age and lived in settings ranging from inner metropolitan to outer urban. One participant lived in both a rural and an urban setting, with a long personal and familial association with the rural context.

Participant demographic characteristics

Characteristic		**n (%)**
Age	18–19 years	1 (9%)
	20–24 years	4 (36%)
	25–29 years	4 (36%)
	30–34 years	0 (0%)
	35–39 years	2 (18%)
	40+	0 (0%)
Sex	Male	4 (36%)
	Female	7 (64%)
	Other	0 (0%)
State/territory (postcode)	ACT (2601, 2914)	2 (18%)
	NSW (2122, 2217)	2 (18%)
	Vic (3013, 3041, 3188, 3806)	4 (36%)
	Tas (7005)	1 (9%)
	SA (5152)	1 (9%)
	WA (6014)	1 (9%)
	QLD	0 (0%)
	NT	0 (0%)
Language spoken at home	English	4 (36%)
	Other	7 (64%)
Other household members*	No-one else	2 (18%)
	A partner	4 (36%)
	Other adults	5 (45%)
	Children	1 (9%)
Work status*	Working full-time	2 (18%)
	Working part-time	6 (55%)
	Working casually	1 (9%)
	Stay-at-home parent/home duties	0 (0%)

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	Studying	3 (27%)
	Retired	0 (0%)
	Looking for work/unemployed	0 (0%)
	None of these	0 (0%)
Previous participation in face-to-face market research	Within the last month	1 (9%)
	Within the last 3 months	0 (0%)
	Within the last 6 months	0 (0%)
	Within the last year	3 (27%)
	More than a year ago	4 (36%)
	Never	3 (27%)
Total		11 (100%)

**Multiple responses possible at this item*
†Table shows only cultural identities selected among 26 options provided, including 'other'