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Gerald Midgley, Amber Elkins, Guy H. Loneragan, Megan Babowicz, Mayukh Dass, Yrjo T. Grohn, Ellen Jordan, Guillaume Lhermie, Lucas Lunt, William A. McIntosh, Juan M. Piñeiro, Jason Sawyer & H. Morgan Scott

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KEEPING ANTIBIOTICS EFFECTIVE - COMBATTING ANTIMICROBIAL RESISTANCE IN U.S. AGRICULTURE

GERALD MIDGLEY, AMBER ELKINS, GUY H. LONERAGAN, MEGAN BABOWICZ, MAYUKH DASS, YRJO T. GROHN, ELLEN JORDAN, GUILLAUME LHERMIE, LUCAS LUNT, WILLIAM A. MCINTOSH, JUAN M. PIÑEIRO, JASON SAWYER AND H. MORGAN SCOTT

ANTIMICROBIAL RESISTANCE

Antimicrobials are medicines that are designed to kill a variety of organisms, most notably disease-causing bacteria. They include antibiotics and other anti-bacterial substances.

Unfortunately, bacteria may develop resistance to antimicrobials, and this poses a major threat to human health in the 21st Century: the discovery of

new antimicrobials has slowed down, but resistance to existing ones is continuing to increase. If antimicrobials lose their effectiveness, millions of people will die from illnesses that can currently be treated.

Any use of antimicrobials can stimulate resistance if the context enables resistant bacteria to multiply at the expense of non-resistant ones. The over-prescription and misuse of antimicrobials increases the likelihood

of resistance spreading, so this needs to be tackled by public health systems.

Unfortunately, this is not just a problem for human health: antimicrobials are also prescribed to food animals (like cows, pigs, sheep and chickens), and some antimicrobial resistant bacteria can move between animals and people. Antimicrobial resistance (AMR) in agriculture therefore poses a double risk to humans: reduction in the effectiveness of antimicrobials *and* disruption to food security.

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A WICKED PROBLEM

This is a truly ‘wicked’ policy problem because there are so many interacting factors to account for: not just between the human and animal health systems, but also between uses of antimicrobials and the profitability of livestock industries and pharmaceutical companies.

There are multiple stakeholders with an interest in the problem, and they often find themselves disagreeing on what it means to use antimicrobials judiciously (or wisely). They also commonly disagree on governance, with government bodies often looking at how industry could be better regulated, and industry resisting top-down regulation and instead advocating for *self-regulation*, or the *voluntary stewardship* of antimicrobials. This disagreement is particularly acute in the USA, where there is a strong culture in many agricultural communities of resisting ‘big government’. It is quite unclear what an effective model of voluntary stewardship, that addresses disagreement, might look like.



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IMPROVING VOLUNTARY STEWARDSHIP

In this context, our team has been working with stakeholders to look at the potential for improving voluntary stewardship of antimicrobials in US agriculture. The funder of our work was the US Department of Agriculture (USDA) [7].

Voluntary stewardship is an approach that relies on the willingness of food-animal producers and supportive industries (e.g., veterinary services and pharmaceutical companies), as well as broader stakeholders (e.g., public health policymakers and consumer advocates), to collectively ensure the judicious use of antimicrobials without the need for regulation, legislation, mandatory compliance or statutory enforcement.

We ran design workshops with four separate stakeholder groups: beef producers, dairy industry representatives, public health policymakers and consumer advocates. We used an approach called

Critical Back-Casting for this. It integrates methods from two different systems methodologies: Idealized Design [1], which liberates the creativity of participants and moves toward agreement on far-reaching plans for change, and Critical Systems Heuristics [6], which offers twelve questions on what a system ought to be doing, who should have decision-making authority, what expertise is important, and what could give the system legitimacy. These questions are particularly useful for exploring governance issues, so deploying them in the context of Idealized Design enabled our stakeholders to think creatively about what would be required for the governance of the voluntary stewardship of antimicrobials [8].

The participants were asked to imagine that all current projects and programs to address AMR had been stopped, and their task was to propose new, creative designs that would be unconstrained by what currently exists. However, to prevent the proposal of unattainable utopias, all the designs had to be *technologically feasible* (either using current technology or technology that could be developed in a timely manner), *viable* (affordable and

socio-environmentally sustainable), and *adaptable* (capable of flexing, or being revised, in response to future, emerging challenges). Because all four stakeholder groups answered the same questions, their views were comparable.

See the Methodological Reflections near the end of this article for practical pointers on how to use Critical Back-Casting in your own projects.

SHARED VIEWS ACROSS STAKEHOLDER GROUPS

There were some common views across the beef, dairy, public health and consumer advocate stakeholder groups on what a voluntary stewardship program should look like. There were also differences of perspective that would have to be addressed to make voluntary stewardship fully operational.

The common views, or emerging consensus, can be summarized in a list of the major characteristics of a potential voluntary stewardship scheme:

- The aim of a program should be the judicious use of antimicrobials, not zero use (less is better, but for animal-welfare reasons, zero is not an option).
- Multi-stakeholder governance should be put in place, with industry in a lead role, and other diverse stakeholders included (either as full decision-makers, external partners or experts to be consulted).
- The governing body should oversee training and information provision for producers and other key decision-makers, and should promote education in wider society about AMR and stewardship.
- The program should be strongly science-informed, with research driving development and change.
- The governing body should also oversee the certification of



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producers demonstrating good stewardship practice.

- The results of certifications (and monitoring information more generally) should be publicly accessible, to enable peer pressure, benchmarking, producer self-reflection and informed action.
- There are existing governance and certification programs for other purposes that could readily be built upon.
- Certification should be linked to marketing, so financial benefits for producers flow from engagement in the program.
- Over-uses or misuses of antimicrobials mostly stem from operational and communication issues in wider agricultural production systems, so judicious use means *changing those systems*, thereby reducing disease and antimicrobial use. This should be the focus of certification, and participants said it would involve taking a systems approach.
- In line with the last point, governance should be focused on improving overall system perfor-

mance, rather than control over clinical judgments made by veterinarians who decide whether to prescribe antimicrobials to individual animals. If action for systems change successfully reduces disease, then decreases in the use of antibiotics will follow, together with lowering the risk of AMR.

- Funding should come from ‘checkoff dollars’ – money collected by industry organizations and professional associations that work for the collective benefit of their members.

GOVERNANCE OF THE COMMONS

It is striking that this model conforms in almost every respect to the principles in Elinor Ostrom’s Nobel-prize-winning approach to governing common-pool, natural resources [4]. *Antimicrobial-susceptible bacteria need to be viewed as a common-pool resource*, as they are integral to the ecosystems used by human beings when they raise food animals, and Ostrom’s model could provide a useful template when

designing an actual, effective voluntary stewardship program.

Ostrom's research [9] shows that, when dealing with a common-pool resource, government-enforced regulation and laissez-faire policies can both meet strong stakeholder resistance, resulting in conflict that damages businesses and undermines sustainability [5].

A more effective approach is often the collective governance of the resource by relevant stakeholders, who need to make decisions in relation to a broad set of economic, social and environmental values. All these values must be managed simultaneously, and it is unacceptable to put off considering one while another is exclusively focused upon – prioritizing values and focusing on them one at a time generally results in the continual discounting of longer-term needs, such as combatting AMR, in favor of addressing shorter-term concerns, such as profitability.

Governance is enabled by a strong focus on the collection of data on activities and impacts, and the provision of information in a way that makes it immediately transparent when important values are being compromised, so peer pressure can be applied and remedial action taken.

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DIFFERENCES OF PERSPECTIVE

The above consensus, and its alignment with Ostrom's model, are encouraging for the potential utility of voluntary stewardship. Nevertheless, some

difficult issues and important differences between the views of stakeholder groups were identified, and these need to be addressed in the development of an actual voluntary stewardship system:

There are structural differences between some food-animal industries. For instance, there is a fair amount of vertical integration in the dairy industry: co-operatives buy milk from the producers, and they have the power to set standards to mitigate AMR. Producers must conform to these standards if they want to sell their milk to that cooperative. In contrast, there is little vertical integration in the beef industry: many small producers sell calves to the feedlots, often through intermediaries such as auction marts and cattle buyers, and then the feedlots compete to sell animals to wholesalers and retailers via 'meat packers' (slaughterhouses or abattoirs). The beef producers are particularly concerned that husbandry standards among the small producers are variable (and these standards are typically unknown prior to the purchase of calves), which accounts for most of the perceived need for antibiotics. However, there is no single body (e.g., a cooperative) able to strongly influence husbandry standard-setting. Different kinds of programs, each with different emphases, will therefore be needed for different food-animal industries.

The beef industry participants mostly focused on local-scale governance, while the dairy participants primarily looked at the national scale. There is a useful model of an adaptive, multi-scale organization, the Viable System Model (VSM) [10], that can reconcile these foci. It is possible to identify three or more 'levels' of governance: national-level (establishing general parameters for stewardship in a science-informed manner), program-level (ensuring each industry certification program meets the specific needs in that industry, as mentioned earlier), and

business-level (looking in each company at how to implement stewardship and secure certification). While the OR project discussed in this article was only focused on the US context, it would be possible to have a global level of governance too, if this could be agreed through international negotiations.

The participants in the four workshops identified different stakeholder groups when it came to inclusion in governance. There is an opportunity for synergy here, because the industry participants mainly looked at the key professions who would need to be involved in implementing voluntary stewardship in agriculture, while the public health policymakers and consumer advocates mainly discussed beneficiaries in wider society. Referring again to the VSM and the three levels of governance mentioned above (national-, program-, and business-level), different stakeholders might be involved at each of the three different levels. Also, the researchers offered a new method for stakeholder analysis that could be useful in the design of an actual voluntary stewardship scheme, as it counters two biases that are common in stakeholder analysis: bias to the status quo, and bias to those who already have a voice in the system [3].

There was a discussion of shaming and stigmatization, with some public health policymakers saying that these are good things to encourage when producers opt out of voluntary stewardship. Peer pressure is certainly necessary, but if the stigmatization is perceived by industry as coming from regulatory authorities, it could undermine voluntary stewardship. The right kind of peer pressure comes about when all industry players can see their own performance in relation to the performance of others, so those who are more successful in addressing AMR then encourage others to make improvements.

CONCLUSIONS

The full report of this study can be found in [7]. Ultimately, the findings from this research (and indeed the Ostrom governance model and the VSM) should be considered a *useful resource*, not a blueprint for implementation [8]. This is important because multi-stakeholder trust and collaboration can be undermined by attempts to impose top-down ‘solutions’.

For the design of an actual voluntary stewardship system, it may be useful to replicate the workshops process used in this research, as it was highly participative – except that more time would be needed, after initial workshops with separate stakeholder groups, to bring stakeholders together and develop a fully collaborative vision. Also, there will no doubt be technical questions about antimicrobials and their use (put beyond the boundaries of this research) that will need to be addressed once voluntary stewardship is established.

The research team would be very interested in supporting any industry or policy organization that wants to take forward this vision of voluntary stewardship. Please feel free to make contact.

METHODOLOGICAL REFLECTIONS

The twelve Critical Back-Casting questions, presented in a generic, plain-English form (not specific to the governance of antimicrobials), can be found in the shaded box. The word ‘system’ has been used, but it could be replaced by ‘service’, ‘organisation’ or any other term that is relevant to the context. These questions are used in workshops with stakeholders, where the participants imagine that current systems have ceased to exist, and they have come together in a team to design new ones. However, as mentioned

THE TWELVE QUESTIONS

- (1) Who or what should benefit from the system, and how?
- (2) What should be the purposes of the system; i.e. what goals should it aim for in order to deliver to the beneficiaries?
- (3) What should be the system’s key measures of success?
- (4) Who should be seen as the key decision makers; i.e., have the authority to change who should benefit, what the purposes should be and how success should be measured.
- (5) What components (resources, people, policies, etc.) should be under the authority of the decision makers?
- (6) What is essential for delivery of the benefits and purposes, but should not be under the authority of the decision makers?
- (7) Who, either in addition to or instead of the decision makers, should be involved in delivering the benefits and goals?
- (8) What should count as expertise; i.e. who should be considered an expert and what should be their roles?
- (9) What are the key factors that will guarantee (or increase the likelihood of) success?
- (10) Who or what could be affected by the activities of the system; should the affected be represented in decision making, and (if so) how?
- (11) To what extent should the affected be able to retain independence; i.e., opt out or neutralise the effects on them, and/or take actions of their own choosing?
- (12) Upon what core values and assumptions should the system be based?

earlier, the participants need to make sure that their designs are technologically feasible, viable and adaptable in the face of future changes.

Critical Back-Casting has been used in approximately 20 projects besides the one presented here, with various participants: homeless children, older people, children in residential care, people with mental health problems and many service providing stakeholders [2]. Several general reflections based on this experience can be provided to support readers in thinking about how they might apply Critical Back-Casting in their own projects:

Facilitation:

- A facilitator is needed to make this work.
- Once a facilitator has used the questions in several projects, they

become internalized sufficiently to inform more free-form facilitation exercises, without the need to go through them systematically.

The questions:

- For every one of the questions above, 6-10 follow-up questions need to be asked to tease out details specific to the context.
- The questions work equally well with professionals, ordinary citizens and people with marginalized identities who have had no previous experience of planning and management. Indeed, more frequently than not, ‘ordinary’ citizens and marginalized stakeholders find it easier to generate far-sighted designs than professionals,

because the latter tend to be more disempowered by limitations built into their current organizations.

The process:

- Expectations need to be managed. Ideally, the method is used in a real planning initiative where stakeholders can be confident that their ideas will inform action. If this is not the case (e.g., if the exercise is only going to inform recommendations for action that may or may not be implemented), then participants need to know this.
- Power relations matter. If the participants don't feel they can talk freely and openly in front of one another, the process will fail. When free and open communication is not possible, an antidote is to run separate groups with different categories of stakeholder.
- There are usually moments in the flow of the discussion when it feels natural and necessary to deviate from the questions to look at what the specific structures for governance should be. This often happens once people have realized that the meaningful engagement of stakeholders is necessary, and they want to look at how this can be accomplished.

Implementation:

- Supporting people with action planning after Critical Back-Casting is essential.

Finally, as long as people can talk freely, workshops using this approach are tremendously exciting (sometimes euphoric) because they almost always generate far-reaching insights. This is therefore a useful approach for providing

a foundation upon which to build further collaboration into the future.

Gerald Midgley has had research leadership roles in government, academia and consultancy, and has extensive experience in public policy, community development, technology foresight and resource management projects. He is an Emeritus Professor at the University of Hull (UK) and holds Visiting Professorships at the University of Birmingham (UK) and Linnaeus University (Sweden).

Dr. Amber D. Elkins is a Senior Data Scientist in Public Health for projects under the United States Department of Defense, Booz Allen, and MAT, Inc. She focuses on fostering improved understanding of complex social problems, given practical and theoretical constraints, within or emergent from different socio-ecological,

cultural and political systems to increase intervention efficacy.

Guy Loneragan was raised in rural Australia. He is the founding Dean of the Texas Tech University School of Veterinary Medicine, the sole purpose of which is to serve the needs of rural and regional communities. Guy is a veterinarian and an epidemiologist. His scholarship focuses on the connection between animal and human health.

H. Morgan Scott is a veterinarian with a PhD and post-doctoral training in public health. A professor of epidemiology in the Department of Veterinary Pathobiology at Texas A&M University, he applies both epidemiological and ecological approaches to better understand the propagation, dissemination and persistence of enteric bacterial pathogens – including those resistant to multiple antimicrobials.

FOR FURTHER READING

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- [8] Blog providing more methodological guidance and additional reflections: bit.ly/Critical_Back-Casting_blog
- [9] A summary of Ostrom's principles for managing common-pool natural resources: <https://www.onthecommons.org/magazine/elinor-ostroms-8-principles-managing-commons/index.html>
- [10] For a brief, up-to-date description of the viable system model, see (pp. 749–751): <https://www.sciencedirect.com/science/article/pii/S037722172300512X>