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Title:

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Date:

2024-01-01

Citation:

Davis, M. D. M., Schermuly, A., Rajkhowa, A., Hardefeldt, L., Thursky, K. & Flowers, P. (2024). Risk individualisation and moral injury in the treatment of infection as impediments to the tackling of antimicrobial resistance. *Health Risk and Society*, 26 (5-6), pp.222-239. <https://doi.org/10.1080/13698575.2024.2345614>.

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To cite this article: M.D.M. Davis, A. Schermuly, A. Rajkhowa, L. Hardefeldt, K. Thursky & P. Flowers (2024) Risk individualisation and moral injury in the treatment of infection as impediments to the tackling of antimicrobial resistance, *Health, Risk & Society*, 26:5-6, 222-239, DOI: [10.1080/13698575.2024.2345614](https://doi.org/10.1080/13698575.2024.2345614)

To link to this article: <https://doi.org/10.1080/13698575.2024.2345614>



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Published online: 24 Apr 2024.



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## Risk individualisation and moral injury in the treatment of infection as impediments to the tackling of antimicrobial resistance

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(Received 31 May 2023; accepted 16 April 2024)

### Abstract

Antimicrobial resistance (AMR) is subject to extensive risk reduction approaches. A central strategy is reducing the unnecessary use of antimicrobials across agriculture and human and animal health care without jeopardising health outcomes for all species concerned. A prominent framework is antimicrobial stewardship which seeks to balance access to effective infection treatments with ensuring that effective antimicrobials are available for future generations. Balancing these goals has proven challenging and the consumption of antimicrobials and AMR both continue to grow. To shed light on this situation, we examined the risk reasoning that underpins AMR reduction in interviews with 51 practitioners, scientists and policy-makers working on AMR in Australia and the UK. Important themes in our analysis were that action to reduce infection risks clashed with AMR reduction rationalities. Participants were often not able to explain how treating an infection for an individual patient could harmonise with the longer-term goal of AMR reduction. Due to the potential for patient harm, making decisions to use antimicrobials was narrated as individualised and moralised. We argue that more effective AMR reduction depends on addressing this fundamental tension in AMR risk, and its individualising and moralising effects, as the starting point – not the outcome – of policy and practice for AMR reduction.

**Keywords:** risk; individualisation; antimicrobial resistance; narrative; Australia

### Introduction

This paper uses the sociology of risk to deepen understanding of the effects of policy assumptions used to help reduce antimicrobial resistance (AMR). AMR is seen as a major societal risk. For example, it has been incorporated into the UK Risk Register (HM Government, 2020) alongside state violence and environmental hazards. In this document

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and many others like it, AMR is a focus of technical risk reduction. However, it has long been observed that technocratic risk reduction is compromised if it ignores social factors (Lupton, 2024). It is also understood that systems designed to reduce risk can themselves generate new risks (Beck, 2009). Moreover, analysts have argued that increased use of theory-informed qualitative research is needed to enhance knowledge and understanding of AMR policy efforts (van den Bergh & Brink, 2021). Researchers have also called for improved insight into the varied cultural organisation of prescribing, including power dynamics between different medical disciplines (Charani & Holmes, 2019). It has also been noted that most of the qualitative research in the AMR field has been conducted by biomedical researchers focussed on the implementation of guidance and regulation for antimicrobial usage in human health and to some extent animal health (Charani & Holmes, 2019; McKenna & Gale, 2022; Thursky et al., 2021). In this paper, therefore, we contribute nuanced qualitative insights framed by the sociology of risk to promote understanding of how policy approaches to AMR can be made more effective. We also raise some critical perspectives that studying AMR contributes to the sociology of risk.

Use of antimicrobials (antibiotics, antivirals, antifungals, antiparasitics) contributes to the growth of resistant organisms that jeopardise health (UK Review on Antimicrobial Resistance, 2016). Antibiotics are used in farming to treat and avoid infections (Patel et al., 2020) and, due to the threat of AMR, considerable efforts have been made to limit and reduce antimicrobial use in food production. Companion animals are also treated with antimicrobials, so veterinarians and pet owners are asked to use them carefully (Scarborough et al., 2023; Smith et al., 2018; Tompson et al., 2021). However, the emergence of infections caused by resistant microorganisms is gradually reducing therapy options and leading to considerable mortality in humans (Antimicrobial Resistance Collaborators, 2022). By one estimate, 10 million people will die each year due to AMR by the middle of the century (UK Review on Antimicrobial Resistance, 2016). AMR, then, is an arch example of the temporal aspect of risk rationality (Beck & Beck-Gernsheim, 2002), which focusses on the implications of present human action for future life.

An informative means of establishing a nuanced analysis of AMR risks is provided by antimicrobial stewardship (Dyar et al., 2017). Because it is comprised of the decision-making tools for antimicrobial use, antimicrobial stewardship engages with many of the technical risks associated with AMR reduction. Antimicrobial stewardship is most common in human health, but is also applied in animal health (Hardefeldt et al., 2022) and agriculture (A. King et al., 2022). Partly in response to the diverse application of the concept, attempts have been made to settle on definitions to promote coherent practice, for example:

“... antimicrobial stewardship is about using antimicrobials responsibly, which involves promoting actions that balance both the individual’s need for appropriate treatment and the longer-term societal need for sustained access to effective therapy. (Dyar et al., 2017, p. 794)

This is an important definition because it links individual use of antimicrobials with an envisaged future, collective good. Harmonising continued access to antimicrobials with the wider challenge of reducing antimicrobial resistance, in the present and future, has proven challenging, however, as we detail below.

In this article we use sociological risk perspectives to explore the rationalities that underpin treating infections and reducing AMR, as apparent within our in-depth interviews with practitioners, scientists and policy decision-makers. We do not offer insights about how best to use antimicrobials since that is beyond the

scope of our sociological analysis. Instead, we use antimicrobial stewardship to explore and critique the risk rationalities of the AMR field and their effects in AMR reduction.

## **Background**

### ***AMR and risk society***

The risk society framework (Beck, 2009; Douglas, 1992; Lupton, 2024) has many implications for AMR. Risk society refers to the transformation of threats to the health and wealth of nations into calculable probabilities that can therefore be managed by action in the present. Action on AMR is often predicated by what can be done in the near future to mitigate longer term risks. However, the calculation of future risk to drive present policy is not a wholly technocratic application of scientific knowledge and reasoned action to avert dangers. Political, social and cultural factors mediate the management of risk, as they do in the AMR field.

Locating the application of scientific reason to risk within socio-cultural processes helps us grasp how risk has far-reaching moral effects. Mary Douglas made the link between the recent role of risk in contemporary society and the functions of sin, virtue and fate in many cultures (1992). Douglas showed how scientific reason applied to risk occurs in contexts that are also imbued with the meanings of right and wrong, and the related moral conduct of individuals and groups. Principal in this system of accountability and blame is that failure to act in the present to reduce a future risk is often attributed to the individual. AMR risk stands as a prime example of this individualised risk morality because it is often attributed to inappropriate patient demand or inappropriate prescribing by the clinician (Davis et al., 2020).

On occasion, moralising culpability can have extensive ramifications in public and professional life. For example, the death of a girl in an Australian hospital in 2021 was the subject of an inquiry and media attention (AAP, 2022). The girl is reported to have died due to a bacterial infection that had not been treated in time with a suitable antibiotic. Media reports focussed on the conduct of the doctors and nurses on duty at the time of the incident, though the death was attributed to system level problems of insufficient staffing. Though adjacent to AMR risk, the sepsis death is emblematic of the individualising application of risk attribution that can lead to the imperilment of professional standing. Organisational or individual culpability, then, is another risk that can flow from decisions about whether, or not, and when to use an antibiotic. As we will see, awareness of the possibility of moral injury informs how prescribers and other experts narrate prescribing decisions.

The focus on individuals in the attribution of risk, too, aligns with governmental systems that seek to devolve state healthcare to the individual, as is common under neo-liberal public policy (Beck & Beck-Gernsheim, 2002). This feature of risk society has myriad iatrogenic effects: individuals are thrown back onto their personal resources to deal with risks; those with fewer resources may experience greater harms; and the state can evade responsibility for the polity's welfare. For AMR, the emphasis on the individual in public health communications is a form of social iatrogenesis (da Silva-Brandao & Ianni, 2020). The individualising tendency of risk attribution also helps to obscure system explanations of risk, for example, the economic assumptions that have weakened the profitability of antibiotics and therefore limited discovery of new treatment options (UK Review on Antimicrobial Resistance, 2016) or the limited capacity of low-

and middle-income countries to be able to implement and support antimicrobial mitigation in their health systems (Kalam et al., 2021).

In addition, sociological investigations of moral injury and individualisation most commonly focus on these effects for members of the general public, patients and other groups subject to social control (Alaszewski, 2021). Less common are analyses that focus on those individuals in social systems who broker knowledge and decisions in relation to risk. In the present context, antimicrobial prescribers, scientists and policy-makers are risk ‘brokers’ and it is important to understand how they themselves negotiate the technical and social risks of antibiotic use and AMR.

### *Antimicrobial stewardship and risk rationalities*

Antimicrobial stewardship is the key means by which prescribers deal with the twinned risks of antimicrobial usage: the risks of infection in the patient and future AMR risks tied to the use of antimicrobials. Antimicrobial stewardship is, however, subject to a degree of situated uncertainty, within which new risks can emerge. For example, in human or animal health care, when microbiological evidence for an infection is not available due to time constraints, prescribers apply criteria to decide if and what antibiotic should be used. In hospital settings, adjustments to treatment are made as diagnostic results become available and with clinical progress, for example, as therapy ‘timeouts’ used in the US (CDC, 2014) and the UK’s ‘Start Smart then Focus’ (Ashiru-Oredope et al., 2012). In primary healthcare settings prescribing is commonly made without microbiological diagnosis, linked with the general practice business models which limit time with individual patients (Biezen et al., 2017). Companion animal prescribing is similarly circumscribed. Though some clinics are equipped to conduct some microbiological diagnostic tests, these can be costly for the consumer and are therefore not always used (Hardefeldt et al., 2018).

In addition to these risk management challenges is the tension between the immediate infection risks for individuals and longer-term, collective AMR risks. For example, in a short commentary, Fitzpatrick et al. (2019) note that antimicrobial stewardship can conflict with sepsis treatment protocols. Sepsis is a potentially life-threatening inflammatory response that needs to be treated quickly with antibiotics. Antimicrobial stewardship seeks to reduce unnecessary and refine overall use of antimicrobials, which can be interpreted to be at odds with the need to act on sepsis. Fitzpatrick and colleagues note that this tension compromises action on both sepsis and AMR because these two risk approaches have not been effectively combined. They also note that sepsis and antimicrobial stewardship programmes are often managed by different teams in hospital settings, amplifying the separation of these approaches. Similarly, Charani and Holmes (2019) noted in a review of antimicrobial stewardship that immediate bed side risks were in tension with action on future risks of AMR. They also found that stewardship approaches and effectiveness varied between country contexts, pointing to a nexus of economic, social and cultural determinants of antimicrobial use. Within the hospital setting, different speciality cultures also shaped alignment with stewardship, for example, surgeons were seen to use antibiotics when they may not be needed to limit risks of infection for their patients. Charani et al. (2019) interviewed doctors, surgeons and pharmacists in the UK, France, Norway, India and Burkina Faso to better understand prescribing cultural variation. They found that in settings where professional boundaries were least hierarchical – as was the case in one Indian hospital – antimicrobial

stewardship worked effectively. These perspectives indicate that risk management in stewardship is both general and particular: the tension between immediate patient risks and long-term AMR risks is a ubiquitous problem, but responses to it are culturally diverse between and within nations and healthcare disciplines.

In depth qualitative research reinforces the view that the patient risk/AMR risk duality is pivotal for stewardship and has extensive ramifications. McKenna and Gale (2022) used a qualitative survey – short answer written responses to fixed questions – of NHS staff in primary and hospital services in the UK to understand stewardship practices. They found that in primary care, in particular, doctors found it difficult to establish antimicrobial stewardship without jeopardising the doctor-patient relationship. Relatedly, asserting stewardship by refusing antibiotics weakened the capacity of the medical practitioner to effectively manage other healthcare issues, showing in another way how risk management needs to be carefully conducted to avoid secondary, harmful effects. Broom et al. (2017) conducted in-depth interviews with hospital doctors in Australia and found that the needs of the individual patient were prioritised over AMR. They attributed this priority to the organisational structure of clinical care in the hospital setting, which bound decision-making to the immediate needs of the patient and de-emphasised the longer term and collective challenge of AMR.

Pandolfo et al. (2022) conducted focus groups and interviews with staff working in UK intensive care units to understand prescribing in that context. Clinicians gave priority to the individual patient, despite awareness of AMR. They also spoke of how failure to prescribe effectively could lead to ethical and legal ramifications for the prescriber. Tarrant et al. (2020) interviewed doctors from hospitals in the UK, Sri Lanka and South Africa to understand how they defined the misuse of antimicrobials and how they practised prescription. Prescribers spoke of the risks entailed in making prescription decisions under conditions of uncertainty with regard to the infection and its severity. In these situations, moral expectations regarding patient safety were paramount. Veterinary surgeons also reported that their decisions to use antibiotics are partly informed by fears of failing to treat the animal and ramifications for their professional reputation and income (C. King et al., 2018).

Several reviews of qualitative research on antimicrobial stewardship have also reinforced the need to address the moral implications of prescribing in relation to AMR, but also tend to focus on the individual prescriber's behaviour and therefore less on cultural context. Borek, Wanat, et al. (2020) used behaviour programming principles to review qualitative studies about stewardship in primary care. They found that the implementation of national guidance could help, in tandem with attention to the skills of the prescriber and their emotional resilience. Tarrant' et al. (2019) narrative review of stewardship principles discussed the twinned moral hazards of failing to treat an infection and the need to preserve antibiotics for the future. Applying principles of behavioural programming, they called for visible and enforceable prescribing protocols, accurate monitoring of prescribing, and the use of incentives and sanctions. An important finding was a proposal for collective decision-making for stewardship to generate improved outcomes for patients and AMR. Krockow et al. (2019) found that prescribers focus on immediate patient risks due to the moral hazard of failing to prevent serious infection. They recommended incentives for stewardship and the promotion of collective decision-making but with a focus on the behaviours of the individual prescriber. While these framings of stewardship do engage with its pivotal moral problem, they give emphasis to individual action somewhat abstracted from organisational and cultural

context. As we have discussed, risk society individualises culpability for risk decisions. It obscures structural drivers and cultural diversity while foregrounding and problematising the risk management practices of the individual. We seek in this paper a different perspective on moral hazard supplied by the sociology of risk to consider how risk management is less a property of the individual and their behaviour and more about the assumptions and norms – including attribution of culpability – that are characteristic of risk society.

The perspective we seek to develop in the analysis below is also important because much of the stewardship implementation research somewhat uncritically reproduces framings which individualise risk. As noted by (Charani & Holmes, 2019; McKenna & Gale, 2022), this research is generally conducted by clinicians in clinical contexts, and only some of this work employs qualitative methods. This qualitative research is most often restricted to descriptions of interview and focus group content to identify the common-sense barriers and enablers of antimicrobial stewardship and to pose recommendations for its improvement. In the Australian context, for example, qualitative interviews have shown that the key enablers of stewardship include: increased education and engagement (Ayton et al., 2022); and stronger support from senior hospital executives (Bishop et al., 2020; Gouloupoulos et al., 2019). For hospitals in rural Australia, researchers have called for greater attention to geographic isolation and local health infrastructure (Bishop et al., 2020; Bishop et al., 2019). In the UK, primary care practitioners reported in interviews that the lack of clinic staff resources and lower socioeconomic status of the patient group led them to prescribe antibiotics to reduce risks (Borek, Anthierens, et al., 2020).

In interview studies, hospital pharmacists have emphasised the need for national guidelines, more leadership, additional resources and feedback on prescribing practices to enhance stewardship (Monmaturapoj et al., 2022). Interviews with community pharmacists in Scotland, meanwhile, found that they endorsed stewardship in principle but were not actively engaged, leading to a call for increased professional education (Tonna et al., 2020). A survey and interviews in France with individuals implementing a national AMS programme found that overcoming organisational separation of stewardship and infection control programmes would be needed (Conlin et al., 2023). A Canadian interview study with primary care doctors (Jeffs et al., 2020) found that leadership, feedback and decision aids would be helpful for stewardship.

Although these findings are informative, they do not address the underlying patient risk/AMR risk dilemma which shapes the effectiveness of stewardship and therefore the reduction of AMR. These studies tend not to address in depth the meanings of culpability and its genealogy in sin and morality revealed in sociological framings of risk and its management (Lupton, 2024).

In this analysis developed below, therefore, we focus on the cultural organisation of responses to the patient/AMR risk duality that lies at the heart of antimicrobial stewardship. We use interpretative qualitative methods, alongside an analytical framework informed by the sociology of risk, to examine the experiential narratives of practitioners, scientists and policy-makers. This approach contributes to the existing literature on this topic by consulting with experts working in human and animal health, scientists and other professionals and therefore situating our research beyond the hospital or GP clinic. We also adopt a critical stance on risk individualisation by assuming that responses to the patient/AMR risk duality are not fully explained by the knowledge, skills and behavioural attributes of the

individual. We see that the focus on the individual flows out of the neo-liberalised risk management cultures found in contemporary social institutions, such as biomedicine (Lupton, 2024). By adopting these perspectives, we aim to offer an expanded insight into the patient/AMR risk duality, its moral hazards and how it may be addressed.

## Methods

Our analysis is based on in-depth interviews with practitioners in human and animal health, biomedical scientists and health policy-makers with regard to the challenge of reducing AMR. We applied purposive criteria to recruit interview participants. We aimed to balance the number of men and women and a spread of years working in the AMR field. We also sought out volunteers in all the states and territories of Australia and a small number ( $n=6$ ) working in the UK to provide some potential for contrast with the Australian interviewee narratives. We emailed 174 individuals (from governments, universities, hospitals, royal colleges, professional associations, peak health agencies, and charities working in the AMR field) and 51 agreed to be interviewed (25 women and 26 men). These interviewees mapped onto our purposive criteria as so: 17 of the 51 participants worked in human health; 15/51 worked in animal health; 13/51 conducted research on AMR; 11/51 were healthcare policy-makers related to AMR; 6/51 were located in the UK. Note that the numerators in these figures do not sum to 51 as some individuals had multiple roles as practitioners, researchers and policy-makers.

The first and second authors conducted the interviews using a topic guide that included: experiences with implementing AMR reduction and antimicrobial stewardship, views on drivers of AMR and its reduction, sources of evidence for policy and practice, collaboration, impact of SARS-CoV-2 on work, and views on the key next steps for the reduction of AMR. Fieldwork coincided with the SARS-CoV-2 pandemic, so interviews were conducted via zoom or telephone. Audio recordings were professionally transcribed for entry into data analysis software (NVIVO) and analysed using modified grounded theory (Bryant & Charmaz, 2019). The first and second authors independently coded the same 5 interviews, first using deductive codes derived from the social science literature followed by inductive codes developed through constant comparison and refutational logic. Examples of deductive codes included, 'One Health'; 'system drivers of AMR'; 'surveillance and measurement of AMR'; 'technology'; 'governance'; and 'collaboration'. Inductively derived codes included: 'power hierarchies'; 'risk'; 'anthropocentrism'; 'fragmented governance'; and 'nihilism in AMR narrative'. The first and second authors conferred to discuss emerging codes and presented them at workshops with the research team. On this basis we developed a code book that was used to recode the data to deepen and nuance the themes. We then selected key themes and developed written memoranda – key interview fragments along with written interpretations – which became the basis for manuscripts, including this one. Interview fragments in what follows are attributed to pseudonyms as per ethics approval.

As context for what follows, Australia's first national AMR action plan commenced in 2015 (Australian Commission on Safety and Quality in Health Care, 2021). In Australia, the hospital and aged care systems are subject to government accreditation with regard to antimicrobial stewardship standards. Primary care and veterinary medicine, however, are self-governing. The UK, by contrast, has had a national strategy since 2013 and stewardship programmes in place in hospital and primary care, with some

inroads into veterinary medicine (HM Government, 2019). In addition, prescribers can access guidance via the Start Smart then Focus toolkit.

## Findings

The analysis we present below focuses on the risk rationalities of AMR reduction presented as two related themes:

- *Managing infection and AMR risks*: how experts addressed the relationship between immediate patient risks and longer-term AMR risks in antimicrobial stewardship and the related biomedical, reputational and moral risks
- *Practising risk individualisation*: how experts spoke of the personalised risk positions adopted by prescribers and how these shaped decisions to use antimicrobials

### *Managing infection and AMR risks*

Our interviewees suggested that the expectation to reduce AMR somewhat contradicted effective treatment, as suggested by others (Broom et al., 2017; Charani & Holmes, 2019; Fitzpatrick et al., 2019; McKenna & Gale, 2022; C Tarrant et al., 2020). In this example, a hospital-based medical practitioner captured this tension:

*... there's two resonant messages that all the frontline staff get and the first one is, 'Don't miss sepsis'. 'If you miss it, you'll be thrown under the bus'... . . . And then, the other side is: 'But we don't want you to prescribe antibiotics unnecessarily because the vast majority of children have viruses.' . . . . I think generally the people I work with have a very good understanding of driving resistance by misuse of antibiotics. But I think there's this contradictory message of the fear of not using antibiotics in a life-threatening situation and getting it wrong ... (Expert Interview 24, paediatric physician)*

This interview fragment echoes the risk duality at the centre of antimicrobial stewardship. It captures the moral hazard that pertains to prescribing decisions, posed as a Catch 22. Notable in this fragment is the fear linked with possible mistaken decisions. It shows that antibiotic use is a matter of reason *and* emotion: treatment reduces infection *and* fears of threat to life and its consequences for all, including the practitioners. This fragment, then, echoes the research findings that prescribers say that their decisions are imbued with moral risks to reputation, career and the sense that they are able to preserve life (Broom et al., 2017; Krockow et al., 2019; Pandolfo et al., 2022).

The personal consequences of treating a patient who succumbs to an infection was a recurrent theme in the interview narratives, particularly among those with experience in human and animal healthcare. In this account, the interviewee suggested that prescribers are more likely to opt for protecting the patient than consider AMR, partly because culpability for a negative outcome is applied to the individual practitioner:

*All of the trainees are aware that antimicrobial resistance is an issue but for them the issue is: 'Am I covering it? What antibiotic do I need to add to make sure I'm covering it?' So they come from the perspective of: 'I've got a febrile, sick child in front of me. If I get the wrong thing or I don't cover the right thing, they're gonna die, it'll be my fault.' Right? So*

*they're very reactive and quite defensive . . . . They know of stewardship as a phenomenon but I don't know that they embrace it as strongly as the other, which is trying to keep themselves protected from the legal or hospital ramifications of getting it wrong. Which they feel much more keenly as the prescriber in the middle of the night . . . (Expert Interview 17, paediatric physician)*

The interviewee mentioned the situation of treating an ill child, a particularly emotive area of medical decision-making with the moral loading of the implied threat to a child's life. The interviewee also drew attention to the situations in which these decisions are made and pointed out that in some settings – 'in the middle of the night' – the clinician acts somewhat alone. The example shows that decisions regarding antimicrobials depend on the situation in which practitioners find themselves. The decision-maker is positioned in a moral and organisational system that 'stabilises' risk in terms of particular blame configurations and emotional resonances (Linn, 2019), in this case, paediatric care with its profound symbolism of young lives under threat, especially in the case of an emergency overnight.

As discussed earlier, we interviewed experts who were not human health prescribers to broaden our investigation of risk rationalities that inform the AMR field. Our veterinarian, pharmacist and scientist interviewees were aware of the risk duality tension. For example, one veterinarian with a research profile in AMR described the existence of hazards pertaining to a prescribing decision that turned out to be the wrong one:

*. . . part of the problem, certainly in veterinarians and possibly also in human health, is that whole sort of fear of litigation as well, right? They're sort of, you know, 'Oh, you haven't done everything to prevent this from happening and you haven't been careful enough.' And certainly, when I was in private practice that would have been something that I would have thought about. But what if it does turn into an infection? Then I get into trouble. (Expert interview 39, Veterinarian and researcher)*

This interview fragment signals the pertinence of the twinned risk rationalities of infection and AMR risks in animal healthcare. Notably, too, the economic circumstances of the prescribing decision, that is, private practice, can help to shape the prescribing outcome.

In this interviewee with a pharmacist, they indicated that reconciling patient safety with AMR reduction remained somewhat unresolved:

*I suppose one of the key things in terms of the drivers of antimicrobial resistance is unnecessary prescribing of antibiotics. You know, there's that defensive medicine aspect . . . . it's that fear of the consequences for the prescriber if they don't prescribe, and that fear outweighs any benefit to the society. I think that's a really tricky one to try and address. (Expert Interview 8, pharmacy & policy making human health)*

In another example from a scientist, they reflected on their experiences during presentations for medical practitioners. They recalled how students responded to their depiction of the AMR threat from an environmental point of view:

*. . . I've given presentations in the hospital about the stuff I do and they're like: 'Well, how does what you're saying impact my decision-making when I'm faced with someone who might have sepsis and I have to give them an antibiotic?' And then they say: 'If it doesn't impinge on that, then I don't have the bandwidth to even consider it. It's all very interesting but it doesn't, it's not something that I'm gonna consider'. (Expert Interview 50, environmental microbiologist UK)*

This interview fragment suggests that AMR is comprehended and accepted as a biological phenomenon, but knowledge of it is not readily applied to the situations prescribers are required to manage. It also suggests that the risk polarisation we observed in Australian narratives on AMR reduction is also found in the UK, echoing the work of others working in the UK and elsewhere (Charani & Holmes, 2019; McKenna & Gale, 2022). A challenge for antimicrobial stewardship then is deepening understanding of how it works to support AMR reduction across the professions and disciplines working in the AMR field.

These examples indicate that AMR risk was often spoken of in ways that opposed effective stewardship with pursuing human and animal safety, which is not the intended effect of antimicrobial stewardship. This perceived antipathy could create tensions for AMR reduction tied to what appeared to be an extensive and enduring interpretation of how it is generally conducted. It seemed to be the case, also, that this antipathy was used as part of narratives seeking to deflect the potential for the moral injury arising from failure to treat and infection, on which prescribers were necessarily focussed. These perspectives, as apparent in our data, reinforce the risk sociology perspectives on the more-than-technoscientific implications of antibiotic use and AMR. These moral implications need to be addressed to strengthen the effectiveness of antimicrobial stewardship and mitigate the potential for moral injury.

### ***Practising risk individualisation***

Our analysis of the interviews showed that antimicrobial stewardship was subject to risk individualisation (Beck & Beck-Gernsheim, 2002). Guidelines for antimicrobial use facilitate decision-making and protect the prescriber and patient – human or animal – from harm. Interviewees alerted us to the ways in which individual prescribers may have different knowledge levels of, or access to, antimicrobial prescribing guidelines, indicating an important agenda for the promotion of antimicrobial stewardship. But interviewees also noted that fears of adverse outcomes existed despite guidelines on the use of antimicrobials, including those done when prescribing support may not be present and echoing the previous comment about responding to a possible infection ‘in the middle of the night’. These uncertainties over and above risk management protocols meant that prescribers had to take a position on the risks they would be comfortable to take.

A physician/researcher explained that in situations of relative certainty it was easy to harmonise decision-making with prescribing guidance. However, under other conditions of greater uncertainty, guidelines become less useful:

*There are hard boundaries. So, for example, when a situation is very clear . . . Let's say, someone just had a standard operation and the surgeon said, 'I want to give this ridiculous antibiotic for a hundred years after this standard operation.' And the hospital policy is, no. They get a pat on the hand instead. You can force that issue. And we do force that issue. And, if necessary, you get bolshy about it. And escalate it in the way that you can do. Most of the circumstances where it's difficult are those circumstances where it's a [complex or uncertain] call. So, for example, you'll have a patient that's been managed by Dr X who will interpret the situation as being possibly or probably due to an infection, whereas you would interpret the situation as being extremely unlikely. There's always a risk tolerance involved. So you might say, 'I think we should just use penicillin,' and 99 per cent of the time that'd be fine. And the doctor in charge will say, 'Well, look, I'm not prepared to take a one per cent risk that you're wrong.' So it's about risk tolerance. Which comes down to personalities and also cohorts. And let's say you have a different risk tolerance in a twenty-*

*year-old [with] neutropenic shock to someone who's already dying of metastatic cancer in the palliative-care ward. (Expert Interview 4, microbiology & human health)*

This example emphasises the variable complexity of different clinical situations and therefore the varied relevance of prescribing guidance. It shows, too, that not all situations can be modelled in guidance and that in those situations the practitioner is required to apply judgement.

The example also draws attention to the situation where a choice between different antibiotics needs to be made. While one clinician might be happy with one choice, another might see that as too risky and opt for another antibiotic. The figure of the surgeon in this account is seen to restrict risk for the patient as much as possible, possibly due to the imperative for positive surgical outcomes. This perspective on disciplinary differences in the management of AMR echoes Charani and Holmes's (2019) notion of disciplinary cultural variation in antimicrobial stewardship and the significance of extra-individual factors. The example, 'I'm not prepared to take a - one percent risk ... ', provides a picture of a clinician taking a risk averse position on how they will choose to manage risks for the patient and the ramifications it may have for themselves.

Reinforcing this concept of risk individualisation, a medical practitioner from the UK noted that guidelines for antimicrobial prescribing are crucial but cannot govern every decision, absolutely. For this reason, the judgement of the practitioner and the risk they are prepared to accept become pivotal to the decision:

*... from the most junior doctor who's just come out of training through to a consultant, they'll all make those prescribing decisions, at one level or another, mediated, mitigated by rules and procedures, formulas and protocols. So, this very junior doctor wouldn't be able to prescribe some antibiotics without getting permission from their consultant microbiologist. So, there's all kinds of rules and systems in place to control that prescribing to some extent or another. But, in the end, it is a doctor writing a prescription and making a clinical assessment, a diagnosis, saying: 'You need to give X or Y, at this point'. (Expert Interview 48, infection control manager UK)*

Guidelines help, but the medical practitioner's individual judgement of the circumstances at hand is also an important factor for decision-making. Moreover, clinicians vary in relation to their knowledge but also their status – the junior doctor – in the power hierarchies of healthcare (Charani & Holmes, 2019). In another interview fragment from a practitioner/researcher, they explained how prescribing guidelines worked in practice and indicated that other considerations shape the decision beyond just doing what a policy says:

*Well, the classical medical paradigm is 'life at all costs'. The flipside of which is 'first do no harm' ... there's all these little silly mottos and sayings. You take the 'life at all costs' paradigm, the archetypal exponent would be the intensive care specialist, the emergency physician and the high-profile surgeon. So, they'll go in, guns blazing and hanging out of a helicopter, and bring you back from the brink of death ... you have those people whose entire focus is the bedside in front of them. But if you present them with a .5 per cent risk of failure, that's intolerable. But then there are those who work in public health, who say: 'If we don't do something about antimicrobial resistance, we're all heading for a total wreckage, like global warming'. And so, where's the sweet spot between these two opposing camps, both of which have the best intentions in the world?. (Expert Interview 4, microbiology & human health)*

This example emphasises the life-saving imperative that shapes decisions in healthcare. Importantly, too, it suggests that different practitioners have different approaches to risk. In the example provided, heroic – ‘hanging out of a helicopter’ – practitioners place saving life in the immediate sense as the highest priority. For this reason, any risk of an untreated infection is intolerable and motivates the use of antimicrobials.

Like many of the examples above, the tension between present patient risks and future patients’ risks shaped this expert’s interpretation of their experiences. Decision-makers were seen to adopt positions in light of the core tension pertaining to different risks, another effect of the individualising effects of AMR reduction. Building on this point of view, an interviewee working as an infectious diseases physician noted also that with uncertainties came complexities and therefore that AMR risk was infused with moral considerations:

*... you can never be 100 per cent right. There’s always going to be a proportion of patients that you won’t get it right on . . . . . and clinicians don’t expect 100 per cent certainty . . . . . you’re trying to strike a balance between the potential risk of what you’re doing and the benefits. And I guess the challenge is that the benefit is to the patient lying in front of you, whereas the risk is a complicated, ethical thing because the risk is not as much to the individual patient, it’s a lot larger kind of societal risk . . . . . the challenge in prescribing is that, for that person sitting in front of you . . . . . it does matter for them. (Expert Interview 14, ID physician human health)*

This interview fragment ably captures how prescribers are positioned at the intersection of patient and AMR risks and provides a picture of antimicrobial stewardship as a complex process with moral ramifications, intersected by disciplinary variations in risk tolerance and status in healthcare systems. This and the previous examples suggest the need for the further development of the structures that help prescribers to harmonise the reduction of patient risk, AMR risk and risks to themselves.

## Discussion

AMR is a prime example of the limits of technocratic approaches to health threats and their troubling iatrogenic effects. Through the example of antimicrobial stewardship, we have shown, in the discourse of a diverse group of experts, how individualisation and the potential for moral injury shape prescribing decisions and the management of AMR risk. Antimicrobial stewardship is outwardly a technical and scientific method for risk reduction, but it is also implicated in the moral cosmology expressed through risk management in neo-liberalised societies that configures enduring moral-ethical commitments between clinicians and patients. Coupled with the tendency of institutions such as biomedicine to individualise risk decisions (Lupton, 2024), making use of antimicrobials is personalised and moralised for experts. It is significant that those most often construed as risk management brokers – those who possess scientific and technical knowledge and are empowered to use these insights and skills to manage the risks for patients – are themselves subject to the social control exercised through the assumptions of risk society (Alaszewski, 2021). The tension between the risk rationalities of infection treatment and AMR risk is made into a problem for the prescriber to solve, including the moral jeopardy they might face if an infection harms a human or animal. In parallel with the deepening of individual responsibility for risk and the life course to which members of the general public are subject, our research suggests that these effects shape the work and career prospects of expert practitioners.

These manufactured risks are significant. Different kinds of experts working in Australia and the UK were not able to speak of how to harmonise the effective treatment of infections in the here and now with the longer-term efforts to mitigate the growing AMR crisis. This situation requires attention to clarify knowledge and understanding of the scope and effects of antimicrobial stewardship and how it synergises with AMR reduction and adjacent interventions such as sepsis risk reduction programmes (Charani & Holmes, 2019; Fitzpatrick et al., 2019; Thursky et al., 2021). This is a vital agenda for health protection, for the sustained tackling of AMR and the support and wellbeing of healthcare practitioners and their patients.

We suggest that there is more than one way of explaining the persistent opposition of these risk rationalities. It could be construed as a problem of policy communications and practice development. There is scope for investment in antimicrobial stewardship practice development and closer links with other programmes, such as those for sepsis, to overcome ostensibly divergent decision-making. However, the risk society lens suggests that this tension runs deeper than messaging and alignment. The management of AMR is not simply a matter of the knowledge and behaviour of the prescriber. It is shaped by neo-liberal risk culture which is organised to foreground the individual as the key moral agent. For this reason, decisions about how to manage AMR are interlaced with symbolic meanings of sin and virtue (Douglas, 1992). The hero surgeon noted by one of our research participants can be seen as the apotheosis of this risk management culture. Moreover, because responsibility for these decisions is individualised, the risks for the individual are high, for example, being held to blame for negative outcomes which are feared to relay into reputation, career and the moral injury of failing to preserve life. For this reason, risk culture makes it hard to not use antibiotics in an effort to remove both technical and cultural repercussions for the prescriber. Our analysis indicates that those making decisions about antimicrobial use lack the means to properly mitigate such moral injury. Antimicrobial use, then, becomes the key means by which it is possible to deflect moral injury. In this view, AMR is driven by a form of social iatrogenesis tied to risk society (da Silva-Brandao & Ianni, 2020) and not simply the knowledge and skills of the prescriber. This insight is important, theoretically, as it shows how risk society has iatrogenic effects that limit the agency of individuals and contribute to harm (Lupton, 2024). Practically, this insight underlines the importance of addressing social perspectives in communication and assistance to promote the effectiveness of antibiotic use and reduce AMR.

Our analysis suggests that decisions to use antimicrobials might be easier if prescribers were less likely to be held individually culpable, that is, if they were embedded within supportive structures that facilitated shared decision-making. Researchers have documented the benefits of collective decision-making for antimicrobial use in hospital settings (Krockow et al., 2020; van Esch et al., 2018). Our analysis concurs but for different reasons derived from our use of the sociology of risk. Collective decision-making may well improve clinical outcomes and harmonise with the goal to contain AMR, but it can also help to mitigate the moralising and individualising effects of risk culture that have been shown to influence prescribing decisions.

The insights in our study developed from interviewing experts from outside the hospital and GP clinic context, enable us to contribute further considerations. Different kinds of experts contribute to AMR policy and practice and they interact with one another increasingly, especially given the push towards One Health collaboration (Australian Government, 2021). It might help, therefore, to facilitate education and dialogue around antimicrobial

stewardship beyond the hospital and clinic so that all AMR experts can better understand the patient risk/AMR risk tension and participate in constructive discussions and solutions. Antimicrobial use regulation, guidelines and audits are necessary but, given the analysis we have developed, collective decision-making and shared insight could moderate some of the pressures of individualisation and related moral jeopardy. Similarly, future research could further explore ways of operationalising collective decision-making across diverse settings within future intervention development. Co-design approaches (Ruby Biezen et al., 2023) could be used to generate the ways and means of enabling collective prescribing decisions across diverse prescribers and the different settings they work within. Adopting a One Health approach and focusing on sharing ideas about how collective decision-making can be enabled across settings and sectors is also highly likely to be beneficial.

The example of antimicrobial stewardship in our study also indicated the importance of organisational context for AMR reduction. Antimicrobial stewardship in hospital settings incorporates the use of diagnostic technology and clinical observation to revise prescriptions and optimise patient safety (Ashiru-Oredope et al., 2012). Stewardship also involves monitoring patterns of antimicrobial use and the quality of prescribing alongside surveillance of AMR itself. Hospital prescribers can therefore adjust and refine their prescribed therapy in line with the overall goal of AMR reduction, but prescribers in general practice or companion animal health settings may not have access to this opportunity. Strategies to assist prescribers to mitigate these system effects would help them to participate in AMR reduction.

As we have shown, risk society related theories provide a useful, critical lens for studying AMR. AMR reduction in our study was often described as being undermined because the need to use antimicrobials was seen to conflict with the need to refine and limit their use, particularly in risk reduction systems that individualise culpability. This inherent tension in risk orientations is true in human health, but is also a problem for animal health and agriculture where the same problem of continued use and risk reduction applies. We see this situation as arising from a failure to grapple with the social and moral conditions of infection risk in combination with AMR risk. These challenges are unlikely to be easily resolved. Effective AMR stewardship will be enhanced, however, if AMR reduction policy and practice address risk individualisation and moral injury to ensure that their effects are accounted for and reduced to the extent that they can be.

### **Acknowledgments**

This research was funded by an Australian Research Council Discovery Project grant (DP200100002). We are very grateful for the participation of our interviewees.

### **Disclosure statement**

No potential conflict of interest was reported by the author(s).

### **Funding**

The work was supported by the Australian Research Council .

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