Research forum: imaging a post-antimicrobial future

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Antimicrobial resistance, or AMR,[1] is a global challenge, with the WHO declaring it one of the 'top 10 global public health threats facing humanity'. Specifically, the WHO, governments and researchers have highlighted the 'misuse and overuse of antimicrobials', and the lack of clean water, sanitation and preventative measures, specifically noting concern over resistant strains of gonorrhoea, methicillin-resistant *Staphylococcus aureus* influenza, HIV, malaria and tuberculosis (WHO 2021). AMR leads to increased morbidity, mortality and costs from infections, not least as a patient may cycle through several antimicrobials before an effective one is prescribed. Additionally, many second-line and third-line (and beyond) antimicrobials are not readily available in low-resource settings. Moreover, antimicrobials are regularly prescribed as a prophylaxis, for instance, to prevent infection in routine surgeries (WHO 2021).

There have long been concerns over AMR within the medical community, going back at least to 1907 (Hutchison, page 359). Sir Alexander Fleming, who discovered penicillin, used his Nobel prize acceptance speech in 1945 to warn of the risk of resistance, and to blame a hypothetical patient who 'misuses' medicine:

> The time may come when penicillin can be bought by anyone in the shops. Then there is the danger that the ignorant man may easily underdose himself and by exposing his microbes to non-lethal quantities of the drug make them resistant. Here is a hypothetical illustration. Mr. X. has a sore throat. He buys some penicillin and gives himself, not enough to kill the streptococci but enough to educate them to resist penicillin. He then infects his wife. Mrs. X gets pneumonia and is treated with penicillin. As the streptococci are now resistant to penicillin the treatment fails. Mrs. X dies. Who is primarily responsible for Mrs. X's death? Why Mr. X whose negligent use of penicillin changed the nature of the microbe (Fleming 1945).

Several decades later a 1992 issue of *Science*, highlighted the issue, starting with a bluntly titled editorial: 'The Microbial Wars' which drew on conflict-related metaphors to describe the relationship between microbes and humans (Koshland 1992). This issue also popularised the concept of a 'post-antibiotic' or 'post-antimicrobial future' (Cohen 1992). This is the concern that, if no new antimicrobial medicines are developed, some infections will become untreatable as microbes evolve resistance to current treatment. The 'post-antibiotic future' invites us to imagine a world, at times dystopic, in which antibiotics no longer work and 'modern medicine' as we know it will no longer exist.

Clearly, AMR is a global public health concern which must be addressed now and, as the articles in this research forum highlight, research and education in the medical humanities can play an important role. Specifically, the articles analyse the ways in which a post-antimicrobial future is imagined through metaphors, visualisations, fantasy and other discursive forms. For instance, politicians and researchers use terms like medieval or refer to the 'Dark Ages', conjuring up a future reminiscent of an imagined 'pre-scientific' past (Irwin 2020). At the same time, the public is expected to act on these warnings through behaviour changes, such as handwashing or properly adhering to medication. The articles in this research forum further examine how these imaginings influence public health interventions and approaches, such as calls for new diagnostics and strengthened surveillance systems. Beyond this, the articles try to find a reordering of human/non-human relationships in these imagined post-antibiotic futures. Through critically reflecting on how researchers and policy makers discuss, write and visualise this problem, the three authors highlight the contributions of medical humanities perspectives on this issue.

Many of the empirical examples in the articles come from Sweden and the United Kingdom, in which the authors draw on government reports, official statements and a variety of material from popular culture. Both countries have driven AMR in international fora, with Sweden appointing an AMR ambassador in 2022 and the two countries most recently cohosting a joint breakfast event at the 75th World Health Assembly in May 2022 (Government of Sweden (2022a, b)). We suggest, although somewhat tenuously, that this high-level attention has trickled down into 'everyday' discourses and public health awareness, making both countries of interest to medical humanities research on AMR.

Implicit in these articles is the question of whether researchers, clinicians, policy makers and society at large should fear the post-antibiotic future. It has been estimated that by 2050, 10 million people will die of infections that cannot be treated because of resistant bacteria and ineffective antibiotics (AMR Review 2016). Yet, Rachel Irwin's contribution, 'Imagining the post-antibiotic future: the visual culture of a global health threat', notes that many of the statistics and projections which circulate are problematic and, in some cases, inaccurate She continues by describing how these numbers become ingrained in public and professional discourse through their repetition and integration into data visualisations and other visual media.

The visual aspects of data are also discussed in Kristofer Hansson and Adam Brenthel's contribution, 'Imagining a Post Antibiotic Era: A Cultural Analysis of Crisis and Antibiotic Resistance'. They also explicitly take up the power aspects of imagination and fantasy. They use philosopher Lars Gustafsson's 'the privilege of formulating the problem'. That is, 'those who have the privilege of defining the problem are also in command of proposing the solution'. The power aspect extends to assigning (or deflecting) blame and responsibility to/from different actors: whether we are discussing individual patients (as Fleming did in 1945), the pharmaceutical industry, governments or the agricultural sector.

All three contributions note the unhelpful metaphors and framings: the post-antibiotic era is described as 'going back' to the Dark Ages or the Middle Ages, and microbes as having personalities and wills to 'outsmart' humans. Specifically, Coll Hutchison critiques military metaphors in 'War & Sweets: Microbes, Medicines and other Moderns in and beyond the(ir) Antibiotic era'. In doing so, he also addresses the power wielded by metaphors, and both their creators and their users. The article further highlights how the narrative of antimicrobials and AMR is intimately

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tied to nationalism, armed conflict, 'modernisation,' capitalism, political ideologies and literal—not only metaphorical—armed conflicts.

Certainly, considering the current and potential state of AMR, it would be prudent to exert caution if we are, indeed, moving into a post-antibiotic future. Bacteria, viruses and other microbes cause suffering and—from a public health perspective—we welcome increased attention to preventative measures, as well as diagnostic tools and new antibiotics. However, the overarching question in these contributions is not whether we should fear the post-antimicrobial future, but rather who wants us to be afraid and why? Who is framing the problem and do these dominant framings prevent us from finding complimentary or alternative solutions?

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NOTE

1. Antimicrobial resistance refers to the ability of micro-organisms—bacteria, viruses, fungi and parasites—to resist antimicrobial medicines; much of the empirical material and theoretical perspectives in this research forum refer to both antimicrobial (micro-organisms in general) and antibiotic (bacteria) resistance, or only antibiotic resistance. However, the terms should not be conflated.

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