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Antimicrobial resistance and biological governance: explanations for policy failure

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ABSTRACT

The paper reviews the state of policy on antimicrobial use and the growth of antimicrobial resistance (AMR). AMR was anticipated at the time of the first use of antibiotics by their originators. For decades, reports and scientific papers have expressed concern about AMR at global and national policy levels, yet the problem, first exposed a half-century ago, worsened. The paper considers the explanations for this policy failure and the state of arguments about ways forward. These include: a deficit of economic incentivisation; complex interventions in behavioural dynamics; joint and separate shifts in medical and animal health regimes; consumerism; belief in technology; and a narrative that in a 'war on bugs' nature can be beaten by human ingenuity. The paper suggests that these narratives underplay the biological realities of the human-animal-biosphere being in constant flux, an understanding which requires an ecological public health analysis of AMR policy development and failure. The paper suggests that effective policy change requires simultaneous actions across policy levels. No single solution is possible, since AMR is the result of long-term human intervention which has accelerated certain trends in the evolution of a microbial ecosystem shared by humans, animals and other biological organisms inhabiting that ecosystem. Viewing the AMR crisis today through an ecological public health lens has the advantage of reuniting the social-ecological and bio-ecological perspectives which have been separated within public health.

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Introduction: a question of perspective

The problem of antimicrobial resistance (AMR) has been much documented worldwide. The persistence of the problem suggests that policy responses have been inadequate or at best have not yet worked. This paper considers what those policy responses are, how they have been framed and by whom. It proposes that the language and focus of the policy discourse indicate a deep structural problem not just for public health but also for food system management. AMR thus illustrates the pertinence of the ecological public health approach and obstacles to it being mainstreamed in policy discourse. In this paper we use the term AMR, although much public discourse has used 'antibiotic resistance'. AMR refers to resistance developing to anti-bacterial, anti-viral and other medicines used against pathogenic infections; it is the more accurate term to describe the public health problem. Most of the public focus and attention, however, has been focused on worsening resistance amongst bacteria, and the diminishing effectiveness of antibiotics used to treat infections caused by pathogenic bacteria. In the common vernacular, 'antibiotic' resistance is often used synonymously with AMR.

Evidence about AMR has mounted for decades, and concerns about the consequences of antibiotics overuse hastening AMR and rendering antibiotics ineffective were made well over half a century ago.[1,2] Policy responses to the threat have been varied, ranging from denial to the nigh apocalyptic, from anticipating a world without effective antibiotics and implicitly anticipating a return to a time before the Second World War,[3] to calls for a massive public investment in a new generation of drugs.[4] Since the evidence base for concern about AMR has only strengthened with each passing decade, it is both timely and important to consider why policy-makers have been so slow to respond to earlier warnings based upon that evidence, and the calls for more urgent action. The World Health Organization (WHO) among others has puzzled over this slow transition from evidence to action.[5]

To some extent, AMR policy is another example of the gap between evidence, policy and behaviour change that has been all too familiar in the history of public health policy development. The UK's National Institute of Clinical Excellence, for instance, issued its first formal guidance to General Practitioners and health workers on over-use and misuse in August 2015.[6] The paper suggests that policy-makers are being offered a narrative of crisis which itself carries some risks. Such a narrative presumes that policy-makers and regulators need to reassert control, with policy messages framed by notions of containment, order and authority in contrast to fears about messiness, disorder or anarchy. In our view, part of the complexity for policy-makers has lain in the different management systems for human and animal health, and the segmentation of state institutions responsible for public health and for food and farming.

The reasons for concern about diminishing antibiotic effectiveness are clear and real. The growing seriousness of AMR, and its human impacts, have been documented elsewhere.[5] Antibiotics are in wide use globally on both humans and animals. Countries vary enormously in antibiotic use, especially when adjusted on a per person or per animal basis. Taking animal production, the WHO has reported that Norway uses relatively small amounts, 20 mg to produce 1 kg of meat, for example, whereas the Netherlands uses 180 mg to produce 1 kg, and the USA an estimated 300 mg.[5,7] In the US, the Food and Drug Administration (FDA) reported that 13.5 million kgs of all US antimicrobials – some 80% of the total – were sold for use in agriculture in 2011.[8] Of US sales of medically important antibiotics – penicillins, macrolides, cephalosporins and other antibiotics of human importance – more than 70% in 2011 were sold for use in livestock and poultry, not for use in medicine; less than 3.3 million kgs of antibacterials were sold for use in human medicine that same year.[9] By size China is the largest antibiotics producer and consumer in the world. In a 2007 survey, the estimated annual antibiotics production in China was 210 million kg, of which 46.1% were used in livestock industries.[10] With such heavy, routine use, AMR is unsurprising.

AMR is an issue that draws out divergent perspectives on the role of policy. Some call for technical development (new drugs); others for legal change (tougher regulatory controls); others for behaviour change (reduced and more judicious use). Some focus on AMR risks to humans; others to animal husbandry. Some call for the application of a systems perspective and 'good multilevel governance' as the key to successful containment;[11] others for tighter prescription rules only. Here is where an ecological public health (EPH) perspective helps make sense; it reduces the policy cacophony – different solutions vying for policy attention.[12]

EPH locates human health problems as the result of interactions between human physiology, context, and the flow of inputs and outputs.[13] Although it has a long history, shaped by mid 19th century Darwinian analysis and subsequent scientific breakthroughs such as germ theory, the isolation of bacteria and viruses, and latterly gene typing, ecological thinking is today mostly associated in public health with the social-ecological perspective.[14–16] The social-ecological perspective, valuable though it has been, has focussed on social environment and dynamics as a determinant of health; the public health importance of the physical and biological environment has been somewhat overlooked. Surely a more full understanding of the dilemma raised by AMR requires both strands of ecological thought: the biological and the social. The strength of the term 'ecological' is its ability to capture both the dualistic and interactive relationship of humans and nature. In the biological sciences the notion of ecological research has more closely retained the Darwinian meaning that Haeckel (who coined the word) gave it,[17] where 'ecological' refers to the multilayered interactions between complex life forms.

Within public health, ecological public health is the term now used to reclaim this broader conception of public health promotion as the task of unravelling bio-human-social connections and reconfiguring them to create the conditions for good rather than poor health.[13] The relevance of EPH thinking is apparent in issues as varied as recognition that climate change requires societal change,[18] to new ways of treating sewage,[19] and cancer.[20] In this sense, ecological thinking is the science of interdisciplinary research stretching across life in its multiple levels and forms and which engages assumptions of complexity, emergence, habit, novelty and system.

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