

Addressing the silent pandemic: The Interplay between climate change and AMR

The global health crisis of antimicrobial-resistant infections is becoming harder to treat. Learn about the Climate Change and AMR Network (CLIMAR) and the Fungal One Health & Antimicrobial Resistance Network (F1AMR), two of eight UKRI-funded networks focused on the relationship between AMR and environmental factors

Antimicrobial-resistant (AMR) infections constitute a global pandemic of bacteria, fungi, viruses, and parasites that are becoming increasingly difficult to treat. Most recent estimates of deaths caused by antibiotic-resistant bacterial infections are between one and five million annually, a similar figure to the number of people who died during the peak years of the COVID-19 pandemic. Fungal infections currently kill approximately three and a half million people every year, with a significant proportion caused by antifungal-resistant strains. These numbers are predicted to increase to the point that by 2050, AMR infections could be the leading cause of death worldwide. This complex pattern of concurrent pandemics has been called the slow-motion or silent pandemic, as it has developed over many decades since the widespread introduction of antimicrobial drugs in the mid-20th century. Millions of tonnes of antimicrobials are used every year, in healthcare to treat human infections, and widely in agriculture, where most antibiotics and antifungals are used to prevent or treat disease in animals and plants.

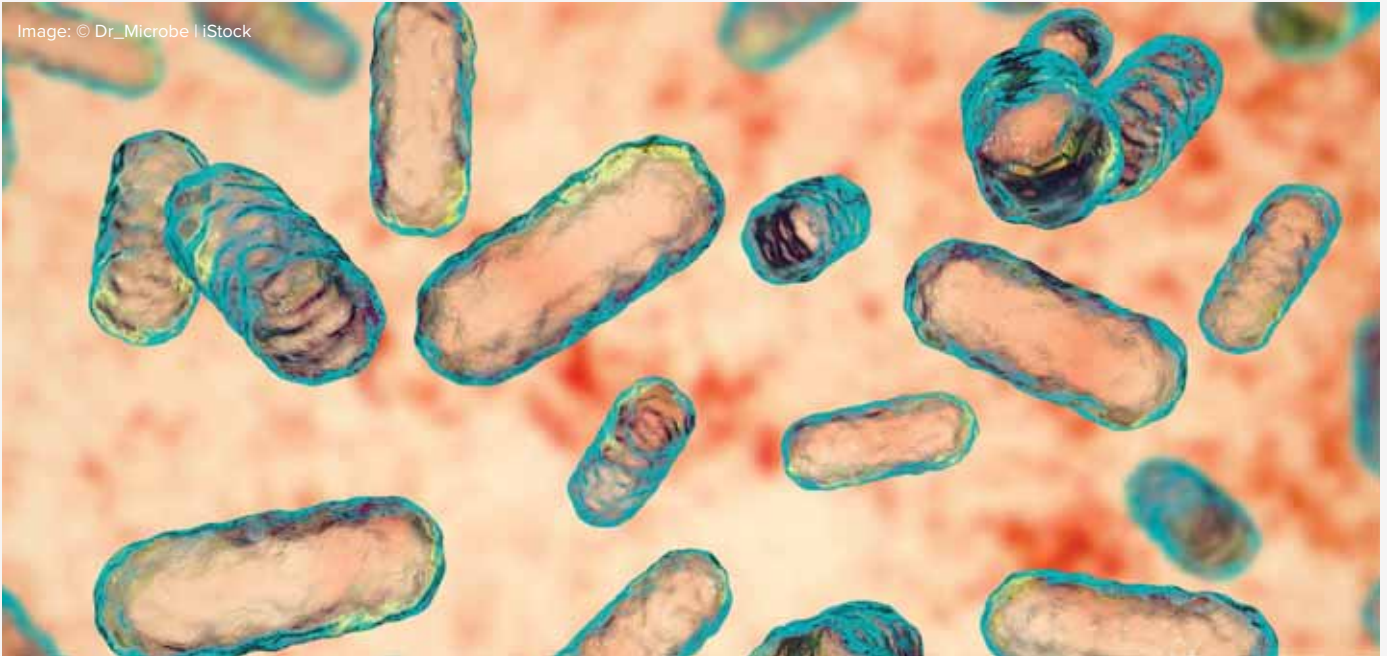
The Climate Change and AMR Network (CLIMAR) and Fungal One Health & Antimicrobial Resistance Network (F1AMR) are two of eight AMR networks funded by UKRI in 2023 to build transdisciplinary connections across academia, government and industry. CLIMAR focuses on the intersection of climate change and AMR and considers drivers such as environmental pollution, impacts on microbial biodiversity, and other processes and concepts encapsulated within Planetary Health thinking. F1AMR aims to generate innovative solutions for the rapidly escalating threat of antifungal resistance. Crucially, both place the role of the environment at the centre of an integrated view of AMR evolution and transmission.

CLIMAR specific activity

CLIMAR focuses on the impacts of the Triple Planetary Crisis, defined by the UN as 'the three man-made environmental emergencies: climate change, biodiversity loss, and pollution,' which are fundamentally affecting bacterial populations that underpin human health, ecosystem function, and critical geochemical cycles. The use of antibiotics, estimated at 50 million tonnes in the antibiotic era, fundamentally shapes bacterial populations across affected human, animal, plant, and environmental microbiomes. In contrast, antifungal drugs and fungicides are used on an even greater scale across many sectors. Antimicrobial residues from treatment of humans and animals are excreted and enter the environment through waste streams, where, alongside antimicrobials used to treat crops and aquatic animals, they have the capacity to drive the emergence of novel AMR organisms and resistance mechanisms that can enter human populations, where they make treatment more difficult or potentially impossible. CLIMAR working groups are examining evidence of interconnections between climate change and AMR, focusing on how climate change and antimicrobials interact to drive the development of AMR in terrestrial and aquatic environments, and how this is transmitted to humans. Several CLIMAR members contributed to a recent University of Leeds and UKHSA Centre for Climate and Health Security-led paper in *Nature Climate Change*, 'A research agenda advancing climate change and antimicrobial resistance as interconnected issues.'

F1AMR and the threat of fungal antimicrobial resistance

F1AMR focuses on the under-recognised threat of fungal antimicrobial resistance as a One Health problem at the intersection of human health, agriculture, and



the environment. Pathogenic fungi cause substantial mortality in humans and losses that account for 30% of global food production. Yet, the ecological and evolutionary drivers of antifungal resistance remain poorly addressed in current AMR frameworks. Central to this challenge is the widespread dual-use of antifungal compounds – azole antifungals are essential medicines for life-threatening human infections. In contrast, closely related azole fungicides are applied on vast scales in agriculture and the built environment and will likely be used more widely as climates change. The environmental contamination of soils, crops and composts with fungicide residues can create selective landscapes that favour resistant fungal populations, which disperse widely and cause hard-to-treat infections in humans. F1AMR brings together scientists, clinicians, industrial partners, and policy stakeholders to develop evidence-based approaches to monitor resistance to antifungals, identify high-risk practices, and inform sustainable antifungal stewardship.

Alignment of both networks works for the NAP

The current AMR National Action Plan (NAP) acknowledges the link between climate change and AMR and focuses on environmental challenges that contribute to AMR infections. This includes the potential for AMR to develop in polluted environments and highlights challenges in sustaining the use of antimicrobials in agriculture to protect animal and plant health whilst minimising potential spread to humans through food or the wider environment. The NAP also considers the environment

as a transmission route for human and animal-associated AMR to spread within and between animal and human populations.

Policy recommendations

Whilst there has been increasing cross-sector collaboration in understanding and addressing AMR, the transdisciplinary nature of AMR makes institutional ownership complex. Responsibility sits across DHSC, UKHSA, APHA, VMD, FSA, EA, and other agencies, which makes it challenging to resolve trade-offs among food security, plant and animal health, environmental protection, and human health. This institutional complexity requires explicit mandates and cross-governmental structures that manage AMR as an integrated One Health/Planetary Health policy problem, rather than treating non-human dimensions of AMR as sectoral responsibilities. While the current NAP acknowledges that the emergence and expansion of AMR are not fully understood, it only briefly mentions the impacts of climate change. It does not provide a complete roadmap to meet these knowledge gaps.

Climate Change Impacts on AMR Using a Planetary Health Framework (CLIMAR) Network

[WEBSITE](#) CLIMAR

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