

## Addressing the crisis: a roadmap for tackling Antimicrobial Resistance (AMR)

### Introduction

Since the first antimicrobials were deployed early in the 20th century, they have drastically transformed modern medicine and have helped to extend the average human lifespan by 23 years [1]. But, as we approach the 100th anniversary of the discovery of penicillin by our co-founder, Sir Alexander Fleming [2], there is a serious risk - and growing evidence - that this golden age in science and human and animal health has come to a close.

Antimicrobial resistance (AMR) is a real and current threat to healthcare systems and economies across the world. Today, AMR is a leading cause of death worldwide, killing more people than HIV and malaria combined [3]. The annual global cost of AMR is estimated at around \$900 billion a year, with healthcare systems across regions in all income levels expected to spend \$412 billion per year between 2015 and 2035. Left unchecked, AMR is predicted to lower life expectancy by 1.8 years over the next decade [4].

The breadth, scale and complexity of the AMR problem demands an urgent, global commitment to collaborative working across sectors and borders. This offers a significant opportunity: the UK has great strengths in the field of AMR and has the ability to become a global leader in driving forward solutions to minimise AMR [5].

The Microbiology Society wants to turn the tide on AMR. From the development of novel antimicrobials or diagnostics tools to the surveillance of antimicrobial use and resistance, microbiologists are at the forefront of developing innovative solutions to tackle AMR.



To this end, the Microbiology Society has launched the 'Knocking Out AMR' project [6], an ambitious, bold scheme of work aiming to promote effective solutions to minimise AMR through cross-disciplinary and multi-sector collaboration worldwide within a 'One Health'<sup>1</sup> context. The project was kickstarted in January 2024 by a series of workshops dedicated to our priority solution areas: diagnostics, surveillance, therapeutics and vaccines. While the outcomes of the workshops were not exhaustive, they highlighted key issues the AMR community faces and identified critical interventions necessary to drive forward the solutions to AMR that microbiologists across the globe are leading.

<sup>1</sup>One Health is an integrated, unifying approach that aims to achieve optimal and sustainable health outcomes for people, animals, and ecosystems. It recognises that the health of humans, domestic and wild animals, plants, and the wider environment (our ecosystems) are closely linked and inter-dependent. (One Health High Level Expert Panel, 2021)

## Challenges faced by the AMR Community

Our engagement activities with the wider AMR community have highlighted three main challenges that are hindering progress towards tackling AMR:

### 1) A failure to grasp the urgency of the AMR crisis

AMR threatens our socio-economical, ecological and political systems and needs urgent, strong political action to catalyse tangible behavioural changes. However, political leaders are failing to grasp the urgency and scale of the crisis. Although the UK has made some progress to tackle AMR since the launch of the O'Neill Review [7] and following the Global Research on Antimicrobial Resistance report [3], key recommendations are yet to be addressed and momentum needs to be rekindled.

Despite strong evidence of their potential to reduce the burden of AMR, innovative diagnostics tests and surveillance systems together with preventative tools, including vaccines, fail to be embedded in our health systems [8]. Clear policy action to increase access to education and information on AMR for the public and our healthcare providers is lacking, which is seemingly leading to increased pressure on healthcare professionals [9] and veterinarians [10] to prescribe antimicrobials unnecessarily.

### 2) A broken innovation pipeline

The current drug development process is fraught with complexities and high costs, deterring pharmaceutical investment due to concerns over limited market access and reduced sales potential, even with innovative approaches being led in the UK and USA to fund new antimicrobials [11]. Furthermore, the development of diagnostic tests is hindered by high upfront costs of research and clinical trials, and a lack of understanding of the potential value of diagnostics tools [8].

Similarly, global vaccine markets are not conducive to the development of vital vaccines targeting resistant pathogens. Key issues include high upfront costs, financial risks and the limited perceived profit potential due to a lack of available data on the impact of vaccines to prevent drug-resistant infections [12].

These challenges are compounded by current regulatory frameworks, which are not fit-for-purpose and impede innovation [13].

Consequently, this broken pipeline has led to a shortage of AMR experts across sectors, as disillusioned researchers exit the field, exacerbating the challenge of tackling AMR effectively [14].

### 3) A fragmented AMR landscape

AMR is an incredibly complex challenge to address, due to the evolutionary nature of microorganisms, widespread antimicrobial use and the intertwined nature of human, animal and environmental health. To effectively tackle this challenge, a cohesive strategy that supports strong co-ordinated action is imperative.

However, the current landscape is fragmented, with academics, industry, healthcare professionals, regulators and policymakers operating in siloes. This disconnect is fuelled by a lack of enabling environments, including a lack of responsibility and accountability at both national and international levels, inadequate financing and insufficient cohesion of data collection, storage and sharing. Without clear leadership, curbing this urgent and potentially catastrophic threat will prove impossible.

Holding policymakers to account is crucial as we work towards tackling AMR collaboratively and across sectors. We welcome the UK's latest five-year National Action Plan (NAP) for the period 2024-2029 [15] and will be closely monitoring progress towards its outlined commitments. While some of the outcomes and commitments in the NAP align with recommendations from our engagement with the wider AMR community, others represent opportunities for further action.

## Recommendations

The Microbiology Society calls on policymakers, funders, health leaders, industry and regulators to:

### Improve awareness and understanding of the urgency of the AMR crisis

#### Intended impact:

There is consensus about the scientific, economic and political case for urgent and co-ordinated global action – carrying on as we have is no longer an option.

#### How can this be achieved?

- > **The UK Government should urgently commission an updated health economic analysis of the cost of AMR** in order to reignite a sense of urgency and generate an evidence base for action against AMR. The new report should build on the new economic study released by the Quadripartite Joint Secretariat [4] and adapt the outlined framework to cover:
  - An updated analysis of the overall cost of inaction to the UK economy.
  - Cost-benefit analyses for investing in innovation pipelines.
  - A cost-benefit analysis for clinical implementation of diagnostics.
  - Proof-of-principle evidence for vaccines reducing the burden of AMR.
- > **The Department for Health and Social Care (DHSC) should urgently introduce the recording of AMR as a reportable cause of death**, in line with Dame Sally Davies [16], the Antimicrobial Resistance APPG [17] and the Royal College of Pathologists' [18] recommendations, in order to increase public awareness and generate accurate data on the scale and impact of AMR.
- > **DHSC, the UK Health Security Agency (UKHSA) and the Department for Environment, Food and Rural Affairs (DEFRA) should work collaboratively to expand their public engagement plans to raise public awareness of AMR** in order to improve public understanding, relieve patient pressure on prescribers and reignite a nationwide sense of urgency.
- > **Public health departments across the four nations, in collaboration with DEFRA, should invest in AMR education programmes, upskilling opportunities and clinical decision-making resources for healthcare professionals, veterinarians and the agricultural sector** in order to raise professional awareness and understanding of the appropriate use of antimicrobials.

### Incentivise the broken innovation pipeline

#### Intended impact:

There is a paradigm shift in how novel antimicrobials, diagnostic tools and vaccines against AMR are valued, which accelerates innovation and maximises the potential of disruptive solutions to tackle AMR.

#### How can this be achieved?

- > **The UK Government should commit to sustaining innovative financing mechanisms for novel antimicrobials, diagnostic tools and vaccines against AMR**, such as public-private partnerships and 'push' and 'pull' incentives in the UK and internationally [19], in order to re-invigorate the pipeline.
- > **The UK Government should capitalise on the UK's strengths** in AMR in order to provide global leadership. For example, the UK Government should continue to champion the principles of the pioneering Antimicrobial Products Subscription Model [20] to incentivise more 'pull' incentives and reinvigorate the AMR ecosystem.
- > **UK Research and Innovation should ensure academic researchers are included in the design of future funding calls and improve transparency around allocating funding for AMR**, in order to adequately fill knowledge gaps which are hindering innovation. Areas of research to consider include bacteriophages, polymicrobial infections, microbiomes and biofilms, self-limiting infections, co-morbidities, the in vivo-in vitro paradox and veterinary pathogens.
- > **The Department for Science, Innovation and Technology (DSIT) should work collaboratively with industry** to stimulate movement of researchers between academia and industry in order to foster multi-sector collaboration, re-invigorate the talent pipeline and accelerate innovation.

### Capitalise on lessons learned during the COVID-19 pandemic

#### Intended impact:

Healthcare professionals, veterinarians and the agricultural sector can rapidly identify drug-resistant infections and treat them with the right antimicrobial, at the right time.

Vaccines successfully protect people and animals against drug-resistant infections and their spread, while also reducing the need for and use of antibiotics.

#### How can this be achieved?

- > **DHSC, UKHSA and NHSE should repurpose the NHS' expanded diagnostic capacity** in order to create an effective diagnostic testing infrastructure and support AMR surveillance.

- > **DHSC and NHSE should support the adoption of existing rapid diagnostic technology in primary care settings**, in line with the British In Vitro Diagnostic Association's recommendations [21], in order to increase public involvement and reduce unnecessary antimicrobial prescriptions.
- > **NHSE and the Medicines Healthcare products Regulatory Agency (MHRA) should develop frameworks for combined clinical trials and expedited regulatory approval** for both new diagnostic technologies and vaccines, in order to rapidly create regulatory pathways that are fit-for-purpose. While progress is already underway to streamline and expediate regulatory approvals [22], regulatory innovation is urgently needed across the whole life cycle of vaccines and diagnostic tools.

## Demonstrate a long-term commitment to tackling AMR

### Intended impact:

A joined-up approach across Whitehall and between the UK and devolved governments with sustained funding to match, underpinned by cross party consensus and evidence-based goals.

### How can this be achieved?

- > **The UK Government should develop and publish an accountability framework on AMR, which details ownership and responsibility of deliverables across government** in order to ensure that the NAP's commitments are met and that there is transparency around monitoring and evaluation of the NAP.
- > **The UK Government should advocate for urgent establishment of an 'Independent Panel on Evidence for Action against AMR'**, in line with the recommendations of the UN Interagency Coordination Group on Antimicrobial Resistance [23]. To encourage the development of data-driven policies, the Panel should develop core metrics to monitor AMR (the 1.5°C metric established by the International Panel on Climate Change is an example [24]).
- > **The UK Government should ensure that funding for measures tackling AMR, including research and development is sufficient, long-term and sustainable**, in order to support its strong

research base and maximise innovation and discovery. For example, we recommend returning to spending 0.7% of Gross National Income (GNI) on Official Development Assistance (ODA) in the next Parliament, to sustain the UK's leading position by strengthening global research [25].

- > **DHSC, UKHSA and NHSE should integrate AMR into current or future health policies** in order to ensure that AMR is considered holistically. AMR should be included into current health policies related to infectious diseases, including the HIV National Action Plan (2022 to 2025) [26], TB National Action Plan (2021 to 2026) [27] and any future strategy around the UK's pandemic preparedness response, including the WHO's pandemic agreements [28].

## Enable global data sharing

### Intended impact:

High-quality, accessible and harmonised datasets are generated across all AMR settings, allowing the rapid identification of emerging threats, surveillance of resistance patterns and assessment of the success of interventions.

### How can this be achieved?

- > **The UK Government should work across the G7 and G20 countries to establish regulatory frameworks for data quality, storage and analysis of AMR surveillance data in a 'One Health' context**, using the English surveillance programme for antimicrobial utilisation and resistance [29], the European Antimicrobial Resistance Surveillance Network [30] and the Global Antimicrobial Resistance and Use Surveillance System (GLASS) [31] as exemplars in order to ensure international standardisation.
- > **DHSC and NHSE should improve and standardise clinical coding and data recording to include AMR** in order to build a sound evidence base to validate new technologies and to inform clinical decision-making.
- > **The UK Government should create legislation to facilitate data sharing.** The COPI notice served during the COVID-19 pandemic could be used as model for example [32].

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