Antimicrobial resistance: addressing the risks

The Microbiology Society is a membership charity for scientists interested in microbes, their effects and their practical uses. It has a worldwide membership based in universities, industry, hospitals, research institutes, schools, and other organisations. Microbiology is the study of all living organisms that are too small to be visible with the naked eye.

At the Society, we work to develop, expand and strengthen the networks available to our members so that the science of microbiology provides maximum benefit to society.

We note that our submission reflects the views of our members and the broader antimicrobial resistance (AMR) community, gathered through our 'Knocking Out AMR' project and engagement activities. We present evidence provided by the AMR community and offer recommendations where appropriate.

Executive summary

- AMR is a growing global crisis that threatens human, animal, and environmental health. The misuse and overuse of antimicrobials have accelerated resistance, making infections harder or impossible to treat.
- Without urgent action, routine medical procedures such as surgeries, cancer treatments and organ transplants could become too dangerous due to the risk of untreatable infections. The economic and societal costs of AMR are staggering, with projections estimating 39 million deaths by 2050 and healthcare costs reaching $900 billion annually.
- The UK has demonstrated leadership in tackling AMR, particularly through its National Action Plan (NAP) and international advocacy. However, progress has been slow, with only 7 of 133 commitments fully achieved since 2019. Key challenges include a lack of transparency and accountability in AMR governance, insufficient funding for research and gaps in public and professional awareness. Regulatory barriers also hinder innovation in developing new antimicrobials, diagnostics and vaccines.
- Recent commitments at the United Nations High-Level Meeting on AMR reaffirm the need for urgent, coordinated global action. World leaders have committed to strengthening surveillance, expanding access to new antimicrobials and ensuring sustainable financing mechanisms for AMR research and interventions. These commitments should be fully integrated into the UK's response to AMR to maintain leadership in global efforts.
- To address these challenges, we recommend:
    - Strengthening public engagement and education on AMR.
    - Enhancing collaboration across human, animal and environmental health sectors ('One Health' approach).
    - Investing in sustainable research funding and innovative financing models.
    - Reforming regulatory frameworks to accelerate the development and adoption of new antimicrobial solutions.

- Improving AMR data collection, sharing and surveillance across sectors.

- The UK must act decisively to maintain its global leadership in tackling AMR and prevent this crisis from escalating further.

The scale of AMR and the risk it poses

1) Antimicrobial resistance (AMR) occurs when micro-organisms (including bacteria, viruses, fungi and parasites) evolve so that they are no longer affected by the medicines that have been developed to target them. These medicines, known as antimicrobials, are critical for treating infections in humans, animals and plants[1].

2) While AMR is a naturally occurring process, the misuse and overuse of antimicrobials in healthcare, agriculture and environmental settings have accelerated the development of resistance, creating a global health crisis[2].

3) AMR poses a threat to people of all ages, but young children are particularly high risk, with around one in five deaths attributable to AMR occurring in children aged under five years[3].

4) Antimicrobial-resistant micro-organisms can cause infections that are difficult or impossible to treat. Without effective antimicrobials:

   a) Routine procedures, such cancer treatments, organ transplants and surgery like hip replacements, could become too dangerous to perform due to the heightened risk of untreatable infections.

   b) Minor injuries from accidents could lead to severe, life-threatening infections.

   c) Treatments for viral infections, such as HIV, or parasitic diseases like malaria, could lose their efficacy[4].

5) The environmental impact of AMR is an increasing concern. Antimicrobial-resistant micro-organisms and residues from antibiotics enter natural ecosystems through wastewater, agricultural runoff and improper disposal of pharmaceuticals[5]. This contamination can:

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[1] World Health Organization. Antimicrobial Resistance; 2023. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance [accessed 4 March 2025]

[2] Microbiology Society. AMR explained. https://microbiologysociety.org/why-microbiology-matters/knocking-out-antimicrobial-resistance/amr-explained.html#_ftn2 [accessed 4 March 2025]

[3] Murray CJ, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet 2022; 399:629-655.

[4] Microbiology Society**.** AMR explained. https://microbiologysociety.org/why-microbiology-matters/knocking-out-antimicrobial-resistance/amr-explained.html#_ftn2 [accessed 4 March 2025]

[5] Environment Agency. Monitoring antimicrobial resistance in the environment; 2024. https://environmentagency.blog.gov.uk/2024/10/24/monitoring-antimicrobial-resistance-in-the-environment/ [accessed 4 March 2025]

a) disrupt microbial communities in soil and water, affecting biodiversity and ecosystem health.

b) promote the spread of resistant genes among environmental micro-organisms creating reservoirs of AMR that can re-enter human and animal populations.

c) affect food safety and security by increasing the prevalence of antimicrobial-resistant micro-organisms in agricultural settings, potentially leading to more outbreaks of difficult-to-control plant and animal infections.

6) Fungal infections in crops may become uncontrollable due to antifungal resistance, threatening global food security. A rise in resistant fungal strains could lead to lower crop yields and increased food prices, disproportionately impacting vulnerable populations and exacerbating hunger and malnutrition[6].

7) AMR is a real and current threat to healthcare systems and economies across the world:

a) A new report estimates that bacterial AMR will cause 39 million deaths between 2025 and 2050, equivalent to three deaths every minute[7].

b) 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[8].

c) AMR is also predicted to lower life expectancy by 1.8 years over the next decade alone[9].

The current measures and governance arrangements in place to address AMR, including government's National Action Plans

[6] Fisher, M.C., Burnett, F., Chandler, C. et al. A one health roadmap towards understanding and mitigating emerging Fungal Antimicrobial Resistance: fAMR. npj Antimicrobials and Resistance 2024;2:36.

[7] Naghavi M, Vollset SE, Ikuta KS, Swetschinski LR, Gray AP, Wool EE, Aguilar GR, Mestrovic T, Smith G, Han C, Hsu RL. Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050. The Lancet 2024;404:1199-226.

[8] Global Leaders Group on AMR. Building the investment case for action against antimicrobial resistance; 2024. https://www.amrleaders.org/resources/m/item/annex-to-the-glg-report [accessed 4 March 2025]

[9] Global Leaders Group on AMR. Building the investment case for action against antimicrobial resistance; 2024. https://www.amrleaders.org/resources/m/item/annex-to-the-glg-report [accessed 4 March 2025]

8) Following the release of the UK's latest AMR National Action Plan (NAP)[10], the Microbiology Society launched a survey to gather feedback and insights from the microbiology community regarding the content of the NAP[11].

9) Survey respondents identified the following strengths:

   a) The NAP reinforces the UK's proactive approach in tackling AMR. The survey respondents welcomed the plan as a meaningful advancement, addressing gaps in previous strategies and reinforcing the UK's leadership on the global stage.

   b) The NAP is a comprehensive framework with defined commitments and clear priorities. The plan's four key themes were widely seen as necessary and well-prioritised. A strong majority (74%) of respondents agreed that the 30 commitments were clearly defined, providing a solid foundation for action.

   c) The NAP is ambitious in scope and objectives. Over half (51%) of respondents found the NAP ambitious enough, particularly in its focus on research, innovation and antimicrobial stewardship. The balance between ambition and realism was seen as a strength, ensuring that targets are achievable while still driving meaningful progress.

10) Survey respondents highlighted concerns in the following areas**:**

   a) Ensuring transparency and accountability. A major concern among respondents was the lack of clarity on how the NAP will be implemented and how success will be measured. Key gaps include defining which departments are responsible for specific deliverables, how progress will be tracked and what mechanisms will hold the UK government accountable for achieving its commitments. Without clear ownership and monitoring, respondents expressed that the plan's ambitious goals may not translate into meaningful action.

   b) The need for clear financial commitments. Many respondents highlighted that the success of the NAP is entirely dependent on sustained financial investment, yet the plan lacks details on funding allocation. Without a clear financial strategy, there is concern that commitments may be undermined by resource constraints. Several respondents emphasised that long-term investment is critical, particularly in areas like research, surveillance and public engagement.

   c) Strengthening public and professional awareness. Raising awareness of AMR among both the public and professionals was identified as a crucial factor in the plan's success. Respondents noted that while public engagement is included in the NAP, it needs to be more ambitious and widespread.

   d) Strengthening the 'One Health' collaboration. Respondents highlighted concerns that the NAP lacks a clearly defined 'One Health' commitment, making it difficult to ensure coordinated action across human, animal and environmental health sectors. The

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[10] GOV.UK. Confronting antimicrobial resistance 2024 to 2029; 2024. https://www.gov.uk/government/publications/uk-5-year-action-plan-for-antimicrobial-resistance-2024-to-2029/confronting-antimicrobial-resistance-2024-to-2029 [accessed 4 March 2025]

[11] Microbiology Society. Response to the UK's new National Action Plan to tackle AMR: survey results; 2024. https://microbiologysociety.org/static/da357d14-3fcb-4666-81f92317e314e6f4/NAP-Survey-results.pdf [accessed 4 March 2025]

absence of well-defined collaboration frameworks has raised concerns about effectively engaging international and cross-sectoral stakeholders.

11) Our engagement activities through our 'Knocking Out AMR' project have also revealed that the AMR landscape is currently 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 and inadequate financing[12].

12) The UN High-Level Meeting on AMR held in 2024 emphasised the need for national governments to establish clear, accountable frameworks for AMR governance, with mechanisms to track progress. The UK must enhance reporting mechanisms for AMR governance to align with international commitments. In addition, the UK's current NAP on AMR does not explicitly include a specific target to reduce AMR-related deaths by 10% by 2030, as set out in the UN Political Declaration. This gap in the NAP highlights the need for more explicit alignment with international targets, ensuring that the UK's efforts are directly contributing to global goals for reducing AMR-related mortality.

13) In order to ensure that the NAP's commitments are met and that there is transparency around monitoring and evaluation of the NAP, we recommend that the UK Government should develop and publish an accountability framework on AMR, which details ownership and responsibility of deliverables across government.

Progress made by government in addressing AMR, particularly in relation to the actions and targets in the 2019-24 National Action Plan

14) The UK has demonstrated global leadership in AMR through key initiatives and collaborations in the last five years, including:

    a) The UK's new Antimicrobial Products Subscription 'push and pull' model[13] for developing antibiotics in the UK is gaining acceptance internationally as a good policy move towards using drugs sparingly without economic loss for producers.

    b) Dame Sally Davies, as UK Special Envoy for AMR, has successfully placed AMR on the G7 and G20 agendas, building momentum ahead of the UN General Assembly High-Level Meeting in September 2024[14].

    c) The UK-funded Fleming Fund has played a crucial role in supporting the Global Research on Antimicrobial Resistance (GRAM) Project, which produced the first global

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[12] **Microbiology Society**. Addressing the crisis: a roadmap for tackling Antimicrobial Resistance (AMR); 2024. https://microbiologysociety.org/static/1001c46f-816b-453a-bb4638e8d4c82659/Knocking-Out-AMR-Policy-Briefing.pdf [accessed 4 March 2025]

[13] **House of Commons Library**. "Netflix" for antimicrobials: The Antimicrobial Products Subscription Model; 2024. https://commonslibrary.parliament.uk/netflix-for-antimicrobials-the-antimicrobial-products-subscription-model/ [accessed 4 March 2025]

[14] **United Nations. Political Declaration of the High-level Meeting on Antimicrobial Resistance**; 2024. https://www.un.org/pga/wp-content/uploads/sites/108/2024/09/FINAL-Text-AMR-to-PGA.pdf [accessed 4 March 2025]

burden estimates of AMR and has helped build surveillance capacity in low- and middle-income countries (LMICs)[15].

d) The target for reducing antimicrobial use in food-producing animals in the UK was met in 2021[16].

15) Despite these efforts, progress has been limited, with evidence showing that 7 of 133 commitments have been achieved[17]. Through our engagement activities, we have identified key areas that require urgent attention, structured around themes from the 2019-24 National Action Plan.

16) Theme 1: Reducing the need for and unintentional exposure to antimicrobials:

a) Lowering the burden of infection:

i) The target to reduce specific drug-resistant infections in people by 10% by 2025 was not met.

ii) The latest UKHSA figures show a 3.5% increase in resistant bacteraemia since 2019, with *E. coli* as the primary culprit. Currently, 21 out of 100 people with bacteraemia have a resistant infection, highlighting the urgent need for stronger interventions[18].

b) Minimising the spread of AMR through the environment:

i) In the UK, raw sewage is still frequently discharged into oceans instead of being properly treated, contributing to the spread of AMR and the UK still lacks regulations for monitoring antimicrobial residues in wastewater.

ii) The UN High-Level Meeting on AMR underscored the importance of the 'One Health' approach, integrating AMR mitigation efforts across human, animal and environmental health sectors. Addressing environmental AMR risks, such as antimicrobial residues in wastewater and agricultural runoff, need to a key UK policy priority to align with global best practices.

iii) We recommend that the government establish regulations or guidelines for water companies to monitor and report the levels of antimicrobials, resistant micro-organisms and their resistance genes in the effluent discharge of wastewater treatment works, as this is currently unregulated.

17) Theme 2: Optimising the use of antimicrobials

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[15] **The Fleming Fund.** https://www.flemingfund.org/. [accessed 4 March 2025]

[16] **Veterinary Medicines Directorate.** UK Veterinary Antibiotic Resistance and Sales Surveillance Report; 2022. https://assets.publishing.service.gov.uk/media/6718c19fe319b91ef09e38b6/2881449-v2-VARSS_2022_Report_v3__October_2024_Update_.pdf [accessed 4 March 2025]

[17] **National Audit Office**. Investigation into how the government is addressing antimicrobial resistance; 2025. https://www.nao.org.uk/wp-content/uploads/2025/02/investigation-into-how-government-is-addressing-antimicrobial-resistance.pdf. [accessed 4 March 2025]

[18] UK Health Security Agency. English surveillance programme for antimicrobial utilisation and resistance (ESPAUR); 2024. https://assets.publishing.service.gov.uk/media/6734e208b613efc3f1823095/ESPAUR-report-2023-2024.pdf [accessed 4 March 2025]

a) Optimising the use of antimicrobials in humans, animals and agriculture**:**

   i) Although human antibiotic consumption has reduced compared to the 2018 baseline[19], the target of reducing antimicrobial use in humans by 15% by 2024 has not been met. Worryingly, overall consumption in 2023 is only 1.9% lower than in 2019.

   ii) Clear policy action to increase to 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 and veterinarians to prescribe antimicrobials unnecessarily.

   iii) To address this, we recommend that:

      (1) The Department of Health and Social Care, (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. We also support the Fleming Initiative's efforts to establish a global consensus on integrating AMR education into school curricula to strengthen public knowledge.[20].

      (2) 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.

b) Stronger laboratory capacity and surveillance of AMR in humans and animals

   i) There is currently insufficient cohesion of data collection, storage and sharing for surveillance of AMR in both humans and animals.

   ii) To address this, we recommend that the UK align with global data harmonization efforts as outlined by the UN Political Declaration:

      (1) 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.

      (2) The UK Government should also 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, the European Antimicrobial Resistance Surveillance Network and the Global Antimicrobial

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[19] UK Health Security Agency. English surveillance programme for antimicrobial utilisation and resistance (ESPAUR); 2024. https://assets.publishing.service.gov.uk/media/6734e208b613efc3f1823095/ESPAUR-report-2023-2024.pdf [accessed 4 March 2025]

[20] Fleming Initiative. Fleming Initiative convening experts on AMR and education; 2025. https://www.fleminginitiative.org/post/convening-ed [accessed 4 March 2025]

Resistance and Use Surveillance System (GLASS) as exemplars in order to ensure international standardisation.

iii) While the Food Standards Agency (FSA) led the Pathogen Surveillance in Agriculture, Food and Environment (PATH-SAFE) programme to measure prevalence and transmission of AMR within the environment and agri-food systems[21], there are currently no plans to continue funding this initiative beyond March 2025. Without sustained investment, there is a risk of losing momentum in this crucial area.

18) Theme 3: Investing in innovation, supply and access to tackle AMR

a) Sustainable investment in basic research:

i) While the UK has a strong research base, several critical knowledge gaps hinder antimicrobial innovation. Bacteriophages show promise as antibiotic alternatives, yet their safety, efficacy and regulation remain uncertain. Polymicrobial infections, biofilms, and microbiomes complicate treatment by reducing antibiotic effectiveness and limiting targeted therapies. Greater understanding of self-limiting infections could help reduce unnecessary antibiotic use, while research on co-morbidities and the in vivo-in vitro paradox is crucial for improving treatment outcomes. Additionally, veterinary microorganisms play a key role in AMR transmission but remain under-researched.

ii) 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.

iii) The UN High-Level Meeting highlighted the urgent need for sustainable financing mechanisms to address AMR. However, recent cuts to Official Development Assistance (ODA) are expected to negatively affect funding for critical research in high-priority areas. To maintain the UK's leadership in AMR efforts, it will be essential to explore alternative funding sources to ensure continued investment in research and innovation.

b) Development of, and access to, new therapeutics, diagnostics and vaccines:

i) 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.

ii) The development of diagnostic tests is hindered by high upfront costs of research and clinical trials, along with a limited understanding of their potential value.

iii) Similarly, global vaccine markets are not conducive to developing essential vaccines that could reduce inappropriate antibiotic prescribing. Key barriers include high initial costs, financial risks and a lack of data on the impact of vaccines in preventing drug-resistant infections.

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[21] **Food Standards Agency.** Pathogen Surveillance in Agriculture, Food and Environment (PATH-SAFE) Programme; 2024. https://www.food.gov.uk/our-work/pathogen-surveillance-in-agriculture-food-and-environment-path-safe-programme [accessed 4 March 2025]

iv) These challenges are exacerbated by outdated regulatory frameworks that impede innovation. Approval processes are often designed for traditional small-molecule antibiotics rather than novel therapies like bacteriophages, microbiome-based treatments or anti-virulence drugs. The lengthy, costly nature of clinical trials and uncertainty in regulatory pathways further deter investment in new antimicrobial solutions.

v) To address this, we recommend that:

(1) The UK Government should commit to sustaining innovative financing mechanisms for novel antimicrobials against AMR, such as public-private partnerships and 'push' and 'pull' incentives in the UK and internationally, in order to reinvigorate the pipeline.

(2) The Department for Science, Innovation and Technology (DSIT) should collaborate 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.

(3) 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, to enhance public engagement and reduce unnecessary antimicrobial prescriptions.

Final remarks

AMR is one of the most pressing public health threats of our time, requiring urgent and coordinated action across sectors. The UK has made significant progress but must now translate commitments into measurable outcomes. Without stronger accountability, sustained funding and regulatory reform, the progress made so far risks being undermined.

We urge the UK Government to take decisive steps to close critical knowledge gaps, support innovation and ensure a cohesive national and international response to AMR. The fight against AMR cannot be delayed—bold action today will safeguard public health, food security and global economies for future generations.