

# UK LEADERSHIP IN ANTIMICROBIAL DISCOVERY AND DEVELOPMENT



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**LEADERSHIP IN ENHANCING ANTIMICROBIAL DISCOVERY**



## Key messages

- As the threat of drug-resistant diseases has increased, the development of new antimicrobial drugs to tackle infections has stalled.
- The ecosystem for antimicrobial research and development is fragmented due to poor coordination, divergent incentives, a human resources crisis, and limited funding.
- The UK's renewed commitment to leadership and partnerships for economic growth, international development and health security can help advance antimicrobial discovery and development.
- To take advantage of scientific and technological advances, new kinds of partnership between the public sector, academia and industry, and between countries, will be necessary.
- Government can play a strategic leadership role built around long-term public investment aligned to public health goals and open and collaborative principles.
- The implementation of a coordinated and strategic approach will require new kinds of leadership throughout the antimicrobial R&D ecosystem.

The threat of infectious diseases that [resist treatment with available antimicrobials](#) is growing. Nearly a decade after the [O'Neill Review on Antimicrobial Resistance](#) (AMR) called for systemic reform of antimicrobial research and development (R&D), the UK has helped catalyse real progress, including the world's first [antimicrobial subscription model](#). Despite these efforts, the number of people engaged in the development of new drugs has decreased and few new products have been discovered and become available.

The UK Action Plan for Antimicrobial Resistance 2024-29 commits the government to continue its leadership in addressing this major global challenge. This can include a central role in supporting antimicrobial R&D through its focus on science and technology innovation as drivers of economic growth and international development. This will require a system-level approach to antimicrobial discovery with new kinds of collaboration between government and leading scientists in the public and private sectors.

The LEAD: Leadership in Enhancing Antimicrobial Discovery coalition is a network of scientists, policy experts and other leaders from the UK and internationally, working together to strengthen the antimicrobial innovation ecosystem. This policy brief draws on their collective expertise to assess the current state of antimicrobial R&D, highlight opportunities for the UK to enhance its leadership and set out how closer collaboration with government can accelerate the discovery and development of urgently needed treatments.



## THE POLICY CONTEXT

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### UK Industrial Strategy

The UK's new [Industrial Strategy](#) identifies life sciences as a key growth sector and commits to making the UK one of the world's top three life science economies through an "enduring, systems-level approach to innovation" backed by long-term investment, closer ties between academia and industry and a strong role for government in shaping and supporting high impact research. It also calls for partnerships with countries with complementary capacities.

Scientific and technological advances are opening new avenues for antimicrobial discovery; new kinds of partnership and coordination will be needed to realise this potential. The lack of short-term opportunities for the commercial success of antimicrobials could make them an ideal testing ground for new kinds of partnership between government, academia, industry and international partners, especially in the Global South, where the burden of AMR is high. These partnerships and the skills they develop can build a foundation for new and profitable life science development in the future.

### Addressing health security

Alongside the strong focus on advancing as a leading science economy, the UK Government recognises the importance of working in partnership with other countries to tackle shared global challenges to health security in a shifting international landscape. As a signatory of the [2025 WHO Pandemic Agreement](#), the UK can build on lessons from the rapid development of a COVID-19 vaccine to promote partnerships for research, development and production in the global response to the threat of AMR.

### UK National Action Plan for AMR

The UK [National Action Plan for AMR](#) renews commitments to advance antimicrobial discovery and provides the UK with a strategic opportunity to play a leading role in this important global effort. It also provides an opportunity to test the implementation of a systems-level approach

to innovation, setting the UK up as a strong global partner. This can provide a foundation upon which agreements for broader collaboration in the life sciences can be built within the UK and with international partners.

## THE CURRENT SITUATION

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### Antimicrobial innovation ecosystem

Antimicrobial R&D has been in steady decline for over two decades. Scientific complexity, paired with weak commercial returns, has led most large pharmaceutical companies to abandon work on antimicrobials. Many experienced teams have been disbanded, and the specialist expertise needed to develop new antimicrobials is disappearing. In 1995, over 3,500 researchers published on antibiotics globally; by 2020, this had fallen to just 1,800. This is a stark contrast with fields like oncology, where over 30,000 researchers are active and long-term careers are far more viable.

One of the challenges of antimicrobial development is that, once approved, the most effective new antibiotics are deliberately used sparingly to slow the emergence of resistance, making it difficult for developers to recoup their investment under conventional market models. This has led to the formulation of strategies for overcoming that challenge by providing “push” and “pull” incentives.

### Push and pull incentives

Push incentives focus on directly supporting the development of promising drug candidates. These include UK-based initiatives, such as Pathways to Antimicrobial Clinical Efficacy (PACE) and UK-supported international partnerships, including the Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator (CARB-X) and the Global Antibiotic Research and Development Partnership (GARDP). These initiatives have played a significant role in rebuilding the product development pipeline. Industry has also set up the AMR Action Fund, making \$1 billion available to support late-stage antimicrobial development. Despite these important efforts, the funding has remained limited so that when a promising product has been identified, it has been difficult to provide sufficient funds and access to specialised expertise and scientific infrastructure to progress its development.

Pull incentives offer rewards for successful developers of an effective antimicrobial, irrespective of the amount used. Despite statements of support for this approach by many governments and in declarations by the G7 and the 2024 UN General Assembly High Level Declaration on AMR, progress in putting these incentives into place has been slow. Only the UK, and Italy have operational pull incentives. Discussions about additional schemes are underway within the US, EU, Canada and Japan, but there is a lot of uncertainty about whether sufficient funds will become available to provide sufficient incentives to attract large pharmaceutical companies back to the development of new antimicrobials and to support existing small and medium companies. This is leading to an increasing interest in the potential role of middle-income countries in both developing new antimicrobials and helping fund their development.

### Ecosystem fragmentation

The current antimicrobial innovation ecosystem is fragmented, with actors having different motivations and incentives, working in silos, with poor data sharing, limited coordination and concerns around intellectual property. There has been an increasing reliance on academic

research groups or small firms to both discover and advance drug candidates. Their funding is often short term and publication-driven and they struggle to access the expertise required to translate promising research into viable drug candidates. A recent study in the UK concluded that push and pull incentives, on their own, are insufficient and that a system-level approach is required.

The Industrial Strategy calls for an “enduring systems level approach to innovation” in which government will play a key role in fostering new kinds of partnership between industry and academia. This will include a long-term cycle of funding for research and innovation and the development of appropriate human resources. It will also include industrial strategy partnerships with other countries, such as the one signed with Japan in 2025, to promote trade and international cooperation. Measures to strengthen antimicrobial discovery need to be consistent with this strategy. In turn, experiences with antimicrobial discovery can provide an early test of the systems approach the strategy calls for.

## **A SYSTEMATIC APPROACH TO ANTIBIOTIC DISCOVERY AND DEVELOPMENT**

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### **New opportunities for antimicrobial discovery**

During the 2000s and 2010s, many large pharmaceutical companies undertook expensive discovery programmes, but the available tools often failed to yield promising drug candidates. This outcome, combined with the economic challenges, led most large pharmaceutical companies to leave the field. Most new antimicrobials in recent years have only offered incremental improvements, with governments sceptical of their public health value. New opportunities within science offer the possibility of a stronger, more innovative pipeline which could help create new momentum by attracting scientists back into the field, encourage and support new talent, and help drive action from governments.

New technological approaches are opening new opportunities for drug discovery. Advances in artificial intelligence (AI) and machine learning are helping researchers identify promising molecules faster and make predictions about their properties. Meanwhile, improvements to high-throughput screening, allow researchers to test thousands of potential compounds, identifying promising candidates more efficiently. Progress in metagenomics and synthetic biology are helping scientists explore natural sources that were previously out of reach, offering fresh possibilities for discovering entirely new types of antimicrobial agent.

Many of these technologies are the result of very large investments in scientific infrastructure and/or the development of a new technology, such as AI. Small academic research groups and early-stage companies have had a limited capacity to benefit from these investments. There is a need for clear access pathways to ensure that the best scientific ideas can access the right tools, data, and expertise.

The UK is well positioned to play a leadership role in the next generation of antimicrobial innovation, utilising and further developing its research capabilities, global partnerships, and policy leadership. UK research organisations have received the second-highest level of funding for human-relevant AMR research. The UK has several assets that could enable it to respond to future opportunities including:

- The UK Health Security Agency’s open innovation platform, which provides researchers with access to specialist capabilities for testing potential antimicrobial products against drug-resistant pathogens
- Advanced scientific infrastructure, such as the Diamond Light Source synchrotron, which enables high-resolution structural biology that can accelerate the design of novel compounds.
- Leading genomics institutes, including the Wellcome Sanger Institute, which are helping uncover new drug targets and previously untapped product types.
- Recent investments in AI and data science, such as the [OpenBind drug discovery project](#), are opening new frontiers in compound screening and optimisation – with the potential to reduce development time and cost significantly.

## Human capital, public investment and coordination

The ability to take advantage of emerging scientific and technological advances will require the rebuilding of the human capital that has been lost from the global antimicrobial R&D ecosystem. Years of underinvestment have resulted in a significant “brain drain,” with experienced researchers leaving the field and fewer early-career scientists entering it. Targeted investment in training and career development is needed to cultivate a new generation of antimicrobial innovators, who are familiar with and can utilise the most up to date technologies. Without a strong pipeline of talent, even the most promising technologies will fail to deliver.

Technological advances will require a shift in how drug discovery and development is organised towards structured, collaborative models with partnerships between organisations with complementary expertise. Such partnerships need to be built around long-term public investment and supported by actors from academia, the public sector, and industry. In areas of global public good, they should be brokered around shared public health goals and underpinned by open science principles, including sharing of data and materials, collaborative access to scientific infrastructure and transparency.

The weak commercial incentives associated with antimicrobials make them particularly well suited to this kind of collaborative, public-good-focused approach. But without active coordination, antimicrobial research risks being deprioritised in national and global investment agendas. Ensuring this field is fully integrated into the UK’s Life Sciences Sector Plan and positioned to benefit from shared technologies and platforms is critical to rebuilding the pipeline.

## Global partnerships for low-cost discovery and development

When promising antimicrobial candidates have been discovered, [progress has often stalled during clinical development](#). Trials can be slow to recruit patients, particularly for drug-resistant infections, whose incidence may be relatively low in high-income countries, and costs rise sharply as development progresses. Although over 90 percent of the global burden of AMR is in low- and middle-income countries, most R&D takes place in high-income countries. Overstretched health care budgets and the escalating costs of pharmaceutical R&D are leading to a search for more efficient ways to develop new drugs.

The growing capacity of India, China and other middle-income countries for research, development and manufacturing of pharmaceuticals is creating opportunities for partnerships to achieve this goal. These countries also have significant burdens of AMR. Building complementary international partnerships with them could support more cost-effective and

sustainable development pathways, while expanding global access. By taking a strategic leadership role in antimicrobial R&D, the UK could not only strengthen the global pipeline, but also enhance its health diplomacy.

The [Ten Year Health Plan for England](#) includes a commitment to create a world-class clinical research environment, supported by the rich datasets of the NHS and a strong base of clinical and regulatory expertise. The relatively low burden of AMR in the UK means that most trial participants would need to be enrolled elsewhere. To ensure global relevance and impact, the UK could set-up equitable international partnerships to support antimicrobial trials in countries with higher levels of drug resistance. This could include joint trial platforms with partners such as India, where UK expertise can help deliver faster, more effective, and more cost-efficient trials – while ensuring the results reflect the settings where the burden of disease is greatest.

## Health security and pandemic preparedness

The [2023 UK Biological Security Strategy](#) includes a commitment to deliver diagnostics, therapeutics and vaccines within 100 days of an outbreak. Many of the investments needed to prepare for viral pandemics are directly relevant to antimicrobial R&D. By supporting these shared technologies through antibiotic-focused programmes today, the UK can build a more resilient innovation infrastructure that can rapidly pivot during an outbreak. Additionally, the UK Biological Security Strategy highlights a desire to develop new, simplified and agile procurement mechanisms for commissioning work on science and technology from UK academia and industry. These tools could be piloted and refined through antimicrobial development projects, ensuring they are ready to deploy in pandemic settings when speed is critical. Funds allocated to national security can provide a vital boost to the AMR response. By aligning its antimicrobial innovation agenda with broader health security priorities, the UK has an opportunity to maximise the impact of its investment and enhance its approach to health security.

## Coordination to enhance antimicrobial discovery and development

The current approach for antimicrobial discovery and development has not yet delivered the products needed to stay ahead of increasing rates of AMR. The traditional pathway, whereby basic research conducted in academic labs has been translated into products by large pharmaceutical companies is no longer a viable approach. Expertise is now distributed across academic institutions, centres of excellence in advanced technologies, small and medium sized companies, firms that manufacture new drugs and vaccines, public health and regulatory agencies, and emerging players such as AI and health tech firms.

To deliver the next generation of antimicrobials, the UK must embrace a new approach that is more open, more coordinated, and more strategically led by the public sector. Without addressing the structural bottlenecks that prevent good science from becoming real-world treatments, even large investments will fall short. The UK has an opportunity to lead by example, developing a more connected, agile, and impactful approach to antimicrobial R&D. To do so, the government can act on the following:

- **Build capacity for stronger coordination of public sector agencies** to ensure strategic ownership.
- **Foster new types of public-private partnerships** that mobilise expertise and provide flexible, and long-term funding focused on public health needs.

- **Ensure efficient use of existing scientific infrastructure and growing capacity for AI**, ensuring easier access for researchers and spin-outs.
- **Growing international collaborations around antimicrobial discovery and development**, in particular with countries where there is growing capacity for pharmaceutical R&D and where the AMR burden is high.
- **Strengthen training and capacity building** to ensure future generations can drive forward antimicrobial innovation and that the UK can attract the best international talent.

By maximising the use of its world-class infrastructure and fostering a more connected, agile R&D ecosystem, the UK can play an important role in discovering future antimicrobial treatments – saving lives, strengthening its life sciences sector, and reinforcing its global leadership in health innovation. The shift to a strategic approach will involve new kinds of leadership in public sector agencies, academia and the private sector. Mechanisms will be needed to bring stakeholders together in building a common understanding of the innovation ecosystem, identifying the roles and responsibilities of the different partners and agreeing a strategy for moving forward. This will require a strong government commitment.

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This LEAD policy brief was written by David McKinney (ARMoR), Alicia Demirjian (UKHSA), Gerald Bloom (IDS), Christopher Dowson (HDC, Warwick) and Tom Barker (IDS). The opinions expressed are those of the authors and do not necessarily reflect the views or policies of their organisations or the UK Government.

Images: Page 1, 3d illustration of drug resistant bacteria. Red pathogenic bacteria on dark background. Credit: nobeastsofierce, Shutterstock. Page 3, Microbiologist inspecting petri dish, observing bacteria growth. Credit: Microgen, Shutterstock.

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The LEAD: Leadership in Enhancing Antimicrobial Discovery coalition works to develop leadership and build collaboration to advance science and shape policy for action against antimicrobial resistance.

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