National Audit Office

REPORT

Investigation into how government is addressing antimicrobial resistance

Department of Health & Social Care,
Department for Environment, Food & Rural Affairs

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What this investigation is about

1 Antimicrobial medicines, including antibiotics, are widely used to treat infections and prevent their spread. An inevitable consequence of using antimicrobials is that pathogens (organisms which cause disease) evolve to develop resistance to them. Antimicrobial resistance (AMR) is common around the world, driven in part by misuse and overuse of antimicrobials. This is a major public health concern because it means antibiotics and other antimicrobials may be ineffective, both today and increasingly in the future.

2 For some years, the World Health Organization and other international bodies have urged countries to take wide-ranging measures to reduce the spread of AMR. In the UK, such action involves multiple public bodies including the Department for Health & Social Care (DHSC), the Department for Environment, Food & Rural Affairs (Defra), where AMR policy is led by the Veterinary Medicines Directorate (VMD), and the devolved administrations of Northern Ireland, Scotland and Wales. These and other public bodies have been coordinating their activities using five-year national action plans.

3 We are investigating the government's response to AMR because it is a serious public health threat, and because the UK's experiences during the COVID-19 pandemic showed the country was not as resilient to such threats as it expected to be.

Our scope

4 This report sets out information on the risk posed by AMR and the UK government's response. It focuses on the response in England, where the UK government has responsibility for the NHS and key aspects of animal health and environmental policy. It does not cover responses in the devolved administrations.[1] In the body of the report we consider:

- why AMR is an increasing threat (Part One);
- the UK government's response in the last five years (Part Two); and
- challenges and opportunities over the next five years (Part Three).

1 These functions of the devolved administrations may be subject to audit by Audit Scotland, Audit Wales and the Northern Ireland Audit Office.

Summary

Key findings

The risks posed by antimicrobial resistance

5 Antimicrobial resistance (AMR) is a major public health threat; poor practices across the world, including in the UK, have worsened the problem. AMR occurs naturally, but globally its acceleration is driven partly by people's misuse and overuse of antimicrobials in humans, animals and plants, as well as subsequent transmission of resistant pathogens, including in food and the environment. Poor practices include using antimicrobials when they are unnecessary (for example, prescribing antibiotics to treat a viral infection, against which they are inert), using the wrong antimicrobials (for example, not prescribing the most suitable antibiotic), or using antimicrobials for longer than necessary. Academic research refers to much antibiotic use in humans being inappropriate, while in England 20% of antibiotics prescribed in primary care are inappropriate. Inadequate infection, prevention and control measures and poor sanitation and hygiene practices increase the problem. There is a growing risk that the antimicrobials humanity relies on will no longer work to treat infections (paragraphs 1.4 to 1.6, 1.9 and 1.10, and Figure 1).

6 Development of new antimicrobials has slowed and is insufficient to withstand or reverse increasing AMR. A response to AMR is to develop new antimicrobials. However, only one new class of antibiotic (the most used type of antimicrobials) in use has been discovered since 1987. This is understood to be a global market failure – the financial returns to pharmaceutical companies from discovering antibiotics are insufficient to incentivise investment, even though new antibiotics would be of great public value. Furthermore – with existing antibiotics as other drugs – the market incentive is to sell in large volumes. But from the point of view of public health it would be better to hold antibiotics that continue to work against resistant pathogens in reserve for only the most serious cases (paragraphs 1.6 and 1.12 to 1.14).

7 There are huge foreseeable consequences for the world, including UK citizens, if humanity fails to address increasing resistance. AMR contributes to an estimated 5 million deaths globally each year; out of these, it is directly responsible for an estimated 1.3 million deaths. In the UK, AMR contributes to an estimated 35,200 deaths, of which it is directly responsible for 7,600 deaths. Research suggests that by 2050 AMR is likely to contribute to an estimated 8.2 million deaths globally each year, of which it would be directly responsible for 1.9 million. The future health effects will not be evenly spread. Health inequalities could worsen, and several groups will be disproportionately affected, particularly babies and the elderly, people with lower socio-economic status, and specific ethnic groups. Prior to antibiotics, infections were the most common cause of death, and life expectancy was on average 20 years lower. The World Bank estimates that AMR could result in $1.2 trillion of additional healthcare costs by 2050. Treating AMR infections already costs the NHS in England an estimated £180 million per year. If AMR continues to advance it may have a negative impact on some people's ability to work, and therefore on the wider economies of affected countries. Resistant pathogens in animals also present risks to their health and welfare, productivity, and food security (paragraphs 1.15 to 1.18).

The UK's National Action Plan 2019–2024

8 The UK government has taken a structured, cross-government approach to AMR for over a decade. Since 2013, there have been three five-year national strategies or action plans, covering 2013–2018, 2019–2024 and 2024–2029. The government also published a 20-year vision in 2019, which aims to see AMR effectively contained, controlled and mitigated by 2040. All include coverage of human health, animal health, food safety and the environment, which is known as a 'One Health' approach. Governance and proposed actions have covered the whole UK, including the devolved administrations. The UK has also sought to play a leading role in international advocacy and supporting the global fight against AMR (paragraphs 2.2 to 2.8 and Figure 3 and Figure 4).

9 The UK National Action Plan 2019–2024 (NAP19–24) was a coherent 'One Health' programme for tackling AMR, though there were some significant gaps. NAP19–24 identified five quantified targets and 133 commitments to reduce the burden of infection, optimise antimicrobial use, and invest in innovation and research. Some of the proposed actions sought ambitious change either in the UK or globally, including major reductions in human infections and antimicrobial use in agriculture. Others were exploratory or procedural in nature, such as gathering evidence on environmental risks from AMR. An external evaluation suggested that NAP19–24 paid less attention to the UK's aquatic environment than the importance of this issue warranted, and there was also limited coverage of social care and health inequalities (paragraphs 2.5 to 2.7, 2.35 and 2.38, and Figure 3).

10 The government spent around £567 million directly on AMR programmes between 2020-21 and 2023-24, while much more public money is spent on relevant activities like purchasing antibiotics and cleaning hospitals. The Department for Health & Social Care (DHSC) and its arm's-length bodies spent most of the direct funding, including £417 million DHSC spent on research and international aid. The Department for Environment, Food & Rural Affairs (Defra) allocated much less funding to AMR, spending around £16 million. To make the progress it has, Defra has relied on persuading the private veterinary sector and other external stakeholders to take voluntary measures. Overall, direct funding remained steady in real terms over the period of NAP19–24. However, some AMR programme staff were redirected from AMR to address the COVID-19 pandemic. A substantial amount of other spending is relevant to AMR, including antibiotic prescriptions, hospital cleaning, constructing new hospitals that are easier to keep clean, and investment in reducing wastewater spills (paragraphs 2.9 and 2.10, and Figure 5).

11 Only one of the government's five quantified domestic targets in NAP19–24 was met or on track to be met in the latest data.

- **There has been no sustained reduction in the amount of AMR-related human infections that the government tracks.** DHSC aimed to reduce human drug-resistant infections by 10% between 2018 and 2025. However, by 2023 infections in England had risen to 13% above the 2018 baseline. Similarly, a target to halve healthcare-associated Gram-negative bloodstream infections by 2023-24 was missed, with the number of infections reducing only slightly.[2] DHSC and the UK Health Security Agency (UKHSA) now consider that the original targets were overambitious due to basing targets on previous success in addressing MRSA infections, which turned out not to be comparable. They also point to the COVID-19 pandemic as a phenomenon that placed the NHS under financial and operational pressure, disrupting plans and making it harder to interpret trends in the data. On both targets, data for 2020-21 showed improvements, but this turned out to be a temporary, pandemic-associated dip (paragraphs 2.14 to 2.18 and 2.35, and Figure 6 and Figure 7).
- **Human usage of antibiotics has reduced in England, but by less than targeted.** DHSC aimed to reduce usage by 15% by 2024, through better diagnostics and prescribing, and by educating clinicians and the public. Again, usage fell significantly in 2020 and 2021 before rising, so that the level in 2023 was only slightly lower than in 2018. DHSC attributes this to a post-pandemic increase in circulating infections which increased demand for antibiotics. A shift from face-to-face to online GP appointments may also have contributed, with some research suggesting GPs may be more likely to prescribe antimicrobials during virtual interactions (paragraphs 2.19 and 2.20, and Figure 8).

2 Gram-negative refers to a group of bacteria which are named after the laboratory test used to identify them. They are the leading cause of healthcare-associated bloodstream infections and include a range of bacteria including *E. coli*.

- **The AMR programme failed to meet a target to report on the percentage of antibiotic prescriptions that are supported by an objective diagnostic test.** NHS England advised it would not be possible to measure the target reliably. Increasing the proportion of antibiotics issued after a diagnostic test was seen as crucial by the authors of the UK's 2016 review of antimicrobial resistance, because it could cut the volume of incorrect prescribing (paragraphs 2.11, 2.13, and 2.35).

- **The target for reducing antimicrobial use in food-producing animals in the UK was met one year late, in 2021, with subsequent targets also mostly achieved.** The target for a 25% reduction between 2016 and 2020 was narrowly missed in 2020 (22.6%), but achieved in 2021. Further targets were set for 2021 to 2024, and most were achieved. However, Defra is concerned that additional reductions could prove harder to secure, likely requiring fresh approaches and measures (paragraphs 2.21 and 2.22, and Figure 9).

12 NAP19–24 had 128 other commitments for DHSC and Defra to implement; some have produced valuable results but by the start of 2024 the government had only implemented seven in full. NAP19–24 included 128 commitments relating to the UK or England which were owned by DHSC and Defra (and 133 including those owned exclusively by devolved administrations). Of these, by January 2024, they had completed seven and they assessed that a further 46 were highly likely to be delivered successfully. The 128 commitments had no explicit deadlines, making it difficult both to assess progress and manage delivery (paragraphs 2.23 and 2.24, and Figure 10).

13 NHS England has made progress with a key commitment to find innovative ways to pay for antibiotics. NAP19–24 committed the NHS to exploring a new payment model which sees it pay a flat rate, or subscription, to pharmaceutical companies for certain important antimicrobial drugs, rather than paying for the quantity that patients consume. This aimed to incentivise the development of new antimicrobials while simultaneously facilitating reductions in their overall use. NHS England has now tested subscription arrangements for two antibiotics and expects to let further contracts in 2026. The UK is among the first countries to attempt such a model, which might be adopted by other nations. NHS England will need ongoing evaluation of the impact of its approach. The cost of the first round of contracts is substantial, an estimated £1.9 billion for supplying these antimicrobials to the NHS over 16 years. The effects remain uncertain given that the UK is only 3% of the global market for antibiotics. Pharmaceutical companies will remain free to determine whether or not they invest more in developing new antimicrobials, and are free to market these antimicrobials to other countries (paragraphs 2.25 to 2.29).

14 In 2019, awareness of AMR among health workers and the public needed to improve; it is not clear that it has. Health workers having accurate knowledge of AMR is important, so they advise and treat patients in ways that promote good stewardship. However, a 2019 survey of UK health workers found that only 59% could correctly answer a set of questions about antibiotic use and antimicrobial resistance, and only 78% felt they knew enough about the subject. When a 2024 survey asked the same set of questions, 62% of respondents answered correctly. Meanwhile, 90% of the UK public knew antibiotics were becoming ineffective but only 49% knew that antibiotics do not work against viruses. UKHSA has run some awareness and education campaigns, but there is limited evidence so far of their impact. Since the COVID-19 pandemic, health workers and the public alike have become more familiar with the principles of good infection prevention and control (paragraphs 2.30 to 2.32).

15 Assessments of NAP19–24's contents were broadly positive while recognising the problems with implementation. An academic review of 114 countries' national action plans ranked the UK's NAP19–24 third after Norway and the USA. Areas of strength included coordination, regulation and research. Areas for improvement included education, public awareness and accountability. An independent evaluation highlighted several gaps in NAP19-24's implementation, including the absence of a central diagnostics data source, limited surveillance of antibiotic use in cattle and sheep, and challenges from understaffing. It was particularly critical of the UK's management of wastewater, where it found a lack of baseline data and coordination (paragraphs 2.35 to 2.38).

The UK's future plans for addressing AMR

16 The National Action Plan 2024–29 (NAP24–29) has streamlined the previous approach and added new areas of focus. The government published NAP24–29 in May 2024. It continues the same themes as NAP19–24 but adds an additional one: being a good global partner (although global activity was already important in the past). There has been a change of emphasis, with more focus on factors that can affect the further development of AMR – a whole system approach to infection prevention and management, public engagement and education, and surveillance – and on health inequalities. Overall, the number of specific commitments has substantially reduced, from 133 to 30 more high-level strategic commitments. This is to enable a better focus on the monitoring of delivery. The role of adult social care as a setting for AMR risks has more prominence than previously, recognising that most deaths from AMR infections are in elderly people. Only four of the 133 commitments referred to social care in NAP19–24, whereas NAP24–29 refers to social care in six of its 30 commitments (paragraphs 3.2 and 3.3, and Figure 11).

17 NAP24–29 has less stretching targets that ought to be more achievable than those in NAP19–24, but in some cases it is unclear to us whether meeting the targets would represent progress towards the 20-year vision the UK set in 2019. NAP24–29 has new quantitative targets on Gram-negative and drug-resistant infections, and on human antibiotic usage, but they seek much less change than the NAP19-24 targets. With regard to human infection levels, the government aims to freeze these at 2019–20 levels, believing this to be very challenging to achieve because of the UK's ageing population, which has an increased number of co-morbidities and susceptibility to infection. But this would mean, other things being equal, that the UK continued to have the same burden of infection as it did in 2019-20 and continued to make the same contribution to increasing AMR. DHSC's view is that lowering these targets was necessary to make them achievable and realistic, and to get support from the healthcare system. The quantitative target on diagnostics was removed because it was deemed not to be measurable. There is no target regarding animal health, though the government told us that it hopes to endorse new targets that will be published in 2025 by the Responsible Use of Medicines in Agriculture Alliance. A new target has been added on the public's and healthcare professionals' knowledge of AMR (paragraphs 3.4 to 3.7 and Figure 11).

18 NAP24–29 has no quantitative target relating to environmental drivers of AMR, which experts agree pose a significant challenge. Research has shown that chemicals and residues in the aquatic environment affect the prevalence and diversity of AMR. In the UK, this impact is likely being exacerbated by the increasing incidence of untreated wastewater entering waterways. Environmental drivers of AMR were not a major focus of the previous NAP, and more progress needs to be made during the life of NAP24–29. Defra officials told us that their focus is on the water companies' investment in wastewater treatment and in reducing storm overflows, and that this will have a beneficial effect on wastewater as a potential source of AMR and infection (paragraphs 3.16 to 3.19).

19 There remain many gaps in knowledge of AMR and how best to manage it. Data on human health are generally strong in the UK; however, there are still key areas for improvement, particularly in understanding health inequalities and the extent to which objective diagnostic testing can support doctors when they are prescribing antimicrobials. In animal health, the gaps are still greater, with limited data on resistance and antimicrobial use in certain livestock species, such as cattle and sheep, and for pets (known as companion animals). The Food Standards Agency (FSA) led a programme with fixed-term funding to measure prevalence and transmission of AMR within the environment and agri-food systems –the Pathogen Surveillance in Agriculture, Food and Environment (PATH-SAFE) programme – but Defra told us that this activity will not continue after funding ends in March 2025. DHSC and Defra aim to address knowledge gaps by encouraging research proposals in the top 10 priority areas in NAP24–29 (paragraphs 3.14 and 3.20 to 3.23).

20 AMR is and will always remain a global phenomenon; the UK and other concerned nations need to move the global community towards measurable, verifiable change. Individually, the UK's internal efforts can provide only limited insulation from rising AMR, though, at their best, they can be templates for others to adopt. To date, partly through NAP19–24, the UK has helped to grow the number of nations that are concerned about AMR and has supported lower- and middle-income countries to improve their surveillance and management of AMR. However, as the UK recognises, further action is urgently needed internationally (paragraphs 1.10, 1.17, 2.1, 2.6 and 2.7, and Figure 11).

21 The Cabinet Office and the Government Office for Science have recently identified AMR as one of 26 chronic risks facing the UK, and intend this analysis to influence government policymaking and spending decisions. Chronic risks are those which pose a continuous challenge to the UK economy and our way of life, as opposed to acute risks which require an emergency response. The government has established a new process for identifying and assessing chronic risks that require a sustained response, of which AMR is one. It is one of only six chronic risks that the analysis directly links to loss of human life, and there are circumstances in which it could present an acute risk demanding an emergency response. The Cabinet Office is currently working with HM Treasury to take a joined-up approach to risk and resilience in the 2025 Spending Review. The Cabinet Office has not made public its chronic risk analysis, but doing so might contribute to increasing wider public awareness of AMR. To date, we are not aware that there has ever been a national resilience exercise which incorporated an AMR dimension (paragraphs 3.24 to 3.30).

Concluding remarks

22 AMR is a serious threat to the health of the public both in the UK and globally, and has the capacity to change our society radically for the worse, with negative consequences for individual human and animal health, for life expectancy, and for the functioning of the NHS, adult social care, and the wider economy, including food security. Although AMR is an inevitable consequence of using antimicrobials, it is also a threat exacerbated by human activity that has been given insufficient attention for a long time. The UK government has been taking seriously its responsibility to address the issue in the UK and to try to coordinate and strengthen international responses. In its national action plans it has adopted a cross-government, multi-disciplinary approach and in some areas has been willing to consider innovative solutions.

23 The limited progress made with NAP19–24 shows how difficult it is to achieve change. The COVID-19 pandemic had a disruptive effect, but more fundamentally it is proving hard to shift the expectations and behaviours of millions of citizens and thousands of public and private institutions, when they continue to find current practices necessary or convenient. The UK's fight against AMR is further complicated by the fact that its population is ageing and spending more years in ill health, both currently correlated with increased antimicrobial use. Sharp reductions in the sales of antimicrobials for animal use show that major changes can be achieved. But the UK remains a long way from the 20-year vision the government expressed in 2019: to control, contain and mitigate AMR through a lower burden of infection, the optimal use of antimicrobials, and new treatments so that everyday illnesses can continue to be cured.

Specific areas for the government to consider

24 As the government takes forwards NAP24–29, we think it should consider the following matters.

a How delivery of its current targets and commitments can be more successful than in NAP19–24, including through the use of strengthened performance monitoring and deadlines for implementation.

b Whether targets for no increase in a range of human infections are stretching enough to make a contribution to the vision of reducing the burden of infection.

c How the results of the new NHS antibiotic subscription model will be tracked, evaluated and made public, including any effects on the research and development of new drugs.

d What the UK's aquatic environment is currently contributing to rising AMR, particularly wastewater treatment and spills, and, as a result, whether new commitments or targets are needed in this area.

e How maximum beneficial impact can be achieved from the classification of AMR as a chronic risk and whether there is value in publishing the government's full list of chronic risks so that universities, funding bodies, businesses and other institutions can better understand the public sector's priorities for research and innovation.

f Whether a national preparedness exercise with a significant AMR dimension should be carried out.