HM Government

Contained and controlled

The UK's 20-year vision for antimicrobial resistance

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Our vision for antimicrobial resistance in 2040

By 2040, our vision is of a world in which antimicrobial resistance is effectively contained, controlled and mitigated.

The United Kingdom (UK) is determined to sustain its efforts to combat resistance, taking local, national and global 'One-Health' approaches across humans, animals, the environment and food, in line with global ambitions and in collaboration with other nations, partners and the international community.

In our vision, stakeholders at local, national and global levels are collectively strengthening policy and practice, ever improving understanding through research and surveillance, developing effective regulation and advocacy to contain and control resistance. In the UK, we will contribute to the global effort through:

- **A lower burden of infection, better** treatment of resistant infections, and minimised transmission in communities, the National Health Service (NHS), farms, the environment and all other settings.

- **Optimal use of antimicrobials** and good stewardship across all sectors, including access to safe and effective medicines that have been manufactured responsibly for all who need them; achieving and maintaining usage levels by sector as good as the best countries in the world where comparable data are available.

- **New diagnostics, therapies, vaccines and interventions** in use, and a full antimicrobial resistance research and development pipeline for antimicrobials, alternatives, diagnostics, vaccines and infection prevention across all sectors; with access to new and old technologies for all.

A collaborative future

In our vision for AMR in 2040, the UK is working with partners across all sectors and levels, including:

- professionals and professional bodies;
- society, across communities with patients, the public, consumers and animal owners;
- the private sector, industry, investors, manufacturers and retailers and;
- the research community and academia;
- the United Nations family, the European Union, multilateral and international organisations; and
- other governments bilaterally, with G7 and G20 partners and others internationally.

Antimicrobial resistance today

Antimicrobial resistance arises when the organisms that cause infection evolve ways to survive treatment. Once standard treatments are ineffective, it is easier for infections to persist and spread. These resistant organisms can be found in people, animals, food and the environment.

Although resistance occurs naturally, the inappropriate use of anti-infectives and antimicrobials in both human and animal[i] medicine, in plants and crops and unintentional exposure, for example through environmental contamination and food, is rapidly accelerating the pace at which it develops and spreads.

By using or taking the wrong kind of anti-infective agent or antimicrobial drug, not using them as directed or in inappropriate concentrations, humans as patients, prescribers, carers and animal owners are driving antimicrobial resistance the world over[ii]. By 2030, the global human consumption of antibiotics is forecast to rise by more than 30% (up to 200% if it continues growing at current rates)[iii]. In the animal health sector, the UK reduced use by 40% between 2013 and 2017, and is expected to reduce further[iv]. However, due to an increase in meat production and meat consumption globally, it is predicted that antimicrobial use in animals worldwide will increase by 67% between 2010 and 2030 primarily driven by an increase in consumption in low- and middle-incomes and Brazil, Russia, India, China and South African (BRICS) countries[v].

A pervasive threat

The rise and spread of antimicrobial resistance is creating a new generation of 'superbugs' that cannot be treated with existing medicines. Already, the organisms that cause many common diseases such as tuberculosis, HIV/AIDS, malaria, sexually transmitted diseases, urinary tract infections, chest infections, bloodstream infections and food poisoning, can resist a wide range of antimicrobials. Some cases of tuberculosis and gonorrhoea are already resistant to antibiotics of last resort.

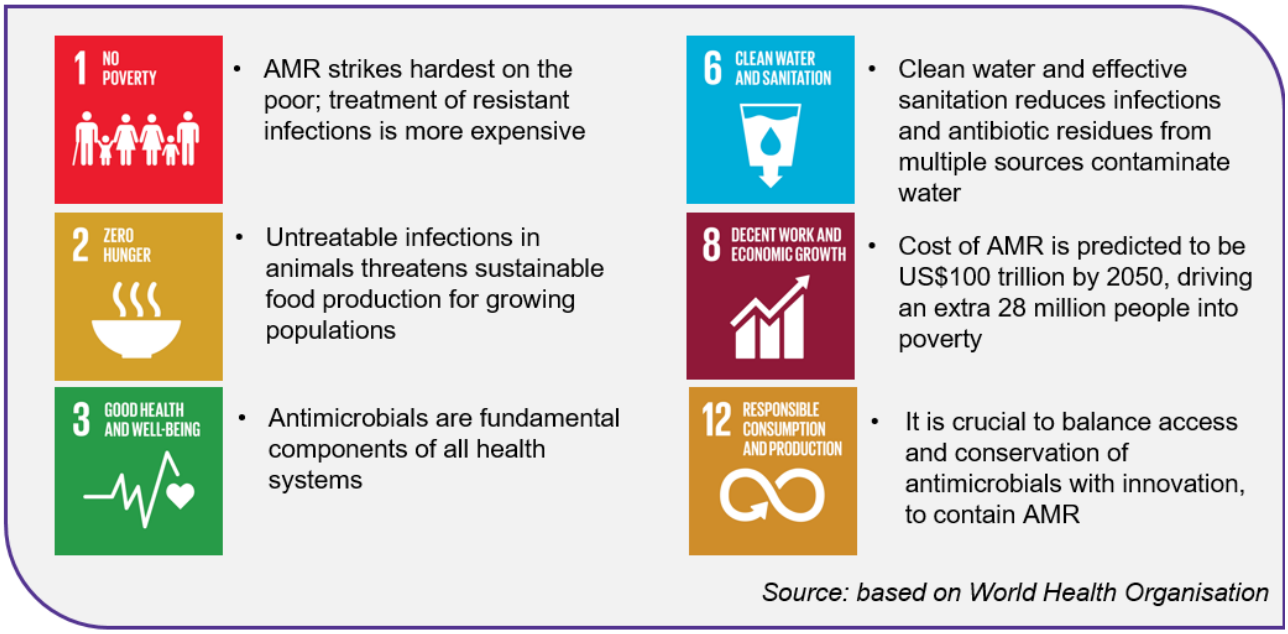
For most antimicrobials, there are few replacement or alternative products in the development pipeline. Research and development of the vaccines, diagnostics, tools and tests needed to prevent infections is similarly lacking.

The impacts of unchecked antimicrobial resistance are wide-ranging and extremely costly, not only in financial terms, but also in terms of global health, food security, environmental wellbeing, and socio-economic development. Already, antimicrobial resistance is estimated to cause at least 700,000 deaths around the world each year. That figure is

predicted to rise to 10 million, alongside a cumulative cost of $100 trillion, by 2050 if no action is taken.

Globally, unchecked antimicrobial resistance also threatens many of the Sustainable Development Goals (Figure 1). The World Bank estimates that an additional 28 million people could be forced into extreme poverty by 2050, through shortfalls in economic output, unless resistance is contained.

Figure 1. Antimicrobial resistance's impact on Sustainable Development Goals



Ensuring veterinary antibiotics remain effective to treat animal diseases is just as important to protect both human and animal health.

The brunt of the impacts will be felt by low- and middle-income countries, but the UK will also feel the impact of rising resistance. In the UK, we will see people suffering longer lasting infectious illnesses, increased numbers of deaths attributable to infectious diseases and the socio-economic costs associated with our increasingly pressured services.

Antimicrobials must be used appropriately in both humans and animals so that they continue to be an effective tool to treat infections when needed.

A global priority

Organisms that have become resistant to treatment respect no borders, either geographical or ecological: the organisms and their resistant genes can easily spread through movements of people, animals, food or water; and they can cross between bacteria and over into different species. That means that containing and controlling antimicrobial resistance requires coordinated, global action across all sectors.

The world's first plan for such action was agreed in 2015, when Member States of the World Health Organisation, Food and Agriculture Organisation and World Organisation for Animal Health endorsed a shared Global Action Plan on Antimicrobial Resistance .

In 2016, the global facing independent AMR review chaired by Lord O'Neill triggered a wave of political and public momentum to address the issue. Later that year, at the UN General Assembly, the global action plan was re-affirmed as the world's blueprint for addressing antimicrobial resistance by 193 Heads of State in a high-level political declaration committing countries to support and implement the plan at national, regional and global levels.

Since then, a global Ad-hoc Interagency Coordination Group on antimicrobial resistance established by the UN Secretary General in response to the declaration has developed a 'Framework for Action' that situates antimicrobial resistance in the wider context of the Sustainable Development Goals. The framework helps to align political agendas and provides a common language and dynamic structure for all sectors to work from, while respecting the endorsement of the global action plan on antimicrobial resistance by all countries.

With a price tag estimated by the World Bank at $9bn per annum, global action to contain antimicrobial resistance will not come cheap. But the Bank argues that putting resources into stopping resistance now is one of the highest-yield investments any country can make.

Antimicrobial resistance in the UK

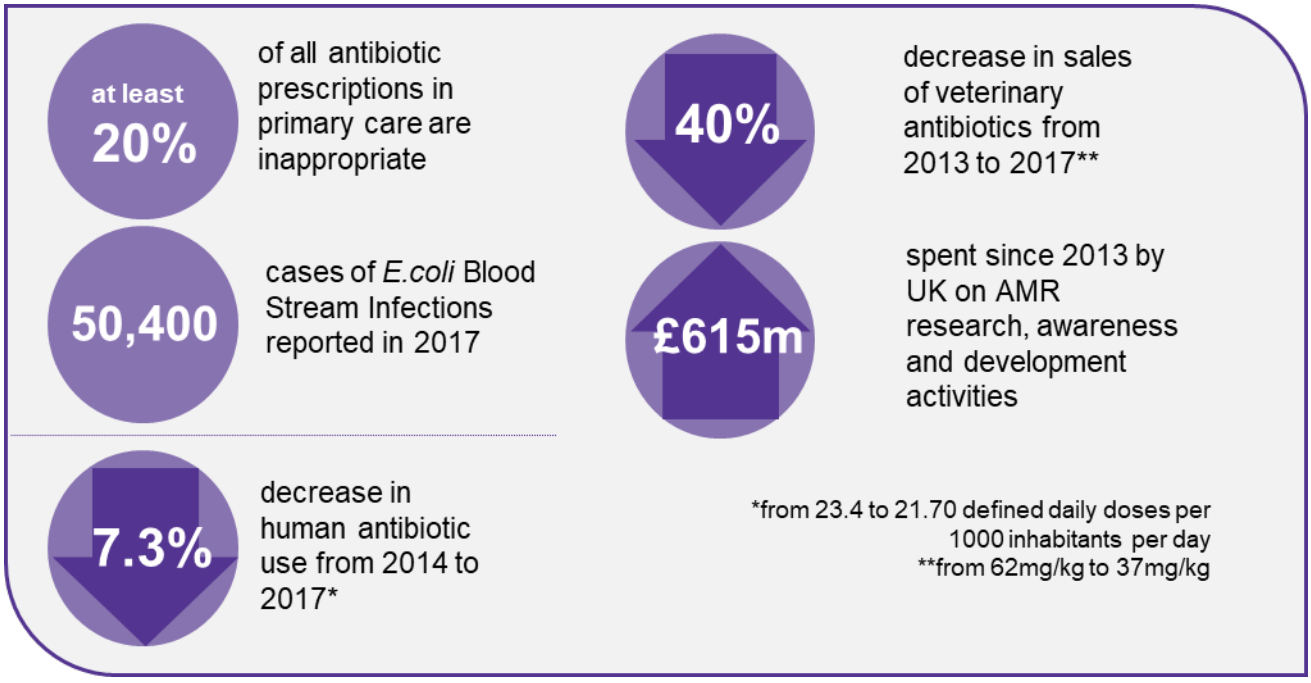
The UK Government has long been an advocate of action to address antimicrobial resistance, with a national strategy and action plan in place since 2000. In 2013, we reinforced our approach with a One-Health perspective and published our first fully integrated five-year strategy and plan for tackling resistance across human and animal health.

The 2013–2018 strategy and UK Government ambitions on antimicrobial resistance have helped reduce antibiotic use in both humans and food-producing animals (figure 2). Other achievements under the strategy include strengthened surveillance data in the UK, investing more in better coordinated research, stimulating global awareness and momentum, and helping to secure global commitments to address resistance, including through the UN General Assembly and UN Environment Programme resolutions, and G7 and G20 declarations.

Despite these achievements, drug resistant infections in humans continue to increase in the UK. While the proportion of *Escherichia coli* (*E. coli)* blood stream infections that are resistant to one or more drugs remained stable between 2013 and 2017, the overall number of *E. coli* blood stream infections increased by 23.3% in England, indicative of

increases across the UK. This increase in absolute numbers creates greater potential for resistance to emerge.

Figure 2. Antimicrobial resistance in the UK: a snapshot.



Worryingly, we have seen an increase in Carbapenemase producing Gram-negative organisms, such as *E. coli,* resistant to key antibiotics due to importations from abroad, local spread and poor prescribing practices. It is critical that we avoid the spread of these organisms in the UK as, once the key antibiotics used to treat them stop working, there are few remaining alternatives.

At the same time, we continue to be high users of antibiotics compared to some other European countries, using twice as many as the lowest user in Europe (figure 3), demonstrating that we have some way to go.

Figure 3: Antibiotic use in the UK

The drivers, spread and impact of resistance in the environment and food chain remains poorly understood and needs more study. More research is also needed to understand which interventions work best to limit the development and spread of resistance in different contexts, at home and abroad.

Ambitions for change

Achieving the goal to contain and control antimicrobial resistance is a job for all nations. The UK is determined to continue to play its part, modelling best practice at home and supporting progress internationally.

By 2040, using surveillance, research, awareness and education activities underpinned by regulation, investment and advocacy, the UK aims to build on its achievements from 2013-2018 and fulfil nine ambitions for change, as outlined below (figure 4).

Figure 4: The UK's nine ambitions for change

1. Continue to be a good global partner

We want to keep working with other countries and international organisations to:

- design, develop and implement global surveillance and monitoring approaches;

- improve the global capability and capacity to tackle antimicrobial resistance, especially in low and middle-income countries and promote access and responsible use of quality assured medicines;
- secure sustainable global governance and accountability structures;
- support systems for effective disease prevention and treatment, including optimising antimicrobial access and use, immunisation, and improved nutrition, water, sanitation and hygiene;
- support effective behaviour change across countries and contexts;
- support strengthening of human and animal health regulatory, delivery and quality systems,
- increase understanding of how international aspects of resistance, including trade, environment, manufacturing and supply impact, including on the UK, and
- support transparency and publication of data by countries and independent monitoring, for example, by the Access to Medicines Index.

2. Drive innovation

We want to continue as world class leaders in research and development by:

- improving our understanding of infectious organisms and how resistance to treatment spreads between and among humans, animals, food and the environment and what the impacts of antimicrobial resistance are, including on different communities of microorganisms or microbiomes;
- identifying sources of antimicrobial residue and resistance genes in the environment and how to reduce their spread to prevent unintentional exposure;
- working with industry to deliver a sustainable supply of high-quality, new and alternative treatments, preventative measures and diagnostic tools in humans, animals agriculture and the environment;
- promoting effective collaboration and coordination in the global research agenda;
- developing the next generation of antimicrobial resistance researchers both at home and in low- and middle-income countries; and
- identifying and promoting innovative sources and models of finance and investment.

3. Minimise infection

We want to achieve UK rates of infection in humans that are the lowest in the world and reduce levels of infections in animals by:

- targeting support at specific disease-reduction programmes;
- having zero tolerance of avoidable infection in human healthcare settings;
- optimising the use of effective vaccines;
- minimising transmission in the environment; and
- promoting good infection prevention and control practices that maximise the use of technology and the built environment.

4. Provide safe and effective care to patients

We want to protect patients by optimising antimicrobial use through:

- strong antimicrobial and diagnostic stewardship,
- ensuring all decisions to use antimicrobials are informed by a diagnostic test, clinical decision support tool or relevant data and where antimicrobial treatment is indicated, prescribe and administer the right agent promptly to reduce harm from sepsis; and
- using data more effectively to measure the impact of resistance on human health.

5. Protect animal health and welfare

We want to achieve antimicrobial use levels per animal industry that are among the best in the world, without jeopardising animal health and welfare. We will

- reduce the impact of resistance on our animals, including aquaculture, through best husbandry practices that can be shown to achieve low prevalence of infectious diseases.

6. Minimise environmental spread

We want to minimise the potential threat of antimicrobial resistance and the dispersal of the drivers of resistance in the environment by promoting:

- effective waste and waste water treatment and handling;
- low use antimicrobial aquaculture practices; and

- environmental stewardship by manufacturers of antimicrobial products; supporting modern manufacturing of medical interventions such as drugs and vaccines, including their active pharmaceutical ingredients.

7. Support sustainable supply and access

We want to secure sustainable access to quality-assured old and new antimicrobials for all those who need them, both in the UK and abroad, by:

- making sure only accredited quality products reach the market;
- understanding the contribution of substandard and falsified drugs to the global antimicrobial resistance burden;
- promoting environmental stewardship in manufacturers' supply chains; and
- influencing marketing approaches and access and stewardship strategies of the global pharmaceutical industry.

8. Demonstrate appropriate use

We want to show that we in the UK only use antimicrobials where appropriate by ensuring our response to antimicrobial resistance is informed by:

- real-time monitoring provided by a fully integrated, harmonised, standardised and comprehensive One-Health surveillance system; and
- robust data collected for defined metrics across sectors and made freely available to all.

9. Engage the public

We want to develop effective societal advocacy by:

- identifying and using the most effective communication channels to fully engage the public on all aspects of antimicrobial resistance;
- making sure people in the UK not only understand antimicrobial resistance but take ownership of the issue and solutions as healthcare practitioners, patients, animal keepers, food processing workers, consumers, buyers and investors.

A shared and informed perspective

Our development of the UK's vision for antimicrobial resistance and high-level ambitions was informed by analysis and consultation. We evaluated the impact of our 2013–2018 antimicrobial resistance strategy against the United Nation's Ad-hoc Interagency Coordination Group's Framework for Action, identifying clear actions on the environment and food, and areas where we can genuinely make an impact.

We consulted widely with experts, professional bodies, industry and academia to ensure our ambitions are realistic, but with enough stretch to stimulate real progress.

We have taken a One-Health approach that will see us working in a fully integrated, cross-sectoral way. We will join up initiatives across sectors as and where appropriate, sharing learning and experience as much as we can. We will also look for ways to embed AMR in all relevant government initiatives, new and old, for example across environment and agriculture, life sciences, and sustainable development, including cross-disciplinary research and our UK Aid work.

Making change happen

To deliver on our ambitions we need to chart an action course for the next 20 years that progressively strengthens our understanding of antimicrobial resistance and of what works to contain and control it, where and how.

Our approach needs to prioritise actions that offer value for money and a real opportunity to make a difference (figure 5). We must align with other relevant national and international initiatives, including the Sustainable Development Goals, the Global Health Security Agenda, Codex Alimentarius and the Global AMR Research and Development Hub, among others.

Our approach must also be rooted in robust multi-sectoral data and evidence gathered from human and animal health, agriculture, environment, food and water. This includes ensuring that we can learn from regular self-assessment and independent monitoring as well as from good practice in managing resistance at home and abroad. We will benchmark with the best countries in the world where comparable data are available.

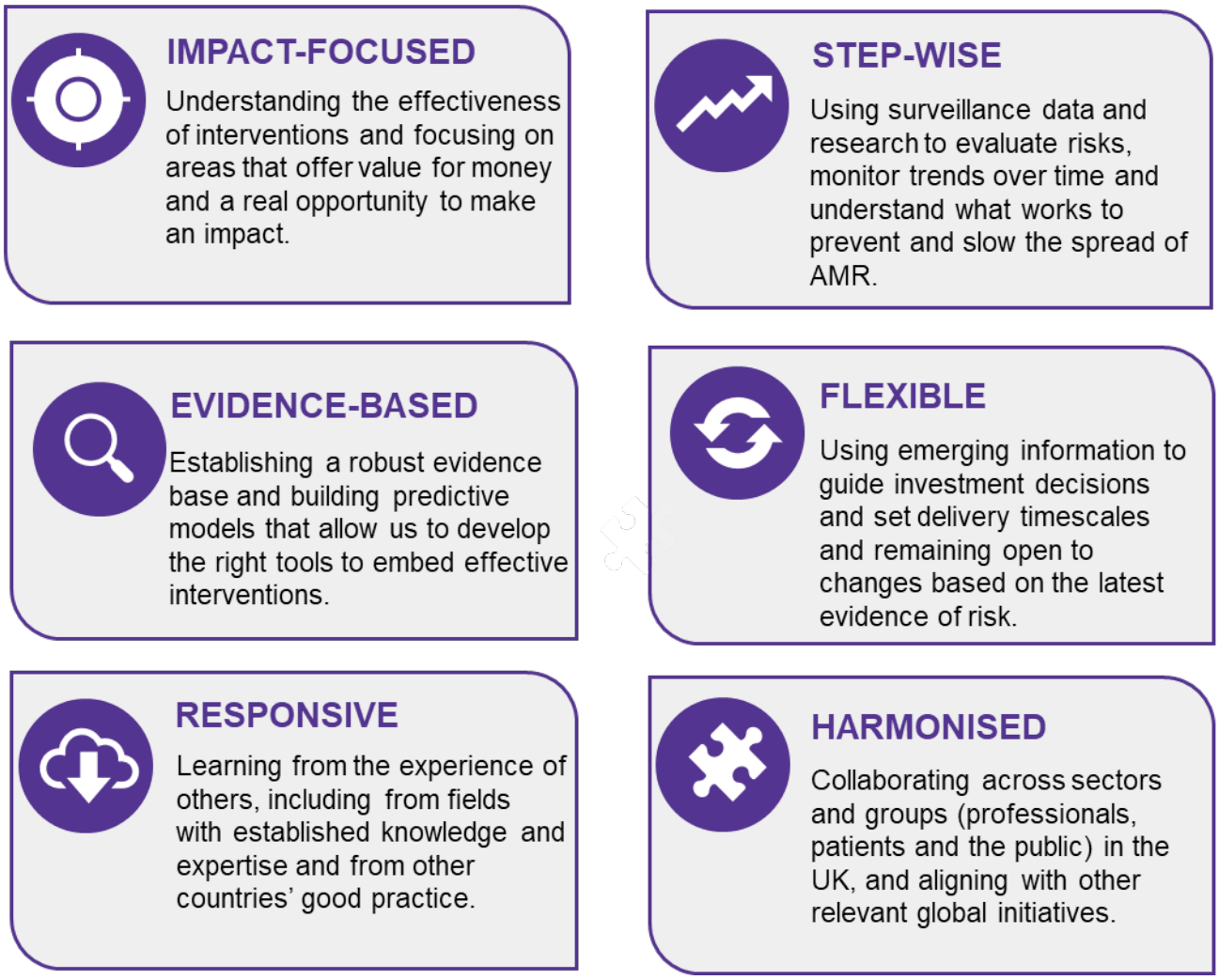
Our 2013–2018 antimicrobial resistance strategy laid the foundations for the long-term, evolving programme of work we need to secure sustainable systems and cultural change in infection prevention and antimicrobial use to impact resistance.

Over the next 20 years, we will build on these foundations through a series of five-year UK national action plans that will each consider past and then present contexts to prioritise actions and direct resources based on the latest information about what the biggest risks are and which interventions are most effective in addressing them. In developing each UK national action plan, we will align with the latest global plans and objectives, using accepted structures to frame our activities (for example, our 2019–2024 plan uses the United Nation's Ad-hoc Interagency Coordination Group Framework for Action to set out our commitments).

For more information on our national action plans, including full details of the most recent plan, see the government's AMR collection page.

We will measure our progress by defining a set of robust metrics, ensuring comparability with other countries wherever possible, and monitoring this over time. We will continue to share our results and emerging evidence across all sectors.

Figure 5. Principles for developing the UK's five-year action plans



Ready, willing and engaged

It will take the combined efforts of diverse UK public and private sector bodies as well as all members of the public to fulfil our high-level ambitions and help contain and control antimicrobial resistance. Each one of us needs to be ready, willing and engaged to play our part.

In 2013, the strong willingness and engagement shown by many different stakeholders responding to our call to action on antimicrobial resistance provided the foundations for our progress over the past five years. Now we need to continue that good work, and go even further in our collaborative efforts to tackle antimicrobial resistance.

The research community

To keep improving our understanding of antimicrobial resistance and develop new safe and effective treatments, we need UK researchers, academics and research funders to:

- fill research gaps and quickly turn results into action;
- focus on key areas, including infection prevention and control, transmission pathways, and antimicrobial resistance's impact on microbiomes;
- draw on diverse disciplines to identify which antimicrobial resistance interventions work, where and how;
- collaborate with others to help development and uptake of new treatments and alternatives to antimicrobials in food production. Also, understanding the operational, social and behavioural barriers involved in implementing the innovations; and
- continue to nurture new researchers and build our collective expertise and academic skills base for antimicrobial resistance research.

Animal and agriculture research

In animal health and agriculture, farmer, food and feed manufacturers and retailers urgently need to work with researchers to identify:

- routes of resistance (how AMR develops, is maintained and spreads);
- evidence-based good practice and control measures;
- effectiveness of available treatments and innovative approaches to increase protein yield without antimicrobials; and
- gaps in diagnostic tools to be filled.

The private sector

To ensure a steady supply of effective antimicrobial resistance treatments, diagnostics and supporting technologies, we need UK companies, industry bodies, trade associations and investors to:

- fulfil the commitments of the 2016 Davos Declaration on antimicrobial resistance to reduce environmental impact, support good stewardship, improve access, and invest in research and development;
- find ways of making and packaging products that reduce the risk of falsification;
- embed good practices in farm assurance schemes, and improve compliance;
- invest in new and innovative products, research and approaches to prevent and manage infections and increase protein production from food;
- work with regulators and government to fill outcome data needs and meet food producing animal sector-specific targets; and
- act as good employers by promoting good hygiene practices, infection prevention and vaccination uptake in the workplace.

Public agencies

To ensure steady commitment to, and support for, tackling antimicrobial resistance, we need government, healthcare and other public agencies to:

- implement the commitments made in the NAP to ensure progress towards our high-level ambitions;
- continue to review evidence as it emerges, and change their approach and interventions as and when appropriate;
- keep their actions under review to monitor, evaluate and publish progress;
- work across organisational and sector boundaries to share learning, experience and ensure a strong One-Health focus;
- maintain awareness, through evidence based system wide interventions; and
- work together to develop the next five-year plan, ensuring the right level of progress towards the UK's vision for 2040.

Professionals

To ensure best practice and good stewardship, we need UK Royal Colleges, professional bodies, and learned societies across human, animal, environmental health and the food chain to engage academia, researchers, clinicians and the public and:

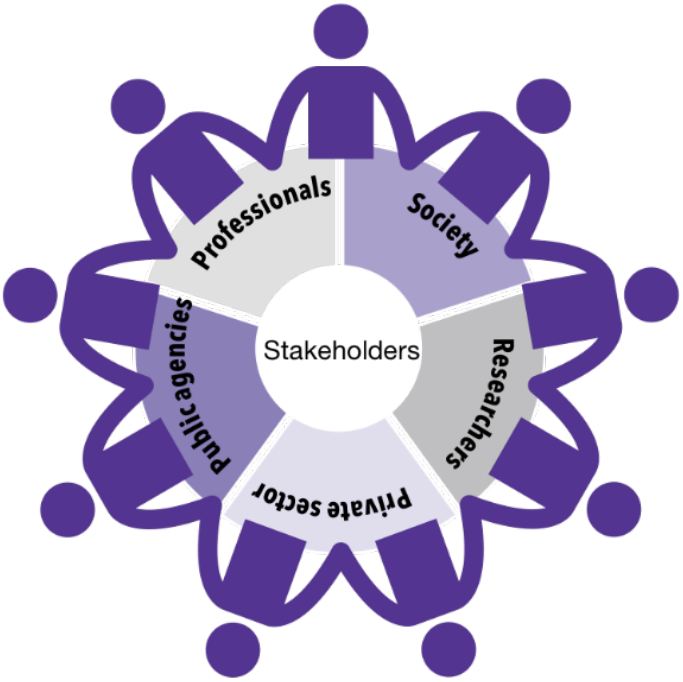
- promote best practice infection prevention and control and antimicrobial use by health workers, veterinarians, farmers and throughout the food chain;
- ensure appropriate training, including antimicrobial stewardship, across sectors and at all levels (from Board to floor);
- promote responsible procurement of medicines; and
- support comprehensive, consistent and comparable surveillance data through robust recording, auditing and antimicrobial testing methods.

Society

To reduce the need for, and use of, antimicrobials, we need everyone to get engaged as patients, animal owners, consumers, civil society organisations and members of society and:

- act as advocates for action on antimicrobial resistance, promoting key messages and holding public bodies and private organisations to account;
- take responsibility for good personal and food hygiene and infection control at home, school, work and when travelling abroad;
- understand the signs and symptoms of infection and know when to seek professional advice;
- understand the risks and benefits of antimicrobials and only use them as directed; and
- encourage good farming practices by buying food that meets high standards of animal health and welfare.

Figure 6: Many different stakeholders have a role in implementing the UK national action plan for antimicrobial resistance



References

[i] Unless stated otherwise, the generic term 'animals' refers to livestock, fish, companion animals and horses.

[ii] anti-infectives include cleaning products such as antibacterial sprays; through the rest of the document, references to antimicrobials includes anti-infectives where that would be relevant in the context of the text.
[iii] Global increase and geographic convergence in antibiotic consumption between 2000 and 2015, published March 26, 2018 in the Proceedings of the National Academy of Science (PNAS)
[iv] VARSS. 2018. https://www.gov.uk/government/publications/veterinary-antimicrobialresistance-and-sales-surveillance-2017

[v] Van Boeckel, T.P., Brower, C., Gilbert, M., Grenfell, B.T., Levin, S.A., Robinson, T.P., Teillant, A., Laxminarayan, R. 2015. Global trends in antimicrobial use in food animals. Proceedings of the National Academy of Sciences May 2015, 112 (18) 5649-5654.

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