CREW CENTRE OF EXPERTISE FOR WATERS

Scottish One Health AMR Register (SOHAR): Updated research insights

Policy Brief

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Recommendations

The following recommendations are based on the updated SOHAR. They aim to support policymakers, funders, researchers, practitioners, regulators and other stakeholders in strengthening Scotland's contribution to UK AMR goals and addressing key gaps in the research landscape.

i. **Sustain SOHAR as a dynamic and integrated resource**
Ensure SOHAR functions as more than a passive archive by establishing regular update mechanisms and strengthening stakeholder ownership. Explore integration with existing research management systems[1] to streamline data input.

ii. **Improve usability and visibility of SOHAR**
Strengthen navigation through searchable functions and visual summaries. Where possible, include planned and ongoing projects to support coordination and forward-looking insight. Introduce an expertise directory[2] to highlight researcher involvement and enable collaboration.

iii. **Use SOHAR to assess progress against NAP commitments**
Leverage SOHAR to track Scotland's research alignment with NAP commitments and identify strategic gaps. Strengthen its value by developing a transparent method to assess the significance of entries, building on earlier scoring approaches[3] with stakeholder input.

iv. **Target investment toward underrepresented AMR research areas**
Prioritise funding for areas with limited representation including animal health, food systems, antifungal use in agriculture, behavioural prevention, public engagement, and health inequalities. Addressing these gaps will help support a more comprehensive and inclusive One Health response to AMR.

v. **Support transdisciplinary AMR research and collaboration**
Transdisciplinary research helps bridge gaps between research, policy, practice, regulation, and innovation. While Scotland contributes to UKRI-funded AMR research networks, transdisciplinary approaches are still developing and not always visible in outputs. Ongoing support for collaborative research can improve coordination, address market barriers, and help turn innovation into practice.

[1] For example, Elsevier PURE[1], widely used by academic institutions, captures research metadata and could help automate population of the register. It includes a tagging feature that links research to the UN Sustainable Development Goals; a similar tool could be developed to align research with AMR priorities under UK or global action plans. Similarly, the SEFARI Research Register[2] offers a Scottish example of how research across institutions can be made accessible to support collaboration and inform policy.

[2] For example, the Centre of Expertise for Waters (CREW) maintains a searchable Register of Expertise[3] focused on the water environment. A similar model could inform a dedicated AMR-focused resource.

[3] The original SOHAR used a semi-quantitative scoring matrix to assess the scope and significance of research activities with respect to 2019–2024 NAP commitments.

Summary

Antimicrobial resistance (AMR) is a critical and escalating global health challenge, responsible for an estimated 1.14 million deaths in 2021[4]. It poses significant risks to public health, animal welfare, food systems, plant health, and the environment. The UK's 2024–2029 AMR National Action Plan[5] (NAP), developed in collaboration with all four nations, recognises research as a core component of its strategy.

SOHAR[6] supports Scotland's contributions to the UK-wide response by mapping AMR-related research involving Scottish institutions. It provides a comprehensive overview of Scotland's AMR research landscape, helping policymakers, funders, and researchers identify emerging priorities and gaps.

This policy brief presents key findings from the 2025 update to SOHAR. It captures AMR-relevant research published or ongoing since July 2021, following the first SOHAR. In total, 952 records were mapped against commitments in both the UK AMR NAP 2019–2024 Addendum[7] and the 2024–2029 phase.

The updated insights highlight Scotland's research strengths in innovation and antimicrobial stewardship, alongside increasing engagement with environmental aspects of AMR. It also identifies key research areas where further attention is needed. These include animal health, behavioural interventions, addressing health inequalities, public engagement, and translating innovation into practice.

'Further research is needed in key areas including animal health, behavioural interventions, health inequalities, public engagement, and translating innovation into practice'

Research Undertaken

A rapid scoping review and stakeholder workshop were conducted between March and May 2025. Projects and publications underwent an initial high-level screening followed by an in-depth review. Records were included if they were (i) relevant to AMR, including within a One Health context; (ii) published or ongoing after the first SOHAR search period (July 2021); and (iii) involved researchers or organisations based in Scotland.

Records were classified according to nine thematic categories (Box 1), expanded from the original SOHAR to reflect the complexity of AMR as a biological, social, and economic issue. They were then mapped to the UK AMR NAP commitments (2019-2024 addendum and 2024-2029 phase). It was common for individual records to align with more than one category and commitment, highlighting the cross-cutting nature of the research.

Please see Appendix 1 for more details on the methodology.

BOX 1: THEMATIC CATEGORIES

- AI & Digital Tools
- Animal Epidemiology
- Clinical AMR & Antimicrobial Stewardship
- Disease Diagnostics
- Environment & Transmission
- Socioeconomic & Policy Dimensions Pathways
- Food Systems & Agriculture
- Innovation & Alternative Treatments
- BioSecurity and Risk Management

Key findings

Scope and Distribution of AMR Research

Since SOHAR's launch, the number of AMR research records involving Scottish institutions captured in the register has increased 3.3-fold, reaching 952 records comprising 682 publications and 270 projects. Together, these generated 1,944 thematic assignments[4] across all nine categories (Figure 1), highlighting the cross-cutting nature of Scotland's AMR research and its growing alignment with One Health principles.

The most frequently represented categories were Clinical AMR & Antimicrobial Stewardship and Innovation & Alternative Treatments, reflecting Scotland's expertise in human-health interventions and novel therapies.

Animal Epidemiology and Food Systems and Agriculture were among the least represented categories, indicating a key gap in the animal dimension of AMR. The Scottish Government's Rural and Environment Science and Analytical Services (RESAS) division is helping to build the evidence base in this area through its 2022-2027 Strategic Research Programme[8], which includes dedicated funding streams for animal health and sustainable food systems research.

Notably, the mid-range positioning of Environment & Transmission Pathways and Socioeconomic & Policy Dimensions suggests growing attention to environmental drivers of AMR and the value of social science in informing effective responses, consistent with evolving global trends[9,10].

In addition to thematic trends, analysis by biological focus showed that bacterial AMR accounted for 50% of records, reflecting current clinical and surveillance priorities (Figure 2). A further 31% of records were non-specific, representing research not attributed to a particular organism. In contrast, targeted studies on other taxa – such as fungi, viruses, protists, and metazoan parasites – remained limited, highlighting a significant gap in efforts to address resistance threats beyond bacteria.

'Targeted research on fungi, viruses, protists, and metazoan parasites remain limited – highlighting a significant gap in efforts to combat resistance beyond bacteria'

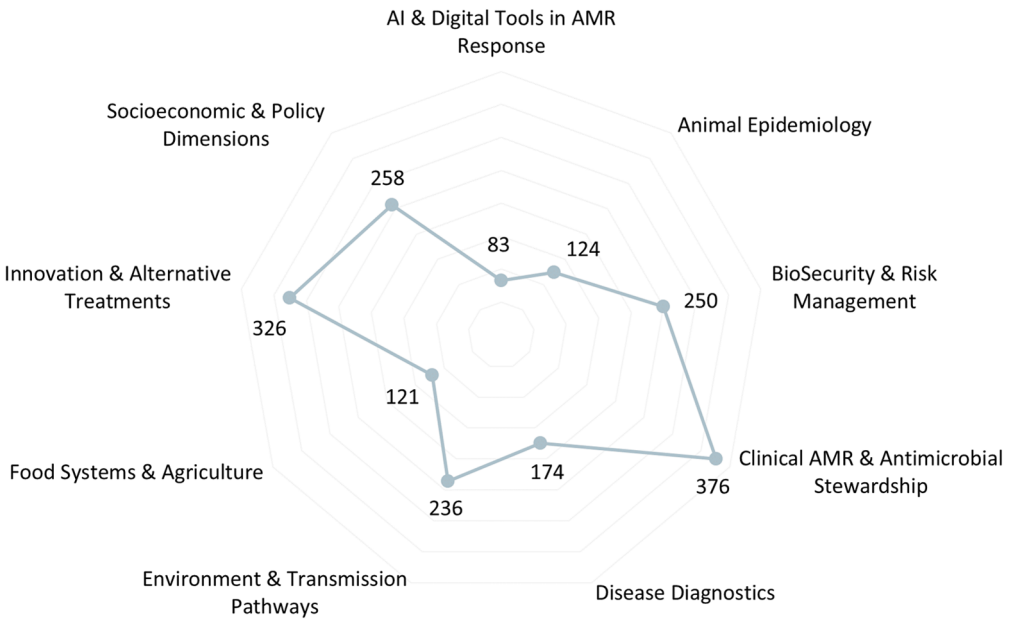

Figure 1. AMR categories represented across publications and projects.

[4] Note: Some publications may be outputs of the same project, potentially leading to overrepresentation in certain categories.

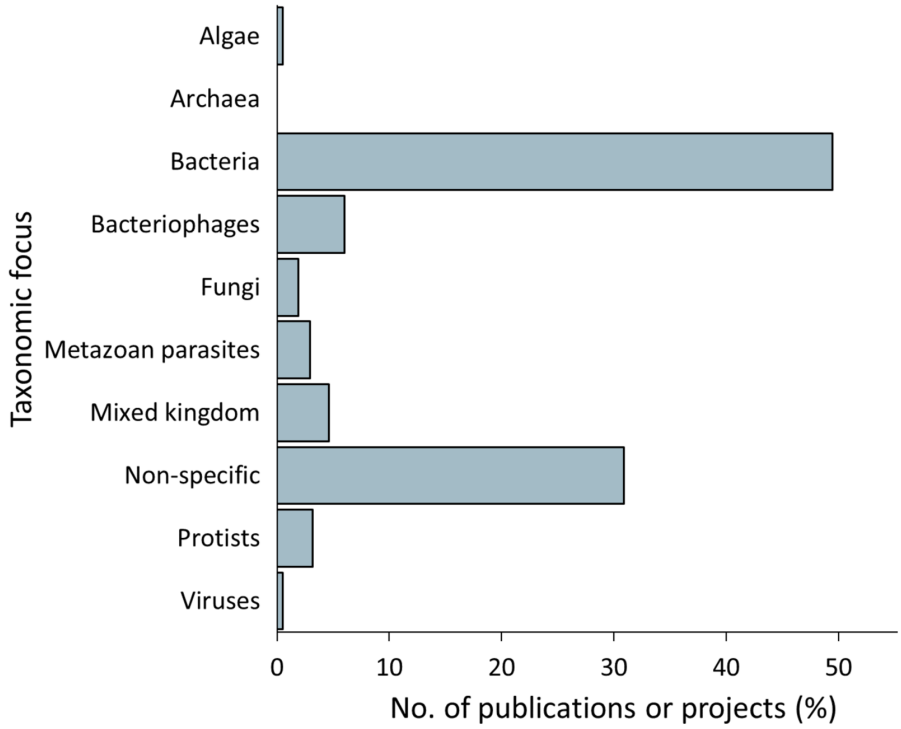

Figure 2. Taxonomic focus of publications and projects.

Alignment with the 2019–2024 NAP Addendum

Records published or completed before 2024 were mapped to the research commitments in the 2019–2024 NAP Addendum (Appendix 2), resulting in 665 alignments (Figure 3).

The most frequently represented research commitments were:

- 4.2f – Exploring alternative interventions and therapies
- 2.4.1a – Reducing evidence gaps on hazards and risks from AMR in the environment
- 3.1.4b – Building the evidence base for antimicrobial stewardship interventions

These findings reflect Scotland's strengths in innovation and antimicrobial stewardship and demonstrate progress in advancing the environmental dimension of AMR.

However, several research commitments accounted for fewer than 2% of alignments, indicating gaps in behavioural infection prevention interventions, agricultural drivers such as antifungal use, and public engagement.

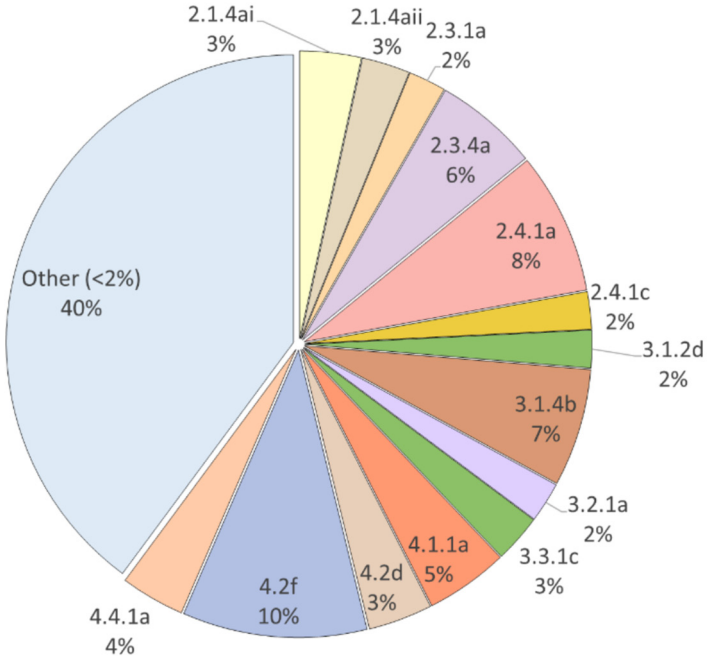

Figure 3. Distribution of aligned NAP research commitments (2019–2024 addendum).

Alignment with the 2024–2029 NAP

Records published or ongoing since 2024 were mapped to the 2024–2029 devolved commitments (Appendix 3), resulting in 571 alignments (Figure 4).

The most frequently represented were:

- 7.1 – Evidence generation and use
- 6.1 – AMR solutions (e.g. vaccines, diagnostics, therapies)
- 3.2 – Optimising surveillance to inform interventions

These findings reflect continuity in research priorities, particularly around evidence generation and innovation. Under commitment 7.1, research most often addressed Priority 5 (understanding drivers, effects, and spread) and Priority 8 (non-antimicrobial interventions) (Appendix 4).

However, some areas remain underrepresented, including data on health inequalities (8.1), efforts to overcome market barriers to AMR solutions (6.3) and support for cross-sector research networks (7.2). This points to gaps in achieving equitable impact and in translating innovation into practice. Nonetheless, Scotland's strong participation in all eight UKRI-funded AMR transdisciplinary research networks[11] highlights active national collaboration.

Perspectives from the Stakeholder Workshop

An online stakeholder workshop was held in May 2025, with participants from Scottish government departments and agencies (with some UK-level representation), the NHS, academia, research networks, and innovation-focused organisations. These included stakeholders working across public health, veterinary, plant, aquaculture, food, and environmental sectors.

Stakeholders recognised the value of SOHAR as a tool for mapping research activity, supporting collaboration, and informing strategic decisions. However, there was shared concern that the register should not become a static repository. Participants emphasised the need to maintain and further develop SOHAR as a dynamic, regularly updated, and accessible resource.

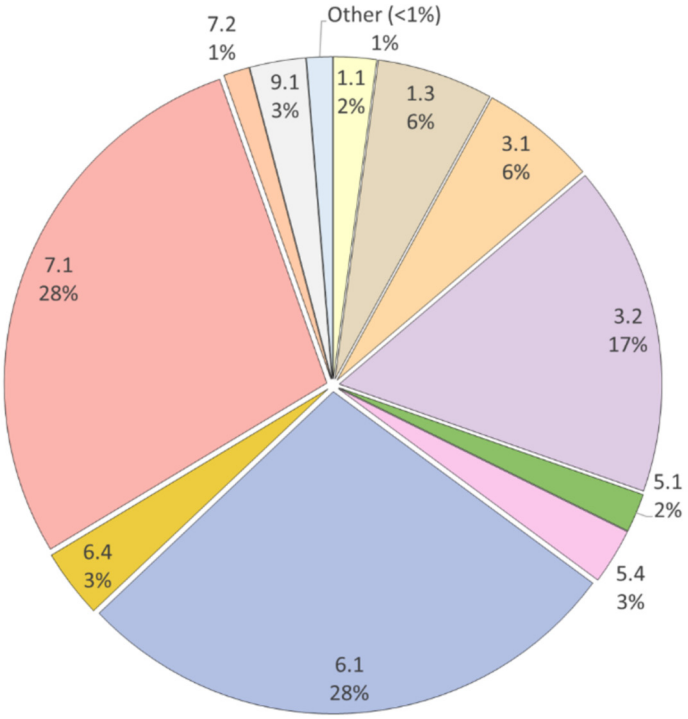

Figure 4. Distribution of aligned NAP devolved commitments (2024–2029).

Conclusions

The 2025 SOHAR update provides an overview of progress in Scotland's AMR research landscape, identifying key strengths, gaps, and opportunities to inform future strategic planning.

Key findings and implications:

- Scotland's AMR research activity has grown substantially since SOHAR's launch in 2021, reflecting sustained national prioritisation.
- Cross-sector collaboration remains strong – particularly in surveillance and UK-wide research networks – though there is scope to deepen transdisciplinary integration across One Health dimensions.
- Innovation and antimicrobial stewardship continue to be key research strengths.
- Environmental AMR research has progressed, particularly in understanding associated hazards and risks. However, research on antifungal use in crop production, and the associated development and spread of antifungal resistance to humans, remains limited.
- Gaps persist in research on food systems, behavioural interventions, public engagement, health inequalities, and the translation of fundamental science into practical tools and interventions.

SOHAR remains a valuable resource for tracking AMR research, identifying gaps, and supporting a One Health response. Its planned migration to the NHS National Services Scotland platform presents an opportunity to enhance accessibility, usability, and long-term sustainability.

To maximise its strategic value and impact, the register should be updated regularly and shaped by ongoing stakeholder engagement. Step-by-step guidance for the current Excel-based register is provided in Appendix 5.

The Excel-based SOHAR version can be accessed here: www.crew.ac.uk/publication/updated-scottish-one-health-amr-register-sohar

Scotland's AMR research activity has increased markedly since SOHAR's 2021 launch, underscoring national prioritisation'

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Appendices

Appendix 1: Methodology Overview

A rapid scoping review was conducted to identify all peer-reviewed publications, grey literature, and research projects related to antimicrobial resistance (AMR) involving Scottish institutions or researchers. Literature published in English from January 2021 onwards was eligible for inclusion.

The review aimed to capture research activities across the human, animal, and environmental domains, aligned with a One Health perspective. Sources included academic databases, relevant grey literature platforms, and institutional or funder project listings. To ensure continuity from the original register, its contents were reviewed to identify key researchers and projects active at that time. These were followed up manually to identify any subsequent outputs.

A two-stage screening process was used. Titles and abstracts were initially screened for relevance to AMR and Scottish affiliation using a standardised screening template that captured key inclusion criteria. Full-text review was then conducted to confirm eligibility and categorise studies by AMR relevance and thematic area. Data were extracted into a structured Excel spreadsheet designed to record publication details, Scotland-based authors, institutional affiliations, AMR relevance, and thematic categories. All entries were cross-checked for accuracy by multiple team members.

Search strategy

- **Data mining software:** Harzing Publish or Perish 8 (Figure 5)
- **Databases searched:** PubMed, Scopus, Web of Science
- **Grey literature, institutional, and research organisation sources:** Google Scholar, UKRI Gateway to Research, SEFARI Gateway, Scottish Government and NHS Scotland websites, Scottish research institutes websites (e.g., James Hutton, Moredun, Rowett), Scottish university websites, and relevant industry/innovation websites (e.g., Microplate Dx, MycoBiologics, Glox Therapeutics)
- **University research offices:** universities were contacted directly where online information was limited or difficult to access (e.g., University of Glasgow, Abertay University, Heriot-Watt University)
- **Search period:** March 2025 – mid April 2025
- **Filters applied:** English language, publication year 2021 onwards, Scottish affiliation required
- **Stakeholder workshop:** Publications and projects highlighted during the May 2025 stakeholder workshop were cross-checked against the dataset and integrated where possible.

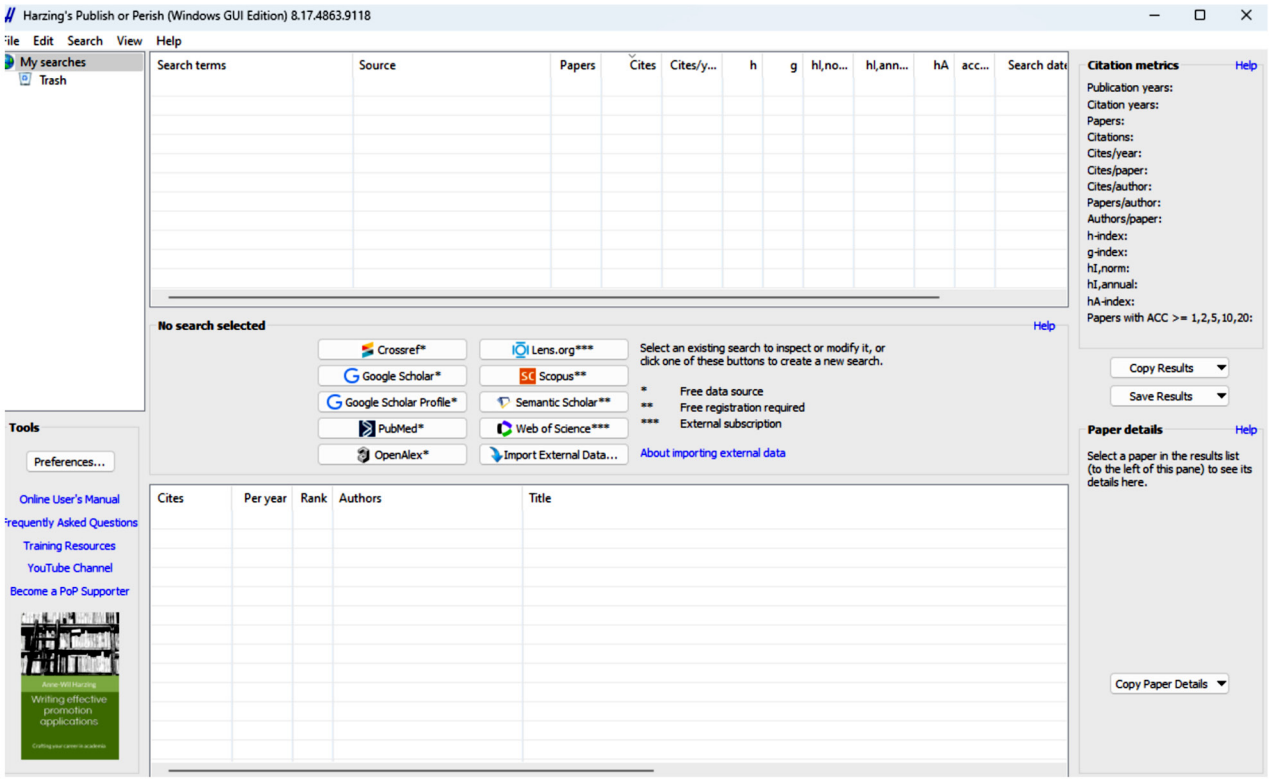


Figure 5: Harzing Publish or Perish 8.

Search terms

Affiliations:

- **Pupmed and Scopus strings**

"University of Edinburgh" OR "University of Glasgow" OR "University of Aberdeen" OR "Abertay University" OR "University of Dundee" OR "University of St Andrews" OR "University of Strathclyde" OR "Heriot-Watt University" OR "University of Stirling" OR "University of the West of Scotland" OR "Edinburgh Napier University" OR "Robert Gordon University" OR "Queen Margaret University" OR "Glasgow Caledonian University" OR "University of the Highlands and Islands" OR "Scotland's Rural College" OR "James Hutton Institute" OR "Public Health Scotland" OR "NHS Scotland" OR "Scottish Environment Protection Agency" OR "Scotland" OR "Scottish Government" OR "Moredun Research Institute" OR "Environmental Research Institute" OR "Rowett Institute"

- **Google Scholar String (Google scholar does not allow filtering by affiliation hence institutional emails were used to filter for Scottish involvement)**

"ed.ac.uk" OR "glasgow.ac.uk" OR "abdn.ac.uk" OR "abertay.ac.uk" OR "dundee.ac.uk" OR "st-andrews.ac.uk" OR "strath.ac.uk" OR "hw.ac.uk" OR "stir.ac.uk" OR "uws.ac.uk" OR "napier.ac.uk" OR "rgu.ac.uk" OR "qmu.ac.uk" OR "sruc.ac.uk" OR "uhi.ac.uk" OR "sac.ac.uk" OR "hutton.ac.uk" OR "phs.scot" OR "nhs.scot" OR "sepa.org.uk" OR "gov.scot" OR "moredun.ac.uk"

Search strings

Search 1

Title contains

"antimicrobial resistance" OR "AMR" OR "antibiotic resistance" OR "ARG"

Keywords contain

"antimicrobial resistance" OR "AMR" OR "antibiotic resistance" OR "ARG"

Search 2

Title contains

"phage" OR "bacteriophage"

Keywords contain

"phage" OR "bacteriophage"

Search 3

Title contains

"access to medicine*" OR "agricultural runoff" OR "agrochemical runoff" OR "alternative* to antibiotic*" OR "AMR surveillance" OR "AMS" OR "animal health management" OR "animal waste runoff" OR "animal-to-human" OR "antibiotic consumption" OR "antibiotic practices" OR "Antibiotic prescribing" OR "antibiotic resistance monitoring" OR "antibiotic stewardship" OR "antibiotic usage patterns" OR "antibiotic use" OR "antibiotic-resistant pathogen*" OR "antimicrobial innovation" OR "antimicrobial policy" OR "antimicrobial prescribing" OR "antimicrobial resistance surveillance" OR "Antimicrobial stewardship" OR "antimicrobial treatment" OR "antimicrobial usage monitoring" OR "Antimicrobial use" OR "appropriate prescribing" OR "aquaculture" OR "ASP" OR "bacteriophage*" OR "behavioural intervention*" OR "biomarker*" OR "biosecurity" OR "built environment" OR "cattle" OR "clinic" OR "clinical" OR "clinical decision support" OR "clinician behaviour*" OR "Clostridioides difficile" OR "community" OR "companion animal*" OR "consumer behaviour" OR "containment" OR "contaminated food" OR "control" OR "control measure*" OR "cross-contamination prevention" OR "cross-infection" OR "cross-sectoral collaboration" OR "dairy production" OR "diagnostic accuracy" OR "diagnostic sensitivity" OR "diagnostic specificity" OR "diagnostic stewardship" OR "diagnostic-driven prescribing" OR "drug development" OR "drug-resistant pathogen*" OR "economic burden" OR "economic driver*" OR "economic factor*" OR "economic impact*" OR "ecosystem*" OR "environmental contamination" OR "environmental hygiene" OR "environmental monitoring" OR "environmental reservoir*" OR "environmental spread" OR "environmental surveillance" OR "environmental transmission" OR "epidemiology" OR "evidence-based prescribing" OR "farm" OR "farming" OR "farm animal*" OR "feed additive*" OR "fertiliser runoff" OR "financial incentive*" OR "fish farm" OR "food chain" OR "food contamination" OR "food guideline*" OR "food handler*" OR "food hygiene" OR "food industry" OR "food legislation" OR "food manufacturing" OR "food processing" OR "food production" OR "food regulation*" OR "food safety" OR "food safety education" OR "food safety standard*" OR "food storage" OR "foodborne illness*" OR "foodborne infection*" OR "foodborne transmission" OR "genomic surveillance" OR "global governance" OR "global health equity" OR "guideline*" OR "HACCP" OR "HAI" OR "hand hygiene" OR "health communication" OR "health equity" OR "health inequality" OR "health literacy" OR "healthcare" OR "Healthcare-associated infection*" OR "herbal alternative*" OR "hospital" OR "hospital hygiene" OR "hospital-acquired infection*" OR "human-to-animal" OR "hygiene management" OR "immune stimulant*" OR "immunomodulat*" OR "infection control" OR "Infection prevention" OR "infection prevention and control" OR "inpatient" OR "international policy" OR "interspecies transmission" OR "IPC" OR "laboratory" OR "legislation" OR "livestock" OR "management" OR "manure runoff" OR "market failure" OR "MDRO" OR "metaphylactic antimicrobial*" OR "MRSA" OR "multidrug-resistant

organism*" OR "multi-sectoral approach" OR "NAP" OR "National Action Plan" OR "non-antibiotic alternative*" OR "nosocomial infection*" OR "nutritional intervention*" OR "one health" OR "outbreak" OR "outpatient" OR "patient safety" OR "pet*" OR "phage" OR "phage therapy" OR "pharmaceutical contaminant*" OR "pharmaceutical pollution" OR "pharmaceutical residue*" OR "plant extract*" OR "point-of-care diagnostic*" OR "policy" OR "policy analysis" OR "policy driver*" OR "poultry" OR "prescriber" OR "prescriber attitude*" OR "prescriber knowledge" OR "prescribing behaviour" OR "prescribing guidelines" OR "prescribing intervention" OR "prescribing practices" OR "prescription audit" OR "preventative medicine" OR "prevention" OR "prophylactic antimicrobial*" OR "prophylaxis" OR "prudent use guidelines" OR "public awareness" OR "public health" OR "rapid diagnostic test*" OR "rapid diagnostic*" OR "rational antibiotic use" OR "real-time monitoring" OR "regulation*" OR "resistance gene transfer" OR "resistance pattern*" OR "resistance tracking" OR "risk analysis" OR "risk assessment" OR "risk management" OR "risk messaging" OR "ruminant*" OR "seafood processing" OR "sediment" OR "sentinel surveillance" OR "standard*" OR "surface disinfection" OR "surveillance" OR "surveillance system*" OR "swine" OR "therapeutic antimicrobial*" OR "transmission" OR "treatment" OR "vaccination" OR "veterinary antibiotic*" OR "veterinary antimicrobial*" OR "VRE" OR "ward" OR "wild animal*" OR "wildlife" OR "zoonosis" OR "zoonotic" OR "zoonotic transmission"

Keywords contain

"AMR" OR "antibiotic resistan*" OR "antimicrobial resistan*" OR "ARG" OR "drug resistan*" OR "multidrug resistan*"

Example String for Google Scholar

"ed.ac.uk" OR "glasgow.ac.uk" OR "abdn.ac.uk" OR "abertay.ac.uk OR "dundee.ac.uk" OR "st-andrews.ac.uk" OR "strath.ac.uk" OR "hw.ac.uk" OR "stir.ac.uk" OR "uws.ac.uk" OR "napier.ac.uk" OR "rgu.ac.uk" OR "qmu.ac.uk" OR "sruc.ac.uk" OR "uhi.ac.uk" OR "sac.ac.uk" OR "hutton.ac.uk" OR "phs.scot" OR "nhs.scot" OR "sepa.org.uk" OR "gov.scot" OR "moredun.ac.uk" AND "antimicrobial resistance" OR "AMR" OR "antibiotic resistance" OR "ARG"

Appendix 2: Addendum to the 2019-2024 UK AMR National Action Plan – Research Commitments

Addendum to the 2019-2024 UK AMR National Action Plan	
Research Commitment	**Description**
1.1.1j	Fund existing and emerging product development partnerships (PDPs) and other global R&D initiatives and international research collaborations that support applied health research and behavioural science to help us understand which approaches to tackling AMR work, where and when.
1.1.1k	Continue to influence global research strategies on AMR-related topics by representing the UK on regional and global mechanisms such as Joint Programming Initiative on Antimicrobial Resistance (JPIAMR), the Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses (STAR-IDAZ) and the Global AMR R&D Hub, ensuring the alignment of UK-funded research with that of other research funders, emphasising the need for research to be useful for frontline teams nationally and overseas (with a particular emphasis on LMICs). This includes identifying and supporting neglected or underfunded areas of AMR research, through, for example, the £50 million Global AMR Innovation Fund (GAMRIF).
2.1.4ai	Support research to understand the relative importance and contributions of different routes of transmission of drug resistant infections.
2.1.4aii	Research potential interventions for control measures and behaviour change initiatives (including their economic impacts) and test impact, acceptability, and feasibility within real world settings. Understand what behaviour changes related to COVID-19 have been helpful and what have been harmful.
2.1.4b	Ensure interventions are piloted and evaluated to help translation of evidence-based research into practice more quickly (and optimise the use of national and Local Improvement Networks and Patient Safety Collaboratives to drive improvements). This should include social science research and implementation research to enable effective evaluation of impact.
2.1.4d	Conduct research on barriers and enablers to embedding fundamental IPC principles within healthcare practice.
2.1.4e	Conduct research on the potential impact of non-pharmaceutical methods (interventions and behaviours) to prevent common syndromes of infection, including hydration, increased mobility, hygiene practices.
2.1.4f	Work with DHSC, UKHSA and with research bodies to develop commitment to research in key elements of UTI prevention, diagnosis and treatment where further evidence is needed, including: any association between hydration and the prevalence and outcome of urinary tract or blood stream infections, antibiotic prophylaxis, the use of ibuprofen, and the potential role of UTI vaccines and barriers to roll-out.
2.2a	Support research to understand how to change behaviours for improved hygiene. Identifying which health behaviours resulting from COVID-19 have had positive benefits and understanding how these can sustainably be implemented into practice.
2.2b	Promote research in countries affected by contaminated drinking water to identify its role in the global spread of AMR.
2.3.1c	Commission research to evaluate the impact of changes in animal husbandry practices and antibiotic use on farm economics and use the findings to promote best practice.
2.3.4a	Identify and address evidence and knowledge gaps on transmission pathways of AMR between animals and the environment within a systems approach.
2.4.1a	Support research to reduce evidence gaps and improve understanding of the hazards and risks from AMR in the environment.
2.4.1b	Explore the establishment of a river catchment based research programme with clear standards for sample collection, analysis, and review, with the aim of delivering AMR monitoring data that can be used to evaluate existing management interventions and inform any new policy initiatives.
2.4.1c	Gather evidence to understand the possible risks and hazards that AMR in the environment may pose to the public; and develop and appraise policy options guided by this knowledge to increase public awareness if necessary.
2.5.1b	Commission food safety research including exploration of collaborations and partnerships to improve the scientific evidence base.
3.1.2d	Research impact of COVID-19 on antimicrobial usage, prescribing, stewardship and resistance. Review messaging on antimicrobial stewardship in order to highlight best practice.
3.1.2e	Explore extent of 'just in case' prescribing in primary care of antimicrobials and the underlying causes. Test and implement interventions to mitigate 'just in case' prescribing.

Addendum to the 2019-2024 UK AMR National Action Plan	
Research Commitment	**Description**
3.1.4a	Work with global partners to develop evidence for and evaluate guideline-based antibiotic management of common infections and syndromes.
3.1.4b	Build the evidence base for which antimicrobial stewardship interventions work to optimise antimicrobial including understanding of different contexts and populations (for example, gender, ethnicity, socioeconomic status).
3.1.4c	Test and implement national and local behaviour change interventions, to reduce inappropriate antimicrobial prescribing and consumption, using behavioural science.
3.1.4d	Research methods for improving and supporting clinical confidence in diagnostic testing.
3.1.4e	Derive, validate, and test implementation of clinical prediction rules to reduce diagnostic uncertainty and identify patients with self-limiting infections who are unlikely to benefit from antibiotics, and patients at risk of infections resistant to first-line treatments who are likely to benefit from broad-spectrum antibiotics.
3.1.4f	Commission randomised controlled trials to compare length or duration of antibiotic courses and examine impact on clinical outcomes and carriage of resistant microorganisms. Use to identify the characteristics of patients who may benefit from longer courses of antibiotics.
3.2.1b	Explore, in collaboration with industry, options to develop rapid and reliable diagnostic tools to inform veterinarians' prescribing decisions; and promote the uptake of these tools.
3.2.1c	Explore research into antifungal use in crops and its impact on antifungal resistance.
3.3.2b	Work with systems that are monitoring the use of antibiotics and AMR in companion animals and horses to refine our understanding of the situation in these sectors. Work collaboratively across UK government administrations, the veterinary profession, and professional bodies to improve the accuracy, availability, and coverage of antibiotic use data in companion animals and horses.
3.3.2c	Implement similar provisions on the use of antibiotics as those in the EU regulations on veterinary medicines and medicated feed in the revised Veterinary Medicines Regulations 2013 as they have an effect in Great Britain, subject to the official public consultation process and through collaboration with stakeholders to agree how it can be applied in practice.
3.4b	Work with the private sector, industry, and academia to develop ways to share data to enhance the sensitivity of our surveillance systems for antibiotic resistance and use.
3.4c	Determine how to use new monitoring tools, such as whole genome sequencing and other molecular-based methods, to improve and add value to our surveillance data.
3.4d	Explore ways of using UK surveillance data to better understand AMR transmission pathways between animals, environment, and humans.
4.1.1a	Support coordinated AMR-related research on priority areas including pathogens on the WHO priority pathogen list as well as TB.
4.1.1b	Continue to influence global research strategies on AMR-related topics by representing the UK on regional and global mechanisms such as JPIAMR, STAR-IDAZ and the Global AMR R&D Hub, ensuring the alignment of UK-funded research with that of other research funders, whilst also identifying and filling gaps and neglected or underfunded research areas, including the £50 million Global AMR Innovation Fund (GAMRIF), emphasising the need for research to be useful for frontline teams nationally and overseas (with a particular emphasis on low- and middle-income countries).
4.1.2	Continue to develop the scientific capacity, by enabling context-specific training opportunities, needed to support and deliver ongoing high-quality research in infectious disease, prevention, social and behaviour sciences, and microbiology related disciplines.
4.2c	Support successful and emerging PDPs and other global R&D initiatives and international collaborations that fund early-stage and/or clinical development of novel and priority anti-infective therapeutics and the expanded use of existing medicines for humans and alternatives to antibiotics for animals, with a particular focus delivering products into use that meet the needs of low- and middle-income countries.
4.2d	Invest in research in academia and businesses, including small and medium enterprises (SMEs), to advance the development of new therapeutics for humans and animals down the commercial pipeline, through UK Research and Innovation (UKRI) and other funding agencies.
4.2f	Explore alternative interventions and therapies such as bacteriophages, monoclonal antibodies, virulence factor modulating products and bacterial biofilm inhibiting or resistance materials and modulators or components of host innate immunity.
4.4.1a	Building on learnings from the COVID-19 pandemic and the rapid roll-out of centralised and de-centralised diagnostics, identify and address R&D gaps for AMR diagnostics (including evaluation of impact) across humans and animals, including the identification of biomarkers and sample collection for validation, to reduce antibiotic-prescribing by ensuring that the right antibiotic is prescribed at the right time. Research should consider the uptake and use of diagnostics and behavioural aspects of use alongside R&D.

Addendum to the 2019-2024 UK AMR National Action Plan	
Research Commitment	**Description**
4.5.2a	Set up a coordinated research programme to develop novel and improved veterinary vaccines, strategies, and diagnostics by engaging with science funders to shape the scope of relevant research calls, identifying opportunities to coordinate and co-fund research, and by engaging with established research networks and initiatives.
4.5.2b	Evaluate existing R&D capacity (including those available through COVID-19) and explore options for developing, improving, adapting vaccines or other tools that prevent infections (and the need for antibiotics) in humans and animals.
4.5.2c	Fund existing and emerging PDPs and other global R&D initiatives and international research collaborations including Coalition for Epidemic Preparedness Innovations (CEPI) that support the development of new vaccines technologies against priority pathogens for human and animal use to reduce infection and the need for antibiotics, with a particular focus on the needs of LMICs.
4.5.2d	Consult with stakeholders, including the pharmaceutical industry, the OIE and veterinary profession, to identify market gaps and understand options for new product development in animal health sectors, in order to support reduction in antimicrobial use. Disseminate findings to relevant bodies to encourage product development to fill critical gaps identified.
4.6a	Commission research into the extent of on-line purchasing, 'under the counter sales' and other illegal sales of antimicrobial agents in the UK, including in light of COVID-19 and the increase in telemedicine.

Appendix 3: 2024-2029 UK AMR National Action Plan – Devolved Commitments

2024-2029 UK AMR National Action Plan	
Devolved Commitment	**Description**
1.1	Informed Interventions: We will continue to improve IPC and biosecurity practices that are informed by the latest evidence base and social sciences to minimise the potential for infection transmission, including outbreaks, optimise the management of infections and reduce the need for antimicrobial exposure.
1.3	Waste minimisation and effective waste management: We will implement effective waste management, wastewater treatment methods and agrochemical stewardship to minimise dissemination of AMR and AMR-driving chemicals into the environment.
3.1	Optimising surveillance of infections and outbreaks, and response: We will optimise surveillance processes through effective, standardised and integrated (where possible) systems to detect, track and model infections and outbreaks or incidents, to monitor antimicrobial usage (including quality of prescribing) and susceptibility, and to facilitate cross-organisational responses to mitigate risks to patients and the public.
3.2	Optimising surveillance to inform interventions: We will enhance technical capacity for surveillance across sectors (and associated analytics and modelling) to inform intervention development, evaluation and application focused on areas of greatest risk, including highest burden of AMR and (where possible) sharing information and lessons to support personnel in all sectors to reduce AMR and its consequences.
5.1	Health and social care training: We will further embed, and will require, the completion of appropriate IPC and AMS training for all health and social care workers and students, to support implementation of best practice for IPC and AMS in their setting and, for specialist posts, to provide career pathways to promote skills retention and succession planning.
5.4	Veterinary workforce knowledge and skills: We will work alongside the veterinary profession to ensure that they have the necessary data, knowledge and skills so that veterinarians are empowered to advise on good husbandry and animal management strategies for disease prevention, prescribe antimicrobials responsibly, and, where appropriate, recommend evidence-based alternative treatments in place of antimicrobials.
6.1	AMR solutions: We will work across the public sector, regulators, academia, and industry to fund and deliver innovative scientific research to develop vaccines, diagnostics, antimicrobials, and alternative therapies (including bacteriophage, polyclonal antibodies, and host-directed therapies), which meet UK and global needs.
6.2	Subscription models: We will implement purchasing arrangements for new antimicrobials that de-link the price paid for antimicrobials from the volumes sold, monitor and evaluate impact, and advocate for the wider use of these 'subscription models' in other countries.

2024-2029 UK AMR National Action Plan	
Devolved Commitment	**Description**
6.3	Overcoming market barriers: We will collaborate across the public sector, with academia and with industry to identify needs and to overcome market barriers, to enable new products to move from discovery to market in an equitable and sustainable way.
6.4	Improvement and adoption: We will drive improvement by assessing and regulating novel technologies and approaches at pace, using evidence to increase timely and appropriate adoption.
7.1	Evidence generation and use: We will fund, collect, generate and use research, innovation and evidence to improve understanding of AMR, its impact and how to mitigate it, with a focus on enabling the necessary research infrastructure, knowledge transfer and disciplines to meet identified research priorities (including those set out in the 'top 10').
7.2	Research networks: We will fund and support transdisciplinary AMR networks and research and innovation grants that support the expansion of AMR communities, supporting cross-sector knowledge transfer and the delivery and implementation of timely, high impact, and independent research and innovation for AMR that meets identified needs of policy makers, practitioners, industry, civil, clinical and broader society.
8.1	Data on health inequalities: We will establish pathways for collecting and reporting data annually on infection incidence, AMR, and antimicrobial use, including (wherever possible) variation by age, sex, disability, ethnicity, nationality, deprivation, geography, and high-risk settings, which will be used to inform intervention development.
8.2	Toolkit for addressing health inequalities: We will collate cost-effective, evidence-based resources into a toolkit, adaptable to local needs, for identifying and addressing health inequalities in access, infection incidence, clinical outcomes, vaccine uptake and antimicrobial exposure to support organisations to develop interventions that address and do not exacerbate health inequalities.
9.1	Prevention and preparedness: We will support improved global prevention of, and preparedness for, rising levels of AMR, including through building sustainable partnerships, supporting global surveillance capabilities, capacity and capability building, and system strengthening.

Appendix 4: 2024-2029 UK AMR National Action Plan – Research Priorities (Commitment 7.1)

2024-2029 UK AMR National Action Plan	
Research Priority	**Description**
1	What is the cost of AMR?
2	What is the relationship between AMR and health disparities?
3	How to influence public awareness and behaviour on AMR?
4	How to address AMR in international settings
5	What are the basic drivers and effects of AMR, and how does it spread?
6	How can we prevent AMR from spreading?
7	How can we optimise the use of antimicrobials?
8	What methods can be used to prevent, treat, and manage infections without antimicrobial medicines?
9	How can we drive innovation of new products for tackling AMR?
10	How can we ensure what is known to work is implemented?

Appendix 5: Guide to Using the Excel-Based SOHAR

Purpose

The SOHAR Excel file provides a searchable record of AMR research involving collaborators in Scotland, designed to support policy development, collaboration, and strategic planning.

Key data fields

The register is formatted as a spreadsheet, with columns representing key data fields. The sample row below uses selected columns to illustrate the structure.

Title	Category	Scotland-based Author(s)	Affiliation	Funder	Year	DOI	Abstract	Mapped 2019–2024 Commitment(s)	NAPcomm_ description	Mapped 2024–2029 Commitment(s)	NAPcomm_ description	Taxonomic Focus

The following table provides a full description of these columns.

SOHAR Key Data Fields	
Column Heading	**Description**
Title	Full title of research publication, project, or network.
Category	Thematic tags based on AMR research categories (see Box 1 in brief). Includes separate columns for Primary, Secondary, and Tertiary Categories where relevant.
Author(s)	All authors who contributed to the research.
Scotland-based Authors(s)	Authors affiliated with Scottish institutions who contributed to the research.
Affiliation	Name(s) of the Scottish institution(s) involved in the research.
Funder	Name(s) of the organisation(s) funding the research.
Year	For publications: year of publication. For projects and networks: separate columns for Start Date and End Date (DD/MM/YYYY format, where available), including a Status column (e.g. Not started/Ongoing/Completed).
DOI	For publications: DOI linking to publication. For projects and networks: a separate URL column provides a link to the project or network description.
Abstract	Brief summary of the research, including aims, objectives, methods used, and key findings where relevant.
Mapped NAP 2019–2024 Commitment(s)	Numerical code(s) of the relevant commitment(s) from the 2019–2024 UK AMR National Action Plan addendum that align with the publication or project.
NAPcomm_ description	Descriptor text corresponding to each mapped commitment, as defined in the 2019–2024 addendum.
Mapped NAP 2024-2029 Commitment(s)	Numerical code(s) of the relevant commitment(s) from the 2024–2029 UK AMR National Action Plan that align with the publication or project.
NAPcomm_ description	Descriptor text corresponding to each mapped commitment, as defined in the 2024–2029 addendum.
Taxonomic Focus	Type of organism studied in the research (e.g. bacteria, fungi, virus, protist, parasite), where applicable.

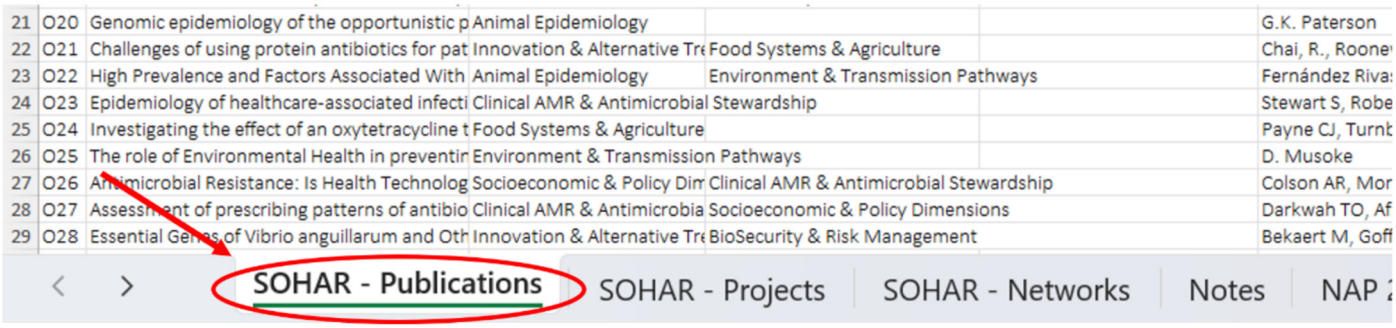
How to use the database

The spreadsheet contains three main tabs for different types of records:

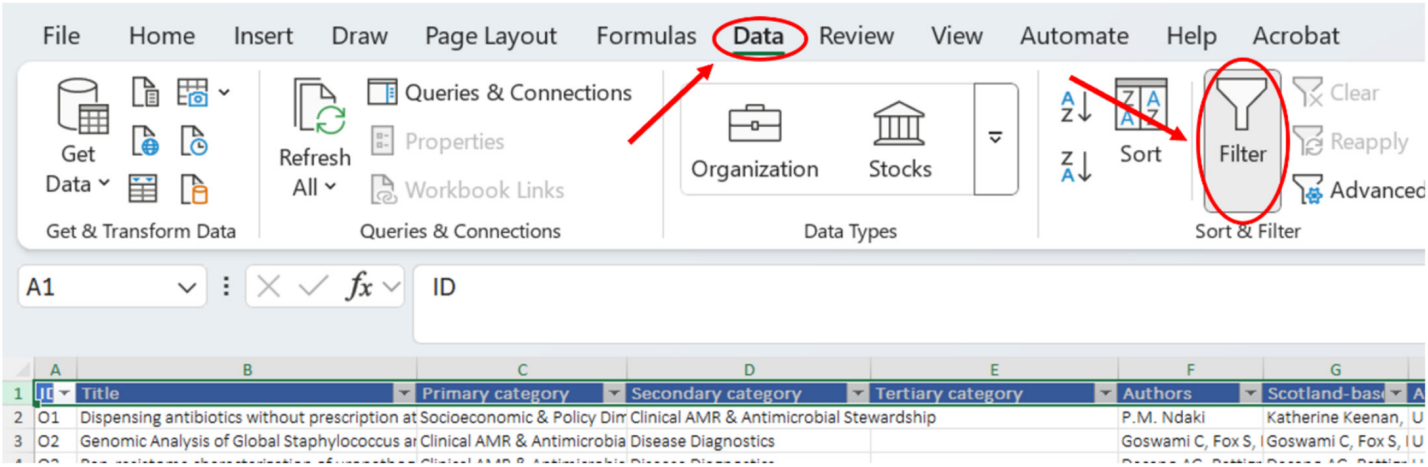
- **Publications** – Includes peer-reviewed articles, editorials, reviews, book chapters, and reports relevant to AMR.
- **Projects** – Covers research projects relevant to AMR.
- **Networks** – Lists collaborative networks relevant to AMR.

Each tab can be filtered and searched separately using a similar approach.

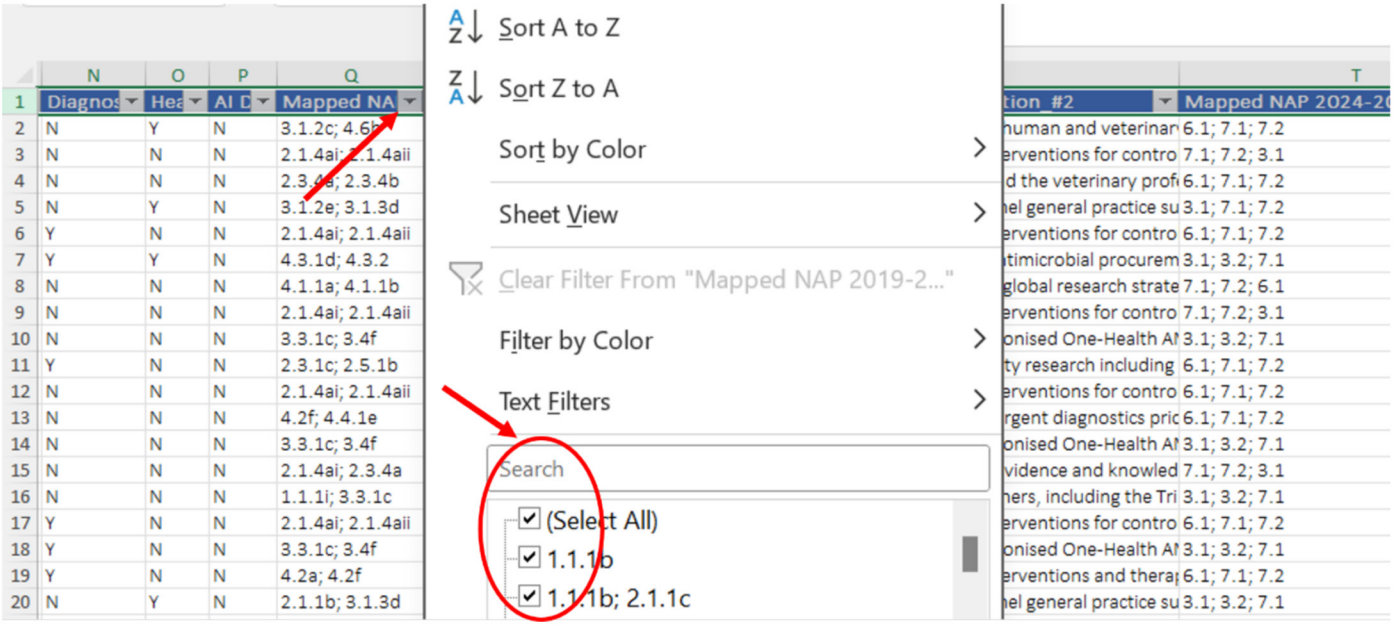
1. Begin by selecting the relevant tab at the bottom of the spreadsheet



2. Go to the toolbar at the top and click the Data tab. Then click the Filter button to enable filtering options.



3. Small drop-down arrows will appear next to each column header. Click the arrow in the column you want to filter. A menu will appear where you can tick boxes to select values or use the search bar to find specific entries. Once you click OK, the spreadsheet will update to show only the matching rows, and the total number of results will be displayed at the bottom left of the spreadsheet.



4. To filter the data further by another category while keeping the current filter, click the drop-down arrow in a different column and apply a new filter.
5. To remove all filters and start again, click the Filter button in the toolbar. This will clear the filters and restore the full dataset.

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