

Pathogen Surveillance in Agriculture, Food and Environment Programme

A £19.2 million Shared Outcomes Fund (SOF) research programme which aims to develop a national surveillance programme for foodborne diseases and antimicrobial resistance.

The Pathogen Surveillance in Agriculture, Food and Environment (PATH-SAFE) programme uses the latest DNA-sequencing technology and environmental sampling to improve the detection and tracking of foodborne disease (FBD) and antimicrobial resistance (AMR).

PATH-SAFE programme background

Foodborne disease (FBD) is a major public health risk with 2.4 million individual illnesses and more than 16,000 hospitalisations per year. Most human disease is caused by a handful of bacteria which enter the food chain from farmed animals or the environment. In addition to FBD, the agri-food supply chain also poses a risk for the transmission of antimicrobial resistance (AMR) through food, animals, humans, and water.

Whilst the UK has made progress in reducing its use of antibiotics in humans and animals in the last five years, [drug-resistant bloodstream infections in humans have increased by 32% from 2015 to 2019](#). The rise and spread of AMR is creating a new generation of 'superbugs' that cannot be treated with existing medicines.

For these reasons, government departments already undertake surveillance activities by analysing samples from food, livestock, and humans. Recent advances in technology and data management offer the opportunity to create a step change in surveillance, to protect public health. The PATH-SAFE programme will establish a new data platform that will allow for the analysis, storage and sharing of pathogen sequence and source data, collected from multiple locations across the UK by government departments and public organisations. This single system will enable rapid identification and tracking of FBD and AMR. This will improve public health and minimise the economic and environmental impact of outbreaks.

Aims of the programme

- to pilot a better national surveillance system for the monitoring and tracking of foodborne disease (FBD) and antimicrobial resistance (AMR) in the environment and agri-food system
- to bring together and build on existing initiatives across the UK and to understand what the end-user needs to improve how they work in this space
- to provide better data to identify the prevalence, source and pathways of FBD and AMR, helping to prevent spread by enhanced targeting of interventions

Benefits of the programme

- the information gathered through this pilot will help us to better identify the sources of FBD and AMR
- we expect this pilot will give users better access to relevant data so they can make more informed, evidence-based decisions

- this data can be used to prevent and predict the spread of FBD and AMR by improved, cost-effective targeting of interventions, providing economic savings both for government and industry
- PATH-SAFE will allow us to better identify and react more quickly to emergent diseases (or diseases of increasing concern) through improved surveillance
- this pilot could reduce the number and cost of FBDs and AMR, lower commercial losses, strengthen UK Science Excellence, and enhance the UK food sector's reputation

Programme structure

The FSA is the lead organisation for the programme, with several core and delivery partners. As the programme develops our partnerships and collaborations continue to grow.

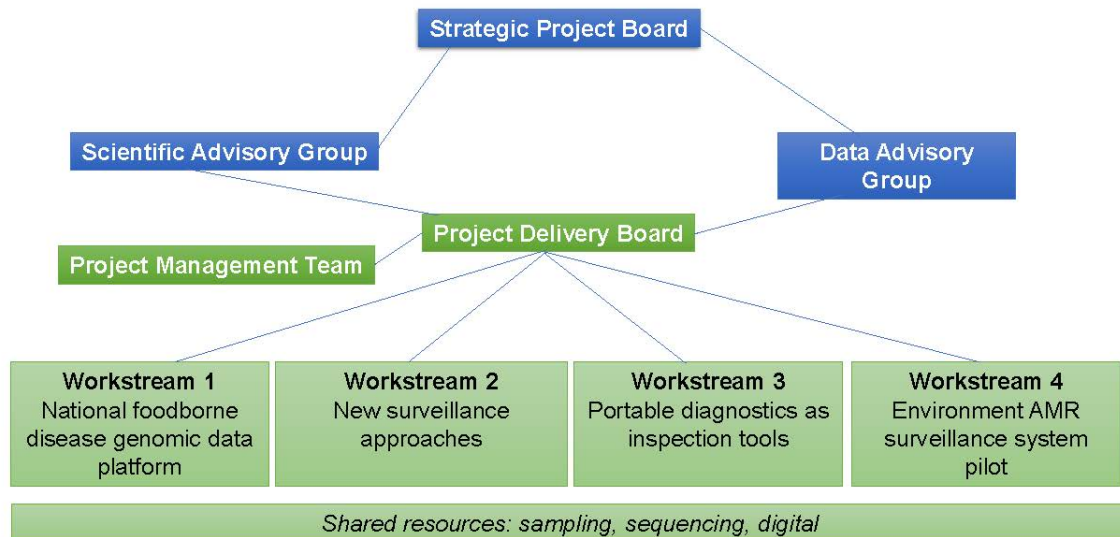
- Food Standards Scotland (FSS)
- Department of Environment, Food and Rural Affairs (Defra)
- Department of Health and Social Care (DHSC)
- UK Health Security Agency (UKHSA)
- Environment Agency (EA)
- Veterinary Medicines Directorate (VMD)
- Animal and Plant Health Agency (APHA)
- Centre for Environment, Fisheries and Aquaculture Science (Cefas)
- Welsh Government
- Scottish Environment Protection Agency (SEPA)
- Bangor University
- University of Oxford
- Queen's University Belfast
- Fera
- Public Health Wales
- Agri-Food & Biosciences Institute (afbi)
- Department of Agriculture, Environment and Rural Affairs (DAERA)
- National Milk Laboratories (NML)
- Capita
- Deloitte
- University of Worcester
- Quadram Institute
- Warwick University
- SRUC
- Moredun
- Aecom
- Cranfield University

The Strategic Project Board sits at the top of the governance structure and provides strategic oversight to the programme.

Sitting outside this Board, as independent groups, are the Scientific Advisory Group and the Data Advisory Group.

The Project Delivery Board, supported by the FSA Project Management Team, has four different workstreams from which information is fed:

- workstream 1: National foodborne disease genomic data platform
- workstream 2: New surveillance approaches
- workstream 3: Portable diagnostics as inspection tools
- workstream 4: Environmental AMR surveillance system pilot



Funding Source and timeline

PATH-SAFE is funded via the [Shared Outcomes Fund \(SOF\)](#). Spending Round 2019 announced £200 million for the Shared Outcomes Fund to fund pilot projects to test innovative ways of working across the public sector.

The first round of the SOF funded a wide range of projects to be run in 2020-21 and 2022-23 the Spending Review 2020 announced a further £200 million was to be made available for a second round of the Shared Outcomes Fund between 2021-22 and 2023-24.

The programme is in phase 2 of the SOF and will run until March 2024. A more detailed timeline and update on key deliverables is under development and will be added here in due course.

Workstream breakdown

Workstream 1: National foodborne disease genomic data platform

Part A: The UK is recognised global leader in genomic database systems. We will utilise this existing expertise, working with academic colleagues and major ‘big data’ stakeholders, to create a user-friendly platform for the rapid interrogation and archiving of genomic data. A key element of the data platform development will be allowing the integration of sample data with other existing data sources, for example, infection data and meteorological data, to create new knowledge.

Partners include: University of Oxford, Capita

Current status: The first phase of the discovery was completed in September as planned. This work showed the complexity of the pathogen data landscape and will be followed by a second phase which will build on previous learnings. We also hope to narrow the focus of exploration to an exemplar pathogen that will be the main focus of the data platform. Planning for the delivery of the data platform by the scientific consortium is in progress. A proposal for delivery will be prepared in the coming months as consortium partners are brought together, with delivery of the system planned to begin in January 2023.

Part B: The aim of the PATH-SAFE Scottish pilot is to use whole genome sequencing (WGS) to understand source attribution, infection threat, and the level of AMR of *E. coli*. Samples will be taken from a range of different reservoirs in Scotland. This includes animal hosts, bathing water, wastewater, soil/plants, food, and humans.

Partners include: FSS, Cefas, SEPA, Moredun, SRUC, MicrobesNG, Public Health Scotland

Current status: Sample collection from abattoir animals (cattle, pigs, sheep and poultry) as well as wild animal hosts (deer and shellfish) is in progress. Food sampling and additional abattoir sampling also started in August. Whole genome sequencing of the samples collected is in progress, as is curation/preparation of the WGS data collected for analysis. Discussions are ongoing to permit access to sequencing data from clinical isolates to allow comparison of *E. coli* genomes from animal, food and environment with clinical datasets.

Workstream 2: New surveillance approaches

Part A: Focusing on Foodborne disease (FBD) in the agri-food environment:
appraise current surveillance systems by identifying existing environmental data and sampling infrastructure for the detection of FBD pathogens

explore whether novel analysis technologies (for example WGS of pathogens from wastewater and shellfish) can improve the accuracy, speed and efficiency of outbreak detection and associated risks

- use high resolution pilot studies (including wastewater and shellfish sampling) at the river catchment scale to determine the feasibility of scaling up to an improved national surveillance infrastructure.
- some of this work will build on existing networks and infrastructure, such as that already in place for water sampling, including recent UK-wide COVID-19 testing initiatives, as well as new approaches.

Partners include: Cefas, Bangor University, Defra, Arup, Welsh Water, Public Health Wales

Current status: Discussion is ongoing with Ribble Rivers Trust and North Devon Biosphere Reserve/N. Devon EA to plan pilot studies and a list of monitoring programmes and data sets to be used for pilot studies compiled. Norovirus qPCR method optimisation progressing (collaboration between Bangor, Cefas and EA) is due to be completed in October. Norovirus sequencing method development is ongoing.

Part B: Focusing on antimicrobial resistance (AMR) surveillance in the agri-food environment, a number of projects will support this work:

- characterisation of AMR *E. Coli* from raw meat to identify resistance genes and circulating plasmids
- AMR surveillance sheep abattoir survey
- AMR surveillance in cattle abattoir survey
- Abattoirs AMR wastewater surveillance pilot
- AMR targets in raw milk samples from dairy herds across Great Britain (GB)
- AMR in imported animal feed
- AMR in imported raw pet food

Partners include: VMD, APHA, Cefas, National Milk Laboratories (NML), FSA, Welsh Government, AFBI

Current status: The first of these projects commenced in September 2022, with others expected to start throughout late 2022 and early 2023. Study and sample designs are under development for three of the studies, with further exploration and scoping being undertaken for the remaining

three studies.

Part C: Utilise the infrastructure developed for NI SARS-CoV-2 wastewater surveillance programme and undertake building level wastewater monitoring to investigate prevalence of a foodborne disease, norovirus, and antimicrobial resistance within the NI care home setting.

Partners include: DAERA, Queen's University Belfast, Department of Health (Northern Ireland), Public Health Agency (Northern Ireland), Northern Ireland Environment Agency, Department for Infrastructure (Northern Ireland), Northern Ireland Water

Current status: This project has been approved and work is underway to begin the project activities. Links will be established with other wastewater work being undertaken across the programme.

Workstream 3: Portable diagnostics as inspection tools

Part A: Investigate the technology readiness levels (TRLs) of in-field FBD and AMR diagnostic technologies. This includes horizon scanning, stage of development and end-user needs. The results of these investigations will inform options for the next stages of in-field testing. The co-design of applications with end-users will be critical to ensure real-world applicability.

Partners include: Fera, University of Lincoln

Current status: Fera, in collaboration with University of Lincoln, will be delivering this piece of work. Contract signature and project initiation meeting took place at the end of September 2022.

Part B: The key aim of this activity is to repurpose rapid, in-field wastewater diagnostic technology that was developed in response to the COVID-19 pandemic for detection of FBD. This workstream will aim to demonstrate its viability, economic value, and versatility in one or more agri-food settings.

Partners include: UKHSA

Current status: This project has been approved and work is underway to begin the project activities. Links will be established with other wastewater work being undertaken across the programme.

Workstream 4: Environment AMR surveillance system pilot

The overall aim of this workstream is to create a scientific and evidence-based understanding of the nature and extent of AMR in the environment and the drivers that influence this. This pilot will deliver an agreed and tested methodology for environmental AMR surveillance. This will include an environmental IT platform that will enable a scaled-up surveillance programme to be undertaken. This IT platform will be designed and developed so that it will have the capability to integrate AMR surveillance data collected from humans and animals. The overall ambition is to establish a UK One Health surveillance system for AMR.

Partners include: EA, VMD, Defra, UKHSA, Deloitte, Quadram Institute, Aecom, Cranfield University, University of Exeter, UK Centre for Ecology and Hydrology

Current status: Sampling across the three river catchments sites continues. The initial results from the phenotypic and chemical analysis have been shared to support the development of the Environmental Exemplar Surveillance (ESS) IT platform, which is set to begin in October. The 'AMR shellfish' project (with Cefas) is progressing and work on the 'Bioaerosol' project with WSP, Cranfield, and University of Exeter has started. Work with UKCEH to review and collate information on the presence of 'AMR in wild flora and fauna' has also started. 'Resistomap' were awarded the contract to supply High Throughput Detection and Quantification of Antibiotic Resistance Genes for some of the river water samples. The 'Exposure and transmission

pathways' project is coming to an end and outputs from Deloitte, Cranfield, Aecom are currently under review. The previous tender for the 'Bathing water' project was unsuccessful so the work has been re-designed to ensure delivery within the timeline. Four project proposals, exploring different aspects in relation of minimum selection concentrations for antifungals and antibiotics, are under evaluation.

Several reports related to this work have been published:

[Selection of river catchments for environmental antimicrobial resistance \(AMR\) surveillance pilot & extension of AMR database](#)

[Determining sampling strategy and assessment options for environmental antimicrobial resistance \(AMR\) in airborne microorganisms](#)

More information

For more information and updates on the PATH-SAFE programme, read the latest PATH-SAFE newsletter.

PDF

[View October 2022 PATH-SAFE newsletter as PDF\(Open in a new window\)](#) (349.35 KB)

Get in touch

If you would like to get in touch with the PATH-safe team, you can email them at pathsafe@food.gov.uk