PATH-SAFE newsletter, June 2023

PATH-SAFE is a £19.2 million Shared Outcomes Fund (SOF) research programme which aims to pilot a national surveillance programme for foodborne diseases and antimicrobial resistance.

Welcome to the Pathogen Surveillance in Agriculture, Food and the Environment (PATH-SAFE) programme newsletter. PATH-SAFE is a £19.2 million Shared Outcomes Fund (SOF) research programme which aims to pilot a national surveillance programme for foodborne diseases and antimicrobial resistance.

News and key updates

- PATH-SAFE webinar series – Our monthly webinar sessions are now in full swing with lots of positive feedback from attendees. Our next webinar takes place on Thursday 13th July and is entitled: 'First steps towards an environmental surveillance system for antimicrobial resistance (AMR) in England.'

Please see our PATH-safe page for sessions you may have missed and contact our team at pathsafe@food.gov.uk if you would like to be added to the invite list.

- **WS4 nearing closure:** Wind down of workstream 4 continues to progress well. Final analysis and reporting writing continues, with preparations for publications underway. One final Research and Development project is expected to complete in Quarter 2 2023 to 2024. Workstream closure is expected to take place in Quarter 2 2023 to 2024.
- **Evaluation:** The evaluation framework report has been completed and is due for publication over the summer. RAND have begun contacting interviewees and the process evaluation interviews are due to commence in the following weeks.
- **Spreading the word:** Over the past few months we have been delighted to receive an increasing number of requests to present PATH-SAFE at different forums, including the Responsible Use of Medicines for Agriculture (RUMA) Board, the Wales Animal and Environment AMR Delivery Group Meeting and the Advisory Committee on Antimicrobial Prescribing, Resistance and Healthcare Associated Infection (APRHAI). Please do continue to let us know about any potential opportunities to share details of the work that PATH-SAFE is undertaking.

Spotlight: Focusing on new foodborne disease (FBD) surveillance approaches in the agri-food environment (Workstream 2a)

We're making great progress on our pilot studies under workstream 2a (WS2a) of the programme, and our initial results are looking both promising and interesting! Led by Cefas, WS 2a is using three pilot studies to gain a better understanding of pathogen source-pathway interactions at different spatial scales, to inform more cost-effective targeting of foodborne disease (FBD) surveillance measures at the national level.

The respective pilot studies focus on:

- assessing potential benefits of sampling at a higher spatial and temporal resolution than the existing monitoring framework
- piloting the use of wastewater surveillance to detect pathogens implicated in FBD at the national scale
- developing data-driven tools to predict risks posed by norovirus and antimicrobial resistance (AMR) in coastal waters, and entry into the food chain.

For **Pilot Study A**, in support of our enhanced spatiotemporal surveillance trial, Cefas has just begun its second 3-month (June-August) period of weekly sampling of river water, wastewater and shellfish in the Taw-Torridge river catchments of north Devon. The samples, taken from diverse locations across the catchments, are being tested and analysed for norovirus (using RT-qPCR; sequencing), and Salmonella spp., Listeria monocytogenes and E. coli (using whole genome sequencing).

Results will be compared with those of samples we collected weekly during the January to March period, so that we can examine any seasonal differences. We are also using existing monitoring data and local information from the River Ribble catchment in Lancashire, which is another major shellfish harvesting area, as controls for evaluation of our catchment models, and to inform ongoing network and statistical analyses.

Pilot Study B: National-scale wastewater pilot studies (Cefas) - Using wastewater samples previously collected as part of the national surveillance programmes for SARS CoV 2 in England and Scotland will enable a proof of concept of how to use wastewater to detect FBD pathogens at a national scale. In addition, combining spatially relevant data on potential pathogen sources with public health (FBD outbreak) data, will enable a better understanding of pathogen pathways and spread, including seasonal influences on outbreaks, identification of 'hotspots' and provision of advice on the most effective monitoring strategies for FBD risk.

Alongside our collaborators at the Environment Agency, SEPA and the Public Analyst laboratories in Glasgow and Edinburgh, we have begun the analysis of almost 3,500 English wastewater samples and over 190 Scottish wastewater samples. The data we have generated so far are very promising and we look forward to sharing our findings with you soon.

Pilot Study C: Development of pre-emptive data-driven tools to predict the risk posed by norovirus and AMR in coastal waters and entry into the food chain (Bangor University) - The primary objective of the North Wales pilot study is to explore the potential of data-driven "active management" approaches in monitoring, predicting, and controlling the transmission of human pathogenic viruses (for example, norovirus) and antimicrobial resistant genes (ARGs) within recreational waters (such as rivers and coastal areas) and shellfisheries. This project combines several novel components that will help the FSA and other agencies better understand the dynamics, flow, and risk posed by wastewater discharges. It is a significant step towards the creation of an AI-based platform in the UK for more precise environmental pathogen risk management. The study zone is the North Wales coastline; focussing on the three major hospital sites and waste-water treatment plants along the coastal zone. A set of interconnected work packages (WP) are designed to meet the objectives: -

WP1. Contribution of hospital wastewater to the pathogen and ARG load of municipal wastewater.
WP2. Role of CSO discharges on pathogen and ARG release from wastewater treatment plants.
WP3. Effects of abiotic and biotic factors on the persistence of ARGs and norovirus in freshwater, estuarine and coastal waters.
WP4. Advanced risk modelling, to demonstrate the integration of data streams for prediction and quantification of pathogen-related risks entering the environment and food chain.
WP5. Stakeholder evidence collection, to assess the challenges and opportunities for active

management of recreational waters

Overall, the study will analyse the contribution of healthcare-derived wastewater to water pollution, with emphasis on its impact on the contamination of the food chain, bathing waters, and shellfisheries.

Workstream (WS) Updates

Great progress continues to be made across the programme. Below are some brief updates but for more detail on each workstream please see our website.

WS1 - National foodborne disease genomic data platform

WS1a Update: Significant positive progress on platform development has been made in recent months. In April, the delivery team held the first end user group workshop, where potential system reporting capabilities were demonstrated and discussed. Further information on user requirements has been and is being gathered from the group via questionnaire and via subsequent meetings in May and June. First meetings with two of the four consortium advisory groups (technical and AMR) took place in May, with first meetings of the remaining two groups (data standards and international) due to take place in June. The system specification is being advanced alongside this elucidation of user requirements and best practice. An important step forward in development has also been made with the recent approval of the genome assembler to be employed by the data platform.

WS1b Update: Sampling, sequencing and analysis continues as planned. Key highlights from last month include:

- the first set of whole genome sequences from wastewater were submitted to Enterobase
- food sampling for summer 2023 has been finalised
- approval for the use of faecal non-STEC clinical samples is expected shortly
- data analysis continues and the first round of host attribution models have been created
- the first (interim) analysis report was successfully completed and submitted to the programme office for internal distribution

WS2 – New surveillance approaches

WS2a Update: The Taw-Torridge 3-month winter sampling period successfully completed at the end of March. Analysis of wastewater, river water and shellfish samples progressing well, with preliminary results used to finalise plans for summer sampling period which has now begun (Jun to Aug). Ribble Rivers Trust review of sub-catchment level pathogen data and local knowledge progressing well. Wastewater sampling and analysis have continued at the North Wales catchment pilot site, with over 190 influent and effluent samples having now been collected and analysis is underway. norovirus and Salmonella isolates obtained from wastewater samples, SARSCoV2 national surveillance sample and Scottish wastewater samples respectively, have now been transferred to Cefas for Whole Genome Sequencing.

WS2b Update: Bioinformatic analysis progressing well for raw meat E. coli isolate whole genome sequences. Sample collection continues to progress as planned for the sheep survey project, bulk milk project and animal feed project (raw ingredients and finished feed), with samples arriving at the analysis laboratories as expected and bacteriology results continuing to follow the expected trends.? Cattle survey set up, including outreach to abattoirs, is now well underway with sample collection expected to start in June.

WS2c Update: Collection, preparation for analysis and analysis of influent and effluent samples

is ongoing. Ethics application for care home sampling has been finalised and submitted. Further protocol and methodology development and optimisation happening across all aspects of the project; including the validation of pre-processing and extraction methods completed and using MALDI-TOF to successfully identify bacteria cultured from wastewater.

WS2d Update: DNA extraction from human disease isolates (from repositories in England and Wales) continues, as does the whole genome sequencing of these isolates. There will likely be scope to add further value to this work with the addition of more sample sets (without impact to the budget or timeline). Work towards extraction and sequencing of agri-food isolates is also underway. Approval has recently been obtained to include deer, geese, sheep and cattle isolates from Scotland in the project. Repositories of wild and domestic bird species are also likely to be included.

WS2e Update: This project is now complete: throughout February and March AFBI successfully processed 100 historical salmonella isolates (culture, extraction and sequencing), and uploaded the sequences to Enterobase.?The sequenced isolates represent a spread of serovars, sampling years and sources from within the available isolate collection. PATH-SAFE has been noted, in comment field on uploaded sequences in Enterobase, to allow identification.?

WS3 – Rapid, in-field diagnostic technologies

WS3a Update: Extensive assessment of identified technologies completed and reported via the provision of deliverable 4: a database of technologies with TRL scores using assessment questions developed in deliverable.? A wider range of key stakeholder and end user have taken part in focus groups and interviews throughout May and reported via the provision of deliverable 7: an evaluation matrix per stakeholder group. Work in now ongoing, including PATH-SAFE Science Advisory Group consultation, to select technologies to transition to the second stage of the project for further development or in-field piloting.

WS3b Update: This project is now complete: 20/30 Labs have completed the proof of concept and optimisation work on utilising LAMP on 7 target pathogen - Salmonella spp, Listeria monocytogenes, norovirus, adenovirus, astrovirus, rotavirus and sapovirus. The final report is undergoing review and will be published in due course.

WS4 - Environment AMR surveillance system pilot

WS4 Update: Wind down of workstream 4 continues to progress well. Final analysis and reporting writing continues, with preparations for publications underway. The live phase of exemplar AMR Environmental Surveillance System development has concluded and a show and tell session was held with end users/stakeholders in May to demonstrate the system. One final Research and Development project is expected to complete in Quarter 2 2023 to 2024. An overview of the 'environmental work' within WS4 was presented by the team at several high-profile board and community meetings. Workstream closure is expected to take place in Quarter 2 2023 to 2024.

Meet the team

Each quarter we will spotlight people working across the programme. In this issue we are focussing on colleagues from Cefas and Bangor University who are leading on the pilot studies under Workstream 2a.

Dr Paulette Posen – Principal Spatial Scientist, Cefas

Paulette has over 20 years' experience in environmental modelling and impact assessment, with a research career split equally between academia and government agency roles. After gaining a PhD appraising groundwater vulnerability to pesticide contamination, she worked as a senior researcher at the University of East Anglia, assessing cost-effective spatial targeting of land use options for achieving good water quality status under the EU Water Framework Directive.

In 2011, Paulette joined Cefas and extended her spatial analysis skills to examine human impacts in the marine environment. In recent years, her work has focused on evaluating terrestrial inputs to marine and freshwater systems, microbiological risks in shellfish growing areas, and sustainable solutions for safe and healthy food production in the context of climate change. Paulette is Principal Investigator on the PATH-SAFE WS2a river catchment pilot studies.

Dr David Walker – Senior Environmental Microbiologist, Cefas

David is a senior environmental microbiologist investigating water quality and bivalve shellfish hygiene, specialising in the development and implementation of methods for waterborne and foodborne pathogens and indicator organisms with a focus on wastewater as a source of contamination to the aquatic environment. He leads the Cefas wastewater science, carrying out research into viral and bacterial pathogens associated with sewage.

From 2020 to 2022, David led the Reference Laboratory for Wastewater Surveillance of COVID-19. In this role he provided high-level and detailed technical guidance to the UK Government for the use of wastewater-based surveillance to support the response to the COVID-19 pandemic. David continues to provide expert advice and carry out investigations in this area, with an increasing focus on implementing One-Health approaches to maximise the efficiency of the Government's surveillance programmes.

Dr Jane Heywood – Programme Manager, Cefas

Jane is a programme manager at Cefas, managing complex, interdisciplinary programmes sitting across four portfolios in Cefas; the International Hazard and Chemicals, Food Safety, Research and Development and Overseas portfolios. Customers within these portfolios deliver to UK government departments and agencies, overseas academic institutes, UK research councils and the European Commission.

Jane project manages all PATH-SAFE work at Cefas, in workstreams 1, 2a, 2b and 4. Jane is a member of the Association for Project Management and has 15 years' experience in leading academic and public sector marine microbiology and fisheries management research projects.

Dr Lisa Cross – Portfolio Lead 'International Hazards & Chemicals' and Path-Safe Sponsor within Cefas

Lisa has over twenty years' experience in the field of Medical Microbiology, having gained her doctorate in 2003 within Cefas, focussing on norovirus detection in Wastewater and the Marine Environment. She then spent twelve years within UK Health Security Agency (UKHSA) developing molecular tests for the detection of pathogens of key public health significance and helping set up the core UKHSA Next Generation Sequencing Service. Since 2017, Lisa moved within Cefas into the project delivery profession and currently is accountable for four major programmes of work.

Dr Kata Farkas, Environmental Virology, University of Bangor

Kata is an environmental virologist with a special interest in the fate and diversity of human health-related pathogens in the aquatic environment. She has been working at Bangor University

since 2015 on various research projects on water quality and shellfish hygiene. Her research helped greatly to set up wastewater-based epidemiology programmes in England and Wales for COVID-19 and other viral diseases. She is the Research and Development lead for method development for the detection of viruses in wastewater and other environmental matrices for the Wastewater Research Centre Wales. She is a Co-Investigator for the PATHSAFE WS2a project working on the abundance and survival of noroviruses in wastewater and seawater.

Dr Reshma Silvester, Microbiology, University of Bangor

Reshma is a microbiologist by profession, with more than 10 years of research experience in the field of antimicrobial resistance (AMR). She is a post-doctoral research officer at Bangor University, since April 2023, for the PATH-SAFE WS2a project. She completed her PhD (Microbiology) from Cochin University of Science and Technology (CUSAT), India, in 'Genotyping, virulence characterisation and survival kinetics of Vibrio spp. from food and environmental sources along the south-west coast of India'.

After her PhD, she worked as a research analyst at the Center for Disease Dynamics, Economics and Policy (CDDEP), presently One Health Trust (a collaborating centre of WHO on AMR), where she focussed on 'Global mapping of AMR in food-producing animals from LMICS'. Additionally, she gained 3 years of post-doctoral experience from CUSAT, India, where she actively contributed to several projects focused on AMR and pathogen surveillance in marine environments, aquaculture farms, and seafood. She has also served as a consultant on an AMR project commissioned by the Veterinary Medicines Directorate (VMD) in the UK.

Prof. Davey Jones, Environment and Public Health, University of Bangor

Davey Jones holds a joint Professorship in Environmental Science between Bangor University and Murdoch University, Australia. His research focuses on soil-plant-microbial interactions and understanding the links between land and water in relation to nutrients and human pathogens. On-going projects include Principle Investigator of several national public health wastewater surveillance projects (Welsh Government, Global Challenges Research Fund, GCRF, and Natural Environment Research Council, NERC), two UKRI projects on microplastic and pathogen dispersal in the freshwater and coastal zone.

Recently finished projects include the UKHSA-ACE, NERC-EMHH VIRAQUA programme on environmental virology and the Food Standards Agency project on active pathogen management in shellfisheries and bathing waters. He advises Welsh Government and Defra on their public health, climate change and land use policy. He is leading Case Study C on the Development of pre-emptive data-driven tools to predict the risk posed by norovirus and AMR in coastal waters and entry into the food chain.

Further information

For any questions or feedback please contact the team at pathsafe@food.gov.uk.

To sign up to the SERD newsletter which contains PATH-SAFE news and link to our full newsletter please visit Food Standards Agency UK (govdelivery.com).

To keep up to date on PATH-SAFE please visit the Pathogen Surveillance in Agriculture, Food and Environment Programme page.