HIS SPARC CONSORTIUM STATEMENT

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FRIDAY 19TH SEPTEMBER 2025

SUMMARY

RATIONALE FOR THE CONSORTIUM STATEMENT

What is the statement for?

- SPARC recognises that risks from AMR and water/wastewater are present in multiple health and social care institutions but published academic evidence is insufficiently mature to allow teams to safely and rapidly address the problem

Why is it needed?

- The aim of this consortium statement is to provide a summary of current evidence, information and expert opinion to support infection prevention teams, healthcare engineers, healthcare leaders, clinical and non-clinical staff who are responsible for the risks of AMR in hospital water/wastewater
- Given the diverse professional groups involved in addressing the risks of AMR and water/wastewater, a consensus is required prior to setting a research roadmap

What about the evidence?

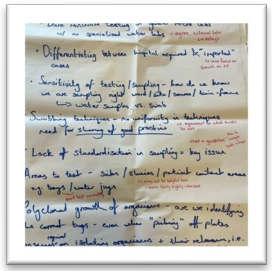
- The authors include references but acknowledge that, for some statements, the evidence is inconclusive or weak, in which case expert opinion is provided from the community of practice. Some statements relate to, or refer to, estates, engineering, cleaning and other professions where academic publications may not be readily available but from whom expertise is required

DEVELOPMENT OF THE CONSORTIUM STATEMENT

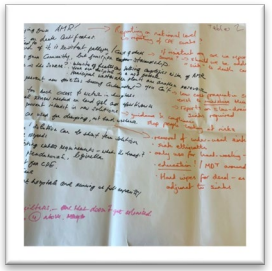
- Subject analysis of SPARC meetings 1 and 2, resources and materials
- Summary listing of statements and research gaps
- Extraction and collation of evidence, opinion and comments on:
  - *Pseudomonas aeruginosa* and related pathogens, AMR, Enterobacterales
  - Biofilm development
  - Biofilm dispersal
  - Infection prevention and control
- Distribution into 4 part document, allocation of working groups, formalisation of sign up process, authorship and acknowledgements
- Aim to finalise by end of 2025, publication on HIS website +/- journal submission(s)
- Accompany with innovation directory of resources

HIS SPARC MEETING 2

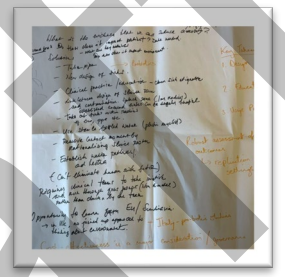
MARCH 17TH 2025



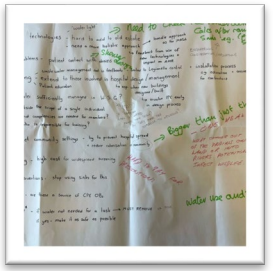
IPC TEAM
Essentials of Practice



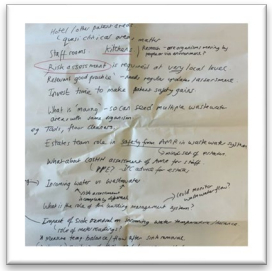
FACILITIES
Precision



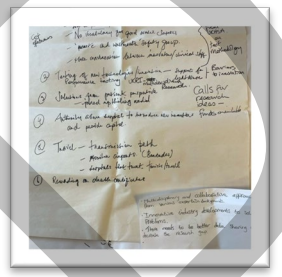
INDUSTRY PARTNERS
Innovation



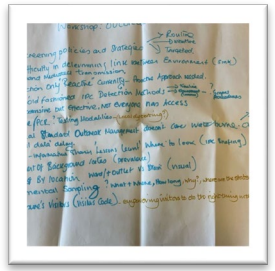
NHS EXPERTS
Getting it right for patients



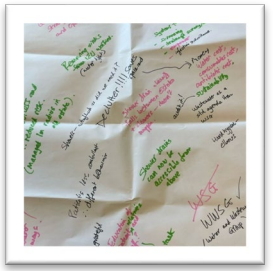
UKHSA
Guidance



ENGINEERS
Compliance



MICROBIOLOGISTS
Analysis



CLINICAL TEAM MEMBERS
Translation to ward care

AMR AND WASTEWATER STATEMENTS

- **AMR bacteria including *Pseudomonas aeruginosa* and Enterobacterales can reside in water and wastewater systems in healthcare environments, these sources are associated with patient AMR colonisation, infection and death**
- **AMR colonisation in the wastewater environment in healthcare settings is likely to be well-established in some settings, but the extent to which this modality contributes to overall AMR development, patient acquisition and clinical infection is not known**
- **The risk of AMR from the healthcare environment varies by country and region, bacterial species, genomic characteristics and mobile genetic elements, antimicrobial selection pressure, patient care needs, the design of the built environment and staff practices around water and wastewater**
- **All sink and shower drains in healthcare premises can be considered at risk of harbouring AMR bacteria (detection methods to confirm or refute are imprecise). This includes clinical hand wash basins, kitchen sinks, decontamination sinks, slop hoppers, macerators and sinks in staff and visitor areas.**
- **For this reason, 'a universal precautions' approach to pipework is likely to have value, especially in areas with high AMR incidence and prevalence**

AMR AND WASTEWATER STATEMENTS

- **Microbiological sampling for AMR Enterobacterales in the healthcare environment, including water, wastewater and splash zones, is not standardised.**
- **Environmental microbiological surveillance is limited by:**
  - **lack of evidence for the optimal sampling methodology (sites and specimens)**
  - **lack of validated testing methods and access to suitable laboratory services**
  - **challenges related to the fact that AMR disseminates sporadically in time and place**
  - **access to molecular typing methods with rapid turnaround, high-level discriminatory ability and affordability which can effectively support outbreak investigations**
- **Healthcare providers perform proactive and reactive water sampling for *P. aeruginosa* and this can be used to establish linkage between the hospital environment and patient samples, however, definitive networks of transmission are often difficult to establish in practice.**
- **Environmental infection control and water safety measures protect patients from opportunistic premise plumbing pathogens arising from the water distribution system, especially *P. aeruginosa*. These measures may also be relevant to AMR prevention but are likely to be insufficient without additional measures targeting wastewater.**

AMR AND WASTEWATER STATEMENTS

- **Current infection prevention surveillance tools are insufficient to detect stealth AMR transmission from water and wastewater as they are based on identifying two patients with the same bacterial species linked in time (e.g. 28 days) and space (e.g. a ward). This does not reflect the epidemiology of AMR and wastewater, or account for complex networks created by mobile genetic elements**
- **Standard infection prevention measures are insufficient to prevent the contamination of hospital environments and wastewater with bacteria from patients known to carry AMR organisms**
- **Standard infection prevention measures are insufficient to control AMR-Enterobacterales and AMR *P. aeruginosa* outbreaks. Further measures targeting AMR in the built environment, especially water and wastewater, are required but not well-evidenced**
- **Effective response measures for AMR in the wastewater environment requires coordinated healthcare leadership, technical and clinical interventions, new IPC guidance and overarching governanc measures could enhance both the current interventions for the commissioning and maintena water distribution systems and current national IPC guidance.**

AMR AND WASTEWATER RESEARCH GAPS

- Evidence is required to establish the relative contribution of nosocomial AMR pathogens arising from the hospital-built environment compared to AMR acquired by other routes
- To what extent is nosocomial AMR transmission being detected by current surveillance measures, and can this be improved by stronger recognition of the risks of AMR in wastewater?
- What is the frequency of antimicrobial resistance in OPPPs, including *P. aeruginosa*, and how does this relate to antimicrobial resistance at ward, departmental or hospital level?
- Given widespread dissemination of AMR in wastewater, should all water outlets (including drains) be targeted in interventions to prevent AMR, or are higher risk outlets (e.g. hand wash basins, kitchen sinks) or higher risk locations (e.g. ICU, haematology) a priority?

AMR AND WASTEWATER RESEARCH GAPS

- **Do effective control measures, both engineering and cleaning practices, for *P. aeruginosa* in the water distribution system impact AMR-Pa incidence in hospitals?**
- **What is the most cost-effective approach to healthcare environmental AMR surveillance, including effective molecular analysis to establish linkage between patient and environmental samples?**
- **Do improvements in antimicrobial prescribing at ward, departmental or hospital impact local environmental bacterial resistance profiles in wastewater, how is this impacted by patient movement, duration of interventions and agents restricted?**
- **What are the most effective infection prevention interventions to prevent AMR-environmental contamination from patients known to be AMR colonised?**

AMR AND WASTEWATER RESEARCH GAPS

- How do nosocomial AMR-Es and AMR-Pa arising from the hospital built environment relate to the other clinical and microbiological risk factors for AMR in:
  - ‘Higher risk’ patient groups (ICU, haematology, renal, neonates, burns)
  - Patients cared for on general wards i.e. not higher risk groups
  - In other settings e.g. endoscopy, theatres, day case units, haemodialysis, chemotherapy units, hydrotherapy, pharmacy areas
- What is the wider ecological impact in the AMR-Es and AMR-Pa from the hospital microbiome flowing into public sewers and public water ways?
- How best can new innovations to reduce AMR risk from water systems in the built environment be trialled using all relevant professional and patient groups, and accounting for environmental AMR density, AMR transmission rates, clinical outcomes and patient experience? In short, can ‘clinical performance testing’ be devised?

AMR BIOFILM DEVELOPMENT – STATEMENTS

- **Biofilm in health and social care pipework is likely to contain non-AMR bacterial isolates which are linked to patient infection causing clinical harm e.g. Klebsiella sp. E coli bacteraemias or vascular access device infections, but current surveillance measures cannot detect transmission of these more susceptible isolates**
- **The biofilm content in health and social care premises is distinct and relates to whether a building is in clinical use or fallow, its local population and clinical practices influencing the 'hospital microbiome' or 'drainome'. These biofilms in pipework have the potential to influence the rate of colonisation / infection of patients in a ward or clinical area**
- **Biofilm growth and development is influenced by component parts of the plumbing estate, and design of water and wastewater infrastructure, with some designs evidenced to be higher risk of biofilm burden and persistence**
- **Biofilm microbial content is influenced by local practices; antimicrobial prescribing, chemical disinfection, waste disposal, patient care practices, nutrition pathways, building and plumbing maintenance and cleaning processes**
- **The risks of AMR in hospital biofilm is likely to arise from:**
  - **Acquisition of resistance via lineages and mobile genetic elements from patients and environmental organisms**

AMR BIOFILM DEVELOPMENT – STATEMENTS

- **Directionality of transmission of AMR between patients and environmental biofilms can be hard to ascertain and can lead to misjudgement about the role of the environment**
- **A routine testing strategy for biofilm is not available in health and social care. If used, biofilm testing in research requires detailed analysis and cautious interpretation using both healthcare engineering and microbiological expertise**
- **AMR biofilm risk to patients may be influenced by the choice of both large and small aspects of the built infrastructure to minimise biofilm, which relates to design of component parts. This is not yet well-evidenced.**
- **Antibiotics can be detected in human waste which is likely to impact wastewater biofilm bacterial populations. Staff practices can reduce the contamination of wastewater related to disposal of antibiotic agents and human waste but it is unknown if this impacts local AMR constituents in biofilm**
- **The materials and methods used to build water and wastewater infrastructure and additional components prior to installation may influence the development, promotion and persistence of biofilm.**
- **Chemical disinfection, heat and UV are used to control AMR in hospital biofilm, but insufficient evidence exists on the optimal interventions to diminish AMR microbial populations and preventing patient AMR acquisition, without risking the promotion of unwanted pathogens**

AMR BIOFILM DEVELOPMENT RESEARCH GAPS

- Studies are required to provide further evidence the relationship between antimicrobial use at ward, hospital and regional level and the associated constituents of AMR biofilm in the healthcare-built environment
- Intervention studies aimed at reducing antimicrobial use and/or antimicrobial contaminated waste disposal are required to ascertain if local practice change can reduce AMR in hospital pipework. This is relevant to both established AMR biofilm (e.g in outbreaks) and for new hospital buildings
- Studies on pre-emptive AMR surveillance of water/wastewater biofilms would help teams to understand the cost-effectiveness and clinical benefits of proactive vs. reactive control strategies
- Improved understanding of transmission networks would be supported by a greater representation of outpatient and community health and care facilities in biofilm research

AMR BIOFILM DEVELOPMENT RESEARCH GAPS

- Studies are required to establish whether biofilm sampling is a cost-effective aspect of outbreak investigations in healthcare, or whether research data provides sufficient generic evidence for national infection prevention guidance on outbreak management
- Studies to establish whether there is clinical utility in proactive point prevalence for AMR biofilm in wastewater, similar to regular water testing for pathogens in water distribution systems.
- Research is recommended to develop technical solutions for rapid testing of AMR in sinks/pipework in healthcare settings (i.e. to be used after a single case), for example dipstick testing for carbepenemase-resistant Enterobacterales (CPE) in wastewater.
- What is the best approach for standardised and optimised biofilm sampling in research scenarios to establish if AMR biofilm interventions are effective. These methods should be suitable in both clinical settings and for sinks/pipework items already removed.

AMR BIOFILM DEVELOPMENT RESEARCH GAPS

- What are the best microbiological and clinical outcome measures for studies investigating the control of AMR biofilm in health and social care environments.
- Studies are required to investigate the best technical interventions to control AMR biofilm in clinical areas with established risks and clinical infections, and for new hospital environments, with focus on:
  - Design interventions
  - Chemical interventions
  - Heat interventions
  - UV interventions
  - Engineering interventions and controls

AMR BIOFILM DISPERSAL - STATEMENTS

- **AMR dispersal is a risk from wastewater, and possible mechanisms of transmission include:**
  - **Water outlet flow hitting drains and being carried up to 2m, creating a 'splash zone' around of sinks and showers**
  - **Contaminated water pooling, especially in wet rooms/shower areas**
  - **Dispersal from sink/shower drain backflow, blockages and floods**
- **Items and persons present in splash zones of sinks and showers are at risk of AMR contamination, this includes clinical equipment, staff, patients, patient personal items. cleaning items and catering items. Some cots and beds are placed in sink splash zones on wards risking patients residing there.**
- **AMR in pipework can be present in kitchens, treatment preparation rooms and dirty utility rooms, and these areas will cater for large numbers of staff and patients and could be the source for AMR dissemination**
- **Silent aerosolisation of bacterial pathogens is a dispersal risk from wastewater, and is likely to be relevant to water systems above and below (vertical transmission networks). This is a risk for AMR dispersal, and could be relevant to other bacterial outbreaks (e.g. Enterobacterales in neonatal units)**
- **Controlling dispersal using simple measures is a good opportunity given the high number of sinks in most current hospitals and the financial, clinical and operational barriers to large scale sink removal/replacement**

AMR BIOFILM DISPERSAL - STATEMENTS

- **Design of sinks and showers, and their drainage system, is likely to impact AMR dispersal in time and place, there are design approaches that have been successful in outbreak control but further evidence is required on the optimal approach to minimise this risk proactively when designing new wards or hospitals**
- **Ethnographic studies are required to map the interaction between staff and the build water and wastewater environment to support effective design solutions that maintain optimal patient safety for all aspects of care**
- **Low cost simple measures can be employed to reduce AMR risk from sink and shower splash zones such as improving storage solutions, removing stored items from dirty utility rooms, etiquette of personal and clinical items and equipment, and though clinical practice changes**
- **Cleaning practices are extremely important, with risk of dissemination of AMR from water outlets on cleaning items (mops, clothes, and buckets). There is also a risk of AMR dispersal in other aspects of cleaning, e.g. automatic mobile floor cleaners. Again, simple measures can reduce these risks and are already in place in many UK hospitals**
- **AMR control in p-traps and bottle traps, and more distal pipework, has been linked to improvements in outbreaks, but evidence-based recommendations on design, disinfection and replacement regimes are required**
- **Point of use filters provide assurance on reduction of pathogen dispersal from water outlets, but carry**

AMR BIOFILM DISPERSAL RESEARCH GAPS

- Does AMR dispersal in both research and clinical environments align to the surrogate studies of dispersal using dye and sink model dispersal optics?
- Does AMR dispersal vary based on constituent biofilm chemical, microbiological and physical factors, and would this knowledge offer opportunities for studies to look at solutions which could be incorporated into biofilm to reduce dispersal risk?
- To what extent does silent bacterial aerosolization contribute to the dissemination of AMR in hospital buildings? What is the optimum design of clinical studies to establish this?
- What are the most effective designs and interventions to reduce biofilm dispersal from sinks, showers and other clinical wastewater systems?
- Does prevention of wastewater blockages and leaks reduce AMR dispersal in health and social care settings, can studies establish linkage between pipework or plumbing failures, AMR dispersal and clinical cases?

AMR BIOFILM DISPERSAL RESEARCH GAPS

- Evidence is required from ethnographic studies to provide insight into the clinical practices that disperse AMR in the hospital built environment, and how staff education and changing hospital design can interrupt these dispersal mechanisms by changing clinical behaviours
- Evidence is required for the optimal cleaning practices to prevent and control AMR dispersal, manual cleaning of sinks, showers and pipework and also automated floor cleaning.
- Evidence is required on the best education and training packages for estates and facilities so they can risk assess activities and minimise the risk of AMR dispersal in their daily work
- Evidence is required on the relative impact of hospital AMR bacterial lineages and MGEs on wider sewage system microbiomes, and whether or not hospital wastewater should be decontaminated prior to entering the main sewer systems?
- Evidence is required on the optimum approach to decontaminating hospital water and waste high risk of AMR, to prevent dissemination outside health and social care settings

AMR INFECTION PREVENTION AND CONTROL & WATER - STATEMENTS

- **AMR risks from water/wastewater systems are recognised by most UK infection control teams and some associated recommendations are included in national guidance documents. However, effective surveillance, robust infection control responses and technical solutions are not always rapidly implemented when AMR risks are identified in the built environment**
- **AMR water-focused investigation and control measures are implemented to control outbreaks of infection in hospital settings, but training, education and expertise in environmental IPC is of variable quality and many settings do not have professionals experienced in water/wastewater risk assessment and best practice**
- **Current guidance and recommendations on AMR in water/wastewater are insufficient to guide a robust multi-professional response to implement current evidence, solutions and improve patient safety**
- **Surveillance measures aimed at detecting an increased incidence of AMR organisms may not be suitable to identify risks from the built environment. Epidemiological tools tracking patient movement, AMR positive patients and analysis over longer periods is required to identify environmental AMR sources.**
- **UK infection control teams may have over emphasised the risk of AMR from outside their own**

AMR INFECTION PREVENTION AND CONTROL STATEMENTS

- **The local incidence and prevalence of AMR will impact the ability of infection control and clinical teams to track environmental transmission routes in health and social care settings. AMR surveillance will also be influenced by the lineages and MGEs involved, and the availability of molecular typing to support epidemiological investigations**
- **Risks of bacterial infection from water and waste-water systems are not familiar to many clinical and non-clinical staff members, the impact of education and training on water safety in healthcare is unknown**
- **There are no standard operating procedures for environmental sampling, infection prevention control measures or practice guidance for estates and cleaning team responses in AMR outbreak settings where water/wastewater is considered a potential transmission source**
- **Water safe care has been introduced successfully to neonatal units, adult intensive care and haemato-oncology units. This includes a bundle of measures, centred around sink removal from patient areas, and controls outbreaks. The wider clinical risks and benefits of water safe processes are not well established by randomised studies**
- **Water safe care requires safe alternative hand hygiene provision, clinical practice change and education and training of staff. Long term follow up data on HCAI rates is required to provide patient safety assurance on modified approaches to hand hygiene e.g. in C. difficile incidence**
- **There is potential for reduction of non-AMR nosocomial bacterial infection as a result of solutions to the**

AMR ENVIRONMENTAL IPC RESEARCH GAPS

- Studies are required to provide evidence of best practice for the epidemiological and microbiological surveillance methods that will prevent harm from AMR in the built healthcare environment in the most cost-effective way
- Research technological advances may support new evidence that HCAIs can be reduced by visual mapping of AMR in time and space, which allows teams to respond to the risks posed by long term stealth dispersal from the built environment
- Research is required to demonstrate the impact of operational pressures, and patient movement episodes, on environmental dissemination of AMR
- Co-production of a bundle of outbreak control measures is required to control environmental AMR in wastewater including clinical effectiveness and cost-effectiveness analysis. More robust interventions (hierarchy of controls) are more expensive:
    - Clinical practice only (low cost, depends on behaviour change)
    - Clinical practice plus small intervention and disinfection (moderate cost)
    - Clinical practice plus large scale changes to the built environment (high cost)

AMR ENVIRONMENTAL IPC RESEARCH GAPS

- Evidence is required to understand if screening asymptomatic patients to understand local AMR risks is useful to inform environmental screening and biofilm control measures
- Evidence is required to understand if using clinical sample triggers as AMR indicators to understand local AMR risks is useful to inform environmental screening and control measures
- Evidence is required to tailor best practice for the use of HPV and UV decontamination in AMR environmental control, with and without associated water safe care interventions
- Studies investigating best practice for NHS environmental sample interpretation and IPC response including how to establish environmental and patient linkage
- Evidence is required to support risk assessment by IPC teams on the likelihood of wastewater AMR impacting on patient care and subsequent morbidity, mortality and length of stay
- Studies are required to provide evidence based guidance on which specialties should employ water safe measures, and to what degree, based on clinical outcomes.

HIGH LEVEL NHS/UK RECOMMENDATIONS

SENIOR LEADERSHIP

- Awareness at governmental, national and board level is required to control the risks of AMR in wastewater
- Accountability for AMR in hospital buildings – clarify who this sits with, and who can drive change
- Cost-effectiveness will determine scale of response, and needs to be incorporated in research proposals
- AMR reporting and open data sharing between organisations will help prevent new harms from environmental AMR
- Standardisation of NHS
- Prevention
- Response
- Training and education

OTHER OPPORTUNITIES

- Community of practice
- Updates to water safety plan and water safety group recommendations based on statements and research (using dynamic approach, not waiting years for updates)
- Novel research collaborations involving
  - Architects
  - NHS estates teams
  - Engineers – multiple disciplines
  - Facilities – catering and cleaning
  - IPC drivers to clinical practice change
  - Ethnographic studies

NEXT STEPS FOR THE CONSORTIUM STATEMENT

AGREE PROPOSAL	ESTABLISH WORKING GROUPS	DEVELOP COMMUNITY OF PRACTICE	FINALISATION AND STRATEGY	RESEARCH ROADMAP
SPARC meeting 3	Part 1 Part 2 Part 3 Part 4	Disseminate to SPARC members and receive feedback	Publication and dissemination	SPARC committee alignment to consortium statement
September 2025	October/November	November/December	January 2026	Ongoing

SUMMARY

Why do we need a consortium statement?

Generating the statement

Part 1. AMR and wastewater

Part 2. Biofilm development

Part 3. Biofilm dispersal

Part 4. Environmental IPC to control AMR

- Your thoughts and questions please.....