Research Q&A: Development and Evaluation of Test Methods for the Detection and Enumeration of Opportunistic Waterborne Pathogens from the Hospital Environment



**Dr Teresa Inkster**

# NHSScotland Assure Research Service

NHSScotland Assure is adding to the knowledge base available to built environment projects. Building on this existing knowledge will reduce risks, increase quality, and promote sharing research with key stakeholders.

Through working with external stakeholders and other NHS Scotland Assure services the research service will ensure information is based not only on best practice but best evidence and will benefit those who need it. The service will seek to ensure that the most up to date and robust research is translated into practice as new and emerging evidence become available.

Throughout 2020 and 2021 the NHSScotland Assure Research service commissioned a number of research projects which address gaps in current evidence. These research topics relate to previous issues and lessons learned within previous NHS Scotland projects and are in line with the key themes identified by NHS Scotland Assure stakeholders.

# Research Q&As

Our research Q&As are designed to talk about these research projects – why the research is needed, what it set out to achieve, what impact it will have on existing guidance and more.

Full research reports are also available by contacting Dr Teresa Inksterat teresa.inkster2@nhs.scot

## Research Q&A with Dr Teresa Inkster

### 1. What is the research that was carried out?

The research has looked into developing and evaluating testing laboratory methodology for the detection and enumeration of waterborne pathogens. Six waterborne pathogens were selected: Acinetobacter spp, Burkholderia spp, Cupriavidus spp, Delftia acidovorans, Elizabethkingia spp, and Stenotrophomonas maltophilia.

The research was a collaborative approach between the Glasgow Royal Infirmary Microbiology environmental laboratory and the UK Health Security Agency (UKHSA) environmental laboratories.

### 2. Why is this research needed?

Water testing for organisms such as Legionella and Pseudomonas aeruginosa is well established but this is not case for less common waterborne organisms, which have been implicated in healthcare associated outbreaks. Following a water incident in a Scottish hospital an aide memoire for water incidents was published by Health Protection Scotland (HPS) in 2019. The purpose of this document was to raise awareness of more unusual waterborne pathogens. The memoire recommends consideration be given to water testing if clinical cases are detected. Currently no standardised methodology for these organisms exists. Without a standardised procedure there is a risk that less optimal methodologies may be used which will fail to detect the organism. Failure to detect these organisms in water could increase the risk of infections in patients as false reassurance may be given and control measures may not be implemented.

It is therefore important that laboratory methodology is developed to support this recommendation. Prompt water testing during a suspected incident/outbreak aids with both the detection of the source and it enables relevant infection control measures to be implemented with the aim of preventing further patient cases.

### 3. Who were the team behind the research?

The Chief Investigator was Dr Teresa Inkster, Consultant Microbiologist (Diagnostics), NHS Greater Glasgow & Clyde.

Co- investigators were:

* Isabel Caldwell, Biomedical Scientist, NHS Greater Glasgow & Clyde
* Heather Aird, Clinical Scientist, Food, Water and Environmental Microbiology Lab, UK Health Security Agency, York, UK
* Caroline Willis, Clinical Scientist, Food, Water and Environmental Microbiology Lab UK Health Security Agency, Porton, Salisbury
* John Mallon, Head of Technical Services, Microbiology, NHS Greater Glasgow & Clyde
* Sandra Lai, Clinical Scientist, Food, Water and Environmental Microbiology Lab UK Health Security Agency
* Sandra Higgins, Service Manager, Microbiology, NHS Greater Glasgow & Clyde

### 4. What did the research set out to achieve?

The research sought to develop optimal testing methodology for each of the six organisms. It aimed to provide recommendations for which agar to choose, the best incubation temperature and the best incubation time. The aim was to develop methodology which could be standardised for use in environmental laboratories, aiding detection of these waterborne pathogens.

### 5. How was the research carried out?

Water samples were artificially spiked with one of the six different types of bacteria by the UKHSA environmental labs. They were then sent to Glasgow for testing to enable the optimal incubation conditions and media to be established. Later mixed cultures were also tested to assess how effective the methodology was for samples that contained mixed organisms which might be more reflective of hospital water samples.

 Ten different isolates of each target organism were selected for use in the study. In addition, it sought to establish any additional method that might hasten the identification of the organism e.g., by applying antibiotic discs to the agar plate. Five different agar types were tested, two incubation temperatures (30°C and 37°C) and agar plates were read following incubation after two, five and seven days.

In the case of one bacterium, Stenotrophomonas maltophilia, Imipenem antibiotic discs were added to agar plates to aid detection.

### 6. What challenges did you encounter?

Very few challenges were encountered. Due to taking place during the COVID-19 pandemic the research did take longer than anticipated. Several planning meetings took place with the labs involved with the development of a timeline and this was key to ensuring things went smoothly.

### 7. What were your main findings?

We were able to recommend a combination of three types of culture media for the optimal isolation of the six organisms. These are tryptic soy agar (TSA), Chocolate bacitracin (BAC) and Pseudomonas Agar (PSA). The optimal incubation temperature was found to be 30°C for five days. Use of MALDI-TOF (matrix assisted laser desorption ionisation time of flight) was sufficient to identify any colonies of bacteria further. The detection of Stenotrophomonas melophilia can be aided by utilising Imipenem antibiotic discs on the agar plate.

### 8. How will the research be used?

The methodology developed in this study can be used by laboratories to reliably detect the six waterborne pathogens and will enable identification of these organisms in response to outbreaks. It is planned to share the work with UKAS (United Kingdom Accreditation Service) and ask for consideration of the work to be further developed by them.

### 9. What are the next steps for study in this field?

The next steps for study in this field are the development of more rapid testing methods e.g., PCR methods, as culture still takes time (up to five days, as this study has shown).

### 10. Will this research have an impact on current guidance?

The research is unlikely to impact directly on current guidance however it will support current guidance where water testing is recommended during healthcare incidents/outbreaks.