

TECHNICAL DATASHEET ESKAPE Pathogens

Understanding Nosocomial Risk Factors

The monitoring of water used in care homes and healthcare facilities is covered by several pieces of Health and Safety Guidance (HSG). The majority of the guidance is on the monitoring of *Legionella* and is supported by the Approved Code of Practice for *Legionella* (ACoP L8) and Health Technical Memorandums (HTM); however, there are a range of other risk factors that need to be considered in nosocomial scenarios. The ESKAPE pathogens are emerging pathogens of concern. ALS Environmental are able to offer rapid identification of these bacteria using our revolutionary MALDI-ToF confirmation technique. The ESKAPE Pathogens are:

Enterococcus faecium

Enterococcus faecium; formerly known as *Streptococcus faecium* until its re-categorization in 1984, is a human pathogen that causes nosocomial bacteremia, surgical wound infection, endocarditis, and urinary tract infections. The bacteria can survive for long periods of time inside hospitals on a variety of surfaces as well as in soil and sewage. Growth temperatures range from 10°C to 45°C in basic or acidic environments, and in environments which are isotonic or hypertonic.

Ent. faecium can be highly drug resistant. The spread of the disease occurs between patients in hospitals due to transfer of the pathogen by hands or medical instruments. Also, antibiotic use can decrease the number of other intestinal bacteria that are susceptible to the antibiotic and decrease competition for the drug resistant *Ent. faecium*.

Staphylococcus aureus

The carriage of *Staphylococcus aureus* is an important source of nosocomial infection and community-acquired methicillin-resistant *Staph. aureus* (MRSA). *Staph. aureus* is common and often found in the nose or on the skin. Most of the time these bacteria do not cause any symptoms. The ability of the nasal passages to harbour *Staph. aureus* results from a combination of a compromised host immune system combined with the bacteria's ability to evade a host's innate immunity. The spectrum of *Staphylococcus* infections can range from skin abscess to life-threatening infections such as septicemia or endocarditis.

Klebsiella pneumoniae

In nosocomial settings, *Klebsiella* bacteria can be spread through person-to-person contact or by contamination of the environment; it is important to note that the bacteria are not spread through the air. Patients in healthcare settings may be exposed to *Klebsiella* when they are on ventilators, or have intravenous catheters or wounds. Unfortunately, these medical tools and conditions may allow *Klebsiella* to enter the body and cause infection; which can be fatal in the immuno-compromised.

Acinetobacter baumannii

Acinetobacter baumannii is a rapidly emerging pathogen in the health care system. *A. baumannii* is usually introduced into a hospital by a colonised patient. Due to its ability to survive on artificial surfaces and resist desiccation it can survive and potentially infect new patients for some time. It is suspected that *A. baumannii* growth favours nosocomial settings due to the constant use of antibiotics by patients in the hospital and causes a wide range of infection including bacteremia, pneumonia, meningitis, urinary tract infection, and wound infection. The organism's ability to survive under a wide range of environmental conditions, and to persist for extended periods of time on surfaces, make it a frequent cause of outbreaks of infection and an endemic, health care-associated pathogen.

Pseudomonas aeruginosa

The monitoring for *Pseudomonas* is covered in HTM04-01 Addendum. Serious infections of *P. aeruginosa* usually occur in the immuno-compromised. Infections of the blood, pneumonia, and infections following surgery can lead to severe illness and death in these people. The highly susceptible nosocomial patients include those on breathing machines, premature babies and patients with wounds from surgery or from burns. Additionally, healthy people can also develop mild illnesses with *Pseudomonas aeruginosa*, especially after exposure to water. Ear infections, especially in children, and more generalised skin rashes may occur after exposure to inadequately chlorinated hot tubs or swimming pools.

Enterobacter species

The genus *Enterobacter* is a member of the coliform group of bacteria. *Enterobacter* species, particularly *E. cloacae* and *E. aerogenes*, are important nosocomial pathogens responsible for various infections; including bacteremia, lower respiratory tract infections, skin and soft-tissue infections. Risk factors for nosocomial *Enterobacter* infections include hospitalisation of greater than 2 weeks, invasive procedures in the past 72 hours, treatment with antibiotics in the past 30 days, and the presence of a central venous catheter. Specific risk factors for infection with nosocomial multidrug-resistant strains of *Enterobacter* species include the recent use of broad-spectrum cephalosporins or aminoglycosides and ICU care.

Stenotrophomonas Maltophilia

Stenotrophomonas maltophilia is an organism of low virulence which can frequently colonise fluids used in the hospital setting (eg, irrigation solutions, intravenous fluids) and patient secretions (eg, respiratory secretions, urine, wound exudates). *S. maltophilia* usually bypasses normal host's defenses to cause human infection. The growth of *S. maltophilia* from sites which would normally be sterile (e.g., blood) usually represents true infection; growth of *S. maltophilia* in microbiological cultures of respiratory or urinary specimens is therefore sometimes difficult to interpret and not always a proof of infection.

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ALS Environmental are one of the first UK laboratories to validate and have accredited to ISO 17025:2005 and the Drinking Water Testing Standard (DWTS), accredit the rapid identification of positive Microbiological samples by Matrix Assisted Laser Disruption and Ionisation by Time of Flight Mass Spectrometry (MALDI-ToF MS). The ground breaking identification technique employed by ALS Environmental, known as MALDI-ToF, allows us to remove the need for presumptive data for bacteriological analysis, with all data reported as Colony Forming Units (CFU).

The impact of MALDI-ToF confirmation on the ESKAPE pathogens is highlighted in the table below.

Bacteria	Incubation Time	Confirmation: Traditional	Confirmation: MALDI-ToF	MALDI-ToF Saving
Enterococci	2 days	1 day	Minutes	1 day
Staphylococcus aureus	2 days	1 day	Minutes	1 day
Klebsiella pneumoniae	1 day	1 day	Minutes	1 day
Acinetobacter baumannii	1 day	1 day	Minutes	1 day
Pseudomonas aeruginosa	2 days	1 day	Minutes	1 day
Enterobacteriaceae	1 day	1 day	Minutes	1 day
Stenotrophomonas	1 day	1 day	Minutes	1 day
Legionella	10 days	2 days	Minutes	2 days
E-coli	1 day	1 day	Minutes	1 day
Coliforms	1 day	1 day	Minutes	1 day
Clostridium Perfringens	1 day	1 day	Minutes	1 day
Salmonella	4 days	2 days	Minutes	2 days
Listeria	4 days	2 days	Minutes	2 days

The instant confirmation of the ESKAPE bacteria allows infection control and water treatment to make rapid decisions on any potential remedial works that may need to be undertaken. The MALDI-ToF can be used to identify any positive bacteria, including Legionella.

Legionella

The MALDI-ToF confirmation of Legionella removes the presumptive stage; meaning that ALS Environmental report positive confirmed Legionella on the original read days (currently days 3, 7 and 10). This is 40% quicker than the traditional approach and is fully ISO 17025:2005 accredited. ALS Environmental have one of the world's largest Legionella species libraries held within our MALDI-ToF. with only 3 known species unidentifiable, two of these are Viable But Not Culturable (VBNC) and the final species is being sourced by our laboratory.

