Looking deeper

The Journal of the Water Safety Forum

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Advanced healthcare solutions from Armitage Shanks

Specialist training will improve water safety

Looking Deeper Editor, **Susan Pearson**

Several years ago, in a private conversation, a senior medical microbiology consultant commented on the importance of getting the word out about the connection between waterborne pathogens and hospital acquired infections (HAIs). But it is hard, he said, when institutions are keen to keep specific 'outbreaks' under the radar because they fear adverse publicity — yet spreading awareness of research dealing with the causes and resolutions of various outbreaks is essential in establishing much wider understanding of water microbiology issues and creating more safety for patients.

So there needs to be more publicity about the transmission of waterborne pathogens — and one of the best ways to highlight the dynamics is through dedicated training programmes.

There needs to be more publicity about the transmission of waterborne pathogens.

What is striking is how often the need for specialist training of all staff involved in infection control now crops up in discussions on HAIs — not just for clinical staff but for everyone involved at all levels in the journey of water from entry to a building to wash hand basins in patient facilities.

This need for training came up in the last issue of Looking Deeper in our Water Safety Round Table review and is emphasised more strongly in this autumn issue.

Looking at how water supply is thought about — or not — before healthcare facilities have even been built, the interview with Dr Paul McDermott advocates the need for specialist training for architects involved in hospital design. For example, better informed architects might avoid the types of problems that arise when cold and warm water supplies are placed too close together and facilitate *Legionella* proliferation.

This need for training is also picked up in the second part of our Water Safety Round Table report, in which the panel highlight the importance of training for plumbers, and is taken up again in our final feature, which details the Watersafe scheme listing competent UK plumbing contractors.

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Editorial Contributions

Susan Pearson

Susan is an independent journalist and communications specialist with a background in biology, medical research and publishing. She has been writing on medical issues for over 25 years and on waterborne infection and water management since 2010.

Elise Maynard

Elise is an independent consultant to the water and medical devices industries and a former Chair of the Water Management Society (WMSoc). She is a state-registered microbiologist and a Fellow of WMSoc, IHEEM, RSPH and IBMS. She chairs and presents at numerous international conferences.

Dr Paul McDermott

Paul is an independent advisor in biological risk, a Technical Assessor for the UK Accreditation Service and a trainer and expert witness on health and safety. He has a background in microbiology research and as a university lecturer before becoming a specialist Health and Safety Executive (HSE) inspector on Legionella risk control.

Stephen Kay

Stephen is Chairman of WRAS, the Water Regulations Advisory Scheme and was instrumental in developing the 'Watersafe' scheme. He is a chartered engineer specialising in water supply and has worked for over 40 years in the water supply industry. He currently works as an independent non-executive director of South Staffordshire Water and Jersey Water.

Share your thoughts with us in the next issue

To keep the conversation on water safety flowing we would really value your reactions to this third issue of Looking Deeper — we would appreciate hearing from you about what you liked, what you feel could be improved on, what topics you want to see discussed. We intend to publish some letters (with your permission) and would also welcome suggestions for contributions from our readers. You can contact us at **editorial@lookingdeeper.co.uk**

In the news...

Drinking water softeners may increase pathogen release

'Hard' ground water high in magnesium and calcium causes mineral scale that can harbour biofilms and many city drinking water systems add softening agents to keep plumbing free of pipe-clogging minerals. However, a new study has found that these chemicals may amplify the risk of pathogen release into drinking water by weakening the grip of bacteria on pipe interiors.

The research, published in Biofilms and Microbiomes by a team from the University of Illinois, shows that despite the addition of antimicrobial agents to water supplies, bacteria growing on mineral scale can reproduce to harmful levels. The group found that the addition of anti-scalant chemicals causes the biofilms to grow thicker and become softer.

"Increased biofilm thickness means more bacteria, and the softening increases the chance that pieces will detach and foul the water supply under normal flow pressure," said Professor Helen Nguyen. "In buildings where water has been stagnating for a while, this could become a public health issue."

"Before this work, we did not have a good understanding of the relationship between the water chemistry and microbiome that exists in plumbing."

Pseudomonas bacteria need less 'food' in Space

While astronauts in orbit are confined to a strange freeze-dried diet, bacteria growing in space thrive on a 'diet'.

This unlikely ability has recently been highlighted by the re-print in the 'Journal of Medical Microbiology' of the first paper describing *Pseudomonas aeruginosa* UCBPP-PA14. An investigation at the Rensselaer Polytechnic Institute, in New York State, explored the effect of phosphate concentration, carbon source, oxygen availability and motility on *Pseudomonas aeruginosa* growth in modified artificial urine media aboard the Space Shuttle Atlantis during STS-135.

The researchers concluded that bacteria cultured during spaceflight exhibited increased final cell density relative to normal gravity controls when low concentrations of phosphate in the media were combined with decreased oxygen availability.

Conversely, when the availability of either phosphate or oxygen was increased, no differences in final cell density were seen between spaceflight and normal gravity.

Multi-million fines on *Legionella* failings warning for healthcare industry

A spate of high profile prosecutions hitting offenders with multi-million fines have followed the 2016 Health and Safety Sentencing Guidelines, sending a stark warning to companies that fail to adequately protect the public from *Legionella* and other pathogenic bacteria.

A new precedent has been set for private healthcare providers with the June prosecution of a major healthcare provider, which was fined £3 million following a major Health and Safety Executive (HSE) investigation into the death of an elderly resident who contracted Legionnaires' disease in one of its homes.

The fine was a result of HSE investigations into major refurbishment works, which revealed that residents were exposed to the risk of contracting Legionnaires' disease.

The care home company had failed to implement the necessary control and monitoring measures required to safely manage their hot and cold water system, while those responsible for overseeing *Legionella* controls had not been adequately trained.

HSE principal inspector Vicky Fletcher noted: "The risk [from Legionnaires' disease] is more acute in care home settings...We would expect those who have a duty of care to understand this and have the necessary controls in place to manage the risk."

This case followed hard on the heels of a May £1.6 million fine imposed on a major car parts manufacturer following an outbreak of Legionnaires' disease and an explosion that both occurred at the same plant within a year. The Legionnaires' cases were caused by failure to safely manage factory water cooling systems.

In 2016, a third large company was fined £1.8 million, despite no cases of Legionnaire's having arisen, after discovery of a serious lack of compliance in maintaining water systems at one of their facilities.

These cases put the spotlight firmly on the need for good risk assessment, training and education and will act as drivers for review of current *Legionella* guidance in general.

Dates for diaries...

WMSoc Designing Out Too
14/11/2018 London

www.wmsoc.org.uk/events

WWEM 2018
21-22/11/2018 Telford

www.wwem.uk.com

11th Healthcare Infection Society conference
26-28/11/2018 Liverpool

www.his.org.uk/education-events/his-2018

Infection and Control Conference
17/01/2019 Salford University

www.salford.ac.uk/onecpd/conferences/the-future-of-infection-prevention-and-control-conference

17th International Conference on *Pseudomonas*
22 -26/07/2019 Putrajaya, Malaysia

www.pseudomonasconference.com/

5th International Conference on Prevention & Infection Control (ICPIC)
10-13/09/ 2019 Geneva, Switzerland

www.conference.icpic.com/

Water Safety Forum — report from the first 'round table' panel Pt.2

Our report on the first Water Safety Forum 'round table' event in the last issue of 'Looking Deeper' covered topics such as scalding risk assessments, risks from splashing, and how to reduce them, and some of the particular requirements in neonatal and paediatric facilities. However, our independent expert panel's exchange on some of the current concerns around water hygiene in healthcare settings was so wide-ranging that we didn't have enough space to reflect back the full scope of all the points raised: Part 2 of our report, below, presents further feedback.

TMVs or manual mixers?

One of the key questions the panel were asked was how they perceived the difference in impact and utilisation between manual taps and taps fitted with thermostatic mixing valves (TMVs), which threw up a range of sometimes divergent viewpoints:

- TMVs are generally fitted to prevent scalding and eliminate the need for scalding risk assessments (RAs) by delivering water at a constant temperature (41°C) that is comfortable for hand washing
- This is particularly important for nurses who are washing their hands up to 40-60 times a day and who therefore particularly welcome a convenient water temperature
- This constant comfortable temperature from TMVs also tends to encourage thorough hand washing by all staff
- However, some panel members saw the complexity of the numerous internal surfaces found in TMVs as problematic, considering that TMVs are more vulnerable to biofilm formation
- The point was also made that TMV cartridges fitted in taps from some manufacturers are designed with a high level of anti-bacterial materials that are less conducive to biofilm growth
- Conversely, other panel members remarked that manual mixing taps allow greater overall control over temperature, which is not possible with a sensor-operated thermostatic mixing tap
- However, a manual mixing valve is an alternative type of proportional blending valve, which can be manufactured using the same materials as a TMV. It is essential to update HTM 04-01 or HBM 00 10 to include an industry-agreed specification for manual mixer valves otherwise some questionable choices may be made, with subsequent infection control and scalding (of both patients and visitors) issues
- Importantly manufacturers will only be able to ascertain costing of a manual product when this healthcare manual specification has been agreed and published. Many observers from the sector would suggest there would be little difference between a thermostatic and manual controlled sequential mixer valve that has the same infection control features that have become usual in recent years: e.g. fully demountable body; detachable spout; open outlet and high velocity low static water smooth internal waterways
- Three types of tap are available: 1) manual mixing taps, 2) temperature limiting taps (no failsafe) and 3) TMVs. While type 1 are the least complicated and type 2 requires less maintenance, there was a consensus that decisions to fit TMVs are generally based on convenience and usability rather than considerations about possible biofilm growth.

The panel advised that the competing priorities between protection from contamination with waterborne pathogens and convenient water temperatures to aid and encourage hand washing need to be discussed more widely within water safety groups (WSGs) as fitting TMVs also has implications for maintenance and water monitoring in augmented care areas in particular.

As highlighted in Part 1 of our report in the last issue of Looking Deeper, the panel emphasised the importance of more training for clinical staff on the biology of waterborne pathogens and the pros and cons of fitting TMVs.

Outlet maintenance

Maintenance of outlets — of whatever type — is fundamental to ensure that water remains pathogen-free. However, sustaining good maintenance programmes also comes with pitfalls. For example, there is a pressure to find contractors who will carry out a vast range of services — yet this needs to be at a competitive cost. It is also crucial to ensure the quality of maintenance procedures themselves, to ensure that the products used for stripping down and disinfecting tap components, for example, are of a good quality and that equipment is kept in clean environments to protect against contamination. This quality of attention also needs to be applied at the installation stage as some problems can be traced back to installation of a water system.

Panel members noted that there have been instances where taps have been re-fitted with a handle of the wrong length, highlighting the importance of ensuring that facilities staff fit the correct interchangeable tap spouts to the correct device.

The importance of knowledge and competence was also emphasised, that contractors carrying out maintenance work must have healthcare experience — yet questioned how individual plumbers, for example, might get that experience in a healthcare environment.

Product testing

The panel also observed how some brand new outlet fittings may become contaminated during product testing or may be contaminated during fitting and discussed how these issues might be addressed.

There was a debate over whether certain fittings should be 'aseptic' and packaged in a similar way to healthcare products, whether fittings should be 'microbiologically clean', what this actually means and how tap manufacturers might achieve this.

Many manufacturers no longer 'wet test' all product components, but mixer cartridges are wet tested by necessity, before being blown dry, because it is not possible to test thermostats without passing through pressurised hot and cold water. However, the microbiological quality of the water used for this testing should be monitored. Ultimately, though, these are not 'sterile' products.

The panel noted the distinction between a 'sterile' and 'clinically clean' product, i.e. a product that does not contain any pathogenic microorganisms. A 'clinically clean' product could be achieved if, for example, sterile water is used for testing and sterile air for blow-drying.

Another issue raised is that there is often a time lag between installation and use in new or refurbished premises. Water may be run through a system to check it is working and then left for several months before use, potentially creating pockets of stagnant water that are vulnerable to microbial proliferation.

Suggestions made were that taps should be sealed into packaging to signpost to plumbers the need of particular care during installation.

The next Water Safety Forum event will be held in spring 2019.

Good system design key to improving water safety in hospitals

Susan Pearson talks to **Dr. Paul McDermott** about the importance of better designed water systems in healthcare facilities.

Dr. Paul McDermott is an independent advisor in biological risk and a former Health and Safety Executive (HSE) specialist inspector on *Legionella* risk control. He has been closely involved, in the recent past, in the development and delivery of HSE strategies on *Legionella*.

Dr. McDermott explains the implications of badly thought out water system design in healthcare facilities and the need for better water system design guidance and input from water safety groups at an early stage in the design and commissioning process.

How can better design play a part in improving hospital water?

The size and complexity of hospitals combined with the high degree of vulnerability of some patients using those systems means that when there is an opportunity, such as building a new hospital or major refurbishment of an existing one, more thought should be given to the design of the water systems. Healthcare water systems should not be designed in the same way as in other types of building — yet the same design criteria are used time and time again.

Examples of bad design that need to be addressed differently from other buildings include the routing of hot and cold pipes. These are very often sited for the convenience of installers and for important maintenance activities — but this should not take precedence over or compromise efforts to control the proliferation of waterborne pathogens such as *legionellae*. Too often, hot and cold pipework is routed together, sometimes within a centimetre of each other, resulting in cold water that is prone to warming. However, in hospitals, where there is a concentration of individuals who are vulnerable to Legionnaires' disease, the primary control method against *Legionella* bacteria in the water distribution systems is to keep hot water at temperatures above 55°C and cold water below 20°C.

Hospital designers need to take into account considerations such as patient well-being and experience, alongside providing visible enhancement of patient areas, so designers' instincts to hide away unattractive pipework is understandable. However, it is crucial to stay in touch with the 'nuts and bolts' of patient care and ensure that these niceties do not compromise patient safety.

It is entirely possible for architects to design water storage and distribution systems that are more appropriate for hospitals — and that would help improve and simplify the ongoing management of water safety. However, there is usually very little involvement at the design stage of water safety groups (WSGs), despite the guidance in HTM 04-0.[1] There may be many reasons for this, but often, the WSG is not consulted early enough in the design phase to influence water system layout. Plans are already in place and changing them is likely to incur additional costs and cause delays in the construction process, which also attracts financial penalties. Instead, new hospitals are often built to 'tried and tested' designs with water systems that are not necessarily fit for purpose.

What role could guidance play in improving hospital water systems?

Considerations about how pipes are laid are not sufficiently covered in HTM 04-0[1] or HSG274.[2] Both sets of guidelines do make some recommendations for healthcare settings but perhaps do not go far enough on the general design and configuration of water distribution systems. For example, there is nothing in the present guidance that tells WSGs they should consider locating hot and cold distribution services systems in separate, insulated conduits.

Consideration should also be given to the placement of cold-water storage tanks, calorifiers and heating systems in relation to each other. Even in relatively recently built hospitals, heating boilers and hot water calorifiers have been placed in the same plant room as cold water storage tanks. This happens because there is often a fundamental lack of understanding of the risks that elevated cold water storage temperatures can have for patients, in connection with *Legionella* in particular. Architects need training on these sorts of issues. Some preliminary training sessions, conducted by Dr Susanne Lee, have demonstrated that given the correct information, architects will come up with some very ingenious solutions for managing risk.

On the plus side, the Hospital Infection Society (HIS) is currently working on a guidance document, led by Dr Mike Weinbren, which will cover these issues and provide authoritative guidance on the matter of hospital water system design.

Does design also need to take into account hand wash basins?

Historically, hospital infection prevention and control professionals have battled to make sure there are enough hand washing facilities to ensure good hand hygiene. This has been an immensely important campaign, but, conversely, this has led to some hospital areas currently being over-provided. A step back is now needed to take human factors into account in order to gauge how these hand washing facilities are actually used. Specifically, we need to consider that certain outlets, perhaps because of their location, may be used less frequently than others, or hardly used at all because of over-provision.

In thinking through placement of hand wash stations, more consideration is needed of what other activities might take place around those areas. Splashes and aerosols from hand wash basins (HWBs) have been found to travel up to two metres from the water outlet. If an outlet is colonised with a waterborne pathogen, such as *Pseudomonas aeruginosa*, anything in that area has the potential to be contaminated with water from hand washing procedures, presenting a significant route of infection for potentially vulnerable patients.

The design of the outlets themselves can be significant here. For example, the new Contour 21+ HWB from Armitage Shanks has a fin moulded into the centre, which significantly minimises splashing.

As well as ergonomics and human factors, we also need to ensure that staff are washing their hands correctly, that the space around wash hand stations is kept clear or consider protective barriers to block the route of splashes onto equipment.

Credit — Dr Mike Weinbren

Splashing from sinks has the potential to contaminate anything in the immediate area

Conclusion

The design of healthcare water systems really needs a rethink. We need to consider the potential for growth of waterborne pathogens in hospital water storage and distribution systems and design them in a way that minimises this. We also need to take into account the number and types of water outlets that are actually needed and take into account human factors when deciding where to locate them. HSG274 recommends considering the installation of smaller, separate, more easily manageable water systems in high risk areas, yet this rarely happens. This might not work in every situation, but is at least worth thinking about.

Hopefully the new HIS guidance will influence future Department of Health and Health and Safety Executive (HSE) guidance so that designers and WSGs have a practical template that outlines how healthcare water systems could be designed better.

References

1. www.gov.uk/government/uploads/system/uploads/attachment_data/file/140105/Health_Technical_Memorandum_04-01_Addendum.pdf
2. HSG 274 Part 2: www.hse.gov.uk/pUbns/priced/hsg274part2.pdf

Armitage Shanks and Pall Medical Water Hygiene Masterclass

13 June 2018, Warwick University Conferences Centre

This conference offered a wide set of viewpoints regarding the management of water in healthcare, covering the many aspects required for an holistic water management plan. Contamination from waterborne bacteria such as *Legionella* and *Pseudomonas* were covered, as well as key aspects of their control.

Dr Christoph Koch gave a very interesting overview of the German legislative perspective, followed by **Elise Maynard** discussing the following UK aspects. There are a number of regulatory documents and guidance driving water management, such as the Health and Safety at Work Act, 1974, the Management of Health and Safety at Work Regulations, 1999, and the Control of Substances Hazardous to Health Regulations, 2002. These have some common aims such as:

- Conducting Risk Assessments (RA)
- Prevention or control exposure
- Maintaining, checking and testing control measures
- Provision of information, instruction and training

Other legislative drivers include the Corporate Manslaughter and Corporate Homicide Act, 2007, covering offences that only a company can commit. There have been 26 convictions to date (fines ranging from £8,000 — £1,200,000). The Health and Safety Sentencing Guidelines, 2016, have also resulted in significant multi-million fines and there have been a number of these related to poor *Legionella* control management, which are covered in our news story on page 5.

The Health and Safety Executive (HSE) have an Approved Code of Practice (L8) which is *Legionella* specific but essentially requires similar common aims to those listed above. The latest revision to L8 notes that Water Safety Groups (WSG) and Water Safety Plans (WSP) should be in place for healthcare premises.

Healthcare legislation is detailed within the Health Technical Memorandum 04-01, which has been updated from being specific to *Legionella* control to now encompass an overall water management plan. The principles related to the safety of healthcare estates and facilities are enshrined in the Health and Social Care Act, 2008 (Regulated Activities) Regulations 2014, specifically Regulation 12(2)(h) and Regulation 15 of the Act.

There are numerous other statutes and legal requirements that NHS organisations and their supporting professionals, contractors and suppliers must comply with. These are covered in the respective Health Building Notes (HBNs), Health Technical Memoranda (HTMs) and the NHS Premises Assurance Model (NHS PAM).

Many of the speakers referred to design and clinical practice and associated issues, for example contamination of taps and wash hand-basins (WHB). Dr Mark Garvey from Queen Elizabeth Hospital Birmingham (QEHB) was unashamedly enthusiastic about his interests, specifically regarding *Pseudomonas aeruginosa*, especially within augmented care areas. He began by describing the main culprit in the transmission of waterborne pathogens in water distribution systems, i.e. biofilm.

Service improvements have been demonstrated due to a new tap design — this research will be covered in detail in the next issue of Looking Deeper. Mark advised that water management requires an holistic approach, with engineering as one facet. Design and commissioning, correct use of WHBs and correct cleaning are also very important elements, and QEHB provide regular training and auditing for WHB cleaning. Mark advised that transmission is highly likely in adult intensive care and therefore there is a need for clinical RAs as there may be both direct and indirect transmission. There is also evidence of transmission in both directions from drains.

Dr Paz Aranega Bou and **Dr Ginny Moore** from Public Health England (PHE) gave two

complementary presentations, discussing the fact that *Carbapenemase Producing Enterobacteriaciae* (CPE) are now endemic in some countries, which is a real concern as bacteria can easily transfer resistance genes. Gram negative bacteria thrive in wet systems and the bottle-type waste trap, which is the most common type in the UK, seems ideally designed to trap water and thus promote bacterial growth. Biofilm is adapted to provide enhanced resistance to disinfectants and easy spread of resistance genes.

The research question was posed "Can CPE re-enter the clinical environment from a contaminated sink?" PHE created a model rig including clinical versus utility sinks. In addition they inspected several hospital WHB/sink waste pipes — many were contaminated with items such as vials, tissue paper and plastic. The trial demonstrated dominance of certain organisms, some that fluctuate and some transient organisms. It is possible that back flow from the drain may have led to cross contamination. There was also some evidence of gene transfer. It was emphasised that biofilm does not have to be visible to have high levels of contamination.

Paz showed some video clips to demonstrate the test rig in action i.e. good versus bad drainage. Agar plates were positioned around the wash hand basin or a cyclone air sampler was utilised to measure dispersal. There was significantly more dispersal when sinks were not draining. Clinical basins, however, were able to mitigate dispersal. There were up to a metre of settle plates on the floor, demonstrating a higher concentration of bacteria closer to sinks (up to a one metre dispersal). Clinical basins, however, showed a lower dispersal distance than sinks. It was concluded that appropriate disposal of liquid clinical waste is of paramount importance as CPE can re-enter the clinical environment.

Ginny discussed contamination of taps and tap components and data from the PHE's specialist rig. She reviewed the hand-washing recommendations for breaking the transmission pathway — 'Clean Hands Save Lives', which is very effective for organisms such as Clostridium difficile and Methicillin-Resistant *Staphylococcus aureus (MRSA)*. Unfortunately there is no real effect on *P. aeruginosa*, which poses the question: "What if water is the main vector?"

Legionnaires' disease is low in UK hospitals, which may indicate that water systems are well managed and makes it important to consider systemic versus

Elise Maynard

retrograde contamination. Some tap designs mean that handles can become contaminated, but sensor taps can prevent this. Thermostatic Mixing Valves (TMVs) are good for hand washing and mitigation of scalding, however they are potentially more complex and so more prone to contamination. PHE investigated typical taps with solenoids that were in contact with water and had an ethylene propylene diene monomer (EPDM) rubber diaphragm.
Data revealed that the removal or replacement of the solenoid resulted in *P. aeruginosa* elimination, which was immediate and sustained. Alternative designs incorporating nitrile or silicone diaphragms had no effect. Ginny discussed antimicrobial silver impregnation of some products, however this does not guarantee an antimicrobial surface and some fittings are already colonised when they arrive from suppliers. The subject of flow straighteners was covered and how they become contaminated through ineffective cleaning practices, incorrect disposal of waste and direct contact. Removal is not always practical and can result in slip risk. Some manufacturers have designed different outlets, all of which demonstrated a reduction in contamination. This research is covered in more detail on pages 10-12 of Looking Deeper Issue 2 (July 2018).

Dr Mike Weinbren gave a highly articulate summary of the issues of water hygiene in healthcare to close the day. He noted that micro-organisms have populated this planet for a lot longer than any other life-form and are highly adaptable. He also noted that there seems to be no centralised learning in hospital design. Antimicrobial resistance patterns are changing and carbapenemase enzymes are destroying our antibiotic options. He discussed the fact that contamination of water has often been reported throughout history e.g. John Snow's investigation of the Cholera epidemic in London's Soho. Joachim Kohn in 1967 identified sinks and drains as being a contamination source. Professor Kevin Kerr in 2009 observed that water contaminated with *P. aeruginosa* could contaminate patients and that despite attracting significant media attention,the neonatal outbreak in 2012 in Belfast was nothing new. He noted that *Legionella* has a regulatory responsibility chain but this is not the case for all waterborne organisms.

Mike also showed some attention-grabbing videos and described a study where a video camera placed above a WHB demonstrated that hand washing provided only 4% of the activity at the basin. Mike's own video of fluorescence showed that splashes were clearly visible, the volume and spread depending on the flow and position of hands. When he placed dye in the drain, back-flow was observed even after multiple tap runs. Time lapse photography showed splash up to two metres.

Mike concluded the day by questioning current hospital design and recognising some of the practical issues that can occur within healthcare. He advised that WSGs need to review blockages in order to determine patterns and trends. It is known that cancer patients lose hair and block drains, so therefore a redesign of shower drains may be appropriate. The WSP depends on hazard identification and a real need to have water hygiene risk assessments. A cross-functional WSG, including project teams and designers is essential for future hygienic design.

References

1. Garvey, M.I. et al "Tap out: reducing waterborne *Pseudomonas aeruginosa* transmission in an intensive care unit", *J Hosp Infect*, Jul 30. pii: S0195-6701(18)30404-3. doi: 10.1016/j.jhin.2018.07.039. [Epub ahead of print]

Dr. Mike Weinbren

Looking Deeper 3 abstracts

J Hosp Infect.

2018 May 29. pii: S0195-6701(18)30281-0. doi: 10.1016/j.jhin.2018.05.016. [Epub ahead of print]

Impact of the relocation of an ICU and role of tap water on an outbreak of Pseudomonas aeruginosa expressing OprD-mediated resistance to imipenem. Tran-Dinh A *et al.*

The aim was to assess the impact of the incidental relocation of an intensive care unit (ICU) on the risk of colonisations/infections with *P. aeruginosa* exhibiting OprD-mediated resistance to imipenem (PA-OprD) by comparing the proportion of PA-OprD among *P. aeruginosa* samples before and after an incidental relocation of the ICU. The role of tap water as a route of contamination for colonisation/infection of patients with PA-OprD was assessed as a secondary aim. A single-centre, observational, before/after comparison study was conducted from 10/2013 to 10/2015. The ICU was relocated at the end of October 2014. All *P. aeruginosa* positive samples isolated from patients that were hospitalized ≥ 48 hours in the ICU were included. Tap water specimens were collected every three months in the ICU. PA-OprD strains isolated from patients and tap water were genotyped using pulse-field gel electrophoresis. 139 clinical specimens of *P. aeruginos*a and 19 tap water samples were analysed. The proportion of PA-OprD strains significantly decreased from 31% to 7.7% after the relocation of the ICU (P=0.004). All PA-OprD clinical specimens had a distinct genotype. Surprisingly, tap water was colonised with a single PA-OprD strain during both periods, but this single clone has never been isolated from clinical specimens. The results demonstrated that relocation of the ICU was associated with a dramatic decrease in *P. aeruginosa* strains resistant to imipenem. The polyclonal character of PA-OprD strains isolated from patients and the absence of a tap water-to-patient contamination highlight the complexity of the environmental impact on the endogenous colonization/infection with *P. aeruginosa.*

Front Microbiol.

2018 May 3;9:879. doi: 10.3389/fmicb.2018.00879. eCollection 2018.

Long-term effects of residual chlorine on Pseudomonas aeruginosa in simulated drinking water fed with low AOC medium. Mao G, Song Y, Bartlam M and Wang Y.

Residual chlorine is often required to remain present in public drinking water supplies during distribution to ensure water quality. It is essential to understand how bacteria respond to long-term chlorine exposure, especially with the presence of assimilable organic carbon (AOC). This study aimed to investigate the effects of chlorination on *Pseudomonas aeruginosa* in low AOC medium by both conventional plating and culture-independent methods including flow cytometry (FCM) and quantitative PCR (qPCR). In a simulated chlorinated system using a bioreactor, membrane damage and DNA damage were measured by FCM fluorescence fingerprint. The results indicated that membrane permeability occurred prior to DNA damage in response to chlorination. A regrowth of *P. aeruginosa* was observed when the free chlorine concentration was below 0.3 mg/L. The bacterial response to long-term exposure to a constant low level of free chlorine (0.3 mg/L) was subsequently studied in detail. Both FCM and qPCR data showed a substantial reduction during initial exposure (0-16 h), followed by a plateau where the cell concentration remained stable (16-76 h), until finally all bacteria were inactivated with subsequent continuous chlorine exposure (76-124 h). The results showed three-stage inactivation kinetics for *P. aeruginosa* at a low chlorine level with extended exposure time: an initial fast inactivation stage, a relatively stable middle stage, and a final stage with a slower rate than the initial stage. A series of antibiotic resistance tests suggested long-term exposure to low chlorine level led to the selection of antibiotic-resistant *P. aeruginosa.* The combined results suggest that depletion of residual chlorine in low AOC medium systems could reactivate *P. aeruginosa*, leading to a possible threat to drinking water safety.

Safe water installation in healthcare

There are many examples of illness being caused by poor workmanship or a lack of knowledge on the part of a plumber. One such outbreak in 2010 left a number of householders suffering from vomiting and diarrhoea because of contaminated drinking water. The cause of this contamination was found to be a cross connection of the victims' domestic rainwater harvesting systems and their potable water supply. It appeared that these properties had new water supply connections installed, yet at the time of installation, no-one had asked these customers whether they had a built-in water recycling system in their home — and, consequently, no risk assessment was carried out to flag up that these addresses should be inspected by the water company.

Watersafe

Concurrently, Government concern over 'cowboy plumbers' introduced the concept of 'approved contractors'. However, this has not been particularly successful and the baton has been taken up by WaterSafe, an umbrella body which brings together the seven existing approved contractors schemes (see image).

"When you're looking for gas or electricity suppliers you will always check their qualifications before using a contractor," notes Stephen Kay, Chairman of WRAS, whose Water Industry Approved Plumbers' Scheme (WIAPS) scheme is one of the seven involved in WaterSafe. "Yet if you're looking for a plumber you can see a whole range of commercial brands but only registered Approved Contractor Schemes require a qualification to become part of that brand. The focus of these commercial brands is on customer re-dress and fair-trading, rather than qualifications and compliance with the regulations. Plumbers should be competent people with a duty of care similar to health and safety."

He noted that consumers often lack awareness or understanding of what makes a good plumber. And with widespread evidence of non-compliance with water regulations by installers and a confusing multiplicity of national schemes and acronyms, it is difficult to find a guaranteed reliable contractor.

This was the background leading up to the establishment of the Watersafe scheme, Kay said; to tighten compliance — and therefore public health and safety — and to make finding an approved plumber simpler for customers. To this end, Watersafe has developed a national plumbing approval scheme that provides recognition for designated competent plumbers and businesses and provides assurance of competency and compliance to consumers seeking water supply plumbing work. Members must be qualified to a minimum of NVQ Level Two in Plumbing or equivalent, possess a qualification demonstrating knowledge of water regulations, and have public liability insurance.

The scheme offers benefits to all parties involved by providing a nationally recognised brand for accredited tradesmen, assurance of competency to customers and, for the water companies, support for compliance with regulations. WaterSafe plumbers are audited for the compliance of their work to the Regulations.

How is Watersafe significant to healthcare?

Plumbing mistakes and bad planning around plumbing have the potential to cause significant problems. For example, ideal conditions for biofilm growth can be created by introducing deadlegs into a system or using the wrong sealants or inappropriate rubber and plastic hosing.

The Safe Water in Healthcare Premises Guidance HTM 04-1 (Part A) states clearly that: "As well as complying with the recommendations outlined in this document, the design and installation of the hot and cold water services, new or extended, in any healthcare premises should also comply with: the Water Supply (Water Fittings) Regulations 1999, Defra guidance and the recommendations of the water suppliers in the Water Regulations Advisory Scheme's (WRAS) 'Water Regulations Guide', and any other requirements of the local water undertaker" (1.10).

Yet there is currently no requirement both in terms of NVQs or CPD (continuing professional development) for plumbers to understand the issues around growth of *Legionella* and other bacteria in water systems. However, Stephen Kay emphasised that in future he would like to see both NVQs and CPD in these areas incorporated into the WaterSafe scheme.

WaterSafe®
LOCAL APPROVED PLUMBERS

WIAPS
WATER INDUSTRY APPROVED PLUMBERS' SCHEME

Supported by: WATER UK · WRAS · The Worshipful Company of Plumbers

Requirements under HTM 04-01 include:

1.11

"Where new healthcare premises are planned or existing premises are to be altered or refurbished, the WSG [Water Safety Group] should be consulted at the earliest possible opportunity and water risk assessments be completed for all projects."

1.12

At all stages of the design, installation and commissioning of new or extended water systems, the design team should liaise and consult with the local WSG in a timely manner, give consideration to HTM 04-01 Parts B and C and incorporate all operational managements requirement into their design.

1.14

All water fittings used in the construction of systems referred to in this HTM must comply with the requirements of the Water Supply (Water Fittings) Regulations 1999 (Regulation 4: "Requirements for water fittings") and if required be in accordance with relevant British Standards and codes of practice appropriate to their use.

For more information about WaterSafe, go to www.watersafe.org.uk

PALL Medical

Armitage Shanks

THE 11TH HEALTHCARE INFECTION SOCIETY INTERNATIONAL CONFERENCE (HIS)

ACC, Liverpool, UK
November 26th - 28th, 2018

Managing Hospital Water Hygiene

Monday,
November 26th
15.45 - 16.45
Room 3A

Chair: Dr. Susanne Lee, Leegionella Ltd

15.45 - 16.15
"Does it take a drought to save patient lives?"
Dr. Michael Weinbren, Infection Prevention,
King's Mill Hospital, Sutton-in-Ashfield, UK

16.15 - 16.45
"How to manage contaminated water outlets in the ICU"
Dr. Mark Garvey, Infection Prevention,
Queen Elizabeth Hospital, Birmingham, UK

WEBSITE
https://medical.pall.com

EMAIL
medical_info@europe.pall.com

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