Looking deeper

THE JOURNAL OF THE WATER SAFETY FORUM

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Advanced healthcare solutions from Armitage Shanks

The race to net zero

Looking Deeper Editor, **Susan Pearson**

While the international community gears up for the UN's latest COP 29 climate change conference in Azerbaijan in November, the NHS continues to work towards its carbon cutting commitments as laid out in 2022's 'Delivering a Net Zero National Health Service' document.

These targets (see Issue 14) inspired the discussion, in the context of healthcare water systems, at Armitage Shanks' recent fourth Water Safety Forum (WSF), which gathered a group of experienced insiders to explore the compatibility of carbon emission reducing and water sustainability measures with water safety. Strategies discussed included reducing energy use by dispensing with or reducing hot water storage (pp 5-9).

The yawning absence of data on water usage for flushing, and other activities, and potential digital solutions for monitoring was also highlighted — a theme expanded on in an interview with panel member Professor Elaine Cloutman-Green (pp 10-12).

This scheme, which originally aimed to deliver "40 new hospitals by 2030", is described as "a centralised programme to deploy a common set of design principles", known as 'Hospital 2.0', alongside "development and application of a common commercial and procurement strategy to achieve economies of scale and mitigate supply constraints."

Acknowledging that "each new hospital has the potential to cause serious harm" the NHP's mission has been put forward as a driver towards a safety culture across the build and lifecycle of a hospital: "the safety of patients must be the priority."

Yet, as the WSF panel emphasised, a standard design cannot be applied to every build.

The last issue of Looking Deeper explored what must be considered for the NHP to conceive designs that would deliver genuine improvement towards infection prevention and

> *"There is a significant requirement for knowledge [on patient safety in relation to water] to be enhanced across a broad range of professional groups, including architects, building contractors, healthcare engineers, facilities personnel, IPC personnel and healthcare professionals at all grades."*
>
> *Dr Chris Settle, Infection Control Doctor, on behalf of HIS*

The group notably concluded: "one size does not fit all"; and that retrofits of existing facilities would largely be impossible.

In this context the WSF participants repeatedly emphasised the importance of involving heathcare experts to inform the design process for completely new healthcare facilities. This is something that, crucially, needed to be addressed within the previous Government's New Hospitals Programme (NHP).

control (IPC). Since then, however, the advent of a new Government has changed the landscape. As it was, the NHP was already facing major challenges. It needed to change its focus towards re-building seven hospitals constructed largely or fully from dangerous reinforced autoclaved aerated concrete (RAAC). And it was also flailing under heavy criticism by a 2023 National Audit Office (NAO) report — which found that the (previous) Government had been slow to develop Hospital 2.0, and had "not [so far] achieved good value for money." The NAO also confirmed that 40 new hospitals could not now be delivered by 2030.

However, there has clearly been an enthusiastic welcome towards the idea of Hospital 2.0 from many quarters within the NHS — as evidenced in last issue's interview with Dr Shanom Ali of the London-based Environmental Research Laboratory (Issue 15, pp 6-9).

At the same time, the Healthcare Infection Society (HIS) is adapting its plethora of infection control training to take account of Hospital 2.0. As the NHP and Hospital 2.0 moves to adapt some of the ways hospitals are engineered alongside subsequent clinical practice to deliver better patient safety in relation to water and wastewater, IPC doctor, Dr Chris Settle commented:

"There is a significant requirement for knowledge on this topic to be enhanced across a broad range of professional groups... HIS is working with NHP to identify the requirements for this educational effort and aims to produce materials that will be useful in achieving the goal of enhanced knowledge... on the subject of water and wastewater as it relates to patient safety.

"This education is needed across the healthcare sector not only because of NHP, but outside that project as well. The principles of improved water and wastewater management will apply in all healthcare settings."

Now, at the time of going to press, the NHP is on hold while under review by the current Government — maybe this will allow a reset of ideas to incorporate all the learning from recent years.

Editorial Contributions

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 30 years and on waterborne infection and water management since 2010. She has been a frequent contributor to IHEEM's Health Estate Journal and WMSoc's Waterline.

Susan Pearson

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, a BSI committee member and was on the steering group for Department of Health HTM 04-01: Safe water in healthcare premises. Elise is a Fellow of WMSoc, IBMS, IHEEM and also of the Royal Society of Public Health (RSPH).

Elise Maynard

Mat is a journalist and writer, with over 25 years' experience of covering complex issues in local Government, science, manufacturing and healthcare. He has been working closely with Ideal Standard and Armitage Shanks, and its international parent company, for several years, supporting with everything from PR to technical writing.

Mat Croshaw

Professor Cloutman-Green is a consultant clinical scientist, an infection control doctor and Deputy Director of Infection Prevention and Control at Great Ormond Street Hospital in London. She also holds an honorary professorship at University College London as part of the Healthy Infrastructure Research Group and is chair of the Environmental Infection Prevention and Control Network.

Professor Elaine Cloutman-Green

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In the news...

ATMOSPHERIC SO_2 DROP MAY BE DRIVER IN LEGIONNAIRES' DISEASE RISE

Declining atmospheric sulphur dioxide levels are likely to be a factor in the global rise in Legionnaires' disease, according to University at Albany researchers.

The US study, published in PNAS Nexus, explored this connection, focusing on cooling towers, a common source of airborne *Legionella* bacteria. *Legionella* bacteria are sensitive to acidity, perishing in low-pH conditions. However, as sulphur dioxide emissions have decreased, atmospheric pH levels have risen, allowing *Legionella* in cooling tower droplets to survive longer, so increasing their spread.

The study found that cases of Legionnaires' disease, which have increased nine-fold in the US since 2000, are particularly high in north-eastern states, especially New York. Researchers mapped disease incidence against cooling tower locations, finding a significant correlation between proximity to them and increased disease risk, extending up to 7.3 km.

The findings underscore the importance of regular monitoring, testing and cleaning of cooling towers to prevent *Legionella* outbreaks. While reducing pollution remains crucial for public health, the study has highlighted the need to address the unintended consequences, such as the increased survival of *Legionella,* to protect vulnerable populations.

Co-lead author Fangqun Yu likened the team's findings to understanding the side effects of a life-saving medication. "Our study is an attempt to identify such side effects, which can help inform strategies to mitigate them while maintaining air quality and its many benefits."

Major new estates guidance on non-tuberculous mycobacteria

NHS England has just released new technical guidance for estates teams to address design that could enhance risk from non-tuberculous mycobacteria (NTM) and other waterborne pathogens. NHS Technical Bulletin (NETB) No.2024/3 "Designing safe spaces for patients at high risk of infection from non-tuberculous mycobacteria and other waterborne pathogens" was published at the end of August – and is the first of a series of important new updates to HTM 04-01.

This new document was developed to enhance the current (2016) HTM 04-01 following an outbreak of the NTM *M. abscessus* associated with a newly constructed lung transplant unit and the subsequent publication of a coroner's prevention of future deaths report in 2022.

The bulletin "aims to ensure that the design, construction and operation of new specialised wards/units, or major refurbishments of existing clinical spaces intended for patients at high risk of healthcare-associated infections (HCAI), do not cause harm from exposure to water, sprays or aerosols derived from water, wastewater systems and associated equipment."

It focuses on making sure that healthcare buildings are safe for this group of patients in particular, "rather than simply giving guidance on how to comply with the prescriptive requirements of standards and guidance."

NET ZERO, THE NHS AND SAFE WATER DELIVERY

How can the drive to net zero in the NHS be compatible with safe water delivery?

This was the question posed to a panel of specialists at Armitage Shanks fourth Water Safety Forum (WSF) held in London in July to discuss what interventions and innovations might be needed and could be developed by industry in order to reach the targets laid out in NHS England's "Delivering a 'Net Zero' National Health Service."[1] As we have reported previously in Looking Deeper (see Issue 14, Autumn 2023), this 2022 document, which followed on from the 2020 launch of the pioneering 'Greener NHS Programme', has set out ambitious targets in response to the NHS's remarkable CO_2 burden — believed to be around 4% of the UK's total emissions. These key aims are hugely challenging:

- To reach net zero by 2040 for all emissions directly controlled by the NHS (referred to as the NHS's carbon footprint), with an ambition to reach an 80% reduction by 2028 to 2032.
- NHS Carbon Footprint Plus: to reach net zero by 2045 with regards to the emissions that the NHS can influence, with an ambition to reach an 80% reduction by 2036 to 2039.

In addition, the Health and Care Act of 2022[2] has also updated the NHS constitution to place new duties on all NHS England Trusts, Foundation Trusts and Integrated Care Boards: to take action on statutory emissions and environmental targets by building resilience and adaptation into NHS processes. In order to deliver net zero decarbonisation, key opportunities — and challenges — for NHS decarbonisation would include the supply chain for pharmaceuticals and medical devices, travel and estates and facilities, with the hospital environment providing scope for some of the greatest reductions.

The constant consumption of huge volumes of water also represents an enormous challenge to the overall sustainability of the NHS. While not strictly within the remit of the NHS's drive to net zero, this issue has been poorly defined as the associated energy use has not been adequately identified from source to tap. In 2021/2022 alone, the NHS is believed, according to ERIC (NHS England Digital: Estates Returns Information Collection), to have consumed 14,000,000 litres, while water and waste and building energy contribute around 15% towards the total carbon footprint across both secondary and primary care estates.

So how to decarbonise?

The WSF panel were presented with a series of questions to consider — stimulating a lively, far-reaching discussion and leading to interesting and constructive interactions between participants. To ensure we report back the key points, this article highlights part of the discussion initiated by several of these questions; the remainder of the panel's thoughts will be reported in the next issue of Looking Deeper in spring 2025.

An absence of data

A major point immediately highlighted by the group was the ERIC estimation of NHS water usage: since this figure appears to be based only on hot water usage per in-patient bed, this was considered likely to be a huge under-estimate, perhaps nearer to 1,000,000,000 litres per year if based on the NHS 2021/22 £260 million water and sewage bills.

Prevention of water stagnation is a crucial element of infection control to prevent the build-up of waterborne pathogens in water systems, making it probable that two thirds of actual cold water usage might be described as 'wastage' from flushing. But what is meant by 'wastage'?

This was debated at length: water is needed to flush, but how much flushing is needed? Taps that are used regularly don't need flushing, but those not often used do need extra water movement.

This certain under-estimate of NHS water usage led the group to an emphatic discussion on the yawning absence of data — both of water usage and CO_2 emissions from energy consumption. This is a serious consideration: Trusts use different methodologies to log data — that is if they can keep track of which outlets are flushed and how often. Without reliable data how can estates and clinical teams work out where and how to make savings? Without usage data how would it be possible to compute how much of this might be wastage?

For example, if good flushing data were available, it would be possible to remove some time from flushing protocols, saving both on cleaners' time and water usage.

Panel member Professor Elaine Cloutman-Green of Great Ormond Street Hospital discusses the difficulties of capturing data, ideally in real time, in some detail in the following interview (see pp 10-12). In particular she emphasises the need for innovative smart tap technology that would identify tap usage, with a "technologically-enabled flush" for under-used outlets.

In this context, Steve Vaughan, Technical Director for AECOM, described a project to identify the effectiveness of using remote sensors to map water movement and temperature in line with guidance across a large heathcare water system. This revealed: *"Flushing is the most expensive and labour intensive process that there is… looking at the locations that the Trust actually had to flush, there were hours and hours of work just on flushing… So reducing that [need for flushing] not only reduces the carbon element, but as long as appropriate flushing is [carried out]… we can still maintain safety while reducing labour costs."*

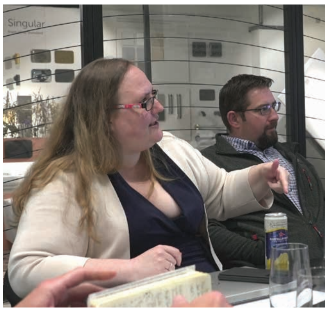
Authorising Engineer Stephen Van De Peer concluded: *"Ultimately, I think we can reduce tap flushing, but…we do not have the data at this point to be able to actually influence flushing. And once we know what is wasted and what isn't wasted, then we can actually target that."*

Going waterless

Independent consultant on the healthcare built environment, Alyson Prince, raised an issue much under discussion by the water hygiene industry: reducing numbers of water outlets, particularly in areas with the most vulnerable patients, such as augmented care units — in order to reduce the risks from water and also to save on water usage and energy to heat that water. She noted: *"Everybody's trying to take hand wash basins out of the clinical environment — but this seems to be a knee-jerk reaction in how to manage and maintain water safety… because then we don't have to think about it because the problem has [apparently] been removed, except that it hasn't."*

In this context, Stephen Van De Peer and Professor Cloutman-Green both emphasised the importance of understanding how people actually use hand wash basins. More recognition would lead to design of facilities and fewer potentially stagnant little-used outlets.

Alyson Prince emphasised the importance of mapping risk department by department. However: *"The problem is that decisions get made for buildings long before people actually come into that space and use the building… There's a disconnect between those two factors in terms of there being nobody at the front end of the design thinking about how the clinical team [in any given particular] area will use the outlets in that area."*



> *"Are we designing for reality or are we designing for the ideal?"*
> *Professor Elaine Cloutman-Green*

Could it be viable to dispense with hot water storage facilities?

While flushing is a key infection control mitigation measure, hot water is the fundamental mainstay in controlling the major challenge of water safety in healthcare — with heating needed to temperatures of 60°C or higher to kill bacteria such as *Legionella*. To date water is often heated by energy-hungry gas fired boilers and then stored in large calorifiers. But is all this hot water essential? Is this an area where energy use — and therefore CO_2 emissions — could be reduced? What options might there be to reduce hot water usage?

Alyson Prince highlighted how difficult it can be to balance a huge system at the commissioning phase and get the correct pressures throughout a large building: *"The process of balancing [can] end up stagnating some of the water in the system, or reducing or increasing the temperature range. And that's when you get biofilm growth colonising the system. So people are focused on flushing… [but could we] actually go back a step and think about how we manage the system when we are filling it, such as trying to maintain two large water storage tanks?"*

Richard Wainwright, Programme Manager for CBRE and a senior Authorised Person for water, also highlighted: *"If you've got a system where you've got two calorifiers in parallel and one of them can support the building, by definition your system is 50% over size or 100% over size."* The panel considered that it could be possible to dispense with major hot water storage in calorifiers to reduce energy use for heating — in certain situations. Options could include smaller localised water circuits with their own heating loops, point-of-use water heaters and air source heat pumps.

However, they noted that these solutions would be difficult to introduce into existing hospitals — but could certainly be considered in new wings and new buildings within existing Trusts. They emphasised the importance of expert design for completely

Continued overleaf >

Water Safety Forum Panel

Elise Maynard — Chair

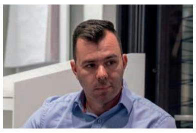
Independent consultant to the water and medical devices industries, state registered microbiologist and a Director of the Water Management Society (WMSoc).

Peter Orendecki

Contract and Support Manager for Water, University Hospital Southampton NHS Foundation Trust.

Alyson Prince

Formerly NHS Infection Control Nurse Specialist in the built environment, now an Independent Infection Prevention and Control Nurse Consultant in the healthcare built environment.

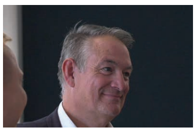


Steven Van De Peer

Head of authorised engineer services at Tetra Consulting. Authorised engineer for water, WMSoc Council member, lead author of CIBSE KS21 rewrite.

Professor Elaine Cloutman-Green

Consultant clinical scientist, Deputy Director of Infection Prevention and Control at Great Ormond Street Hospital, London, honorary professor at University College London.

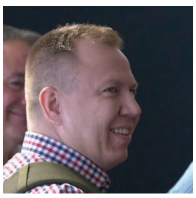


Greg Markham

Estates and Assets Director at Serco Health, Chartered Engineer and Estates professional, past president of IHEEM.

Steve Vaughan

Technical Director for AECOM, lead for the Public Health, Engineering and Fire Protection team, technical standards and general policies, past chair of CIBSE (SoPHE), Society of Public Health Engineers. Lead author for CIBSE Water services section (chapter 2) of Guide G.



Richard Wainwright

Programme Manager for CBRE, a Senior Authorised Person within the business unit, overseeing all things water. Background as water treatment engineer and heating and ventilation engineer.

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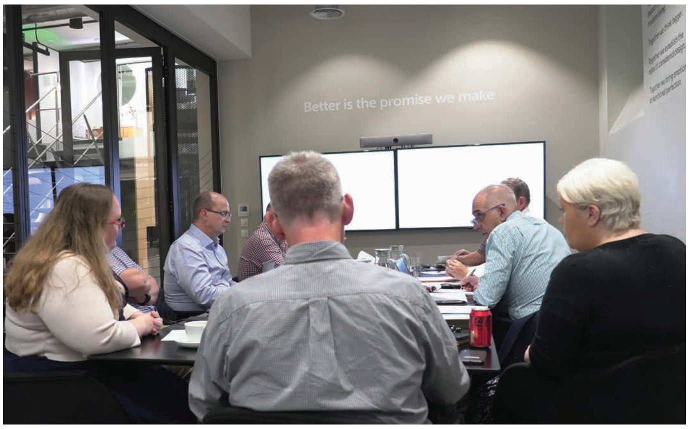

new healthcare facilities — although with a new Government, at the time of going to press, there is now uncertainty over the development of those that may have been in the pipeline through the previous New Hospitals Programme.

There was also concern about resilience if large scale storage capacity is removed since HTM 04-01 guidance states a requirement for a nominal capacity for 12 hours storage of water on site.

Would smaller localised water circuits with localised heating loops be more cost-effective?

Richard Wainwright highlighted that small localised heating loops or satellite systems with small hub sets would require less monitoring, which would reduce some facilities management costs.

> ***"Keep it clean, keep it cold, keep it moving, and heat only where needed."***
> *WSF consensus*

Moving away from huge centralised hot water systems would be entirely viable according to Steven Van De Peer and could be achieved by fitting individual wards with plate heat exchangers. He described how this could work with smaller hot water loops per ward or for two wards off plate heat exchangers:

"Rather than having centralised hot water storage and loads of little tertiary loops that all have to be balanced... I'm much more in favour of having smaller satellite loops around areas that even with linear drops that don't have returns on them for the hot water system can be just fed by cold water, which gives great usage across the cold, to all the different areas."

Greg Markham, Estates and Assets Director at Serco Health, noted that the small size of some plate heat exchangers provides scope for fitting them into ceiling voids.

A small primary storage and distribution system or network could work from these hubs and reach each individual area, eliminating the need for tertiary loops. This would come back to design, perhaps designed with the plant room external from the ward, but feeding the ward.

The group agreed that these smaller decentralised systems would certainly be an option for new facilities and refurbishments, but would be too disruptive to fit into an existing working hospital.

However, Peter Orendecki, Contract and Support Manager for Water at University Hospital Southampton, still felt that such a system might have the potential to work in an existing hospital: *"as long as you can put your primary supply to what's going to feed [the] heat exchanger and... if there is a [suitable] connection into the existing pipework."*

Is the use of instant hot water heaters at point of use practical and viable?

The panel considered that instant hot water heaters would be practical and viable in certain locations, with induction heating of a single cold water pipe to the temperature required by the guidelines. The actual capacity that could be supplied would need to be measured against a hospital's existing hot water system capacity.

However, they had certain provisos:

- The new pipework must not create dead-legs, which could cause stagnation and biofilm build-up when not in use.
- Potential compatibility issues with thermostatic mixing valves (TMVs). Richard Wainwright noted: *"They will need to be adjusted for healthcare usage so that they can't heat water above a TMV-suitable temperature."*
- Will they heat fast enough to reach the required water temperatures?
- Failure of the life cycle of the equipment.
- A localised circuit may not have enough capacity to deal with a surge of hot water usage.

Steven Van De Peer also highlighted: *"We have to stick to the HTMs and HBNs... [but] we now have a requirement*

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...to go back to the design concept, ... to formally derogate to NHS England every time we're moving away from guidance... [so] it's almost ludicrous then at this point that we're having to formally derogate away from guidance that is out of date in the first place."

No one size fits all

The discussion also focused on digital innovation and other technical fixes that might facilitate the removal of stored hot water or reducing heating to lower temperatures. These will be explored in Part 2 of our Water Safety Forum coverage, and will look at: air source heat pumps, copper/silver ionisation, other biocides, heat pumps and solar.

Overall, the panel were clear that there won't be any one solution that fits all healthcare environments. Every different patient population will have different needs and different risks, and what the risk assessment might want to address in one unit could be very different in another.

They also highlighted the contradiction that sometimes systems can become complicated in reaching for de-carbonisation goals, and therefore the importance of looking back to the HTM guidance that instructs on avoidance of over-complication of systems.

Whatever solutions might be adopted to reduce water heating, there was a consensus mantra the group came up with: ***keep it clean, keep it cold, keep it moving, and heat only where needed.***

Dates for diaries...

Heathcare Estates
8-9/10/2024 Manchester, UK
www.healthcare-estates.com/

IFHE (International Federation of Healthcare Engineering) 2024
15-17/10/2024 Cape Town, S.Africa
sbs.co.za/ifhe2024/

ESGLI (ESCMID Study Group for *Legionella* Infections) 2024
24-25/10/2024 Dresden, Germany
esgli.info/

IWA Biofilms 2024 Conference
24-26/10/2024 Shanghai, China
iwabiofilm2024.tongji.edu.cn

CIBSE Build2Perform Live
13-14/11/2024 London, UK
build2perform.co.uk/

FIS/HIS International Conference 2024
20-24/11/2024 Liverpool, UK
his.org.uk/training-events/fis-his/fis-his-2024/

London Climate Show
27-28/11/2024 London, UK
climatetechshow.com

World Plumbing Day
11/03/2025 Global
worldplumbing.org/worldplumbingday/

World Water Day
22/03/2025 Global
un.org/en/observances/water-day

IPC Conference 2025: Identify, protect, contain
29-30/04/2025 Birmingham, UK
infectionpreventioncontrol.net/

References

1. NHS England: "Delivering a 'Net Zero' National Health Service," 2022.
2. Health and Care Act, 2022: legislation.gov.uk/ukpga/2022/31/contents

The July 2024 fourth Water Safety Forum took place at Ideal Standard's London Design and Specification Centre as part of Armitage Shanks' 'Thought Leadership' programme — which aims to facilitate conversations between users and industry on areas of concern to together develop ideas for the marketplace.

THE NUMBERS GAME: why we need more data in order to cut carbon

Mat Croshaw talks to Professor Elaine Cloutman-Green about water usage in the NHS and infection prevention and control in the context of delivering against net zero targets.

Professor Cloutman-Green is a consultant clinical scientist, an infection control doctor and Deputy Director of Infection Prevention and Control at Great Ormond Street Hospital in London. She also holds an honorary professorship at University College London and is Chair of the Environmental Infection Prevention and Control Network.

Introducing herself at the latest Water Safety Forum (WSF) — which asked the question *"How can the drive to net zero in the NHS be compatible with safe water delivery?"* — Professor Cloutman-Green wrapped up by saying" *... so I care quite a lot about water, the environment and infection control. "* The "quite" is clearly an understatement. Her passion, commitment and knowledge come across very clearly as she talks about the role changes to water usage have to play in cutting carbon emissions in the NHS. We are talking a week after the WSF took place, going into greater depth about some of the views Professor Cloutman-Green expressed during the discussions.

As described in the main WSF report (see pp 5-9), the NHS is officially estimated to be responsible for around 4% of the UK's total CO_2 output — with the NHS "Delivering a Net Zero National Health Service" report setting out its aim to achieve net zero by 2040 for the emissions the NHS controls directly. Use of water in general, and heating it in particular, makes a very significant contribution to the NHS carbon footprint. A clear opportunity for lowering carbon emissions relates to flushing, which was discussed in detail at the WSF.

How important is this to patient safety?

"If you have an established system with biofilm in it, you can put any biocide you like in it but that's only going to take out the top layer. Flushing means that you get a shearing action to get rid of the biofilm but also the flushing means you keep the water moving, which is important in infection prevention and control.

"Flushing is a big use of water, especially if you're doing it to taps and other outlets that are already being used a lot, which effectively makes it a waste. But then to work out which outlets aren't being used a lot, someone has to go around and identify whether there has been a patient in there in the past 24 hours, stand there for three minutes while it's flushing and then turn it off. Just one of the buildings I have responsibility for has 900 taps. If each one is flushed for three minutes every day, that's a lot of time and a lot of water.

> *"The problem is that we don't have the data to make informed decisions... In this digital age we should have that granular data."*

"Then there's the issue of assurance. Even if you believe it has been done, you don't have any real confirmation; no way of checking. You can look at changes in use patterns in the building but that doesn't tell you where in the system it hasn't been done."

A problem of data

"If we want to reduce water wastage and therefore our carbon emissions, we need to understand what we use.

You can't get the wastage data until you have the usage data. Then you can work out what you quantify as wastage and what you quantify as risk management.

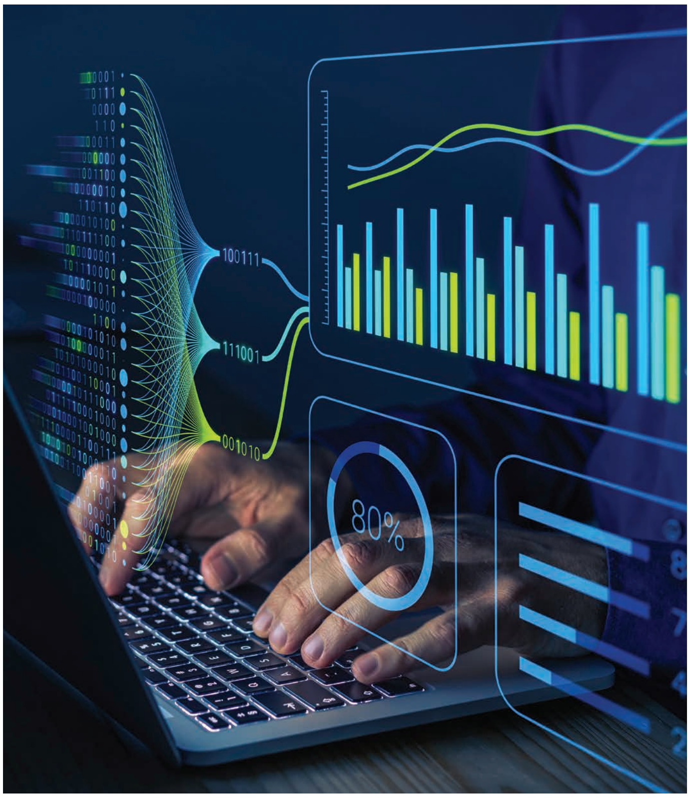
"We certainly can't remove the need for flushing. The problem is that we don't have the data to make informed decisions. If we knew how much was waste, we could work out very quickly how we could cut that out."

The need for innovation

What data would you like to have? Obviously, there is such a thing as too much data.

"I want a tap that records use, auto-flushes if it hasn't been used in the past 24 hours and reports back that it has done it. I also want that data in a dashboard that I can report to my Water Safety Group. That's all!

"This is where innovation would be really helpful. I've spent ten years trying to find a tap that will do those things, and without that data, it's impossible to make evidence-based decisions."



But we also need a change of attitude when it comes to how we think about data. Data is only as valuable as the meaning people give to that data and the value they attach to it. Estates and facilities have access to immensely important data. We need people to understand the importance of that data in order to be able to change the conversation.

Barriers to change

Huge changes are obviously needed in order to enable the NHS to reach net zero. Looking at water as one area of many, it's clear there's a lot to do.

"The kinds of measures proposed are not going to be achieved with the existing estate. This will need to be included in new build hospitals.

"Retrofitting energy efficiency and bacteria prevention measures into existing infrastructure is likely to be more expensive and less effective. Building new hospitals provides an opportunity to build these kinds of measures into the specification right at the beginning."

What do you see as the barriers to change?

"Cost is obviously the main issue. At the moment, no-one is specifying anything that's not absolutely necessary. It's a race to the bottom when it comes to tendering."

You have said that "data moves much faster than the guidance." Can you expand on that further?

"We are basing designs on HTMs that are based on research from a few years ago, but our data collection runs at a much faster rate than our guidance. I have risk-based data that's in papers and the conversations that we have in outbreaks, and that moves much faster than HBNs and HTMs.

"We need to be using recent research in the design process. Everything we design is old before we've even broken ground because we are not bringing that innovation piece into what we are doing."

What we also need to do is have innovation embedded within this process, and that is never going to come from the guidance. If guidance is only ever updated every five to ten years, and it takes two years to write a guidance document, the minute it's available it's already seven years out of date.

You talked in the WSF about "being brave" in terms of making change.

"Currently, we're looking too often at the small picture; the low hanging fruit; the changes in the way we buy things, for example. If you change the way you're buying things, you make the decision to buy a certain product from a certain supplier and that has an effect now and for the amount of time that particular thing lasts. Then you have to make the same decision in a few months or you're relying on a colleague to make the same decision.

This has to happen for hundreds of buying decisions over several years to add up to an impact of a reasonable size in terms of carbon emissions.

"I think sometimes there's a need to be braver about the commitment we're making. If you're making changes in the way a building is designed and therefore used, you are committing to a change that will last for decades."

Bringing people together

How do we enable these big changes?

"We are not doing a good enough job of bringing different people into this space, pooling the thinking that already exists, to talk about change. We need to bring in people who do research and do cross-disciplinary thinking. I think there's a lot of space for innovative thinking. Some of it is actually straightforward if you have the right people in the conversation.

"In health, an architect can say 'this is going to be the main door.' But colleagues will always use the door that makes the most sense to them in terms of how far they have to walk. We do the same with sinks and other things. We put them on a footprint when we are [creating] a design, but we don't actually do that piece on human behaviour, thinking about visibility, cognitive load and what people will actually be doing in [any] space?

"We also have a lot of guidance written by people who don't work in a clinical space. We need cross-disciplinary involvement right from the beginning."

ANTIMICROBIAL RESISTANCE

by Elise Maynard

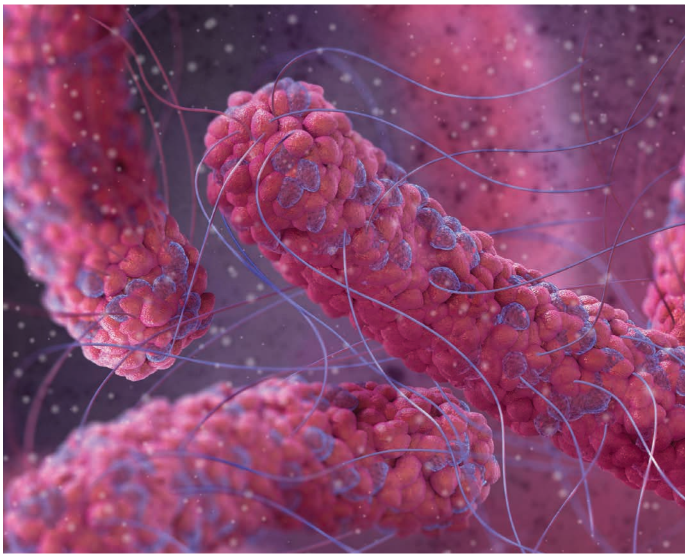
A recent search on Pubmed using the search terms "antimicrobial resistance and hospitals" yielded approximately 5000 results over the past year alone. Antimicrobial resistance (AMR) is one of the top global public health threats – it is estimated that in 2019 alone bacterial AMR was directly responsible for 1.27 million deaths and contributed to 4.95 million deaths globally.[1]

In addition to death and disability, AMR has significant economic costs. The World Bank estimates that AMR could result in US$ 1 trillion additional healthcare costs by 2050, and US$ 1 trillion – US$ 3.4 trillion gross domestic product (GDP) losses per year by 2030.[2]

The main drivers for increases in AMR pathogens are mis- and overuse of antimicrobials in humans, animals and crops. This affects all countries, all regions and all income levels and is further exacerbated by poverty. This leads to subsequent risks: that infections are harder to treat, while research into new antibiotics is wholly inadequate. Addressing AMR is a complicated task, including the appropriate use of antibiotics, better surveillance and more research and development (R&D) into antimicrobials, including diagnostics and vaccines.

Updated WHO Bacterial Priority Pathogens

The World Health Organization (WHO) has recently released its updated Bacterial Priority Pathogens List (BPPL) 2024,[3] featuring 15 families of antibiotic-resistant bacteria grouped into critical, high and medium categories for prioritisation. This incorporates new evidence and expert insights to guide R&D for new antibiotics and to promote international coordination to foster innovation. Carbapenem-resistant *Pseudomonas aeruginosa* is listed as 'High Priority.'



UK five-year plan on AMR

In the UK, the previous Government announced a new five-year plan[4] to combat AMR (published 8th May 2024), which introduces several themes:

- Theme 1 – Reducing the need for, and unintentional exposure to, antimicrobials
- Theme 2 – Optimising the use of antimicrobials
- Theme 3 – Investing in innovation, supply and access
- Theme 4 – Being a good global partner.

This aims to support the UK Government's 20-year vision to contain and control AMR by 2040 and is utilising lessons learned from Covid-19 by strengthening surveillance of drug-resistant infections before they emerge and by incentivising industry to develop the next generation of treatments.

One key initiative is the expansion of the world's first 'subscription model' for antimicrobials. Launched as a pilot in 2019, the model pays companies a fixed annual fee based on the value of their antimicrobials to the NHS, rather than the volume used. This approach aims to encourage innovation and ensure a steady supply of effective treatments.

Microbiology vision statement

The Microbiology Society have taken up this challenge by creating a vision statement,[5] which aims to guide their members to find and promote effective solutions to minimise AMR through cross-disciplinary and multi-sector collaboration worldwide within a 'One Health'[6] context.

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Recent AMR abstracts >

J Infect Public Health.

2024 Jul 17(7):102469. doi: 10.1016/j.jiph.2024.102469. Epub 2024 May 31. PMID: 38838607.

Antibiotic resistance pattern of waterborne causative agents of healthcare-associated infections: A call for biofilm control in hospital water systems.

Gholipour S, Nikaeen M, Mohammadi F and Rabbani D.

The study aimed to investigate the presence of clinically relevant opportunistic bacteria and antibiotic resistance genes (ARGs) in hospital water distribution systems (WDSs). Water and biofilm samples (n = 192) were collected from nine hospitals in Isfahan and Kashan, located in central Iran, between May 2022 and June 2023. The samples were analysed to determine the presence and quantities of opportunistic bacteria and ARGs using cultural and molecular methods. *Staphylococcus spp* were highly detected in WDS samples (90 isolates), with 33% of them harbouring mecA gene. However, the occurrences of *E. coli* (1 isolate), *Acinetobacter baumannii* (3 isolates), and *Pseudomonas aeruginosa* (14 isolates) were low. Moreover, several Gram-negative bacteria containing ARGs were identified in the samples, mainly belonging to *Stenotrophomonas*, *Sphingomonas* and *Brevundimonas* genera. Various ARGs, as well as *intI*1, were found in hospital WDSs (ranging from 14% to 60%), with higher occurrences in the biofilm samples. Our results underscore the importance of biofilms in water taps as hotspots for the dissemination of opportunistic bacteria and ARG within hospital environments. The identification of multiple opportunistic bacteria and ARGs raises concerns about the potential exposure and acquisition of HAIs, emphasising the need for proactive measures, particularly in controlling biofilms, to mitigate infection risks in healthcare settings.

Clin Microbiol Infect.

2024 May 15:S1198-743X(24)00242-8. doi: 10.1016/j.cmi.2024.05.008. Epub ahead of print. PMID: 38759869.

Controlling the hospital aquatic reservoir of multidrug-resistant organisms: a cross-sectional study followed by a nested randomised trial of sink decontamination

Catho G *et al*

The hospital water environment is an important reservoir of multidrug-resistant organisms (MDROs) and presents a risk for patient safety. This study assessed the effectiveness of thermal and chemical interventions on sinks contaminated with MDRO in the hospital setting. A cross-sectional assessment was conducted of MDRO contamination of sinks and toilets in 26 clinical wards of a tertiary care hospital. MDRO-contaminated sink traps were then replaced and randomised (1:1:1) to receive chemical (sodium hypochlorite), thermal disinfection (steam), or no intervention. Interventions were repeated weekly for four weeks. Sinks were re-sampled seven days after the last intervention. The primary outcome was the proportion of decontaminated sinks. MDROs of interest were extended spectrum beta-lactamase (ESBL) producing and carbapenemase-producing *Enterobacterales*, and non-fermentative Gram-negative bacilli. In the cross-sectional assessment, at least one MDRO was identified in 258 (36%) of the 748 samples and in 91 (47%) of the 192 water sources. In total, 57 (42%) of the 137 sinks and 34 (62%) of the 55 toilets were contaminated with 137 different MDROs. The most common MDRO were ESBL *Enterobacterales* (69%, 95/137), followed by Verona Integron-Borne Metallo-b-Lactamase (VIM) carbapenemase producing *Pseudomonas aeruginosa* (9%, 12/137) and *Citrobacter* spp. (6%, 5/137). In the nested randomised trial, five of the 16 sinks (31%) in the chemical disinfection group were decontaminated, compared with 8 of 18 (44%) in the control group (OR 0.58; 95% CI, 0.14e2.32) and 9 of 17 (53%) in the thermal disinfection group (OR 1.40; 95% CI, 0.37e5.32). Our study failed to demonstrate an added benefit of repeated chemical or thermal disinfection, beyond changing sink traps, in the MDRO decontamination of sinks. Routine chlorine-based disinfection of sinks may need to be reconsidered.

J Hosp Infect.

2024 May 11:S0195-6701(24)00167-1. doi: 10.1016/j.jhin.2024.04.021. Epub ahead of print. PMID: 38740300.

Hospital water environment and antibiotic use: Key factors in a nosocomial outbreak of carbapenemase-producing *Serratia marcescens*

Kim UJ *et al*

The healthcare water environment is a potential reservoir of carbapenem-resistant organisms (CROs). Aim: To report the role of the water environment as a reservoir and the infection control measures applied to suppress a prolonged outbreak of *Klebsiella pneumoniae* and carbapenemase-producing *Serratia marcescens* (KPC-SM) in two intensive care units (ICUs). The outbreak occurred in the ICUs of a tertiary hospital from October 2020 to July 2021. Comprehensive patient contact tracing and environmental assessments were conducted, and a case-control study was performed to identify factors associated with the acquisition of KPC-SM. Associations among isolates were assessed via pulsed-field gel electrophoresis (PFGE). Antibiotic usage was analysed. The outbreak consisted of two waves involving a total of 30 patients with KPC-SM. Multiple environmental cultures identified KPC-SM in a sink, a dirty utility room, and a communal bathroom shared by the ICUs, together with the waste bucket of a continuous renal replacement therapy (CRRT) system. The genetic similarity of the KPC-SM isolates from patients and the environment was confirmed by PFGE. A retrospective review of 30 cases identified that the use of CRRT and antibiotics was associated with acquisition of KPC-SM ($P < 0.05$). There was a continuous increase in the use of carbapenems; notably, the use of colistin has increased since 2019. This study demonstrates that CRRT systems, along with other hospital water environments, are significant potential sources of resistant micro-organisms, underscoring the necessity of enhancing infection control practices.

More AMR 'Latest research' Pg 16 >

Understanding pressure balancing valve technology in healthcare

A planned update to HTM 04-01 is expected to continue to permit the use of manual valves, which would include Pressure Balance Valve (PBV) taps, in appropriate healthcare settings.

The adoption of manual valves and taps is subject to risk assessment. Where there is a risk of full immersion or where the critical care of the very young or elderly is involved, a thermostatic mixing valve (TMV) should be used. The aim is to cut the cost of initial installation and commissioning, while also reducing the ongoing maintenance costs for facilities management.

In light of this change how do PBV and TMV technology compare? And when might PBVs be the appropriate choice for healthcare settings?

How does PBV technology work?

A PBV maintains a consistent water temperature at the tap outlet by adjusting to changes in water pressure.

A sudden drop in pressure in either water supply will prompt the PBV to automatically adjust the flow from the other supply to keep the temperature stable — using a "sleeve and shuttle" mechanism inside the valve to control the amount of hot and cold water mixed together.

When a pressure change is detected, the shuttle moves within the sleeve to adjust the water flow, ensuring the outlet temperature remains relatively consistent.

If the cold water supply fails, the hot water flow is quickly reduced to prevent scalding. The reverse happens if hot water pressure drops.

Comparing PBVs and TMVs

Thermostatic mixing valves (TMVs) provide precise temperature control by mixing hot and cold water to a pre-set temperature, regardless of inlet temperature and pressure changes.

They remain the gold standard in terms of safety, especially in environments where patients may be vulnerable to scalding. They are ideal for areas where maintaining a specific water temperature in the critical care of patients is required.

However, TMVs require regular maintenance, as per NHS guidelines (HTM 04-01: D08), which can be costly and time-consuming, especially in large facilities.

Whilst all water outlets require regular maintenance, PBVs do not need the stringent servicing required for TMVs, which can lead to significant cost savings in facilities management. While not offering the same level of precision in temperature control as TMVs, PBVs are effective at preventing scalding, particularly in environments with fluctuating water pressures.

When are PBVs appropriate in healthcare settings?

PBVs can be a suitable choice in healthcare environments that have been thoroughly risk-assessed for scalding and where, unlike in critical care areas, the water temperature does not need to be controlled as precisely as with TMVs. They are particularly useful in areas where water pressure fluctuations are common.

Proposed HTM changes

The proposed changes to the Health Technical Memoranda (HTM) in 2025 are expected to be outlined in the updated HBN 00-10 Part C. While the full details are yet to be finalised, the anticipated changes include:

- Increased focus on manual tap technology as a viable alternative to TMVs in certain healthcare settings
- Enhanced safety standards for the installation, operation and monitoring of both TMVs and PBVs, particularly regarding scald prevention and the control of *Legionella* bacteria
- Infection control enhancements, including the design and maintenance of taps and mixing valves to minimise the risk of bacterial growth.

J Hosp Infect.

2024 Jun 1;150:96-104. doi: 10.1016/j.jhin.2024.05.015. Epub ahead of print. PMID: 38830540.

Retrospective genome-oriented analysis reveals low transmission rate of multidrug-resistant *Pseudomonas aeruginosa* from contaminated toilets at a bone marrow transplant unit

Rath A *et al*

Prevention of toilet-to-patient transmission of multidrug-resistant *Pseudomonas aeruginosa* (MDR PA) poses management-related challenges at many bone marrow transplant units (BMTUs). A longitudinal retrospective analysis was conducted of the toilet-to-patient transmission rate for MDR PA under existing infection control (IC) measures at a BMTU with persistent MDR PA toilet colonisation. The local IC bundle comprised: (1) patient education regarding IC; (2) routine patient screening; (3) toilet flushing volume of 9 L; (4) bromination of toilet water tanks and (5) toilet decontamination using hydrogen peroxide. Toilet water was sampled periodically between 2016 and 2021 (minimum every three months: 26 intervals). Upon MDR PA detection, disinfection and re-sampling were repeated until 3 cfu/100 mL was reached. Whole-genome sequencing (WGS) was performed retrospectively on all available MDR PA isolates (90 out of 117 positive environmental samples, 10 out of 14 patients, including nine nosocomial). WGS of patient isolates identified six sequence types (STs), with ST235/CT1352/ FIM-1 and ST309/CT3049/no-carbapenemase being predominant (three isolates each). Environmental sampling consistently identified MDR PA ST235 (65.5% ST235/CT1352/ FIM1), showing low genetic diversity (difference of approx. 29 alleles by core-genome multi-locus sequence typing (cgMLST)). This indicates that direct toilet-to-patient transmission was infrequent although MDR PA was widespread (detection on 79 occasions, detection in every toilet). Only three MDR PA patient isolates can be attributed to the ST235/CT1352/FIM-1 toilet MRD PA population over six years. Stringent targeted toilet disinfection can reduce the potential risk for MDR PA acquisition by patients.