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IHEA
Institute of Healthcare Engineering, Australia

HEALTHCARE FACILITIES

21ST CENTURY HEALTHCARE ENGINEERING

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Cover: Delegates gathered at the IHEA Healthcare Facilities Management Conference 2022.

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EDITOR'S MESSAGE

I am delighted to put into your hands this Winter 2022 Edition of *Healthcare Facilities*. Thanks to members, sponsors and advertisers who have contributed to the excellent content before you.

This edition is a celebration of our first in-person National Conference since COVID began, and a special thanks is due to Conference Convener, Fred Foley and his team for putting together such a stimulating event. Fred has provided a wrap-up summary of the event on page 11, so please take the time to remind yourself of the great time we had, or if you missed it, Fred's article might encourage you to register for the 2023 Conference to be held in Adelaide.

Once again this edition provides you with excellent technical content an deep-dive into some innovative technologies supporting indoor air quality, a case study on risk management of a water system in NSW, and a challenging message about hospital security.

As the world begins to open up to global travel, and as many might be getting the opportunity for some long-overdue leave, there are a number of related events you might consider attending in other countries. Whilst many of us just want to leave work and careers behind if we are getting away on leave, there might be some good incentives to attend a work-related event in another country.

The 2022 IFHE Congress is being held in Toronto, Canada in mid-September and promises to be a stimulating opportunity to connect with global colleagues in healthcare engineering or to broaden your horizons. To the theme, *"Unleashing Innovation – Healthcare Engineering Excellence"* more information can be found at the Canadian Healthcare Engineering Society web page www.CHES.org

Across the Ditch in New Zealand, NZIHE is also hosting their 2022 national conference in beautiful Christchurch, on November 16th-18th. IHEA was happy to welcome NZIHE President, Gavin Carey-Smith at the IHEA Conference in Perth, and Gavin and the NZIHE community will warmly welcome any IHEA members to their event. Please visit www.nzihe.org.nz for more information.

Please enjoy this Winter edition of *Healthcare Facilities* and share with your peers and encourage connection through the IHEA network.

Regards
Darryl Pitcher – Editor

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NATIONAL PRESIDENT'S MESSAGE

I am happy to be writing this message as incoming National President of IHEA … again. I've had the honour of serving in this role previously between 2009 and 2011. Whilst much has changed in the past decade or so, my passion and interest in healthcare engineering remains strong. At the Perth Conference in May, the National Board met in-person for the first time since February 2020, when COVID was just emerging as a global threat. Since then, travel and large events have been almost impossible, and IHEA has really felt this impact, so it was excellent to be together discussing the way forward for IHEA.

I'd like to thank outgoing President, Jon Gowdy (NSW) for his commitment over the past 3 very difficult and unusual years. Work commitments have placed considerable pressure on everybody involved in healthcare engineering, and I know many on state committees and with National Board responsibilities were stretched to their limit, so I thank everybody who has supported IHEA through this period.

In-person Annual General Meetings and Board meetings, and consequently the rotation of Board members have all been disrupted, however there are some changes occurring on the National Board. Adrian Duff is replacing Brett Nickels as QLD state representative. Mark Hooper has also stood down from the National Board, with the Vic-Tas branch presently represented by Steve Ball. Together with myself, Jon, Steve and Adrian, IHEA directors currently include Rohit Jethro (WA – National Treasurer), Michael Scerri (SA/NT - Membership Registrar), Peter Easson (WA), Rob Arian (NSW) and Fred Foley (WA). Thank is due to Mark Hooper (Vic-Tas) and Brett Nickels (QLD) for their representation and efforts on the national Board. I look forward to continuing my work with the National Board in leading IHEA into the future.

State branches will be convening their annual meetings about now, so for members it is an ideal time to step in to support your local committee and branch. It was obvious at the Perth conference that there is a renewed enthusiasm for interaction between members, sponsors and industry representatives, and we welcome anybody with drive and enthusiasm to further the interest of IHEA at a local or national level. Please make sure you get together with your local colleagues and use the network provided through the IHEA to share, learn, laugh and grow.

The hot topic for IHEA members now is the imminent release of **IHEA Connect** – the newly constructed IHEA app and web-based platform for members to connect. We congratulate Alex Foster (WA Branch) and Gavin Carey-Smith (NZIHE President) for their suggestion in the 'competition' to name the new app – **IHEA Connect** was adopted, because it epitomises everything that IHEA is trying to achieve – connection. Keep an eye out for the email notifying of your new login credentials and membership renewal process.

The previous IHEA LDP App will need to be deleted, and replaced by the IHEA App available on your device app store. It is also available by clicking on "Member Login" at www.ihea.org.au. We are excited through this process to be able to offer a monthly direct debit payment plan, which has been requested by members for many years – it is now available through I**IHEA Connect**!

All the best
Darryl Pitcher,
IHEA National President

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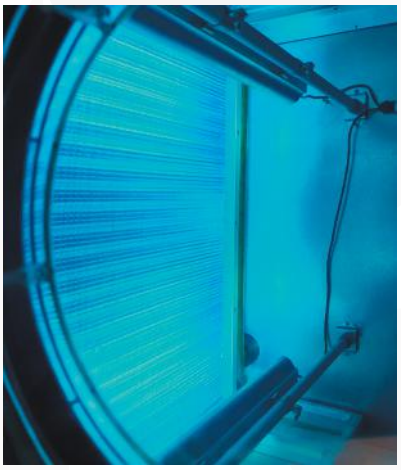

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QUEENSLAND BRANCH REPORT

Greetings from sunny Queensland! As I write, the weather in the south of Queensland now has that 'winter's edge', though our colleagues further north continue to enjoy the balmy advantage of being closer to the equator! For our members further south in the country, a trip to QLD at this time of the year is worth considering, especially considering the up-coming mid-year event we are planning.

Mid-Year Conference, July 14th, 2022

The Queensland Branch Committee has been actively organising the Mid-year Conference coming up in July. A full one-day program has been put together this year and is packed with promise, under the overall theme:

Resilience: Floods, Fires, Pandemics….

- Can your organization weather the storm?
- Resilience through systems and people.
- Infrastructure - designing in resilience.
- Lessons from real life examples.

One of the most interesting topics on the program comes from Townsville:

On the theme of dealing with the extremes, our colleagues from Townsville will be share their experience dealing with the aftermath of the floods including the loss of water supply at the Townsville University Hospital. The Australian Defense Force provided a round-the-clock water supply using their mobile water treatment plant which created an trial run before the plant was shipped to Fiji to help in the aftermath of Tropical Cyclone Cody. As one colleague put it, "they can get water out of mud…….".

Once again, we are being well supported with sponsorship by our local suppliers and consultants and as usual, the conference will conclude with a tradeshow. A special thanks to all of our corporate stakeholders for their continued support.

National Conference

Those members that made the journey to Perth for the National Conference all report a huge success and enjoyed their time reconnecting with fellow-members from across Australia and New Zealand. Congratulations to our WA colleagues for putting on a great event, which was much delayed by COVID and many other significant planning challenges.

Committee of Management

Our COM members currently are:

President	Brett Nickels
Vice President	Matt Smith
Treasurer	Michael Ward
Secretary	Danny Tincknell
National Board Rep	Adrian Duff
Committee Member	Christopher Aynsley-Hartwell
Committee Member	Arthur Melnitsenko
Committee Member	David Gray
Committee Member	David Smith
Committee Member	Peter White
Committee Member	Mark Fasiolo
Committee Member	Mark Collen

If you would like to communicate with the QLD Branch via email, please do so at ihea.qld@ihea.org.au .

Wishing you all a happy Winter and enjoyment of the great weather that this time of year brings (for those of us in Queensland). Hope to catch up with as many as you as possible at the Mid-year conference.

Brett Nickels
President, QLD Branch

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WA BRANCH REPORT

Wednesday the 11th of May 2022, was a day of celebration, a day we thought would never come, for this was the day the twice-postponed National Conference finally arrived. Looking back, when the West Australian branch accepted the challenge to host the next National Conference, little did we know what was to befall us all.

The conference committee was formed, plans were set, and a vision created, to make our conference, the one to be remembered. A few months in, a cloud of uncertainty descended on the whole of Australia (and much of the world), and our focus turned toward survival. Our conference was in jeopardy.

Throughout the pandemic challenges, the committee did not cease to execute their responsibilities and whilst at times the momentum may have slowed, it never stopped. Finally, early in 2022, the cloud lifted, and the conference was given the green light. The following few months were a blur, with re-confirming sponsorships and exhibitors, re-booking speakers and presenters, however the biggest challenge of all, was resurrecting the confidence and enthusiasm of our membership. The IHEA had taken a hammering during the pandemic.

Our conference had far reaching implications for the IHEA. Not only was there pressure for this event to be a financial success, it also had the more important task of reuniting our members.

The conference themed, *21st Century Healthcare Engineering*, commenced at the Perth Convention and Entertainment Centre at 9:32 am on the Wednesday morning, some 2 ½ years and 2 minutes late. The proceedings started with the familiar master class. On previous occasions, the master class has followed a theme linked to the Conference, but on this occasion, we decided to do something a little different. We invited three keynote speakers to educate and enlighten us on subjects totally unrelated to the main theme. We also decided to include the masterclass as part of the full registration package. This posed a dilemma; how would we cover the additional cost of hosting the masterclass? I put this to our membership, and I was truly amazed by the response. Our long standing IHEA supporter, Ryan Milne of Eco Safe International, quickly snapped up the opportunity to be a part of this event. My sincere thanks extend to Ryan and the crew at Eco Safe International for their support of this activity.

The sessions opened with Dr Nicholas Mabbot speaking about the science of sleep, a subject all Healthcare Facility Managers could benefit from knowing a little more about. I encourage you to view Dr Mabbot's YouTube presentations. They are insightful and helpful. We then listened to Rebecca Hannon who spoke about the onset of work-related depression. This is a silent problem that has beset a lot of healthcare workers, and it is time to speak up and support each other. For something completely different, we heard from Rosco McGlasson, the fastest Australian in the world. Rosco entertained and amazed us with his exploits and how he intends to break the 1000 mph (1609.34 kph) barrier in his rocket powered *Aussie Invader 5*. Rosco epitomises the Australian spirit; 'Aussie Aussie Aussie, Oi Oi Oi'!

The afternoon saw delegates visit either, the Perth Zoo or Fiona Stanley Hospital. Sadly, the intended visit to the Royal Flying Doctor's Jandakot operations centre had to be cancelled, due to the pandemic impacting on their staff. I attended the Perth Zoo, a place I had not been to for a long time. We were treated to an excellent back of house tour and learned how the facilities team care for their animal charges and, heard about the challenges they face. Their achievements with conservation and preservation are truly remarkable and to be commended.

The feedback I received from the delegates who visited the Fiona Stanley Hospital was extremely positive and complimentary. They were welcomed by an enthusiastic team, who took them into some of the restricted areas of the facility. How privileged were we to receive such attention? There are some maintenance team members who have never seen these areas. The last time the National conference came to Perth in 2015, the state-of-the-art Fiona Stanley Hospital had only just opened so this was a good opportunity to reveal the lessons learnt and to showcase this still-excellent facility.

The day closed with the traditional trade show, which was proudly sponsored by Grosvenor Engineering. 33 exhibitors showcased their businesses and products which included a wide selection of new technologies and products for all to see. I have to say that the evening was also an excellent opportunity to reconnect with old acquaintances and to renew old friendships. I personally met with so many people I had not seen since the pandemic began. I extend our heartfelt thanks to our sponsor and to our exhibitors, who not only supported us financially, but also joined us as part of the IHEA community.

Day two opened with a welcome from our National President, Darryl Pitcher. After which delegates were welcomed to country by Noongar Leader James Webb. James not only welcomed us but enlighten us with a brief history of his first nation peoples. James was followed with the official opening by Dr David Russel-Weisz, the Western Australian Director General of Health. Dr Russel-Weisz spoke on the challenges of managing the pandemic and on the visions for WA Health into the 21st Century. Next, we heard from our gold sponsor Schneider Electric. A big thankyou to Schneider for once again supporting the IHEA.

Our first Keynote speaker, Shara Evans took the audience on a journey through the futuristic present with her vision of what technology has delivered to the medical world. Some of the technology is, to tell the truth, a bit frightening with how artificial intelligence is seamlessly blending itself into our daily lives. One could ask, what has the advances in medical

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technology got to do with Facility Engineering? Well, it will only take one savvy entrepreneur to think, I could make a few dollars out of this and, bingo … it is in our world. We'd better be prepared!

The rest of the morning and afternoon was peppered with excellent papers, and in no order, we heard from AppTegral, Aurecon, Eco Safe International, IHEA Vic-Tas member, Steve Ball and Anixter.

Special Guest presenter Paul Ingram, Nurse Manager from the Royal Flying Doctor Service, addressed the audience with an overview of who the RFDS are, what they do and how they do it. The dedication of their team is truly inspiring and even though the RFDS was founded in the east, it has become a jewel in WA's crown. The RFDS recently celebrated the 94th anniversary of its first flight.

The day concluded with the conference gala dinner held at the Beaumont on the Point function centre. The night was packed with conversation, merriment, excellent food and we even had an impromptu performance on the bongos. I am not revealing who that was, as what happens on conference stays on conference. The evening went so quickly, and the group finally faded into the night at about 11pm. Who knows who went where after the dinner, but there were a few bleary eyes the next morning?

Speaking of the next day, we began a bit later than usual with our second keynote speaker, Mr Gihan Perera. Gihan continued with the conference theme, with his presentation of Living with Technology. Gihan's entertaining dialog focused on the people aspect of technology, put very simply, you still need people to have a Zoom meeting, irrespective of how good Zoom may be in bringing the meeting together. Gihan presented with dry wit and a steady stream of humorous anecdotes, whilst he also enticed us to think actively about the future of health – very much in line with our continuing theme of 21st Century Healthcare.

The day panned out with another selection of excellent papers, again in no order we listened to Honeywell, Grosvenor Engineering Group, Enware and Opira. We ended the day and the conference with our third keynote speaker, Professor Peter Newman. Professor Newman spoke to us about the past affecting our future and the need to learn from history. He focused his presentation on energy sustainability and how Western Australia is contributing to solving the world's energy problems.

The quality of the presentations set before the judging panel tasked with identifying the 'best paper' posed a seriously difficult task. The best paper award went to, Normand Brias of Opira. Our perpetual trophy is now on display in Normand's office, and we congratulate him for his excellent presentation. I encourage everyone to get a copy of the presentations and savour the content, you will not be disappointed.

The conference ended at 3pm on the Friday, where the committee members retreated for a well-earned rest and few quiet beverages.

On reflection, the key learning of the conference was to realise just how technology has embedded itself into our daily lives and I hope the delegates left with the following thoughts.

- we had a quick glance into what the future holds;
- we recognise that people are the most important contributor to technology in healthcare, and;
- most importantly if we do not have a world in which to live, the whole point of technology is lost.

The committee set out to deliver a high-class, high-quality, and memorable conference and I believe we achieved this result in spades. Did we add value to the IHEA? I believe so! Did we contribute to bringing our members back together? Absolutely! However, as for being memorable? I will let history determine that. I do know that we did break from some traditions by introducing new innovations. Were they all a success? Some were good ideas and some, not so good. We did set a record of being the longest sitting conference committee in the history of the IHEA. That is something to share with future generations – and we hope it isn't repeated.

My sincere thanks must go to the committee members. To Katie Tomkins and Chloe Brix from Iceberg Events, to National President, Darryl Pitcher, to the WA Vice President, Alex Foster, to the WA State Secretary Andrew Waugh, to State Treasurer Yuri Deans and to WA Executive members Sarah Bailey and Jana Simpson. Their dedication and enthusiasm flowed through the whole planning process and into the delivery of the whole event, and each deserves to be recognised for their efforts.

With the conference now a memory, the IHEA WA committee has now turned its focus to maximising the reconnections made during the conference. We have set our sights on rebuilding our branch meeting platform by reintroducing a range of site visits. In the next 6 months we have plans to visit a local motor rewinding factory, to hold a PD session with a surgical clinician, to visit a local hospital to hear how they used the pandemic lock downs to perform highly disruptive electrical upgrades, to visit Rosco McGlasson's work shop to see *Aussie Invader 5*, to hold a country branch meeting and to visit the RFDS Jandakot operations.

The remainder of the year looks exciting.

Fred Foley
IHEA WA State President and Ex Conference Convenor

VIC/TAS BRANCH REPORT

The activities of the IHEA have not been at the front of everyone's mind for the past couple of years because, let's face it, most Hospital Engineers and Facilities Managers have been heavily in demand. We have all endured the shared experience of providing an environment conducive to the provision of safe, consistent care to our communities in the midst of a pandemic.

Many of us have spent long hours designing and implementing systems to mitigate the risk of COVID transmission. These have usually been focussed on the control of airflow and we have become experts on air scrubbers and portable HEPA filters.

Apart from our members not having free time it has been difficult to arrange meaningful activities when we cannot meet face to face. Because of this the essence of our face to face meetings being networking and the information sharing of informal conversations has been lost. We have arranged a few online meetings but the collegial experience is not the same.

The National conference in Perth was well attended in May and effective in breathing some life back into the personal experience of being an IHEA member.

We as the Vic/Tas Committee of Management thought we had a great idea for a first PD which is a tour of the Melbourne Metro Tunnel Project which runs past the Royal Melbourne hospital. Although the concept is good it depends on actions from a few third parties which are dragging on. This will still be an excellent event at some point in the future but we really need to plan some informative PDs for our members to meet each other and possibly even have a site tour of a facility.

We have also had some resignations from the Vic/Tas CoM recently which is to be expected as time goes by.

Getting the vitality back into the Vic/Tas branch following the pandemic has been a lot more difficult than any of us anticipated which is why we are now reaching out to our members for help. We are requesting three things from our members;

1/. If you have or know of a venue where 30 or so members could get together, listen to a presentation from fellow members and a sponsor go on a site tour and then enjoy a light luncheon provided by the sponsor then please contact me and I will be most happy to assist in the arrangements. We have sponsors who are eager to be involved.

2/. We need some fresh ideas in the Vic/Tas branch. If you have ever considered contributing to the state committee, then now is a great opportunity. Because we are all very busy, the duties of the committee are structured to be time efficient. We meet once a month online, there may be some follow up activities from the monthly meeting such as communicating with sponsors or arranging activities around a PD but generally the time taken in the fulfilment of these items is about an hour per month. If you can contribute to this then your input would be greatly valued. Please contact me to discuss your interest and availability, I will be happy to discuss the time commitment to make sure that it fits in with your availability before you make any commitments.

3/. When you see the next notice for a PD please do your best to attend. We get excited when we can get members together as we did before the pandemic to reconnect, share and renew friendships.

Please contact us on ihea.victas@ihea.org.au
Steve Ball
Member Vic/Tas CoM.
National Board Member..

Michael McCambridge
Vic-Tas Branch President

IHEA HEALTHCARE FACILITIES MANAGEMENT CONFERENCE 2022

Darryl Pitcher - President Opening Address

Dr David Russell-Weisz – DG WA Health – Conference Address

Jana Simpson – IHEA WA – Session Chair

Winner – Peter Cooper, SA

Welcome Reception – Grosvener Engineering

Steve Delides – Ecosafe

Conference Convener – Fred Foley, WA

Julie and Bill Sulivan – Greencap

Steve Ball – IHEA, Vic/Tas

IHEA HEALTHCARE FACILITIES MANAGEMENT CONFERENCE 2022

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QED – Sarah Bailey and Reena Strehle – WA

Opira – Exhibitor

Gary Gilbert – Anixter

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Speaking with Nicholas Kraus, the Managing Director of InovaAir Australia, an Australian air purifier manufacturer on the Central Coast of NSW, we asked what's important when selecting an air purifier in healthcare facilities?

What type of air purifiers should be used?

When selecting an air purifier in commercial environments including patient and staff areas, it's important to get a system that includes an H13 medical-grade HEPA filter.

This is where the filter is made from paper with airtight seals. HEPA paper is used in medical applications because it guarantees the same high efficiency for the life of the filter which is typically up to 3 years.

Synthetic filters commonly found in the majority of home air purifiers only last around 6 months before the efficiency of the filter starts to reduce. These types of air purifiers are better suited to dust & allergen removal rather than filtering viruses.

Where should an air purifier be operated?

We find hospitals are using InovaAir systems in patient rooms where there are COVID positive patients, suspected positive patients, ER's and staff areas.

They are designed to operate 24/7 and portability is key to allow for ease of filter changes in negative pressure rooms or quarantined areas.

Are air purifiers suited to daily surface disinfection?

Important consideration should be given to the construction materials of an air purifier. Not only should the air purifier be compatible with ethanol based alcohol disinfectants, the exterior casing should avoid crevices around the air intakes and discharge vents which could harbour viruses and bacteria.

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Innovations in Indoor Air Quality (IAQ) Management for Healthcare Environments

Dr Michael Taylor

Practice Manager – OHYG and Principal Mycologist, Greencap

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Team Manager – OHYG, Greencap

An acute focus on indoor air quality, particularly relating to infection risks over the COVID-19 pandemic period, has heightened the awareness of the impact of airflow and aerosol transmission within workplaces. Guidance has been provided by the World Health Organization (WHO), Centers for Disease Control & Prevention (CDC), SafeWork Australia and other agencies to adjust the existing ventilation and filtration systems with the goal of reducing infectious potential.

Many facilities have attempted to incorporate the guidance to reduce infection risks with increased or altered ventilation rates, increased fresh air provision, heightened filter efficiencies and added non-standard air treatment (disinfection or purification) devices. Verification of these adjustments has brought with it a heightened requirement for insight into real-world, high-resolution information and tools to help guide building managers and engineers.

This paper will discuss some of these interventions and alterations to air handling, and provide discussion of a novel DNA based system for rapid, high-resolution insight into the air quality in healthcare facilities.

Infection prevention and aerosol-based hazards

The rapid emergence of SARS-CoV-2 infections in early 2020 produced a significant interest, both public and professional, in disease transmission routes, with early conclusions made that the primary transmission route of SARS-CoV-2 was surface borne, or by respiratory droplets and less attention given to aerosol generation and transmission. However, these early assessments were subsequently revised to demonstrate that aerosol transmission was the key driver of COVID-19 infections, precipitating a rapid shift in focus from fomite transmission and cleaning activities, to airflow, ventilation and filtration-based investigations and interventions.

Whilst historic publications on viral transmission are plentiful, never had such a large real-world series of observations been possible. Emerging publications demonstrated that the most efficient route of transmission was via direct contact with exhaled respiratory droplets which are generated when an infected person exhales, coughs, talks, sings etc (Liu et al., 2020; Chan et al., 2020; Burke, 2020; WHO, 2020; Hamner, 2020; Ghinai et al., 2020; Pung et al., 2020; Luo et al., 2020). Whilst these droplets contain infectious viral particles in high concentrations, they do not travel long distances and many of them fall to the ground with 1.5-2 metres of the infected person. It was suggested at this early stage that these droplets may travel further when an infected person yells, coughs or sneezes and in some circumstances may give rise to infectious aerosols, smaller droplets which remain airborne and infectious for longer periods of time.

Over time, a greater focus was given to the role of aerosol transmission of COVID-19 and the role of ventilation in propagating conditions amenable to airborne spread over distances greater than 1.5 metres. Heightened infection risks were noted where aerosol generating procedures were being carried out, such as in healthcare settings, or during gatherings in enclosed or crowded spaces attended by infected people (Leclerc et al., 2020), such as during choir practice (Hamner, 2020) in restaurants (Lu et al.; Fisher, 2020) and in conditions conducive to creation and maintenance of aerosols such as abattoirs (Middleton, Reintjes and Lopes, 2020). Whilst the current rate of infections of COVID-19 has reduced due to our recognition of these aerosol risks, our attention on improving indoor air quality in healthcare facilities should extend beyond

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the current pandemic to both prepare for future emergency situations, but also to address the constant challenge of hospital acquired infections.

Nosocomial pneumonias are a serious risk to patients, especially those with haematological malignancies and in immunosuppressed groups. While invasive devices and procedures are the most common infection pathway for hospital acquired infection, airborne transmission of contaminants is a significant risk factor. As an example, in 2015-2016, 17,854 cases of hospital acquired pneumonia were reported in Australia (Independent Hospital Pricing Authority – AU, 2018), at an estimated additional cost of $39,406 per patient. Maintaining adequate ventilation and air filtration performance within internal healthcare settings is therefore essential to ensure healthy and safe spaces for all, particularly with a newly heightened expectation for healthcare and aligned facilities to investigate their HVAC setup and enact changes to reduce the risk of aerosol transmission. However, a distinctly limited set of tools exists to interrogate the movement of air and aerosols through a system, generally leading to interventions made with a lack of accurate observational data.

Appropriate ventilation design in healthcare settings requires air change rate of 6-20 air changes per hour (ACH), in addition to appropriate layout and extract positioning to minimise stratification, poor mixing of fresh and recirculated area, dead spots (areas of low air flow), or migration of air outside of containment zones for isolation rooms.

Existing technologies

A range of established technologies and methodologies exist to improve air quality and mitigate infection risks from aerosolised contaminants. All have value and can be used to great effect, but when implemented incorrectly, or not verified once operational, these techniques can prove ineffective, costly and in some cases, actually detrimental to internal air quality.

Filtration & HVAC setup

The setup and operation of ventilation and filtration systems relies upon a balance of the amount of air passed through the system or space (and from this calculated air changes per hour, ACH), temperature and humidity control, and the filter rating. Calls for facilities to increase the amount of fresh air introduced into their HVAC systems, or to increase the number of ACH are often met with a poor system (increased humidity) or efficiency outcomes as energy costs dramatically increase with each ACH, and may shorten the life of plant and equipment now placed under significant additional load.

These recommendations, although likely beneficial if implemented correctly, are often made without insight into the existing system efficiency and operation, and without considering the range of intermediate interventions that may be made ahead of costly or unnecessary technical alterations to a HVAC system.

Ventilation and filtration of internal air can be adjusted via changes to existing HVAC operating parameters, for example by increasing fresh air intake ratios, or upgrading the specification (Minimum Efficiency Reporting Value, or MERV rating) of filtration media to capture the virus and preventing it from recirculating. However, this can result in reduced air flow if the HVAC system operates outside of designed ranges, along with associated increases in energy consumption and costs. Installation of portable HEPA air filtration units is another method to improve local air quality, but the benefits of this technology may be marginal in comparison to the high capital and operational costs, especially if not sized and placed appropriately in the space.

Finally, the use of physical barriers to alter and segregate air circulation pathways within internal spaces is a well-recognised mechanism to reduce person-to-person airborne transmission of aerosolised contaminants. This technique however may generate other detrimental impacts to occupants, and is often not practical in operational healthcare settings.

UV lights

Ultraviolet radiation in the UVC spectrum (200-280 nm) has been extensively employed as an antimicrobial treatment of air, water and materials and has a demonstrated efficacy as observed by decades of data (Kowalski, 2010; Bolton and Cotton, 2011). This efficacy however still relies upon the appropriate application of UVC at sufficient power for sufficient time to cause damage to the microbes it is attempting to damage or kill. UVC exerts a detrimental effect on microbial cells and viruses as the RNA, DNA and many intracellular proteins absorb light in the spectrum of 200–280 nm (Bolton and Cotton, 2011; Kowalski, 2010).

The required doses of UVC for inactivation of SARS-CoV-2 have been proposed, based upon both contemporary work studying the current pandemic strain, as well as historic coronaviruses and model strains, which typically require an order of magnitude greater dose than those reported for MS2 (Tseng and Li, 2005; Walker and Ko, 2007). Proposed doses to achieve at least single log reduction (>90%) in viral infectivity will be dependent on the initial viral concentration, but a conservative dose of at least 20 mj/cm2 has been proposed to achieve a 4 log (99.99%) reduction in viral infectivity. A brief summary of studies demonstrating the effect of UV on disinfection of SARS-CoV-2 and comparable coronaviruses is presented in Table 2.

For UV air treatment, the effect of particulate load plays a strong influence on the total UV dose received by targets, with shadowing and scattering of UV light greatly decreasing the total absorbed dose. The inclusion of a HEPA filter may dramatically increase the efficacy of a UV light air treatment unit.

Bipolar ionisers

The observation that charged airborne ions influence the sedimentation rate of airborne particulate has existed in the scientific literature for well over 100 years, with studies specifically on interactions between charged ions and bacterial growth existing since the 1930's (Tchijevsky 1933).

The use of industrial and more recently personal ionising devices has been studied extensively and consistently demonstrates that when an appropriately powered and sized ion generating device is used, there is a significant measurable decrease in many airborne particulate fractions, and some volatile organic compounds (Daniels 2002).

The basic principle of operation of these devices relies upon the application of an electric current to an electrode sufficient to generate a discharge which ionises the surrounding air, resulting in the production of charged ions, with the increasing generation of ozone occurring at higher voltages. The ions generated will interact/attract both each other and with aerosols to form larger agglomerations which more rapidly sediment and drop out of the air column (Fletcher et al. 2008; Lee, 2008).

Outside of a laboratory setting both the Centre for Disease Control (CDC), and The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) still consider bipolar ionisation an 'emerging technology' and state that:

[Bipolar ionization] Systems are reported to range from ineffective to very effective in reducing airborne particulates and acute health symptoms. Convincing scientifically rigorous peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered (ASHRAE 2021).

Table 2: Proposed UV dose required to achieve suitable reduction in infectivity of coronaviruses.

Virus	Wavelength	UV dose (mj/cm2)	Log reduction	Study
SARS-CoV-1	Undefined biosafety cabinet UV lights	120	5	(Kariwa, Fujii and Takashima, 2006)
SARS-CoV-2	254 nm	20	4	(Patterson *et al.*, 2020)
SARS-CoV-2	254 nm	40	6	(Patterson *et al.*, 2020)
SARS-CoV-2	280 nm	37.5	3.1	(Inagaki *et al.*, 2020)

Contemporary Observation and Verification Methods for HVAC systems

Although such a variety of HVAC setups and interventions exist, their suitability and cost/benefits are likely not clear or assumed in many instances. To verify whether ventilation and filtration technologies are adequate and fit-for-purpose, both from a general indoor air quality (IAQ) perspective, and specific to infection prevention, it is necessary to undertake quantitative assessment of the HVAC system and the associated areas serviced.

Depending on the nature of the system, these assessments can be used to: establish baseline conditions for existing engineering controls and HVAC systems; identify high-risk aerosol transmission routes; assess the integrity of containment barriers during construction or renovation works, or model the speed at which aerosolised contaminants dissipate in smaller, enclosed spaces.

Typically, these assessments use observational methods such as velocity measurements at air register outlets and temperature and humidity measurements. More quantitative investigations employ tracer gas monitoring, particle challenge testing and computational fluid dynamic (CFD) modelling. However, each of these comes with certain limitations or assumptions.

Tracer gas analysis, using compounds such as Sulfur hexafluoride (SF6) provides a much more direct measurement of ACH and airflow movement when applied by a skilled consultant, SF6 however, does not mimic the movement of particulate contaminants, is a potent greenhouse gas, and is substantially heavier than air.

Carbon dioxide (CO2) gas tracing is notably less expensive and more available than SF6 and similarly the field detection equipment is significantly less costly. This has lead to CO2 monitoring or gas tracing being frequently recommended as a surrogate measure of ACH. However, due to the natural presence of CO2 in air and exhalations of the occupants, results are frequently misinterpreted, for example an area with very poor air mixing rates may paradoxically show low CO2 if the gas source is not able to disperse throughout the building/room. As with SF6, CO2 tracing also only assesses adequacy of ventilation and does not verify filtration due to the gaseous nature of the compound.

Conversely, particle challenge testing is able to assess filtration by the generation of relatively short-lived test aerosols comprising of sub-micron particles, such as Poly Alfa Olefin (PAO) to evaluate the integrity of high efficiency particulate arresting (HEPA) filters, but is less suited to assessing ventilation.

An adjunct to these on-site measurements is the use of computational fluid dynamics (CFD) modelling, which is typically based on assumptions derived from design specifications, and may not be representative of actual on-the-ground conditions, or may be conducted using theoretical ventilation rates without on-site measurements.

Emerging monitoring and verification technologies

An emerging verification technology, which has shown promise in hospital and infection prevention and control studies, utilises a water-based synthetic DNA marker compound to model aerosol movement in internal spaces.

This process, veriDART™ by SafeTraces, was developed with support from the National Institutes of Health (NIH USA) and uses non-hazardous DNA-tagged aerosols dispersed by a nebuliser designed to mimic the poly-dispersive range of particle sizes released by coughing or sneezing. After a defined period of circulation, sampling of the aerosolised particles is carried out at specific locations via the use of static air sampling pumps and filters. Samples are analysed by quantitative polymerase chain reaction (QPCR) to determine the concentration of DNA marker compound at each sampling location. From these results, the log10 reduction of the DNA signal can be calculated moving away from the origin point. The sampling data collected is then used to generate heat maps or dilution curves to identify efficacy of existing ventilation and filtration controls and protocols. In healthcare settings or in areas where infection prevention is a specific objective, a reduction target of 99.9% decrease in DNA signal intensity over a defined time period can be established as an adequate endpoint for certifying a HVAC setup.

There are three principal performance assessments which this technology allows end users to assess:

Survey test (zone or floorplan focused assessment)

Dilution test to determine the timeframe and required conditions for aerosol contaminants to dissipate in a room, and

Recirculation / Filter Challenge test (assessing filter performance for aerosol contaminants).

Survey testing

Survey tests model the movement of aerosolised particles and indicate how the aerosol will behave under current engineering controls and HVAC system operating parameters, and can be used to identify 'hotspots' or high-risk areas where aerosols accumulate or do not disperse. Survey tests can be scaled with multiple origins and detection points, e.g., chosen beds within a ward, as required to achieve measurement objectives.

In the case below provided by SafeTraces, the assessment identified a hotspot where aerosol contaminant migration occurred from an open plan area to an enclosed space, in preference to the open plan area adjacent to the origin point.

Dilution testing

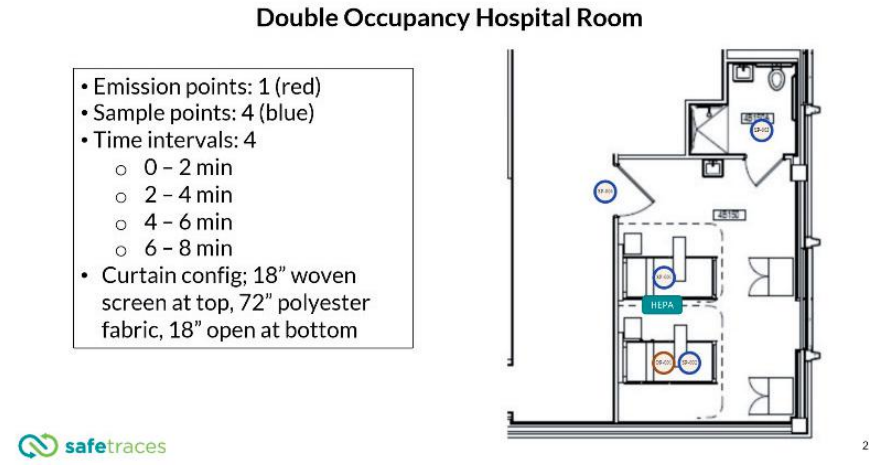
Dilution tests are used to verify the time and controls required to effectively reduce exposure risk to an acceptable level within enclosed spaces or rooms. The data generated can be used to compare existing ventilation system operation parameters against ventilation conditions once additional air filtration or air mixing conditions are applied to a system (for example, via portable HEPA filtration units, doors open/closed or increase fresh air intake percentages for HVAC systems).

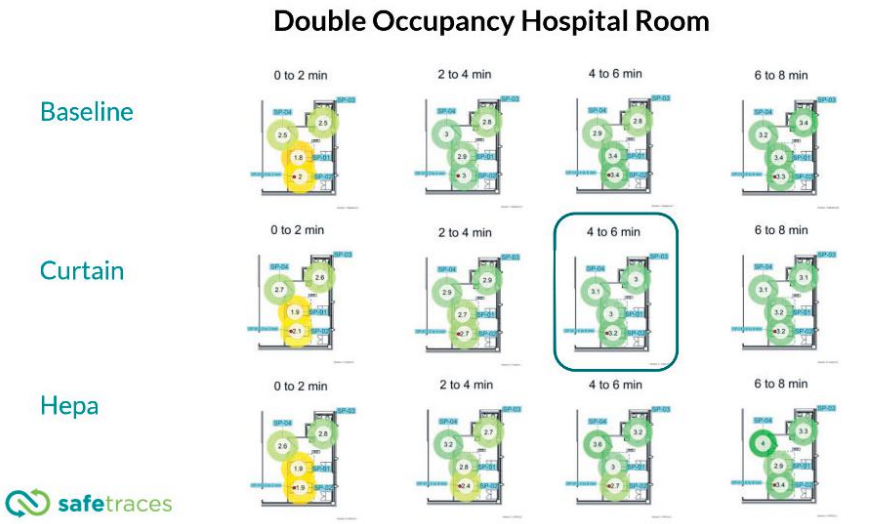
In the hospital setting below (provided by SafeTraces) of a double occupancy patient room with a curtain divider between patients, a dilution test was integrated with a survey test to determine if the centrally provided ventilation and filtration was adequate, or if supplementing with portable HEPA filtration devices was justified from both an infection control perspective and on financial grounds.

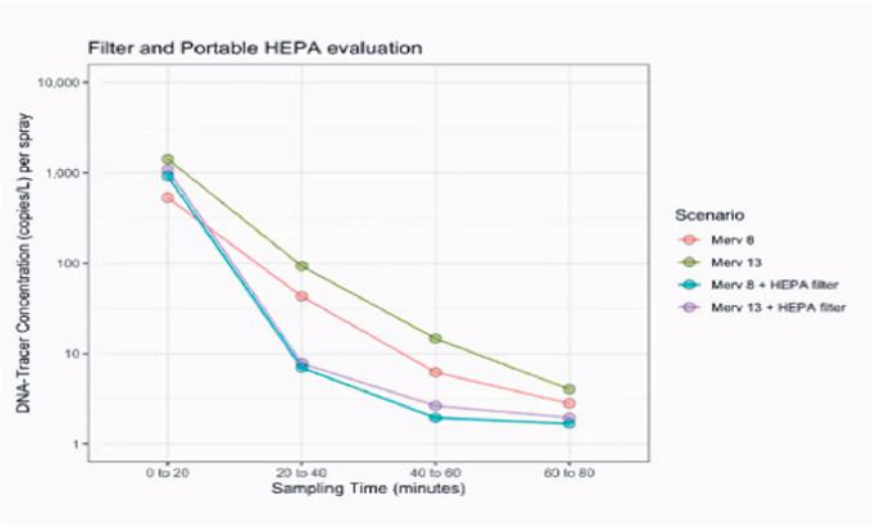
Three scenarios were tested as follows:

- **Scenario 1** - Centrally provided ventilation and filtration (with an air change rate of 13 ACH in the patient room)
- **Scenario 2** - Scenario 1 conditions with a curtain dividing two patient beds (curtain was open weave for top 45 cm and bottom, allowing for air flow, and
- **Scenario 3** - Scenario 1 conditions with a portable HEPA filtration device.

Scenario 2 (closed curtain) delivered comparable performance results to Scenario 3 (HEPA filtration) after







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8 minutes, and achieved faster dissipation of aerosols than Scenario 3 after 4 to 6 minutes, clearing aerosols by 99.9% at all sample points.

Subsequent testing revealed that the portable HEPA filtration device chosen for the assessment had not been optimally sized and specified for the room. The selection of an inadequate or inappropriate retrofitted filtration device is a common occurrence, and frequently during procurement inadequate consideration is given to the noise generated by portable HEPA filtration devices and additional operational energy consumption.

Recirculation/Filter challenge testing

Filter efficiency testing can be used to assess filtration adequacy prior to capital outlay, or to measure the impact of retrofitted filtration upgrades following implementation. The example shown below compared MERV8 to MERV13 filters in the HVAC system alone, and then again in combination with portable HEPA filtration devices.

The application of veriDART™ in the above study provide by SafeTraces found that the portable HEPA filtration devices significantly reduced tracer concentrations when compared to using either MERV 8 or MERV 13 in isolation, indicating that the additional impact of MERV 8 or MERV 13 was likely negligible.

Conclusion

The vast assortment of available technologies, HVAC system design setups and facility layouts frequently results in an over or under estimation of the risk boundaries around aerosol migration and infection transmission potential, with little observational data to support these assumptions. Insight into the true function of healthcare HVAC systems is a critical step to improve infection prevention and control efforts.

The rate of preventable nosocomial respiratory infection (pneumonia) presents a significant risk to immunocompromised groups, and can be reduced by insight into the operation of HVAC systems and aerosols within facilities by applying emerging technologies to investigate key airflow processes.

SafeTraces veriDART™ provides some advantages over conventional gas tracing studies, and can assist in the optimisation of HVAC systems and completion of quantitative cost benefit analyses of system modifications.

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Enhancing service quality and reducing risks through operational monitoring of the water system: the Mid North Coast LHD experience

Jason Hinds

Enware

The challenge to keep a busy working hospital operational and safe is becoming an ever-demanding task. Water Quality Risk management (WQRM) has experienced heightened awareness, of recent times only exacerbating this challenge. Scald risks were one thing: now legionella. How are health care engineering teams expected to comply with the range of legislative reporting requirements while managing these risks with limited resources, tools, and support? This paper looks to present a biographical account of the challenges facing a regional local health district's Asset and Facility Manager, appointed to ensure the hospitals under their management remain operational and safe for staff and patients. It looks to explain, from this operational perspective, the degree of liability to which the hospital is exposed due to a lack of compliant reporting, and how this burden and risk became the motivation to improve quality standards using technology and data driven evidence. It looks to provide a pragmatic explanation on how operational monitoring of the heated water systems can enhance customer experience, improve quality standards, optimize operations, and reduce management risks.

NSW Health have always had stringent legislation around water safety plans and the operational management of water quality risks such as scalding and legionnaires disease. The Requirements for the Provisions of Cold and Heated Water Policy Directive (1) sets out the legal requirements to be met by all hospital chief executives, owners, and operators in maintaining a safe environment for patients. This legal framework addresses requirements for the prevention of scalding and the control of systems that are likely to grow micro-organisms that are liable to cause Legionnaires' disease. This policy directive outlines several key operational activities and reporting requirements that each facilities management team must ensure occurs regularly to mitigate safety issues concerning warm water systems and thermostatic mixing valves. Such activities include monthly safety temperature checks of warm water delivery, and temperature stability checks of thermostatic mixing valves, including diagnostic reports if any temperature variance is observed, followed by a maintenance report of all service interventions. Within the daily operational challenges associated with keeping a busy hospital running, all these required activities, which tend to get left to the hospitals under resourced engineering staff, can often be forgotten and missed, creating a compliance risk for all involved.

Adding to this risk is corporate governance legislation around water quality risk management which has seen heightened awareness since the introduction on Enhealth's Guidelines for Legionella control in the operation and maintenance of water distribution systems in health and aged care facilities (2) which is driving the need to improve quality standards. First legislated in Queensland where amendments were made to the Public Health Act 2005 and the Public Health regulation 2018, these changes were all designed to improve water risk management practices in all public and private health care facilities.

As stated, (3), Regulated facilities are required to:

- have a water risk management plan that addresses all water-related hazards which includes, but is not limited to,

monitoring for the presence of Legionella in water used by a facility
- operate in accordance with their water risk management plan
- demonstrate both timely and appropriate remedial responses are/have been undertaken in line with their water risk management plan in response to incidents including the detection of Legionella in water used by the facility.

Penalties apply for non-compliance of certain requirements, with this penalty framework reflecting the significant responsibility hospital and residential aged care facilities have for the proactive management and control of the health risks to their patients and clients.

Enhealth offers insights into how to best manage water quality risks through several suggested mechanisms. This includes proactive operational and verification monitoring programs such as regular water sampling, maintenance regimes to ensure temperature devices are working correctly, cleaning regimes to remove debris and biofilms from plumbing components, and system temperature monitoring and flushing interventions. However, these are guidelines only and each hospital needs to develop a Water Quality Risk Management (WQRM) team, define their risks, and create a risk management plan accordingly.

The legislation is pointing the finger at those governed to manage the hospitals from the top down to own this responsibility. Legislative compliance, as well as greater consumer choice and a widening disparity between best practice management across jurisdictions, all combine to elevate the risks and assist in driving quality change. However, there is little additional funding allocated to support these changes and quality improvements, leaving those tasked with implementing them at an operational level now under even more pressure and uncertainty, further increasing risk. For health engineering teams the challenge to keep a facility operating safely is an almost impossible mission made more challenging with limited tools, technology, and processes to assist. This challenge is heightened further for many regional health districts struggling with a range of other obstacles that exist due to their geographic location. For the MID north coast Local Health District (MNCLHD), the liable risks become so great that the Capital works and Asset Management team headed up by Stephen (John) Miles looked to technology as a solution to optimize their operations and improve quality standards.

The NSW Mid North Coast *Local Health District* (MNCLHD) provides health services to over 218 180 residents across a geographic area approximately 11,335 square kilometres midway along the NSW coast. They provide a range of public health services to that community through seven public hospitals and twelve community health centres extending from the Port Macquarie-Hastings local government area in the south up to the Coffs harbour Local government area in the north. The districts services include the Mid North Coast Cancer Institute and Mid North Coast Brain injury service. Their primary health care issues are associated with mental health and chronic age-related illness (4).

Image 1 – Mid North Coast Local Health District

Being situated midway along the NSW coast has its benefits with a temperate climate and many beautiful beaches. From the perspective of the asset management and engineering team, it's a fabulous area to live and work. However, the area is regional and with that comes inherent challenges. The tyranny of distance between sites extends operational tasks across days as opposed to hours, stretching their available workload. The health facilities within the group range in age and condition which results in operational inconsistency across sites. As stated by John; 'there is a lack of general recourses and staff which can impact the quantity of the operational services provided and their ability to maintain minimum standards'.

For this small, under manned team, the drive and desire to maintain and improve their operational quality standards meant they needed to explore new ways to work and new technologies that could assist them. One area of their operational governance which was often overlooked was water quality risk management. As stated by John, "meeting NSW health regulations and now Enhealth guidelines is an ongoing challenge. Apart from having a lack of resources to do the job, there is also a lack of process and tools to assist so progressing to a minimum best practice is difficult

to achieve'. There was an unsettling realisation that their record keeping was slipping and therefore the compliance to regulations was not being met.

In an interview with John Miles, he explained that "the Australian Health Facility Guidelines (AUSHG) increases the number of fixture outlets across the facility, and with shorter warm water dead legs required to reduce legionella risk, we have a higher density of thermostatic mixing valves to manage. These design requirement increases our operational workload which is already overloaded and hence increases our scalding and stagnation risks. Our days were flooded with unplanned maintenance tasks and general operational duties which left little time for proactive or planned processes to help to improve the facilities operating performance. Necessary tasks like the flushing of unused taps were a resource challenge as too was collecting monthly temperature readings from all TMVs."

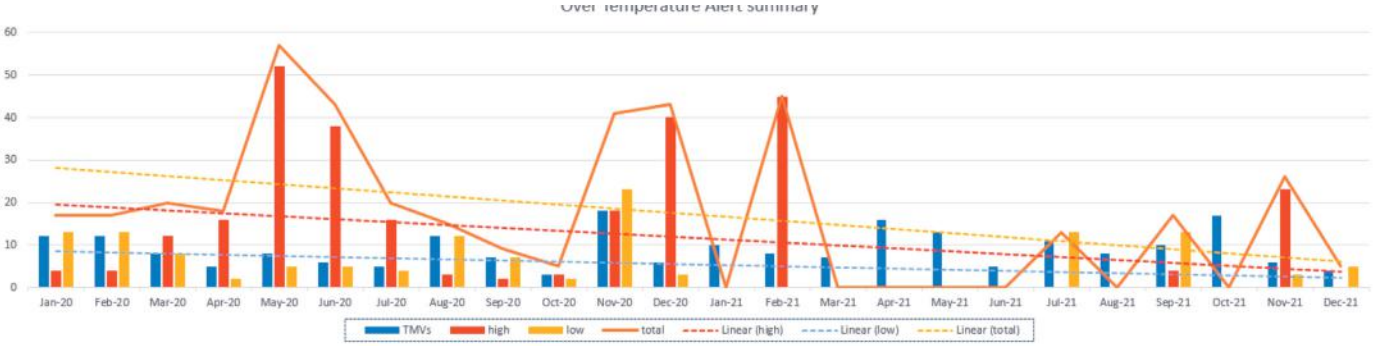
Image 2 – TMV Monitoring system typical installation.

"Our reporting was a problem area. The lack of time to document up reports on issues, whether it was water risk related, or anything, was of real concern. The quality of our reporting was limited, resulting in compliance drop off. Not only did it leave our team and organisation liable from a compliance perspective, but there was also little evidence to provide an audit reference that would allow monthly or annual performance reviews to identify areas of concern or opportunities to fix".

It is widely known the only way to improve is to start measuring. Without good data or evidence, establishing a performance and quality baseline from which to improve is not possible. The inclusion of an operational monitoring system into the Port Macquarie upgrade provided the opportunity to start their quality standards improvement journey.
Based off continuous monitoring of all thermostatic mixer's temperature performance, it automatically enhanced NSW Health compliance reporting as well as provided evidence on operational issues in which to plan out possible improvement opportunities.

From a compliance reporting perspective, the system provides auditable accounts for monthly temperature readings for all TMVs, and traceability of any temperature performance

Graph1 – shows Monthly temp reading trends up to 100% compliance over 2 years, with sufficient flow reaching approx. 90% compliance.



Graph2 – shows significant reduction in over temp alerts (high/low and no# valves) for a 2 year period reducing unplanned maintenance tasks

issues, diagnostics and records maintenance interventions. Aligned directly to NSW Health legislation, the monitoring system automates this compliance process as well as aids identify TMVs that need to be run every month to ensure temperatures are captured accordingly. In direct alignment with EnHealth guides, the system also monitors fixture usage and will identify fixtures that have not registered sufficient daily water flow for a 7-day period and provide a list of fixtures requiring flushing. As opposed to informing cleaning staff to flush all taps and showers while they are cleaning patient bathrooms or operational programs like 'Flushing Fridays', the monitoring system narrows down and identifies only the individual fixtures needing to be flushed, saving approx. 70-80% of staff time, water and energy.

Through continuous monitoring of the system over time, the engineering staff became aware of their most prominent stagnate fixtures and would proactively flush them when in the vicinity, further optimizing the management of the system. These reports assist staff to better know their site, as well as assist new employees to learn about the dynamics of the facility much faster. When operational interventions are planned, such as thermal flushing programs, John indicated that they used the system to record the events, providing traceability of their actions as well as verifying whether their sub-contractor plumbers are doing the job correctly. As the system continually records all temperature delivery events it can assist to ensure the patient experience is comfortable, particularly with respect to showering and bathing activities. John also stated, "It was also useful as a tool to retrospectively investigate unfounded legal claims from a past customer that they experienced a scald event while in the care of the hospital".

Operational improvement commenced through observation and identification of system performance issues that occurred as the facilities operations were coming online. The operational monitoring system aligns with its Managed Services technical engagement was providing a monthly account of all over temperature alerts occurring across the site. Each of these events can be a result of the ongoing changes in the plumbing systems demand and the dynamic nature of its operation. However most importantly, these events highlight risks that impact the patient's experiences which need further investigation, resulting in unplanned maintenance tasks.

Through the ongoing surveillance of the system and diagnostic support from the monitoring systems Managed Services team, water safety risk reporting was significantly elevated, ensuring a much higher level of compliance and service quality standard. Over time the continuous monitoring has allowed the engineering team to better identify problem fixture areas across the facility and proactively plan maintenance tasks to suit resource availability. This has allowed the engineering services team to optimize their time through reduced demand for reactive service tasks which has seen an approx. 75% reduction in unplanned maintenance.

The MNCLHD has expressed the intention to expand the Smart Flow fleet to ultimately encompass all the LHDs facilities under the one system, based on the clear benefits gained from the SFS service.

The improvement of the performance of the TMV fleet can been seen in graph (2) which shows the reduction in the number of TMVs registering alert events over time, and the number of alert events registered by individual TMVs, indicating improved fleet performance as well as compliance outcomes.

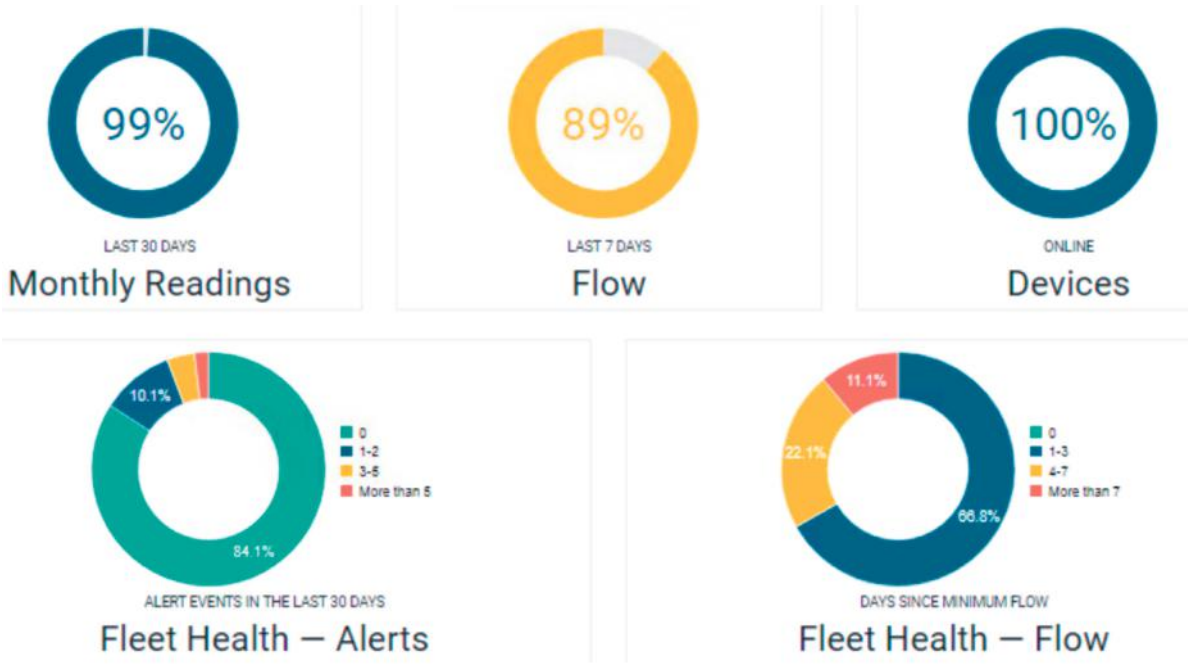


Image 3 – Dashboard UI - System fleet health

After initially installing their first operational system into Port Macquarie Hospital back in 2014 and signing onto a managed service agreement for that site in 2016, MNCLHD have now had the operational monitoring system installed into their newly development Kempsey Hospital and concluded that the benefits of the system's Managed Services technical support in both time efficiency for their staff and better compliance outcomes for their operations were such that they signed a full service agreement for both Port Macquarie and Kempsey Hospitals. By 2019, their new Hospital at Macksville had their fleet of thermostatic mixing valves monitored and were also added to the service.

The TMV fleets for each of these are:

Port Macquarie Hospital	208 TMVs
Kempsey Hospital	111 TMVs
Macksville Hospital	111 TMVs
Total	**430 TMVs**

During the last four years the Operational monitoring managed service has continually monitored and reported on each of these fleets as the total number of monitored TMVs has grown. It is available in a hard-wired configuration to align with new renovations as they occur or offered wirelessly, enabling all existing assets to now be included in the system across the whole local health district. This provides greater opportunity to benchmark facility performance and reduce risks through consistency in operation. At a time when the asset teams were struggling to maintain a basic level of reporting and compliance, they now have an auditable data base of all operational activities captured for their entire thermostatic mixer fleet across 3 sites. This has proven to not only reduce the scald and legionella risks for their patient customers but reduced their legal compliance risk while providing the catalyst to enhance the quality standards of their service.

References

1. NSW Health Policy Directive – Water: Requirements for the provisions of cold and heated water. 2015. Water – Requirements for the Provision of Cold and Heated Water (nsw.gov.au)
2. Enhealth.Guidlines for Legionella Control in the operation and maintenance of water distribution systems in health and aged care. 2015 Guidelines-Legionella-control.pdf (health.gov.au) www.mnclhd.health.nsw.gov.au/about/
3. Queensland Health. Legislation for water risk management in healthcare and aged care facilities. 2017. Legislation for water risk management in healthcare and aged care facilities | Queensland Health.
4. Mid North Coast Local Health District. About - Our District. About us - Mid North Coast Local Health District (nsw.gov.au)

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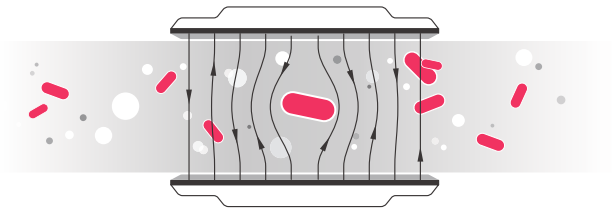

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THE PROMISE OF THE COMMON DATA ENVIRONMENT

The next generation of data, or data for the next generation?

Rogier Roelvink
Customer Strategy Director
Oracle Construction and Engineering

Facilities and assets in the built environment are highly complex systems of systems, and their success is determined by thousands of interconnected decisions made every day, at every level, across multiple organisations. Each of those decisions has the potential for inefficiency and risk, which can inevitably lead to additional costs and disruptions.

Over the last two decades, the industry has adopted technology in the form of point solutions to solve specific issues and embraced first-generation platforms. These have helped improve efficiency and connect teams, but the data from these solutions too often continues to be locked away in specific applications and proprietary formats. This makes it difficult to use the massive and fast-growing volumes of data to get a holistic view of performance across processes, services, and assets within a portfolio.

With hundreds of decisions all happening at once, how can technology platforms better keep everyone synchronised, and provide the team the visibility, tracking, and reporting they need to stay on track? Improving how data is managed – and how it is used to inform decision-making – is key to solving this challenge.

The next generation of data platforms are already on the horizon, as new technologies and disruptors are being brought to market every day. It is therefore time for facilities management to start thinking about the next generation of data platforms to collate data and information. Empowering individuals and teams to make informed decisions to deliver upon our collective obligation to steward and curate the built and natural environment to benefit the next generations.

True common data environment

The advent of the common data environment (CDE) and the benefit potential for facilities management is hailed throughout our industry. Although the potential appears significant, I am somewhat sceptical about the current ability to both establish a true CDE and to realise these benefits.

The current capability offered by technology and real time access to data and information is unprecedented. The internet of things is promising to provide a whole new level of connectedness that is practically too much to fathom. Information and data can be provided on everything at any time, but will we be able to discern the valuable relevant information within the torrent of available data?

One challenge is to determine what data and information is relevant when and subsequently decide where and how to store the data and information that is potentially relevant at some point in the future. The next challenge is how to extract, maintain, store, and access data and information currently

held and generated by different point solutions.

This is where a true CDE comes into its own. The true CDE is the trusted single source of truth that stakeholders can rely on. The true CDE synchronises all relevant data and information, connects stakeholders to this data, empowering them to make informed decisions.

The true CDE allows you to connect the data and information generated by such disparate systems like the building management system (BMS), the BIM and digital twin, environment management system (EMS), health and safety system, security system, contractor maintenance management system (CMMS), integrated workplace management system (IWMS), enterprise resource planning (ERP) system, or any others in use in your organisation relevant to the built environment.

> A true CDE is a cloud-based space where information from the built environment is stored and accessible to stakeholders. This access depends on stakeholders' requirements and/or level of authorisation, as well as their contractual obligations. – Adapted from Oracle description of a Construction CDE https://www.oracle.com/au/industries/construction-engineering/what-is-cde-and-bim/

Art of the possible

What if we were to combine all the facilities management systems and digital twins? We would have access to a pool of information and data that will provide us with opportunity for informed and robust decision making beyond anything we can imagine. We will be able to have buildings instruct repairs themselves, have access to proactive and predictive fault diagnosis. We will have an opportunity to quantify and qualify exactly how, where, when, and what facilities management contributes to the core business.

> **Example:**
>
> A water pump needs maintenance on valves every 10 Gl (giga litres). But the maintenance requires specialist parts with a three-month lead time. Today we have the technology that could automate the administrative burden around this. Once you have sensors/counters installed you will be able to predict when your next 10 Gl has gone through, even with seasonal or activity related fluctuations. The system could automatically place an order for parts four months prior to the estimated maintenance date, notify the specialist contractor and place a work order. The contractor can attend site, conduct the maintenance update the relevant records in almost real time, issue the invoice and get the invoice authorised for payment within hours, maybe even minutes from attending the site and completing the work.

Data and information will allow us to bring facilities management into the executive sphere as we have been talking about for decades. We will have the evidence and measures that will make executives sit up because for the first time in history they will have access to robust data to support their decisions.

Imagine, the lights being out in a certain department and the facilities manager receiving a message when she is having her breakfast that reads:

"Lights out in department X. Order placed with contractor Y, accepted and will attend site by 9:30 AM. Head of department informed and has acknowledged the situation and accepted the solution." Then after 9:30 AM another message comes through that reads: *"Lights fixed, PPM schedule updated, asset data base updated, asset history updated, fault report logged, contractor compliant, invoice raised, authorised for payment and put in payment process – job closed."* Although this may seem far-fetched, the technology exists today that would allow this to happen.

Having data and information will allow facilities managers and, in the future, systems to make informed decisions, record the contribution to the core business and become more proactive by using data analytics and forecasting. The possibilities are endless if systems and data sources are connected and share data and information.

Yes, you will need to work on defining what is important to you and why it is important and how important it really is. You will need to define the acceptable parameters of operation for all aspects of your facilities management services, but once you have mapped these, technology can be used and applied to manage and monitor it and relief the administrative burden and largely reactive nature of the facilities management industry.

The time is now

We collectively can create and demand connected systems, as well as more usable data. The technology is available and will continue to advance to make this a reality. I believe we are at a point in time right on the cusp of significant change in facilities management, the way we do things, and the recognition we receive.

We have the power to create a demand for data and information that will put us on the map of every decision-maker and executive. Interconnectivity of systems and tools through a true CDE. A CDE that obviously complies with the relevant standards and requirements like for example those set out in ISO 19650, the international standard for managing information over the whole life cycle of a built asset using BIM.

We need to become smarter about how and where budgets are assigned and spent. Data and information will provide us with the justification we and stakeholders seek. It will allow us to quantify risks and core business contributions. Data and information will provide us with insights that are unparalleled. We will be able to become more proactive, more accurate in predicting and pre-empting issues and address them before they occur.

We can present quantifiable business cases to our executives to aide their decision-making. Ultimately, a smart true CDE synchronises all relevant data, connects teams, tools and systems, and empowers stakeholders to make informed decisions.

About the Author

Rogier Roelvink is a Customer Strategy Director at Oracle Construction and Engineering. He supports clients in digital transformation throughout Asia-Pacific. Rogier has extensive asset and facilities management advisory experience and a passion for informed decision-making. He is actively advancing the facilities management industry as chair of the FMA's Digital Technology & Innovation Special Interest Group.

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COMPUTER-AIDED FACILITIES MANAGEMENT

Peter Harris

CEO – Micad

Covid-19 pandemic bought unprecedented pressures to healthcare systems around the world. We asked leading Property Management Software provider Micad about the impact on CAFM (Computer Aided Facilities Management) and the key learnings from the pandemic.

The unparalleled pressures the Covid-19 pandemic has bought to the healthcare system will be felt for years to come. Patient care in such a situation is extremely difficult, but how effectively each healthcare organisation can respond depends partly on the accuracy and availability of the estates and facilities space data.

We know that good estate management is vital to facilitating effective healthcare, but under the conditions of a pandemic this reliance on the facilities to deliver becomes magnified significantly. Excellent estates management is critical to achieving the best clinical outcomes.

Space matters

When a crisis hits the healthcare system, some of the first questions are; 'what do we have?' and 'where is it?' Basic questions but fundamental, nonetheless. 'What do we have?' starts with the simple question of space. Importantly, space is not just a block of air defined by boundaries, we need to know its size, volume, departmental ownership, function, ventilation, risks and attributes, such as does it have a vinyl floor, the latter being particularly useful for planning clinical activities.

Being unable to rely on accurate data puts additional pressure on healthcare organisations when responding to a crisis. We have witnessed first-hand the need to re-purpose space at short notice, and how those healthcare organisations that had accurate space data have been able respond more efficiently.

"Our Micad system and space data has proven to be invaluable in assisting the Trust with the planning and reorganisation of space and facilities during the coronavirus situation"

Michael Wigmore, Computer Aided Design Manager
Guy's and St Thomas' NHS Foundation Trust

With Micad property management software in use at over 180 NHS Trusts across and over 1000 healthcare sites globally, we have seen first-hand how varied the quality, quantity and availability of space data can be.

So where do you start? Getting the basics right is critical.

You must ensure you have the basic information relating to space, such as:

- What does the space consist of?
- What is the space used for?
- Who owns and occupies the space?

What space consists of should be measured by up-to-date CAD plans that define the layout and proportions of all floor plans. The departmental ownership, function and occupancy need to be matched to the physical space records to create an accurate and complete picture.

There is nothing new here, but many Trusts struggle to maintain accurate space records. Despite the requirements of internal reporting requirements and ERIC returns, ongoing project works often fail to be part of the update process.

Fragmentation and lack of maintenance of space data is in partly due to the constantly changing nature of the estate. Repurposing space is a natural evolution of a healthcare estate, with most having several refurbishing or building projects occurring at any one time. As a result, changes in space aren't always communicated back to those maintaining the data.

In addition, an effective management policy must be enforced to make sure all space changes across the estate are communicated back to those who are responsible for maintaining the data, be that internal staff or a specialist

third party provider. Accurate space data is vital and is arguably even more important during a crisis like the Covid-19 pandemic.

Beyond Space

As we know CAFM's reach goes far beyond just space records, as it provides the solution for planned and reactive maintenance along with a variety of compliance orientated requirements such as asbestos, fire and legionella. Add to that, property transaction management, backlog maintenance, and other regular audits, such as cleaning and waste and it's clear to see the impact CAFM systems have on the real time visibility and reporting across a healthcare estate at any point in time.

Having an up-to-date asset register coupled with understanding compliance levels of common risks is fundamental to contingency planning and reacting to new threats. A challenge raised by several Micad clients during the pandemic was the need to understand where oxygen feeds were available. Within Micad IPR, schematics for oxygen, fire compartmentation and water can all be presented alongside the 'as built' CAD plans that are used to create an accurate register of all the spaces. Combining these key datasets in an easy-to-use platform provides an enriched holistic view of the that helps those with a responsibility for planning contingency and emergency responses. For example, knowing where asbestos may be present in relation to a proposed repurposing of a space will have a big impact on its feasibility. Micad's IPR brings these data sources together, elevating the value of the data and enabling evidence-based strategic decision making.

The requirement for accurate space data isn't new. These requirements are bestowed upon healthcare organisations through central and regulatory instruments such as HTMs, Health and Safety Regulations and ERIC. But what the past two years have highlighted is that all baseline data and reporting mechanisms need to be instantly available and that their absence undermines the ability to mitigate risk as effectively as had the up-to-date CAFM information been present.

The Future

With the pandemic shining a spotlight on data resilience and existing systems, Covid-19 has been a wakeup call for many healthcare organisations. It is interesting to note that the services of companies specialising in the collection of key estates information for Trusts have never been more in demand. This increased awareness should be used as an opportunity to ensure estate data accuracy that can be maintained better for future planning and decision making.

The digitisation of the NHS is high up the agenda and CAFM has a vital role to play. Coupled with this is an ever-accelerating technology drive that presents new ways of data capture and analysis, enabling interoperability and strategic decision making. Micad's new technologies can maximise the investment in quality data currently being sort by many Trusts. From better dashboards of key datasets to 360 walkthroughs of buildings and enhanced mobile applications; the dynamic of how information is harvested, maintained, reported on, and analysed will help healthcare organisations better respond to the next crisis, whilst allowing them to run their estates more efficiently in the meantime.

Key Takeaway

It's crucial for key stakeholders to consider the whole data picture when resilience planning. We do not know when the next crisis will occur and how it will manifest itself, but it is clear that having access to accurate space data across the estate will help with the implementation of mitigation measures aimed at improving patient care and reducing risk.

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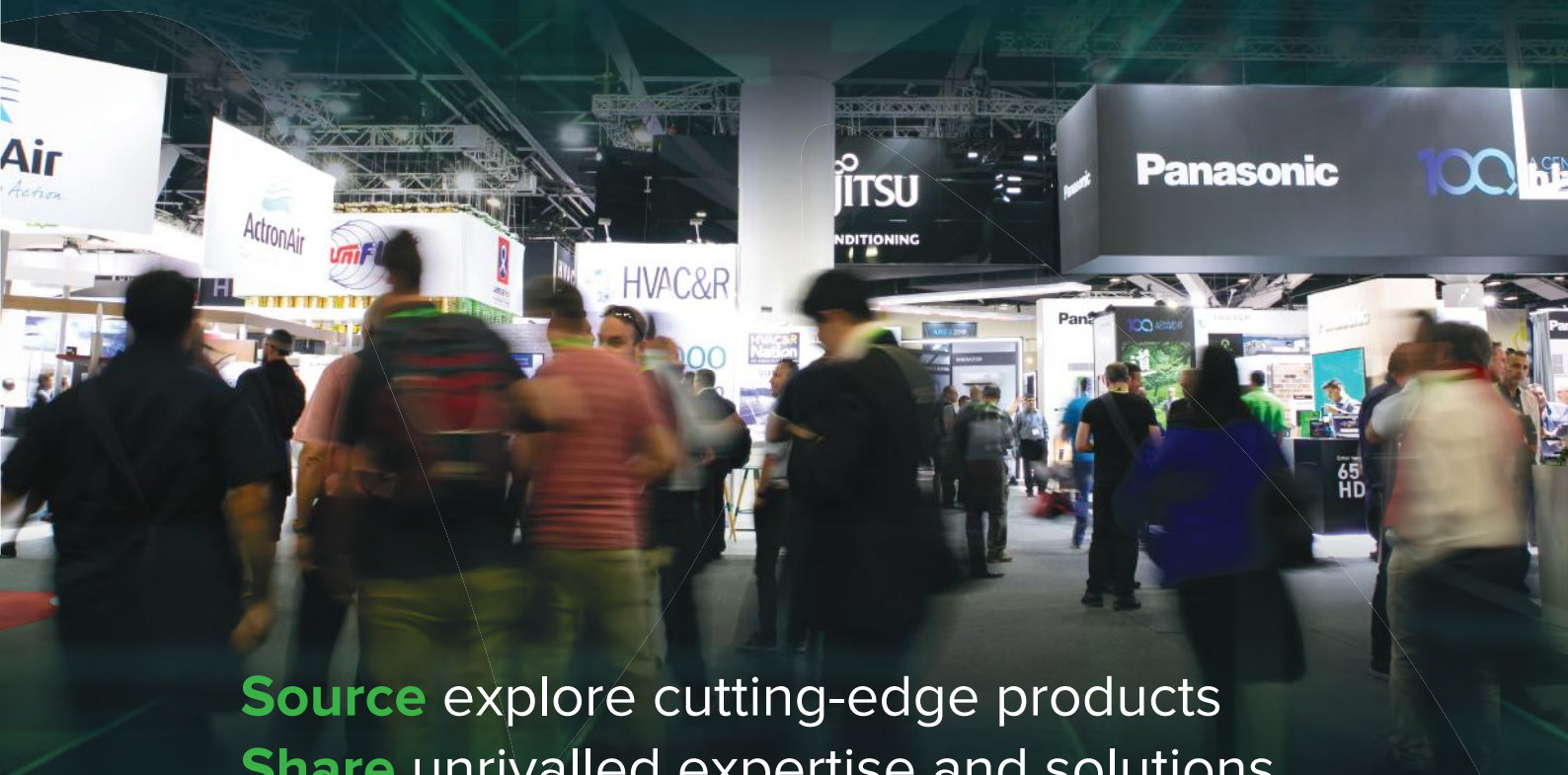

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Hospital Security

Simon Hensworth
BSc (Security Science) (ICCP – Advanced)
Security Consulting Group (SCG)

Hospital environments are unique from a security perspective. They require a balance of privacy, accessibility, safety and security for patients, visitors, and staff. There is a wide range of sensitive information, assets and substances that need to be secured, such as patient records, high value or sensitive equipment and controlled substances (drugs).

Before undertaking any activity related to this article, it is recommended you consult a licensed Security Professional

Facilities, including those with an Emergency Department, generally experience a high throughput and diversity of patients and visitors, which makes monitoring, screening and tracking of authorized individuals a challenge. An increased patient turnover often contributes to a high stress environment, further exacerbated by the presentation of emotionally charged visitors, drug or alcohol affected patients, mentally unstable individuals, and patients who are particularly vulnerable due to age, injury or illness. The pandemic has added a new level of complication to the already challenging hospital security environment, resulting in shortages of staff, fear amongst the public and additional threats to health and safety.

Providing an adequate level of security requires a holistic approach and a multi-layered strategy including Security Management, incorporation of security principles, procedural, physical and electronic security, and consideration of new technology as it becomes available to determine whether processes can be enhanced or improved.

Security Management

Security for critical infrastructure such as hospitals must follow a formal and logical approach. Security should be managed in the same way as any other management function, following a cycle of planning, implementation, monitoring and review, for continuous improvement to be achieved. Management of the security function should incorporate a structured and programmed regimen of security risk assessment including assessment of Criticality, Threats, and Vulnerabilities to determine the most cost-effective means of mitigating security risk to an acceptable level. Security risks can be managed through an integrated system incorporating security principles, and cultural, procedural, physical, electronic and cyber security strategies.

Security Principles:

Defence-in-Depth should be a consideration for critical rooms and sensitive areas of the hospital, ensuring that the most vulnerable individuals and activities are given an inherently higher level of protection by locating them within multiple layers of security controls, whether these be physical, procedural or technological.

Deter, Detect, Delay and Respond, or 3DR, is a methodology to assess the ability of physical security to manage security risks and incidents. 3DR can assist in testing existing or planned physical security for a hospital to determine the likelihood of physical security successfully minimising the escalation of negative consequences from an incident.

Crime Prevention Through Environmental Design (CPTED) should be considered, including Natural Surveillance, Natural Access Control and Territorial Reinforcement. The correct application of CPTED principles promotes good safety perception by users of the environment, and contributes to mitigating a range of potential security and safety risks. Furthermore, CPTED can result in less reliance on additional technology or overt security measures that are often unsightly and expensive to retrofit.

Procedural Security

Procedural security includes policies, procedures, guarding, and other processes that support the security function. Security awareness programs and security related training are vital for promoting a positive security culture and ensuring that staff are optimally equipped to support the hospital security function.

For a hospital environment, staff need to be aware of important issues such as: how to support the facility's security systems and processes, how to identify a potential risk before it escalates, how to de-escalate risk-behaviours, and timely reporting of security incidents to maximize the effectiveness of security incident/intelligence records and trend analysis.

For a hospital environment, security training strategies should incorporate a holistic approach to risk de-escalation. De-escalation tactics should emphasise early assessment of risk potential, using strategies and supporting resources to calm behaviour, and may include unconventional de-escalation strategies. Options for de-escalation should be considered early in the planning process of a hospital facility, to ensure that suitable resources are provided to support effective de-escalation.

Physical and Electronic Security

Physical security and security technologies also play a key role in deterring, detecting, delaying and responding to security incidents. The design of all systems must be based on a risk-informed Operational Requirement to ensure that they will remain fit-for-purpose throughout their lifecycle.

A Security Management System (SMS) should integrate Intruder Detection Systems (IDS) duress alarms, Electronic Access Control systems (EACS), and enhanced CCTV, including smart detection analytics.

For a larger hospital, security technology should be managed centrally from a Security Control Room or similar via an SMS, so that site activities can be monitored and a response to incidents can be prioritized, coordinated and managed in an efficient manner. The value of detection is minimal without an effective response capability,

One of the most important elements of a hospital security profile is the duress system. These are often integrated by the SMS as part of the IDS function. Duress alarms are vital for supporting safety of staff and patients to enable instant reporting of high-risk incidents such as Code Black events. A duress alarm integrated with CCTV cameras can provide increased situational awareness for monitoring and security personnel, particularly when equipped with audio functionality.

Electronic Access Control Systems (EACS) must be carefully considered and designed to ensure that it supports public access whilst maintaining security of staff and patient-only areas. EACS may also require advanced functionality to enable specific zones to be locked down to contain high-risk patients, control contamination or assist in managing rare but high consequence incidents such as an active armed offender incident.

CCTV is critical for central monitoring staff to maintain surveillance and coordinate activity across the facility. It can be used for monitoring persons of interest, verification of alarm activations, guiding response personnel to incidents and for post incident analysis and investigation. However, for this functionality to be effective, the system design must be based on a formal Operational Requirement process.

New technologies

Security technology is constantly evolving and the market should be monitored for opportunities to improve security processes. Some recent technological developments that may support security for the hospital environment include systems that prevent or detect tailgating at access-controlled doors and facial recognition replacing access cards, which enables hospital staff to keep their hands free for other tasks as they move between locations. CCTV manufacturers have also developed specific analytics to assist with identifying potential COVID cases. This could also be used at access control points to assist in risk management prior to admitting entry to sections of a hospital. Modular booths that incorporate access control and temperature scanning for COVID monitoring are also available.

About the author

Simon is a Senior Security Consultant with Security Consulting Group (SCG). Simon has over 20 years' experience in the Security Consulting Industry, has a Bachelor of Science Degree in Security Science from Edith Cowan University and is an ICA (International CPTED Association) certified CPTED professional (Crime Prevention Through Environmental Design), ICCP - Advanced. Simon has provided security solutions for many clients with major assets across Australia and is involved in all aspects of security, security technologies, promoting security and promoting security awareness.

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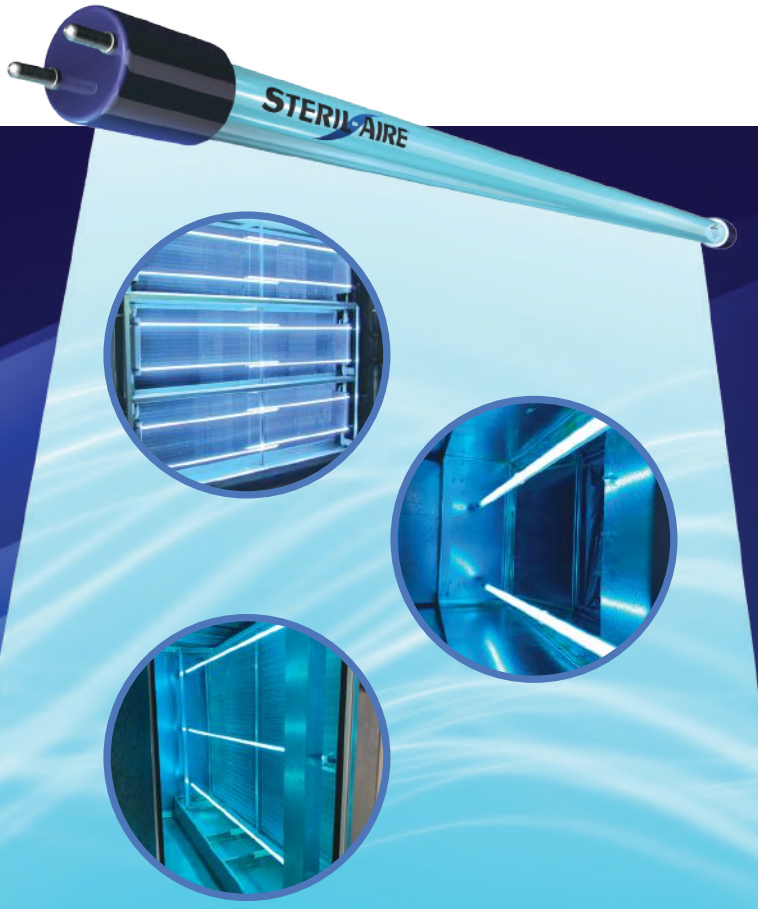

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Effect of enhanced ultraviolet germicidal irradiation in the heating ventilation and air conditioning system on ventilator-associated pneumonia in a neonatal intensive care unit

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Objective: The objective of this study was to test the hypothesis that enhanced ultraviolet germicidal irradiation (eUVGI) installed in our neonatal intensive care unit (NICU) heating ventilation and air conditioning system (HVAC) would decrease HVAC and NICU environment microbes, tracheal colonization and ventilator-associated pneumonia (VAP).

Study Design: The study was designed as a prospective interventional pre-and post-single-center study. University-affiliated Regional Perinatal Center NICU. Intubated patients in the NICU were evaluated for colonization, and a high-risk sub-population of infants <30 weeks gestation ventilated for ≥14 days was studied for VAP. eUVGI was installed in the NICU's remote HVACs. The HVACs, NICU environment and intubated patients' tracheas were cultured pre-and post-eUVGI for 12 months. The high-risk patients were studied for VAP (positive bacterial tracheal culture, increased ventilator support, worsening chest radiograph and ≥7 days of antibiotics).

Result: *Pseudomonas*, *Klebsiella*, *Serratia*, *Acinetobacter*, *Staphylococcus aureus* and *Coagulase-negative Staphylococcus* species were cultured from all sites. eUVGI significantly decreased HVAC organisms (baseline 500 000 CFU cm^2; $P = 0.015$) and NICU environmental microbes ($P < 0.0001$). Tracheal microbial loads decreased 45% ($P = 0.004$), and fewer patients became colonized. VAP in the high-risk cohort fell from 74% ($n = 31$) to 39% ($n = 18$), $P = 0.04$. VAP episodes per patient decreased (Control: 1.2 to eUVGI: 0.4; $P = 0.004$), and antibiotic usage was 62% less ($P = 0.013$).

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Conclusion: eUVGI decreased HVAC microbial colonization and was associated with reduced NICU environment and tracheal microbial colonization. Significant reductions in VAP and antibiotic use were also associated with eUVGI in this single-center study. Large randomized multicenter trials are needed. *Journal of Perinatology* advance online publication, 24 March 2011; doi:10.1038/jp.2011.16

Keywords: nosocomial infection; antibiotics; prematurity; ventilator-associated pneumonia; neonatal intensive care unit

Introduction

Nosocomial infections constitute a major public health threat affecting many people worldwide, and are the direct cause of morbidity and death in large numbers of hospital patients.[1] These nosocomial infections increase length of stay (LOS) and health-care costs,[2] and the associated emergence of

antibiotic-resistant microorganisms[3] is viewed by the World Health Organization as a global threat.

Spread of nosocomial infections through contact and localized droplet transmission is long understood, and hand washing has been the primary focus of infection control groups. It is more recently recognized that many infectious diseases are transmitted through inhalation of airborne infectious particles, and that these particles can be disseminated through heating ventilation and air conditioning systems (HVACs).[4] The Centers for Disease Control and Prevention recommend that high-efficiency particle air filters be applied downstream in hospital HVACs as a means to prevent spread of airborne microbes.[5] However, all filter types can become leaky or contaminated, releasing significant quantities of pathogens into the indoor environment.[6] In addition to surface contamination secondary to contact spread, it may be that microbes housed in HVAC systems are contributing to the hospital bioload. Multiple studies have documented pathogenic bacteria, fungi, viruses and mold present in the air.[6–12] The HVAC itself is colonized with common nosocomial pathogens, and may constitute a significant reservoir.[9,13,14]

Ventilator-associated pneumonia (VAP) is a nosocomial infection of the lung in intubated patients, including neonatal intensive care unit (NICU) patients. Rates have been reported as 16% of infants born at 25 to 29 weeks' gestational age,[15] 1.4 to 3.5/1000 NICU ventilator days in all NICU patients[16] and 12.5/1000 ventilator days in babies born at <1500 g.[17] A comprehensive study carried out at the Washington University St Louis Children's Hospital in infants <2000 g at birth demonstrated that VAP occurred in 28% of ventilated patients, the VAP rate was 6.5/1000 ventilator days for babies <28 weeks' gestation at birth and VAP was an independent predictor of mortality (odds ratio 3.4).[18] Tracheal colonization rates as high as 87% have been measured in intubated NICU patients.[19]

The germicidal effect of UV light, through dimerization of DNA, has been described for a wide range of microorganisms, including bacteria, fungi and viruses.[20,21] Ultraviolet germicidal irradiation (UVGI) is recognized as an intervention that reduces dissemination of airborne infections,[4] and has been applied with some success to ceiling air in tuberculosis clinics[22] and operative suites.[20] We hypothesized that enhanced UVGI (eUVGI, or Pathogen Control System) (Vigilair Systems, North Tonawanda, NY, USA), applied to central coil components of an NICU HVAC would decrease pathogens in the HVAC, thereby decreasing pathogens in the NICU air and surfaces, and thus decrease tracheal colonization in intubated NICU patients. We

further hypothesized that this would decrease VAP prevalent in our smaller premature intubated infants.

Methods

Study design and setting

This is a prospective pre-and post-intervention design study. Although our NICU is supplied by two HVACs, the intubated patients were all in an area supplied by one HVAC, so a randomized study was not possible. The study was conducted from 2001 to 2003 at The Women and Children's Hospital of Buffalo NICU. Several practices remained unchanged throughout the study period including: (1) infection control protocols for hand washing (in room sinks with running water and bactericidal soap) and universal contact precautions; (2) the NICU surface cleaning schedule and materials (Cavacide, Metrex, Romulus, MI, USA); and (3) respiratory protocols for equipment cleaning, ventilator circuit changes and daily humidifier water changes. Endotracheal tubes and flow-inflating bags were not routinely changed. Tracheal aspirate collections involved a gloved, open suction technique with sterile saline instilled into the trachea and then suctioned into a sterile trap and sealed. Although the practice of earlier extubation did increase over the study period, this was mitigated in our analysis by the high-risk sub-population, including only babies who were ventilated for at least 14 days. The HVACs were equipped with 95% filters (ASHRAE 52 to 76 specification) that were last changed 1 year before the study, and were not changed during the study period. The HVAC components were not manually cleaned.

Patient population

Tracheal microbial colonization was measured in all NICU patients who had an endotracheal tube in place at baseline, 1, 2, 7 and 12 months after eUVGI. The University at Buffalo Children and Youth Institutional Review Board waived the need for informed consent. To determine the impact of eUVGI on nosocomial lung infection, we identified a sub-population with a high incidence of VAP. Patients born <30 weeks gestation, who required ventilator support for ≥14 consecutive days beginning in their first week of life, had a >70% incidence of VAP in our NICU, and so we defined this subpopulation as 'high risk' for VAP. Patients were excluded from the high-risk sub-population analysis if they had congenital heart disease, complex congenital anomalies, other NICU stays, ventilator days >200 or died or were transferred while on ventilator support. There were 2, 0, 3 and 1 baby (babies) who met exclusion criteria, respectively, in each 6-month epoch.

Patient data were analyzed in 6-month epochs: 6 months before eUVGI installation in July 2001; the next 6 month transition period during which the HVACs' microbial contamination was progressively eliminated; the following three 6-month intervals, ending June 2003. After July 2003, patients were moved to a newly built 64-bed NICU with eUVGI in place, and the study was closed.

Intervention

In July 2001, eUVGI, also called Pathogen Control System, was installed in the HVACs supplying the NICU (eUVGI schematic, Supplementary Information). The eUVGI system design included UV lamps (Sterile-Aire, Burbank, CA, USA) of optimal size and placement for specific microbial elimination. eUVGI had been placed previously in 12 buildings (to treat 'sick building syndrome' and improve HVAC efficiency) or hospitals. Also designated as Qualified Anti-Terrorism Technology[23] by the Department of Homeland Security, eUVGI had been installed into the United Nations building. By 2009, eUVGI had been placed in 35 hospitals in 13 states.

Microbial studies

Cultures of HVACs, the environment and intubated patients' tracheas were obtained before eUVGI installation and over the next 12 months. Six HVAC sites were tested including the cooling coils' air effluent side,[2] drain pan,[2] and bulk water condensate.[2] A total of 43 environmental sampling sites were designated: ambient air,[7] outside air[1] and NICU surfaces, including work stations,[2] laundry hamper,[1] diaper weigh stations,[3] tap water,[8] sink drain traps[8] and ceiling diffusers for supply air.[7]

HVAC and environment samples were collected using methods standardized for inanimate surface and air contamination,[24] and were analyzed by an independent laboratory (Pure Earth Environmental Laboratory, Pennsauken, NJ, USA). NICU mixed air and outdoor air samples were collected in duplicate over 2 min by an Andersen N-6 Impactor (Graseby/Andersen, Atlanta, GA, USA) using malt extract agar and Sabouraud dextrose agar media (Hardy Diagnostics, Santa Maria, CA, USA) for environmental fungi and blood agar plate media for environmental bacteria. Surface-wipe samples were obtained using a BBL culturette (Becton Dickinson, Franklin Lakes, NJ, USA) with a sterile rayon-tipped swab that was moistened with a modified Stuart's transport medium before sampling 1 square inch of surface area. The completed swab specimen was placed back into its original container, sealed, placed immediately into a clean cooler and shipped next day via air to the laboratory for identification and quantification of fungus, mold and bacteria to the species level. Upon arrival at the laboratory, each surface wipe was immersed in a sterile test tube containing 10 ml of sterile distilled water. The test tube sample was kept at room temperature for 10 min and then placed in a rotary shaker (3.81 throw, 220 r.p.m.) for 1 min. The resulting suspension or dilution was then inoculated (0.1 ml aliquots) on a 2% malt extract agar (for saprotrophic fungal growth) and a trypticase soy agar (for environmental bacteria growth). The results provided estimates of the total number of viable propagules per ml of suspension. The samples were immediately incubated at 25±1 1C, along with laboratory controls.

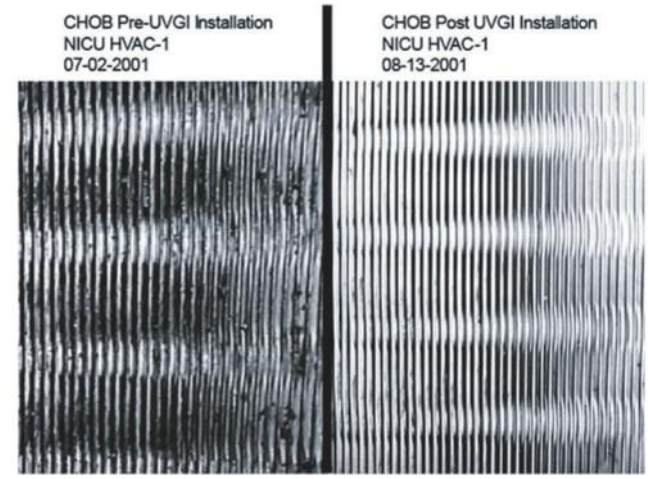

Figure 1 Photograph of a cooling coil in the neonatal intensive care unit (NICU) heating ventilation and air conditioning system (HVAC) before and after installation of enhanced-ultraviolet germicidal irradiation (pre- and post- eUVGI) installation.

Figure 2 The microbial load of neonatal intensive care unit (NICU) surfaces was widely variable early in sampling, but all surfaces approached zero during enhanced ultraviolet germicidal irradiation (eUVGI).

Tracheal aspirates from routine suctioning of intubated patients by bedside nurses at predetermined sampling times were analyzed by the hospital laboratory (Kaleida Labs, Amherst, NY, USA) using standard hospital microbiology laboratory techniques with plated culture media for clinical bacterial and fungal isolation.[25] Positive cultures were reported as rare, few, moderate or as heavy growth for each organism.

The diagnosis of VAP was derived from the Centers for Disease Control and Prevention/NNIS age-specific definition of nosocomial pneumonia,[26] and required all of the following: a tracheal aspirate culture positive for pathogens,[27] increased ventilator support requirements, new and persistent infiltrates on chest radiographs and a ≥7-day course of antibiotics. Decisions on patients' treatment with antibiotics, ventilator support and LOS were made by a qualified neonatologist (who was unaware that VAP was being ascertained) based on assessment of clinical, laboratory, radiographic and culture results.

Outcome measures

To quantify NICU tracheal colonization, we defined an airway microbial load index (MLI), whereby each pathogen per patient sample was quantified on a scale of 1 to 4 for rare, few, moderate or heavy growth, as reported by the hospital microbiology laboratory, and totaled. Patients whose tracheal aspirates showed no growth were assigned a zero. MLI scores for all patients were averaged as a measure of overall NICU patient microbial load for a given sampling time point. The length of time of intubation at the time that the samples were obtained did not correlate with colonization as measured by tracheal MLI (mean days of ventilation for each sampling time point was 22.19 days at time 0 days, 31.46 days at 1 month of eUVGI, 28.29 days at 2 months, 59.75 days at 7 months and 27.6 days at 12 months of eUVGI).

VAP episodes, types of organisms, number of antibiotic courses, antibiotic days, ventilator days and LOS were compared between the pre-and post-eUVGI time periods. There was a trend for the age at first VAP episode to increase over time (P . 0.08 by one-way ANOVA).

Statistical analysis

The relationship between post eUVGI installation time and the tracheal and HVAC microbial load was assessed with linear regression, and a log transform was applied to the MLI

variable. A mixed model was used, which fit the environmental samples, as a function of a random time and random location effect. To statistically assess observed differences in time, a likelihood ratio test was used. Logistic regression was used to assess differences in VAP; secondary end points were analyzed using Poisson regression. Because gestational age independently predicted LOS and ventilator days ($P < 0.001$), models were adjusted for gestational age. If overall differences were significant ($P < 0.05$), eUVGI groups were compared with the control group in pairwise manner, with a Bonferroni adjustment. The Cochran–Armitage test for trend and the Pearson correlation coefficient were used where appropriate. Simple with-and without-eUVGI comparisons were analyzed by the Student's paired t-test (SAS statistical software; Cary, NC, USA). All statistical analyses were performed by a biostatistician (GEW).

Figure 3 Enhanced ultraviolet germicidal irradiation (eUVGI) decreased the microbial load of the heating ventilation and air conditioning system (HVAC) (mean CFU/cm2 x 1000) and patients' tracheas MLI*. *MLIFmicrobial load indexFa score to quantify overall NICU density of tracheal colonization at a point in time, whereby each airway pathogen is quantified on a scale of 1 to 4 (rare, light, moderate and heavy growth as reported by the laboratory) and totaled for each patient, for example, a patient with light growth of three pathogens would have an MLI ¼ 3, whereas a patient with heavy growth of three pathogens would have an MLI ¼ 12; patients whose tracheal aspirates showed no growth were assigned a zero.

Results

Microbial studies

Multiple bacteria, fungi and mold were isolated at various times from the HVACs, NICU environment and intubated patients' tracheas to describe the microbial environment throughout the environmental study period (Microorganism Table, Supplementary Information). At baseline, the HVAC components, cooling coils and drain pan condensate were visibly contaminated (Figure 1) and cultured positive for moderate-to-heavy growth of fungi and Gram-negative rods, and lighter growth of Gram-positive cocci and Bacillus species. NICU surfaces and air showed a similar population of microbes. Sink traps were heavily colonized with Gram-negative rods; tap water was negative. *Pseudomonas aeruginosa*, *Serratia marcescens* and *Klebsiella pneumoniae* were the most common isolates in tracheal aspirates. eUVGI caused a 3-log reduction in the HVACs' microbial load within 3 days (Figure 2). By approximately 6 weeks the HVACs had

Table 1 Demographic profile of NICU and high-risk cohort and VAP results

All NICU patients		Post-eUVGI		
	Pre-eUVGI 1/01–6/01	1/02 –6/02	7/02 –12/02	1/03 –6/03
Admissions, *n*	310	345	368	316
Average daily census, *n*	42.4	46.4	46.6	39
% Inborn	66	59	69	60
% Patients with tracheal MLI≤1	14	30	39	44
No. of babies admitted <30 weeks	54	57	73	51
No. of babies <30 weeks and ventilated for ≥14 days (% of all babies <30 weeks) High-risk cohort (mean (s.d.))[a]	31 (57)	25 (44)	24 (33)	18 (35)[b]
Gestational age, weeks	26.4 (1.9)	25.7 (1.5)	26.2 (1.6)	26.0 (1.6)
Birth weight, (g)	901 (173)	816 (140)	853 (105)	845 (188)
Total parenteral nutrition/central-line days	37 (12)	41 (9)	45 (13)	51 (17)
Length of stay, days	98 (57)	92 (26)	89 (24)	105 (40)
Ventilator days	50 (33)	44 (23)	44 (27)	48 (28)
No. of VAP episodes per high-risk patient	1.2	0.7	0.8	0.4[a]
% with at least one VAP	74	56	54	39
No. of VAP episodes per high-risk patient with any VAP	1.7	1.3	1.5	1.1[b]
No. of antibiotics per high-risk patient	2.6 (2.7)	1.7 (1.7)	1.9 (2.4)	1.0 (1.5)[b]
Antibiotic days	20.9 (24.2)	17.3 (20.8)	18.8 (25.3)	9.5 (14.7)

Abbreviations: eUVGI, enhanced ultraviolet germicidal irradiation; MLI, microbial load index; NICU, neonatal intensive care unit; VAP, ventilator-associated pneumonia.
[a]*n* = 2, 0, 3 and 1 in each time period met exclusion criteria (congenital heart disease, complex congenital anomalies, other NICU stays, ventilator days >200 or died or were transferred while on ventilator support).
[b]*P*<0.01 compared with pre-eUVGI.

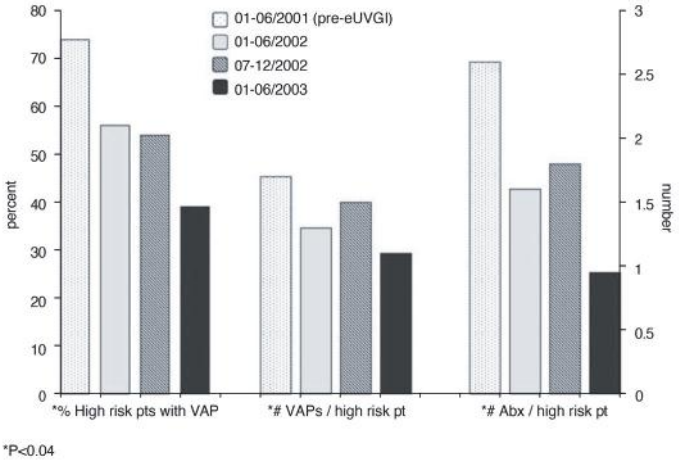

Figure 4 During enhanced ultraviolet germicidal irradiation (eUVGI), the proportion of high-risk patients (<30 weeks gestation and X14 days ventilator support) who developed ventilator-associated pneumonia (VAP), as well as the number of episodes of VAP and the number of antibiotics per patient in this population decreased. pt, patient; Abx, antibiotics.

no visible contamination (Figure 1) and by 6 months HVAC cultures were negative (Figure 3). Similarly, NICU surface cultures approached zero during eUVGI ($P < 0.0001$, Figure 2). Baseline tracheal secretions had a heavy bioload (MLI: 4.2; $n = 21$), which decreased with eUVGI as HVAC colonization decreased (Figure 3). The percent of patients who had no or little tracheal colonization (MLI ≤ 1) increased from 14% pre-eUVGI to 44% post-eUVGI (Table 1).

Ventilator-associated pneumonia

The clinical environment and patient population did not significantly differ among pre-and post-eUVGI groups (Table 1). Patient ventilator days, LOS, central-line days, gestational age and birth weight were similar for all groups. The percent of patients <30 weeks gestation who met the criterion of ≥14 ventilator days decreased over time (57 to 35%; $P = 0.01$, Table 1).

Approximately 74% of the high-risk sub-population had VAP before eUVGI was installed. After eUVGI, VAP decreased to 55% after 6 months and to 44% at 18 months ($P = 0.04$, Table 1). In addition, both the number of VAP episodes and number of antibiotics per high-risk patient decreased significantly (Figure 4). VAP was 88% polymicrobial with pathogen species similar to those identified in the HVACs, NICU environment and routine tracheal aspirates. Among the four 6-month cohorts of patients, Gram-negative bacteria were identified in 72 to 100% patients with VAP, and 0 to 62% grew Gram-positive bacteria. Gram-negative rods including *P. aeruginosa*, *Escherichia coli*, *S. marcescens*, *K. pneumoniae*, and *Stenotrophomonas*, *Acinetobacter* and *Enterobacter* species were identified three times as often as Gram-positive cocci (*Staphylococcus aureus*, *Coagulase-negative Staphylococcus* and *Enterococcus* species), and this proportion did not change with eUVGI. *P. aeruginosa* was the most common species isolated with and without eUVGI (57% pre-eUVGI; 43% at 18 months after eUVGI). Fungi, including *Candida albicans*, *Candida parapsilosis* and *Mallasezia furfur*, were isolated in 17 and 14% of VAP cultures, respectively. During eUVGI, antibiotic use was reduced (Table 1). As expected, gestational age correlated negatively with LOS ($r = –0.34$) and ventilator days ($r = –0.51$); LOS ($r = 0.37$) and ventilator days ($r = 0.53$) correlated positively with VAP. All correlations were significant ($P < 0.001$).

Discussion

This study demonstrates that eUVGI eradicates microbes in the central cooling coils and components of the HVAC and decreases the microbial load of the NICU environment. Many of the bacteria eliminated were Gram-negative bacilli known to be associated with serious nosocomial infections in the NICU.[28] eUVGI was associated with a reduction in colonization of patient airways and VAP. These results suggest that it is possible that airborne pathogens may contribute significantly to surface contamination and patient colonization. The delayed improvement in tracheal colonization and VAP following reduction of bacteria in the HVACs and environment possibly reflects the persistent, although progressively diluting reservoirs in patients who were admitted before or early in the eUVGI period and who remained hospitalized in close proximity to patients admitted later.

Although contact is well-accepted as a means of transmission of nosocomial infection, concepts of airborne transmission of hospital infection are evolving.[29,30] Early studies showed that all airborne and dry-surface microbes undergo desiccation; however, often overlooked were the genetic repair and secondary rehydration with ambient humidity that virtually ensure spread of disease by the aerobiological pathway.[22] Many microbes have the capability of remaining airborne and viable, or settling and re-suspending for extended periods in the indoor environment,[31] and may exist as single cells or spores, aggregates or as biological material carried by non-biological particles.[32] In addition to reports of airborne transmission of infection in medical patients, surgical wound infections have been correlated with air bacteria levels.[33] In a preliminary report of eUVGI placed in HVACs that supply air in operating rooms, eUVGI decreased the number of positive bacterial cultures in the HVAC system as well as in the air sampled at the level of the operating table.[34]

Pneumonia is the second most frequent nosocomial infection for all patient populations.[1] Although a VAP prevalence of 20% has been described for NICU infants who were intubated ≥48h, with a mean age at diagnosis of 9±7 days,[35] adult patients on ventilator support have up to 40% incidence of nosocomial pneumonia, increasing to 70% with adult respiratory distress syndrome (ARDS).[36] Our VAP rate of 74% is closer to this ARDS population, and our high risk

infants, intubated for >14days, more closely resemble this sicker population as compared with infants intubated for a mean of 9 days. Pediatric patients with VAP contract 1.9 episodes per patient,[37] similar to our rate of 1.7 episodes per high-risk NICU patient. Comparable to adult and pediatric populations, VAP was largely polymicrobial in this cohort, and Gram-negative organisms were isolated more often than Gram-positive organisms.[19,35] *P. aeruginosa* was the most common isolate, and all species in our population were virtually identical to those in other populations.

Nosocomial infections generate a significant financial burden to hospitals. In a recent study[2] of a combined PICU–NICU population in which 32% developed VAP, the hospital cost for patients with VAP was $308 534 compared with $252 652 in the non-VAP patient. Thus, we speculate that overall costs could be decreased if eUVGI decreases VAP; also, we did not study other nosocomial infections.

Finally, given the evidence for aerosol transmission of influenza viruses[10] and their inactivation by UV radiation,[21] eUVGI installed in health-care facility HVACs may contribute to pandemic preparedness by offering an enhanced level of protection to health-care workers,[38] similar to its use in buildings for protection from bio-terrorism agents.[6] eUVGI may also diminish the incidence of bacterial super infection, frequent causes of mortality during flu pandemics.[39]

Several issues limit interpretation of these data. A more rigorous randomized design was precluded by the NICU layout, and the necessary pre-and post-comparisons are subject to possible clinical care changes over time. We cannot rule out that VAP may have decreased over time because of unidentified clinical or environmental interventions. Actually, the decreased percent of patients <30 weeks with prolonged ventilation over time may reflect, in part, early extubation practices, and suggests that those neonates who remained intubated and thus met criteria may have constituted an even sicker population in the later post-eUVGI cohorts. The close timing of environmental and clinical responses with HVAC improvements suggests these may have been affected by eUVGI. DNA testing would have more definitively linked the HVAC and NICU environmental reservoirs with the patients' organisms, but was beyond the scope of this study and could be considered in a more definitive randomized controlled trial.

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Conclusion

In conclusion, eUVGI eradicated microbes in HVACs, and was associated with a decrease in NICU environmental pathogens and tracheal colonization. Significant reductions in VAP and antibiotic use in NICU high-risk patients were associated with eUVGI in this limited study. Large multicenter randomized trials are needed to further characterize the effects of eUVGI on the full spectrum of adult, pediatric and neonatal hospital populations.

Note

The outcomes of the study were achieved by providing a minimum UVC output of 750 µWatts/cm2 on the AHU internal surfaces measured in 12 Deg C air with a velocity of 2 m/s.This amount of minimum UVC intensity at end of lamp life achieved the necessary dosages for the reduction of airborne pathogens.

Conflict of interest

Corinne Leach, MD, PhD, is the spouse of Vigilair Systems stockholder and former CEO (Timothy Leach), and she introduced the concept to our group.

Acknowledgments

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References

1 Vincent JL, Rello J, Marshall J, Silva E, Anzueto A, Martin CD *et al*. International study of the prevalence and outcomes of infection in intensive care units. *JAMA* 2009; 302: 2323–2329.

2 Srinivasan R, Asselin J, Gildengorin G, Wiener-Kronish J, Flori HR. A prospective study of ventilator-associated pneumonia in children. *Pediatrics* 2009; 123: 1108–1115.

3 Opal SM, Calandra T. Antibiotic usage and resistance: gaining or losing ground on infections in critically ill patients? *JAMA* 2009; 302: 2367–2368.

4 ASHRAE ASoH, Refrigerating and Air-Conditioning Engineers. *ASHRAE Position Document on Airborne Infectious Diseases*. Airborne Infectious Diseases Position Document Committee: Atlanta, GA: (www.ashrae.org/positiondocuments) 2009.

5 Sehulster LM, Chinn RY, Arduino MJ, Carpenter J, Donlan R, Ashford D *et al*. *Guidelines for environmental infection control in health-care facilities. Recommendations from CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC*. American Society for Healthcare Engineering/ American Hospital Association: Chicago IL, 2004.

6 Brickner PW, Vincent RL, First M, Nardell E, Murray M, Kaufman W. The application of ultraviolet germicidal irradiation to control transmission of airborne disease: bioterrorism counter measure. *Public Health Rep* 2003; 118: 99–114.

7 Kumari DN, Haji TC, Keer V, Hawkey PM, Duncanson V, Flower E. Ventilation grilles as a potential source of methicillin-resistant *Staphylococcus aureus* causing an outbreak in an orthopaedic ward at a district general hospital. *J Hosp Infect* 1998; 39: 127–133.

8 Jones AM, Govan JR, Doherty CJ, Dodd ME, Isalska BJ, Stanbridge TN *et al*. Identification of airborne dissemination of epidemic multiresistant strains of *Pseudomonas aeruginosa* at a CF centre during a cross infection outbreak. *Thorax* 2003; 58: 525–527.

9 McDonald LC, Walker M, Carson L, Arduino M, Aguero SM, Gomez P *et al*. Outbreak of *Acinetobacter* spp. bloodstream infections in a nursery associated with contaminated aerosols and air conditioners. *Pediatr Infect Dis J* 1998; 17: 716–722.

10 Tellier R. Review of aerosol transmission of influenza A virus. *Emerg Infect Dis* 2006; 12: 1657–1662.

11 Li Y, Leung GM, Tang JW, Yang X, Chao CY, Lin JZ *et al*. Role of ventilation in airborne transmission of infectious agents in the built environment—a multidisciplinary systematic review. *Indoor Air* 2007; 17: 2–18.

12 Yu IT, Li Y, Wong TW, Tam W, Chan AT, Lee JH *et al*. Evidence of airborne transmission of the severe acute respiratory syndrome virus. *N Engl J Med* 2004; 350: 1731–1739.

13 Gundermann KO. Spread of microorganisms by air-conditioning systems–especially in hospitals. *Ann N Y Acad Sci* 1980; 353: 209–217.

14 Moritz M, Peters H, Nipko B, Ruden H. Capability of air filters to retain airborne bacteria and molds in heating, ventilating and air-conditioning (HVAC) systems. *Int J Hyg Environ Health* 2001; 203: 401–409.

15 Holleman-Duray D, Kaupie D, Weiss MG. Heated humidified high-flow nasal cannula: use and a neonatal early extubation protocol. *J Perinatol* 2007; 27: 776–781.

16 Foglia E, Meier MD, Elward A. Ventilator-associated pneumonia in neonatal and pediatric intensive care unit patients. *Clin Microbiol Rev* 2007; 20: 409–425.

17 Hentschel J, Brungger B, Studi K, Muhlemann K. Prospective surveillance of nosocomial infections in a Swiss NICU: low risk of pneumonia on nasal continuous positive airway pressure? *Infection* 2005; 33: 350–355.

18 Apisarnthanarak A, Holzmann-Pazgal G, Hamvas A, Olsen MA, Fraser VJ. Ventilator-associated pneumonia in extremely preterm neonates in a neonatal intensive care unit: characteristics, risk factors, and outcomes. *Pediatrics* 2003; 112: 1283–1289.

19 Aly H, Badawy M, El-Kholy A, Nabil R, Mohamed A. Randomized, controlled trial on tracheal colonization of ventilated infants: can gravity prevent ventilator-associated pneumonia? *Pediatrics* 2008; 122: 770–774.

20 Goldner JL, Moggio M, Beissinger SF, McCollum DE. Ultraviolet light for the control of airborne bacteria in the operating room. *Ann N Y Acad Sci* 1980; 353: 271–284.

21 Sagripanti JL, Lytle CD. Inactivation of influenza virus by solar radiation. *Photochem Photobiol* 2007; 83: 1278–1282.

22 Riley RL, Nardell EA. Clearing the air. the theory and application of ultraviolet air disinfection. *Am Rev Respir Dis* 1989; 139: 1286–1294.

23 QATT. Support Anti-terrorism by Fostering Effective Technologies Act of 2002 (SAFETY); Qualified Antiterrorism Technology *(QATT). Homeland Security Act of 2002* 2002; Title VIII, Section 861–862, p 2238.

24 AIHA. AIHA Field Guide. 1996.

25 York MK, Gilligan P. Lower respiratory tract cultures In: Isenberg HD (ed). *Clinical Microbiology Procedure Handbook*, 2nd edn. ASM Press: Washington DC, 2004.

26 CDC CfDCaP. Criteria for defining nosocomial pneumonia. www.cdc.gov/ncidod/hip/NNIS/members/pneumonia/Final/PneuCriteriaFinal.pdf 2002.

27 Katayama Y, Minami H, Enomoto M, Takano T, Hayashi S, Lee YK. Usefulness of Gram staining of tracheal aspirates in initial therapy for ventilator-associated pneumonia in extremely preterm neonates. *J Perinatol* 2010; 30: 270–274.

28 Karlowicz MG, Buescher ES, Surka AE. Fulminant late-onset sepsis in a neonatal intensive care unit, 1988–1997, and the impact of avoiding empiric vancomycin therapy. *Pediatrics* 2000; 106: 1387–1390

29 Langmuir AD. Changing concepts of airborne infection of acute contagious diseases: a reconsideration of classic epidemiologic theories. *Ann N Y Acad Sci* 1980; 353: 35–44.

30 Lawrence JC, Lilly HA, Kidson A. Wound dressings and airborne dispersal of bacteria. *Lancet* 1992; 339: 807.

31 Hirai Y. Survival of bacteria under dry conditions; from a viewpoint of nosocomial infection. *J Hosp Infect* 1991; 19: 191–200.

32 Owen MK, Ensor DS, Sparks LE. Airborne particle sizes and sources found in indoor air. *Atmos Environ* 1992; 26A: 2149–2162.

33 Friberg B, Friberg S, Burman LG. Correlation between surface and air counts of particles carrying aerobic bacteria in operating rooms with turbulent ventilation: an experimental study. *J Hosp Infect* 1999; 42: 61–68.

34 Adams W, Valence M. Effectiveness of UV lights inside air handling units in reducing airborne bacteria and fungi in hospital operating rooms Abstract, American Industrial Hygiene Association 2008 meeting URL: http://www.aiha.org/education/aihce/archivedabstracts/2008abstracts/Pages/defaultaspx, Minneapolis, MN 2008.

35 Yuan TM, Chen LH, Yu HM. Risk factors and outcomes for ventilator-associated pneumonia in neonatal intensive care unit patients. *J Perinat Med* 2007; 35: 334–338.

36 Markowicz P, Wolff M, Djedaini K, Cohen Y, Chastre J, Delclaux C *et al*. Multicenter prospective study of ventilator-associated pneumonia during acute respiratory distress syndrome. Incidence, prognosis, and risk factors. ARDS Study Group. *Am J Respir Crit Care Med* 2000; 161: 1942–1948.

37 Elward AM, Warren DK, Fraser VJ. Ventilator-associated pneumonia in pediatric intensive care unit patients: risk factors and outcomes. *Pediatrics* 2002; 109: 758–764.

38 WHO. Avian Influenza, including Influenza A (H5N1), in humans: WHO interim infection control guideline for health care facilities. http://wwwwprowhoint/NR/rdonlyres/EA6D9DF3-688D-4316-91DF-5553E7B1DBCD/0/InfectionControlA1inhumans-WHOInterimGuidelinesfor2pdf. World Health Organization 2007.

39 Lockman JL, Fischer WA, Perl TM, Valsamakis A, Nichols DG. The critically ill child with novel H1N1 influenza A: a case series. *Pediatr Crit Care Med* 2010; 11: 173–178.

Supplementary Information accompanies the paper on the Journal of Perinatology website (http://www.nature.com/jp)

MOVE FIT IS CHANGING LIVES VIA EXERCISE

Since its beginning in May 2012, Move Fit has aimed to change people's approach to exercise; rather than being a chore, or demand, physical exercise should make life easier, prevent injury and promote independence, allowing everyone to become the best version of themself.

Company director and principal exercise physiologist Matthew Mikhail is highly skilled in treating injuries and chronic diseases. He knows how to treat exercise as medicine, and how to modify lifestyle through evidence-based prescribed exercises, improving health drug-free, promoting wellbeing and longevity. Move Fit is a provider for NDIS, Veterans Affairs, Work Cover and Exercise Right for Active ageing amongst others.

In 2021 Matthew expanded the exercise modality range by including HUR pneumatic exercise equipment." I always dreamed about exercise equipment that would accurately monitor training and track progress, hoping to find a complete exercise solution with automated data– information to accurately assess and monitor the progress of my clients, allowing me to treat my patients based on numeric facts, rather than a subjective feel. All these wishes were fulfilled in the HUR digital range. "

The feedback from clients has been positive and they have improved their health faster than expected. They appreciate the ease of the use of the cards, enabling automated individual settings for training programs, as well as the "live" visual feedback given by the monitors. The safe and attractive design, together with comfort and ease of use, feels like "an upgrade to business class". The low noise level and safety of the equipment is also welcomed by service dog Jess, who is helping her owner Alex reach his best performance. Alex has been training at Move Fit for a while now. His results are improving constantly as he can easily see his own progress, being a major motivating factor.

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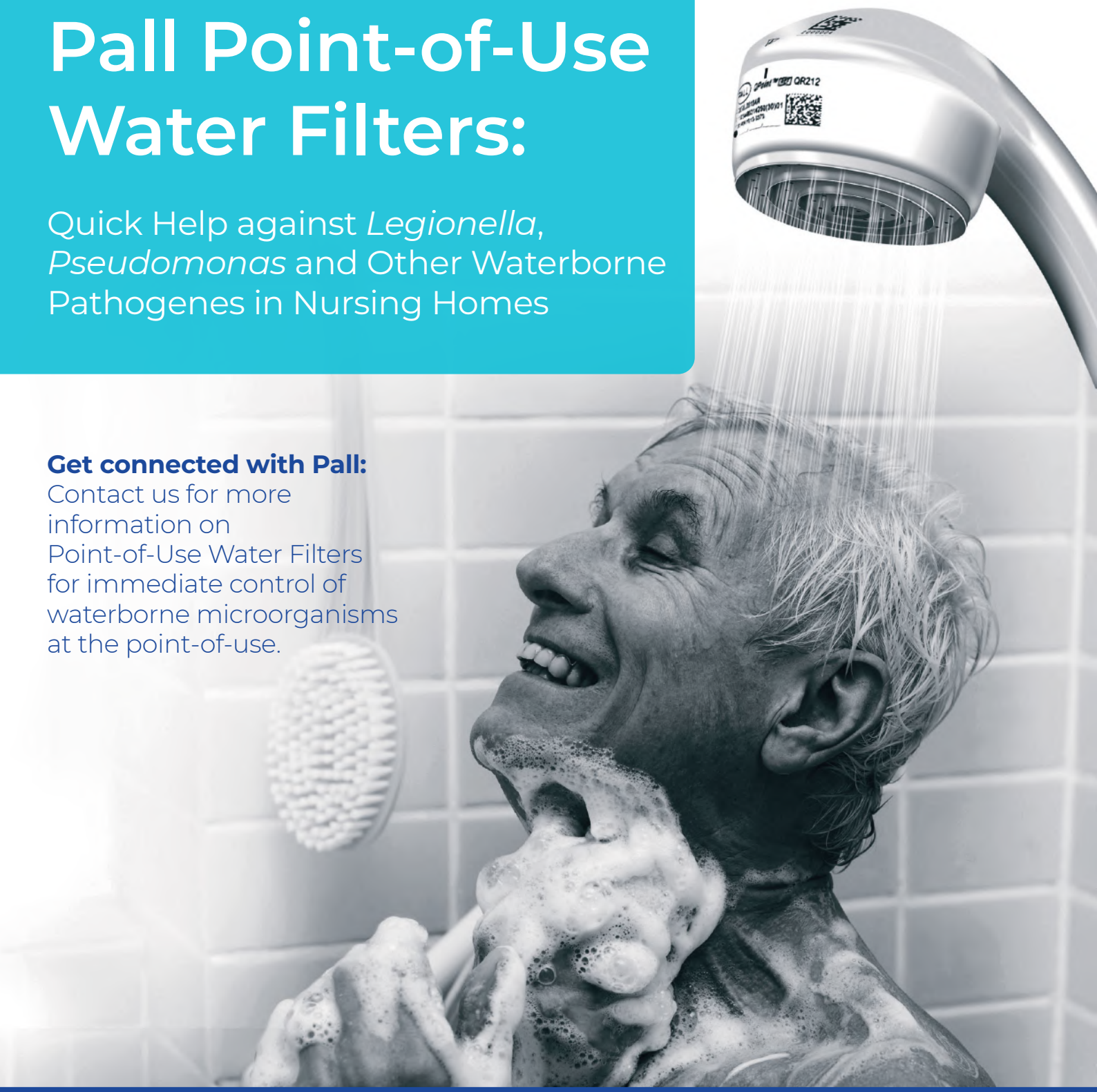

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BUILDING BETTER TO ELICIT MORE VALUE FOR MONEY

Martina Cardi

Bryden Wood

Bryden Wood architect Martina Cardi explains how it helped deliver a cutting-edge, best-in-class hospital in the UK that cost 30 per cent less to build than comparable facilities. Along with reducing cost, Bryden Wood's work on Circle Birmingham Hospital focused on sustainability, reducing carbon in both construction and operation, as well as designing in flexibility for future developments – both known and unknown.

Bryden Wood are the architects and engineers of a new facility in Edgbaston, a suburb of Birmingham in the English Midlands in the United Kingdom. The purpose of the Circle Birmingham Hospital project was to deliver a new, best-in-class hospital – England's largest bespoke rehabilitation hospital. Its aim is to combine outstanding clinical outcomes and patient safety, with an excellent experience for patients, staff and visitors – all in a building that is architecturally, technically and sustainably outstanding.

Circle Birmingham Hospital is the second hospital Bryden Wood design for Circle Health, and we incorporated all the learning from designing the award-winning Circle Reading Hospital into this new project.

The Reading hospital, opened in 2012, was designed to increase in scale from Circle Bath Hospital and adapt to the local need while maintaining the patient experience focus. As a testament to the success of this approach, Circle Reading Hospital was awarded with the Building Better Healthcare Award for 'Best Internal Environment' in the 'Patient Experience' category.

In addition to prioritising patient experience, our designs for Circle Health hospitals have had to adapt to a changing healthcare landscape. The challenges to operational mobilisation and different funding flows in Circle Reading identified the need to employ a design that could respond to an emerging and evolving business case.

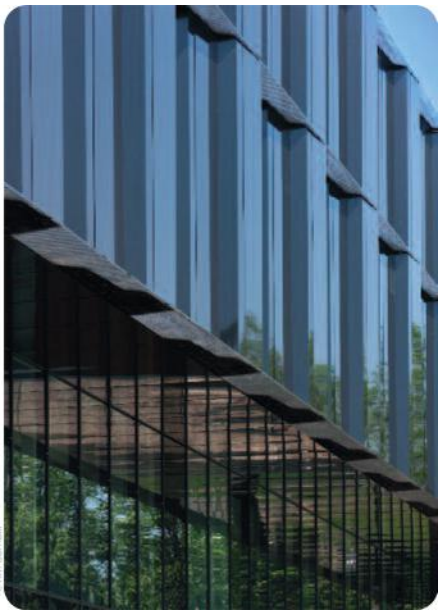
Circle's second brief to Bryden Wood for Circle Birmingham therefore reflected key features of the Circle Reading facility, while clearly stipulating a requirement for flexibility to accommodate a dynamic business case aligned with the organisation's strategic development.

Our 'Design to Value' philosophy applies our integrated design expertise to analyse projects exhaustively, and make

sure that we deliver the solution that adds the most value. We also built on all the learning that we gather from other projects. In our earlier work on Circle

Reading Hospital, we conducted extensive research into the use dynamics of a hospital, optimising the layout to deliver a hospital with a design that allowed a significantly improved experience for both staff and patients.

Circle Birmingham Hospital was built on the site of the former Pebble Mill BBC TV studios. The hospital opened in September 2020, with five operating theatres, ten first-stage recovery beds, ten consulting rooms, 20 second-stage recovery beds and 140 bedrooms. It also has a comprehensive imaging department and a large physiotherapy capacity for elective care and rehabilitation services.



Designed to meet the needs of patients, staff and visitors

The design of the hospital is based on a combination of our specific long-term research into the design and construction of healthcare facilities, and our broader research and development into advanced methods of design and construction, namely our Modern Methods of Construction (MMC) platform approach to Design for Manufacture and Assembly (P-DfMA).

We optimised the design to improve clinical outcomes and patient safety by applying the learnings from our research into best case departmental adjacencies – including analysis on patient and staff flow – from Circle Reading Hospital.

We worked closely with our client to establish an initial 8,000 square metres 'nucleus' hospital design that separated critical, high-tech, high-spec space from non-critical spaces - such as consulting rooms and reception waiting areas - to set up the building typologies in line with the appropriate clinical departments.

The full 18,000 square metres 'complete' hospital was instructed into the contract following a joint venture agreement shortly after the construction of the nucleus phase started on site.

We followed a platform approach to design the hospital, the basic principle of which is to design to the commonalities between spaces both within and across sectors. This approach resulted in a rationalised, efficient design using a grid of four- and eight-metre spaces, which accommodated all repeated rooms such as treatment, inpatient and day case rooms.

Perhaps counterintuitively, this has afforded the client flexibility during all design stages, as opposed to limiting their options. The platform approach gave the client an opportunity to broaden their clinical offering and, indeed, sign a joint venture with a new partner, whose rehabilitation services were added to the nucleus.

The entrance to the hospital is characterised by a large and spectacular cantilever structure, with two bedroom floors overhanging the administration and atrium spaces. The double-height space within the atrium enables light to flow into the entrance space, creating a welcoming environment. The waiting and café areas overlook the hospital's garden.

It is important, however, never to forget what the main purpose of a hospital is, and so patient, staff and visitor experience was always our main focus – including considerable engagement throughout with all stakeholders. The hospital delivers absolutely on that front – it is beautiful to look at and a pleasure to be in.

This site presented us with a number of specific challenges, including several visually and environmentally important trees which were the subjects of tree preservation orders. We managed to retain these trees - and hence support ecology on site - through careful consideration of both pedestrian and vehicle access, and the way in which we sited the hospital.

Creating a therapeutic environment

As with Circle Reading, we have created a hospital that does not feel like a hospital, yet provides a clinical environment of the highest level of quality. The entrance and waiting areas bring a more friendly, even 'domestic', feel and link both visually and physically to a calming outside environment. We love the feedback from the client that they heard one child visitor say, "Mummy, I thought we were going to a hospital today".

Sustainability, carbon reduction, flexibility and future fitness

It is not enough for a hospital to be excellent when it first opens its doors. A hospital must also remain excellent in operation and be able to respond not only to its own changing requirements, but those of local and neighbouring environments, populations and infrastructure; whether driven by unforeseen events like COVID-19, or longer-term political and social changes.

For example, we designed accommodation areas within the hospital using future climate change scenarios and the latest adaptive thermal comfort methodologies. This has allowed the design to reduce its reliance on comfort cooling systems with their associated operational carbon emissions and refrigerants while still delivering good occupant comfort.

In addition, the commercial model dictated high levels of occupancy of the building from day one, which drove the design of a nucleus facility from the early stages. This building could then expand as the business grew and shape itself for any potential clinical scenarios.

The best response to the demands of sustainability is to create the most efficient, flexible and adaptable design. The efficient use of materials is core to our platform approach, which naturally tends to the leanest and most compact design by optimising every element, eliminating approximation and allowances, and taking every opportunity to reduce inefficiency and waste.

We are also faced with a climate crisis that requires every building to be designed and built for reduction in both embodied and operational carbon.

The platform approach led to a structure with significantly lower embodied carbon compared to a traditional construction.

Furthermore, the site and adjacent area were also prone to annual flooding, causing damage to infrastructure and residential neighbours. We created a sustainable drainage solution on site which prevented this.

Increased quality at reduced cost

The flexibility in the design was fully exploited on this project. Following the initial design for the elective surgery facility, we were able to incorporate a large-scale rehabilitation facility. This will be the first large-scale centre of its kind in the UK and has been designed to provide the missing link between acute and community care provision.

By adopting best practice from Europe and the United States, this facility will:

- Provide intensive therapy that exceeds National Health Service (NHS) levels and is proven to improve patient function.
- Enable care to be delivered at 30 per cent lower cost compared to the cost of an NHS acute bed.
- Release 10-20 per cent acute beds enabling local NHS trusts to increase their operational facility and flow.
- Increase patient functionality resulting in reduced cost of long-term care – 80 per cent of patients in European facilities return home leading to
- significant potential benefits in relation to independent living and return to work.

The design as delivered represents a step change in healthcare design, delivering enhanced patient and staff experience, as well as significant cost savings. The typical cost of NHS hospital stock in the English Midlands is £3,000-£3,500 per square metre. For this building, we achieved a cost of £2,300 per square metre, a saving in the region of 30 per cent.

Setting a precedent for healthcare construction platforms

The building has been seen as an exemplar by the Department of Health of Social Care and a number of NHS Trusts. It is a marker for future UK hospital projects and the benchmark by which they can be measured in terms of flexibility, adaptability, quality, cost, delivery, patient experience, patient safety and clinical outcomes.

In September 2021, the UK government's Infrastructure and Projects Authority (IPA) published *Transforming Infrastructure Performance: Roadmap to 2030*. The IPA said that the roadmap describes 'a vision for the future in which we collectively prioritise the societal outcomes we need, and use modern digital approaches and technologies, alongside improved delivery models to achieve them.'

To deliver this vision, and apply it to the £650 billion national infrastructure and construction pipeline, they identify five key focus areas. The third of these is 'addressing the need for social infrastructure using a platform approach.' The IPA says that they are working to mandate a platform approach to construction across social infrastructure within the next two years.

Circle Birmingham Hospital demonstrates what a platform design can bring to the form and function of a hospital. Given what the UK government has said, it is one of the earliest exponents of how all hospitals will soon be designed, for the benefit of all of us.

Martina Cardi

Martina Cardi MAarch(Hons.), ARB is director and architectural healthcare lead of Bryden Wood, UK. Martina joined Bryden Wood in 2015. After leading an integrated design team for the Circle Birmingham Hospital and Rehabilitation project, from conception to completion through a number of design and construction phases, Martina is now involved in a number of healthcare schemes of different sizes and clinical briefs, ranging from advanced oncotherapy to health and wellbeing hubs. Martina's focus is to ensure clinical excellence is maintained while MMC exemplar solutions are deployed. Thanks to her experience gained on a number of DfMA and MMC programmes in other sectors, Martina is now leading the 'NHP Pathfinders assessment' of eight of the UK's New Hospital Programme schemes to assist in maximising the MMC opportunities at programme level. Martina is also acting as technical advisor for a number of NHS Trusts.

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FINANCING SMARTBUILDING: VALUE IN THE 'NEW NORMAL'

Mark McLoughlin
Siemens Industries and Markets

Mark McLoughlin of Siemens Industries and Markets explains how specialist finance is unlocking the benefits of smarter healthcare estates.

COVID-19 has caused a crisis for building owners and landlords – both in the public and private sectors. Patterns of work and public service are clearly changing as a result of the crisis and its aftermath.

The way in which we use public and commercial indoor spaces has been profoundly altered, shining a light on the need to optimise the hygiene, safety and energy efficiency of buildings. We have seen a massive effort globally to rapidly and urgently adapt hospitals to cope with the pressures of the pandemic, operating safely and with flexibility.[1]

Making healthcare buildings smart allows this flexibility – whether from the perspective of agile changes of use, security and safety, or enhanced ability to morph to volatile circumstances. The evidence suggests that not only have smart hospitals been seen to cope better with the pressures of a global pandemic,[2] they are also a valuable long-term asset in transforming healthcare delivery so that it is clinically and financially sustainable long into the future.[3]

Indeed, there is a perfect storm of factors which are coming together to simultaneously drive change and make healthcare buildings smart. Firstly, the economic pressures resulting from the pandemic are focusing minds on ways of achieving building management cost efficiencies – especially through energy efficiency.[4]

At the same time, COVID-19 has introduced new rules and ways of working to ensure hygiene, infection control and safety in buildings.[5] Alongside these topical pressures are existing and emerging regulatory requirements that make fire and security upgrades mandatory.[6] Furthermore, various policies around the world are setting targets to reach higher environmental standards in buildings.

Making the case for smart healthcare facilities

Smart buildings deploy automated and digitalised technology to enable more efficient, more effective building capabilities and management. The data generated by IoT (internet of things) sensors provide real-time information for quick reactions. Smart technology helps transform the building from a cost burden to an active contributing partner – a new team member – in running a public sector organisation and coping with the new normal.

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It is arguable that hospitals that fail to become smart will struggle to deliver patient and community services effectively and efficiently. Smart, digitalised hospitals – that already use technology such as touchless controls, distanced temperature measurement and remote buildings management – have been seen to cope better with the pressures of a global pandemic, serving as an inspiration to others to accelerate their digital transformation.

In hospitals, smart, adaptive building systems can provide ideal conditions for patients' recoveries by leveraging artificial intelligence to optimise temperature, air quality and flow (vital for infection control), lighting and other variables within patient rooms as well as optimising energy consumption. Ultimately, patient safety and outcomes improve, length of stay is reduced and patient throughput for the hospital increases.

Unlocking the benefits of smarter healthcare estates

One example is a not-for-profit healthcare clinic near Lyon in France that needed to upgrade its fire and security systems, not only to meet statutory requirements, but also to assure patients of their optimum safety and security at all times. The clinic has just under 300 beds, of which over half are for geriatric patients. The clinic did not want to raise capital and so turned to Siemens for a tailored financing solution.

A managed service agreement was established, across a 60-month financing period. This allowed the clinic to move ahead quickly with the initiative, without having to raise CAPEX permissions from its Paris headquarters, and account for the monthly cost in its operating budgets. To minimise disruption for the clinic, the upgrade was performed during the scheduled annual maintenance visit.

Another example is Signature Healthcare, an award-winning health system based in Brockton, Massachusetts, USA. Signature Healthcare worked with Siemens to identify critical upgrades to its main heating and cooling systems at its primary hospital campus, resulting in a $9 million infrastructure improvement plan. By leveraging the full breadth of Siemens' expertise and smart financing structures, Signature Healthcare was able to fund the infrastructure plan, simplify its debt structure and, ultimately, provide for financial flexibility.

Financing the cost of conversion through energy efficiency

While there is wide consensus around the need to make health estates smart, all countries and sectors need a way of making that conversion financially sustainable. How can this be done? The starting point is to use smart technology to reduce energy consumption in healthcare buildings. This produces hard financial savings that – through smart financing arrangements – can be harnessed to subsidise or even pay for overall smart buildings conversion. This can be done at an enterprise level, or in small incremental steps, each of which proves its return on investment.

For whole building and multi-building projects, budget-neutral schemes are available from specialist financiers to enable conversion. They are increasingly becoming known as 'Building Efficiency as a Service' (BEaaS) arrangements.

The integrated solutions provider introduces technology and systems to create smart buildings that deliver a clearly predictable level of energy savings. The reduction in energy costs is then harnessed to effectively fund the cost of conversion.

While the level of energy reduction will vary – depending on external climate, cost of power, and other factors – in most cases the savings can be reliably reflected in a financing structure to deliver self- financing smart building upgrades anywhere in the world, although the technique, to date, is most mature in the western world. After the end of the financing period, the facility benefits from the ongoing reduced energy consumption, along with all the other added benefits of smart buildings.

Many building efficiency and smart buildings projects are undertaken in smaller incremental steps. If this approach is chosen, then the capital-neutral economics of BEaaS cannot be deployed. Nevertheless, there is a huge operating advantage in being able to spread conversion costs over a financing period – managing cash flow by aligning expenditure with the rate of energy savings.

The building technology products that make energy efficiency and smart capabilities possible come to market through a supply chain of distributors, value-added partners (VAPs), solution builders, and engineering, procurement and construction (EPC) companies.

Various forms of smart equipment and technology finance are available to manage the cost of acquiring upgrades such as energy-efficient HVAC control and building automation (on-premise or via cloud), remotely managed digital controls for fire safety and security, remote occupancy management systems, touchless controls throughout a building, and much more.

Where the solution provider has teamed up with an expert financier, who understands the technology, its applications and its benefits, then financing arrangements – often based on leasing structures – can be tailored to fit the building owner's/manager's precise cash-flow profile, aligning costs with the rate of benefits and/or savings gained.

The investment challenge

Evidence has also been offered showing how energy efficiency is the key financial starting point for meeting smart buildings aspirations, and that specialist financing techniques allow that conversion to happen without the need to source and deploy large amounts of capital.

What, then, is the size of the investment challenge of energy efficiency conversion in healthcare buildings that these financing techniques help to make happen in an economically sustainable way? It is important to present an estimate of the sheer financial scale of energy efficiency conversion to appreciate how important the role of smart financing is – especially since many authorities in the public sector, for instance, have noted that it simply cannot be afforded out of public capital alone.[7]

The latest insight paper from Siemens Financial Services establishes the urgency and value of smart buildings conversion, as well as the mandatory drivers that are focusing attention on converting existing buildings to greater energy efficiency.

This insight study has modelled the cost of official buildings energy conversion targets by 2040 at $14.4 billion in the healthcare sector. These estimates illustrate the sheer size of the investment challenge, and underline the importance of

smart finance to make smart buildings transformation happen in a financially sustainable way.

In a budget-constrained environment, energy efficiency savings are increasingly seen as the ideal starting point for smart buildings transformation - either as a single investment or as a series of incremental projects - with smart financing techniques playing a major role in enabling those future savings to finance the cost of conversion.

References

1. WSP. Hospitals after COVID-19: How do we design for an uncertain future? October 2020 [https: /www.wsp.com/en-GL/insights/ hospitals-after-covid-19-how-do-we-design- for-an-uncertain-future].
2. Harvard Business Review. *How Hospitals Are Using AI to Battle COVID-19*, April 2020. CNBC. *How China is using robots and telemedicine to combat the coronavirus*, March 2020.
3. Healthcare Global. *Smart hospitals: the digital future of global health*, April 2020.
4. Bloomberg NEF. *Liebreich: Energy Efficiency Key to COVID Recovery*, June 2020.
5. Architectural Digest. *How the COVID-19 Pandemic Will Change the Built Environment*, March 2020.
6. Modern Building Alliance. *EU Pilot project on fire safety*, May 2020.
7. See, for instance: European Commission – Build UP, The European Portal for Energy Efficiency in Buildings, *Financing Energy Efficiency in Buildings*, August 2019; Energy Efficiency Infrastructure Group, *Making Energy Efficiency a Public and Private Infrastructure Investment Priority*, October 2019.

Mark McLoughlin

Mark McLoughlin has worked as a key account manager for Siemens Industries and Markets for the past eight years and boasts 20 years of experience in the finance and leasing industry. Mark's current role focuses on supporting Siemens by providing innovative financing solutions as part of its value proposition to customers. Mark views the rapidly increasing pace of change in the industry represents as one of his greatest challenges as well as one of his greatest opportunities. In recent years, there has been a move away from traditional product selling to solution selling and for many in this industry this change can present a difficult transition. Using his knowledge and experience of finance to help facilitate the move towards 'solution' selling provides Mark with great satisfaction and he views these innovative financing solutions as a positive enabler for customers.

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3) Diagnostics of Air Purification PlasmaShield Device by Spatially Resolved Emission Spectroscopy: https://www.mdpi.com/2571-6182/5/2/16

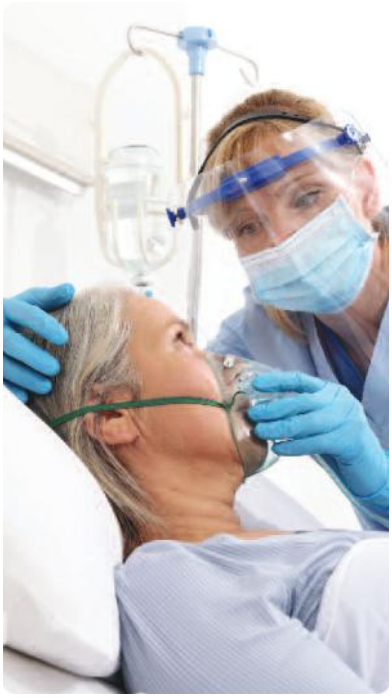
SHIFTING ROLE OF NURSE CALL SOLUTIONS DURING COVID

Matt Wakelam
Senior Healthcare Solutions Manager
Static Systems Group

Matt Wakelam, senior healthcare solutions manager at Static Systems Group, explores the ways in which the COVID-19 pandemic has stimulated more sophisticated ways of working and led to far greater recognition of the many benefits delivered by advanced nurse call technology.

Digitalisation is changing the face of healthcare, and, through necessity, the COVID-19 pandemic has encouraged greater acceptance of the digitally-enhanced hospital, allowing transformation to take place more quickly than would have been the case in normal times. The pandemic saw Static Systems Group (SSG) work in close collaboration with numerous clinical teams throughout the UK and overseas to help hospitals embrace the full functionality of nurse call – far beyond patient-to-staff communication.

By developing innovative solutions and integrating critical alarm and patient-to-staff communication with other advanced healthcare technology, we have not only helped healthcare providers to reduce the exposure between COVID-positive patients and care teams but have, at the same time, assisted hospitals in enhancing workflow efficiency through improved communication and collaboration across the clinical space.



The COVID-19 pandemic has stimulated more sophisticated ways of using advanced nurse call technology.

One interesting example of this has been the acceptance of speech communication available with our systems to help reduce the risk of infection transmission.

The benefits of two-way communication between patients and clinical staff

During the early stages of the pandemic, for example, we were approached by a UK-based NHS Trust with whom we have a longstanding relationship. We were tasked to help reduce the exposure between COVID-positive patients and care teams in one of the Trust's hospitals. We enabled the nurse call speech facility, connected it with the existing telephony system and provided staff with 'hands- free' devices.

This meant that prioritised and triaged events were sent directly to staff - allowing alerts to be received at any location. It also meant two-way voice communication between staff and patients was made possible – allowing conversations to take place and assessments to be made without the need to approach the patient bedside.

Reducing the risk of transmission

The amount of repeat visits to a patient for a single call was consequently reduced as by talking with the patient in advance, staff were able to check which supplies or information were required prior to attending the bedside. By minimising the amount of time spent in the patient's room, the risk of exposure and transmission of the virus was much lower.

Furthermore, the amount of PPE being used was reduced as it was only now being used when it was necessary to enter the patient room and not for every query. In addition, the hands-free and touch-screen intercom options offered by our nurse call systems proved to be particularly valuable when used within the hospital's isolation rooms, with touch- screen intercoms located outside each room.

Having a two-way speech facility also delivers benefits for COVID-positive patients as - even when being cared for in isolation - patients can quickly and easily speak to those responsible for their care and receive reassurance, making them feel less isolated. By integrating our nurse call systems

with other facilities such as lighting, blinds, heating and entertainment, we are able to make patients feel more in control of their immediate environment. This can have a positive impact on patients who are facing a prolonged and difficult period in hospital.

Taking these steps on this particular project significantly reduced the risk of infection transmission and increased the safety of both patients and staff. The same can be said of another project we worked on during the pandemic where two-way voice communication was specified as an essential component of the chosen nurse call solution. This project was for the design, installation and commissioning of a nurse call system for North Lantau Hospital Hong Kong Infection Control Centre (HKICC), a temporary isolation hospital funded by the central government for treating COVID-19 patients in the Hong Kong Special Administrative Region.

The hospital covers a land area of 30,000 square metres and comprises six inpatient buildings, a medical centre and other facilities. It is capable of providing 136 wards and 816 negative pressure beds.

Its design is in line with the standards required for a permanent structure. To build a hospital of this scale in Hong Kong would normally take four years, however, with new building technology and construction going on around the clock, the project was completed in just four months.

In order to assist the hospital in achieving its vision, the nurse call system SSG recommended included a patient- to-staff speech facility at each bedside, offering all the benefits highlighted above in the UK-based project.

Furthermore, at HKICC, the patient hand units we supplied contain a silver- based antimicrobial agent, which is incorporated during the manufacturing process to help further strengthen the infection control measures instigated by the hospital. Importantly, the active agent will not degrade over time and can be cleaned with a sterilising wipe to eliminate biohazards and reduce cross-infection risks between users.

Incorporating speech allows assessments to be made without the need to approach the patient bedside.

Patient hand units contain a silver-based antimicrobial agent to help further strengthen the infection control measures instigated by the hospital.

Improving communication and collaboration between clinical teams

Throughout the COVID-19 pandemic, many hospitals have benefitted from enabling two-way speech, but thanks to the interoperability between systems, trusts have also reaped the benefits of improved communication and collaboration between individual team members and between different clinical teams.

The latest nurse call devices allow individual clinical staff and different care teams to talk to and message each other directly, which can lead to improved communication. However, when you add in logic-based automation the solution becomes even more powerful - automating or smartening up interaction between different parts of the clinical space.

By using logic, nurse call events can be processed independently or with information gathered from multiple systems to create intelligent alerts and automated actions or responses. Once the events are being automatically triaged, we can then look at how different parts of the clinical space collaborate or communicate with each other.

The goal is to create a unified approach to prioritising and delivering alerts as this will help to create consistency in the way care teams respond to events and provide staff more time to care.

Reducing alarm fatigue and cognitive overload

The COVID-19 pandemic has placed care teams globally under unprecedented levels of pressure and has drawn attention to the many interruptions and events that are simultaneously clouding the clinical space. While communication between patients and care teams is a fundamental aspect of every healthcare setting, it can also prove disruptive if clinical staff are frequently notified of events relating to patients whose care they are not responsible for.

If clinical staff are exposed to an excessive number of alarms, it can result in sensory overload, desensitisation to alarm sounds and an increased rate of missed alarms. Commonly referred to as ‘alarm fatigue’ or ‘cognitive overload’, it can ultimately put patient safety at risk.

Conclusion

Nurse call solutions can play a vital role in helping to reduce alarm fatigue and alleviate cognitive overload in clinical environments – and have done so throughout the COVID-19 pandemic when care teams have faced unparalleled levels of stress.

By automatically triaging and prioritising events so that the event details are only sent to those staff members that need to be aware of them, communication between patients and

care teams can be made easier. With events only sent to the relevant staff member, they can then automatically clear the events from their body-worn notification devices as soon as they are dealt with.

As a result, staff are only presented with active events that are both 'live' and intended for them. This not only has the instant effect of reducing alarm fatigue and cognitive overload, but it also means that all the events are logged and can be guaranteed a response.

Reducing alarm fatigue and alleviating cognitive overload will continue to be a significant challenge for trusts, and one which must be addressed in order to avoid clinicians becoming overwhelmed and, in the worst-case scenario, missing a potentially clinically significant event.

How we automate, collaborate and communicate within the clinical space will only continue to evolve, with AI at the forefront of future developments, and we are proud to be playing our part in developing intelligent solutions for the future. We anticipate even more widespread adoption of innovative and sophisticated technologies, as well as more examples of integration with other clinical systems and building services

Matt Wakelam

Matt Wakelam is senior healthcare solutions manager at Static Systems Group (SSG). Matt joined SSG as a technical apprentice in 2001 and, following completion of his apprenticeship, became a technical support engineer. While supporting UK and global clients, he gained an in-depth knowledge of a broad range of technologies and systems in use within the clinical environment. He progressed through the company to his current role. Matt has been instrumental in developing systems and solutions that have even greater potential to improve patient and staff safety and collaboration through automated alerts, alarms and enhanced workflows using integration. He is passionate about the integration of clinical systems, removing system boundaries and providing clinicians with the information they require directly to their fingertips, thereby maximising the time available to spend in direct care of patients.

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Monolithic vs Modular UPS Systems

Luke Eiland

Service Manager,

SolarEdge Critical Power Division

Increasing demand for reliable power, coupled with the growing use of essential electrical equipment and digitization, is driving up adoption of UPS systems. While data centers, hospitals, and manufacturers were among the first to adopt the technology, demand for UPS systems is expanding to other users such as research facilities, schools, or anywhere with critical power applications. Considering the high stakes associated with energy failure, what are the most important factors to consider when choosing such a system?

UPS System design boils down to two main types – monolithic or modular. The original UPS design, the monolithic system, is a solution made of single sub-systems including one static switch, one rectifier, one inverter etc. – but importantly, they have no intrinsic redundancy. The later developed modular UPS is, as the name suggests, made up of several smaller components that can be added or removed to scale the solution up or down. Looking at both UPS solutions, we will analyze the benefits of each in relation to three main decision criteria – cost, reliability and simplicity.

Cost – Is it all about price?

When making any investment, cost is always the primary consideration. When it comes to UPS systems, and if comparing systems of a similar power requirement, the traditional monolithic solution has the lower initial price tag. This is why, traditionally, it has been the solution of choice for organizations with smaller power requirements – especially if their needs are unlikely to change in the near future. However, for those businesses with larger power requirements or where increased flexibility is needed, there is more to consider.

While there are different model sizes of monolithic systems, there is less flexibility in terms of power capacity than with modular UPS. Subsequently, monolithic UPS users often end-up paying more for a system that's larger than they need to reach their power requirements. Additionally, should their power requirements change, due to a lack of design flexibility, a whole new monolithic system is often required.

This is one of the strengths of modular UPS. To increase the capacity of your modular system, it's as simple as buying additional power modules and slotting them into your existing rack. What's more, should you have multiple modular UPS solutions at your facility, you can also swap modules from system to system to address changing load profiles - increasing efficiency savings and mitigating risk.

Reliability – When you can't afford to fail!

Designed to ensure that your power supply is reliable and uninterrupted, a UPS system must be extremely robust and reliable – obviously, this is critical when powering lifesaving medical equipment or other essential electrical devices.

Traditional monolithic systems feature a simple design. Consisting of fewer individual components, this means that there are less failure points in the system. Alternatively, modular UPS solutions spread the load over many more components. Which it could be argued, provides many more potential failure points. However, in a monolithic system, failure of one component could mean failure of the system as a whole. But in true modular units, if one module fails, it's separated from the rest of the system and the other modules pick-up the slack to ensure continued operation/power. This is a key distinction between modular systems. Not all modular solutions are the same, and only 'true modular' UPS, like our own SolarEdge solutions, provide this functionality.

Like many things in life, being handmade is generally better, however UPS systems are not one of them. While large monolithic solutions are manufactured manually with the resulting risk of human error, smaller power modules for modular UPS systems are manufactured and tested utilizing automated solutions. This approach adds to reliability, with

each of these smaller modules also being machine tested before shipping – something that's not undertaken within the monolithic manufacturing process.

Simplicity is key!

Thankfully, failure of a UPS system is uncommon, but replacing individual components as part of regular system maintenance is both expected and planned. Ensuring that your system remains operational, or that you have back-up power during those service intervals, can be a big issue with considerable consequences for your operation.

For this, modular UPS systems are relatively easy to maintain. In a true modular solution, each essential part is hot swappable and can be removed for maintenance or replaced while the system continues to run. Conversely, a monolithic system will likely need to be shut down for maintenance of core components, which means that you either lose your back-up facility during this period, or you have to switch to another system – essentially meaning that you need two units to provide the same service, with all the associated costs of purchasing, installing and maintaining two UPS devices. Now, some users also install two modular UPS systems for ultimate peace of mind, but this trend is beginning to change as depending on the load's criticality, it's often not necessary.

Crucially, and unlike the modular approach, if certain individual parts fail in a monolithic environment, the process of replacing them is often complex and time consuming, requiring a specialist UPS engineer representing additional downtime and cost.

In Summary

Both UPS systems are reliable, but they employ totally different designs to provide different levels of flexibility and autonomy. For organizations with lower critical power application requirements, a monolithic solution will be both cheap to install and generally fit for purpose. But as we've explored, you could also be installing a system that's larger and more expensive than you need, as well as being more costly to maintain in the long run. Plus, should your power requirements change, and you need to add more capacity, monolithic solutions don't have the system flexibility to support you.

For organizations that require ultimate reliability and no downtime, a modular UPS system is very appealing - but on the face of it, they do look more expensive. But, when the total cost of ownership is calculated considering ease of maintenance, a smaller floorspace footprint and overall system flexibility, the modular argument becomes very compelling.

For further details visit criticalpower.solaredge.com

UPS Key Considerations

Maintenance	System availability System serviceability (accessibility, weight & size of components, etc.)
Floor space	System footprint Ability to expand without adding floor space
$ Costs	Infrastructure Labor Investment in future expansion
Mitigate risk	Number of failure points Mean Time To Repair (MTTR) vs. Mean Time Between Failures (MTBF) Automated manufacturing & testing processes

QED ENVIRONMENTAL NOW IN SYDNEY, MELBOURNE AND BRISBANE

QED Environmental Services was founded in Perth 30 years ago. Healthcare engineers in Western Australia turn to QED for managing risks to environmental compliance and building performance.

The company recently announced the opening of an office in Sydney, following expansion to Brisbane and acquiring a Melbourne-based business in 2018.

A permanent presence in the major markets of NSW, Victoria, Queensland and WA gives QED a national footprint to serve engineers in all healthcare systems, public or private, across the country.

QED's Managing Director, Michael Taranto, remarked "Our team can now collaborate nationally to ensure we offer leading solutions, with local service delivery to all the major healthcare systems."

QED's services in healthcare facilities include: water quality risk management, indoor air quality, hazardous materials, mould risk management and slip resistance testing.

For further information contact www.qed.com.au

FIRST LOOK: MALMET'S DUR-SPECIFIC FRONT LOADING WASHER DISINFECTOR

Malmet is proud to present Healthcare Facilities Magazine readers with a glimpse of the first front loading washer disinfector designed specifically for the dirty utility room.

Set to hit the market later this year, the unit is a game changer for facilities looking to maximise DUR space and functionality, while still being able to access high quality, DUR-specific equipment.

The WDF enhances Malmet's range of tried and tested washer disinfectors. Providing thermal disinfection for clinical accessories, the WDF goes over and above the standards and compliance for infection prevention - so you can rely on its performance. But what's really exciting about the WDF is its size and versatility.

The WDF is the ultimate in space saving. While the unit boasts a large capacity chamber, its design still allows bench space to be built above, or there's options for a stand and added storage underneath. This means your facility doesn't have to sacrifice space for the sake of high capacity thermal disinfection - the WDF is the best of both worlds.

"We've partnered with hospitals and healthcare facilities for several decades, and we've seen how DUR design has evolved," said Peter Kirkup, Malmet CEO. "At the same time, we've recognised the needs of engineers have changed when it comes to DUR equipment that can work in with those evolving design needs."

"Bringing the WDF to market is our response to those real needs," added Mr Kirkup, "Put simply, it's a high quality, Australian-built machine that supports DUR design to achieve maximum functionality. Ultimately, it's our way of giving building designers, engineers and clinical staff all the options at their fingertips as they build and provide high quality, safe care environments."

For more information on Malmet's new front loading machine, contact info@malmet.com.au or call 02 6953 7677.

WHAT'S THE POINT OF DISINFECTING AND SANITIZING IF YOUR SOLUTION ISN'T UP TO STANDARD?

Test strips are an effective, affordable, and easy solution that can work for everyone.

Test strips have been around since the late 1930's and ever since then have been getting better in terms of reliability and accuracy whilst also increasing the testing parameters that can be measured.

Test strips are a fast, reliable, and affordable way to monitor sanitizer concentrations; and can help give you the reassurance that your working environment is not only clean, but safe. There are a range of cleaning and disinfection solutions which need to be made at the time of use from concentrations. The concentrations need to be closely monitored to ensure the sanitizer is working effectively. Too little sanitizer will allow the growth of harmful bacteria and too much can be toxic and corrosive to equipment.

The most common test strips to verify a particular solution will generally show measurements in ppm (part per million) or mg/L (milligram per liter). Food preparation or site disinfection sanitizers may consist of one of the following:

- Peracetic Acid Solutions, up to 2000ppm
- Hydrogen Peroxide Solution, up to 1000ppm
- Quantitative Ammonia Compound Solution, up to 1000ppm
- Chlorine Solution, up to 800ppm
- pH test strips, 0 to 14

Depending on the application for sanitization, will determine the necessary concentration. Tests strips can confirm instantly if a readymade solution would be satisfactory. They are also the cheapest method to get a reliable, accurate result.

Contact Vendart Diagnostics Pty Ltd Phone: 02 9139 2850
14/128 Station Rd, Seven Hills NSW 2147
Email: sales@vendart.com.au
Website: www.vendart.com.au

MTA COOLING SOLUTIONS FOR MEDICAL TECHNOLOGY

MTA cooling systems are widely applied within modern medical facilities, specialising in imaging and oncology technologies, for the cooling of **MRI, LINAC** and **PET** machines.

MTA SpA have been focused towards product development to meet the upcoming ERP2021 energy reduction program for Europe as well as meeting local energy benchmarks in Australia.

Key development areas for the MTA range of air-cooled water chillers include:

TAEevo Tech:

This range of scroll compressor air-cooled process chillers now covers nominal cooling capacities between 8 to 259 kWr as well as introducing key energy saving technologies such as electronic expansion valves, variable speed condenser fans and oversized condensers to reduce compressor discharge pressures and increase maximum ambient run temperatures.

Aries Tech 2:

Complete redesign of the Aries Tech scroll compressor air cooled chiller range.

Now offering nominal cooling capacities of 162 to 945kWr, this range now comes as standard with shell & tube evaporators, V configuration condenser coils, optional internal chilled water buffer tanks with choice of single or dual water pumps. This range also provides a choice on refrigerant type, standard with R410A or option of a lower GWP refrigerant, R545B.

For further details on the MTA product range visit our website www.mta-au.com or contact us on 1300 304 177 / email sales@mta-au.com.

EFFECTIVE LIFE CYCLE PLANNING

As the health care sector emerges, cautiously, from the pandemic enforced lock down, stiff competition from core business for increasingly constrained budgets is likely to be the order of the day.

In this environment a major challenge for healthcare engineers will be securing support for asset replacement projects. It has always been the case, understandably, that business cases for the replacement of non- core assets such as chillers and boilers are much more difficult to make than those for the replacement of core business assets.

Of course there are many reasons for this that include:

- It is difficult to make the case that an asset requires replacement when it appears to be operating effectively;
- Engineering assets often fail in service gradually and stakeholders get used to 'living with' the inconvenience of unreliable operation- making it difficult for the need to replace them to be perceived; and,
- Key decision makers typically have a better understanding of the need for core business assets than they do for non- core business assets.

Faced with these challenges a number of healthcare engineers are turning to RMIT's CAMS life cycle modelling tool to help communicate their long term asset replacement needs to senior management. Developed over the last twelve years by PhD students using a range of statistical analytical tools, a suite of 900 curves have been developed that model asset degradation over time. These curves are initially applied at individual asset level. CAMS then uses a self-learning algorithm informed by asset condition data, that is uploaded over time, to model how each individual asset is deteriorating in the field.

Asset data can be analysed and reported at both micro and macro level, assets can be classified in any way the client specifies, for example from the point of view of risk, priority or asset type.

Key to CAMS's success has been the ability to present technical data about asset life in a way that is intuitive to senior management from a non- technical background.

A large number of healthcare organisations, throughout the country have found success in deploying CAMS and see it as an essential tool in planning asset replacement activities. Helping to prioritise these works over time and to manage the expectations of senior stakeholders. Particularly when planning major items of future capital expenditure.

For further details please visit our website www.macdonaldlucas.com

TRISTEL RINSE ASSURE

As of June 2021, healthcare facilities are required to have completed a gap analysis for AS/NZS-4187, in line with NSQHS Advisory AS18/07. Additionally, a documented remediation plan is required by December 2021. While these Standards cover a number of elements, one of the most discussed topics is Final Rinse Water; specifically Tables 7.2 (Manual Cleaning Manual Disinfection and Washer-Disinfectors) and 7.3 (Washer Disinfectors in Accordance with ISO 15883-4 For Thermolabile Endoscopes) and the conundrum of final rinse water in Endoscopy.

Tristel's long history and foundations in Endoscopy has led to the development of Tristel 'Rinse Assure' – a unique system designed specifically to produce bacteria-free, AS/NZS-4187 compliant water for EWDs. The Rinse Assure system combines filtration and RO, along with chemical dosing using trace amounts of Tristel's chlorine dioxide chemistry. These are all calibrated depending on a site's requirements.

Tristel Rinse Assure is a compact, affordable and permanent solution. Rinse Assure's unique design means that RO water can be stored in an internal tanks, with different sizes depending on the requirements of the EWD bank. If RO is already present, a small system without RO can easily be installed. Tristel's dedicated service engineer can provide free site and requirement assessments, as well as water testing. Additionally, chlorine dioxide has been found to be effective against biofilm; Tristel is currently undertaking studies and testing to explore Rinse Assure's capacity to make this claim.

Tristel Rinse Assure: the total solution for EWD final rinse water.

https://tristel.com/au-en/product/tristel-rinse-assure/

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