GAMA GLOBAL WEBINAR SERIES

What's lurking in your hospital drains?

MARCH 2023

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GLOBAL WEBINAR SERIES

Objective:
To provide our partners and healthcare workers the best support in IPC knowledge and our innovations.

Format:
Webinar topic align with relevant global awareness days

Possible contact sessions:
Due to different time zones, the webinars will be recorded and shared on GAMA website (under Latest news > Webinars)
https://gamahealthcare.com/global-webinar-series

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BEFORE WE BEGIN

- You are **on mute** and your **camera is off** for the duration of the webinar.
- Please place any questions in the **Q&A** section for answering at the end of the webinar.

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OUR SPEAKERS

Dr Phillip Norville
Clinical & Scientific Director

Dr Phillip Norville has over 10 years' experience working with healthcare organisations, helping improve and implement effective infection prevention solutions.

Dr Jack Pike
Area Sales Manager

Dr Jack Pike has successfully implemented and supported a range of GAMA products within leading healthcare organisations in London and across the Southeast of England.

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AGENDA

1. What are wet biofilms?
2. Biofilms in drains
3. Drains biofilms and infections
4. Introduction to Clinell Drain Disinfectant
5. Case study - Successful cases in the UK

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BIOFILMS

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BIOFILMS

- Microbial cells grow together attached to a surface/ forming aggregates
- More than 99% of all bacteria live in this way, forming complex microbial communities

Individual (planktonic) bacteria attach to a surface using such things as pili, fimbriae and membrane proteins.

Extra-polymeric substances adhere bacteria together and the surface – lipopolysaccharides, proteins, lipids, glycolipids and nucleic acids.

Bacteria replicate and form a colony within the protection of the biofilm.

Bacteria detach from the colonies and are capable of forming new biofilm colonies on another surface.

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BIOFILMS

It's a harsh world out there.

Just like any form of life, microorganisms need a few things:

- Food
- Moisture
- Shelter

Attach and survive.

More than 99% of all bacteria live in biofilms:

- Complex microbial communities immersed in extracellular polymeric substances, that protects them from harsh environments as well as antimicrobials and biocides
- They occur at physical interfaces (liquid/solid; solid/air; liquid/air)

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BIOFILMS

Many advantages:

- Low metabolism requirement
- Low motility, so no energy expenditure
- Improved exchange of nutrients, information (through quorum sensing) and DNA transfer
- Phenotypic diversity
- More resistant than planktonic bacteria due to sessile (attached) cell formation and protection by peers
- Ability to form 'persister' cells when lack of metabolites

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WHERE ARE BIOFILMS FOUND IN HEALTHCARE?

Devices
- Endotracheal tubes
- Contact lenses
- Vascular central catheters
- Cardiac valves/grafts
- Pacemakers
- Peripheral vascular catheters
- Urinary catheters
- Orthopaedic implants

Tissue infections
- Chronic wounds
- Bone infections
- Urinary tract infections
- Biliary tract infections
- Kidney stones
- Lung infections/cystic fibrosis
- Endocarditis
- Tonsillitis, dental plaque, sinusitis

Environmental
- Medical equipment, ventilator tubing and accessories
- Dry biofilm on patient care equipment and furniture
- Sinks and showers

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BIOFILMS IN HOSPITALS

- Widespread on surfaces and drainage systems in hospitals and contribute to pathogen survival despite cleaning and disinfection
- Cannot be detected by swabbing or contact plates
- Regrow within one day when provided with nutrients
- "Current cleaning practices are inadequate to control biofilm development."
  Vickery et al. (2012) *J Hosp Infect* 80: 52-55
- Bacteria from biofilm are transferred by hands from one fomite to multiple fomites, suggesting a persistent environmental source of pathogen
  Chowdhary, D., et al 2018. 'Transfer of dry surface biofilm in healthcare environment: the role of healthcare worker's hands as vehicles', *J Hosp Infect*.

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WATER AS A SOURCE OF CARBAPENEM-RESISTANT ORGANISMS

Table 2. Water Reservoirs Containing Carbapenem-Resistant Organisms[a]

Water Reservoir	Studies, No. (N = 32)	References
Drains/drainage systems	17	Peña et al [35], Kotsanas et al [26], La Forgia et al [28], Betteridge et al [7], Leitner et al [20], Wendel et al [29], Breathnach et al [21], Leung et al [24], Snitkin et al [22], Tofteland et al [32], Vergara-López et al [33], Yomoda et al [9], Stjarne Aspelund et al [12], Odom et al [11], Knoester et al [25], Landelle et al [37], Seara et al [34]
Sink surfaces	14	Betteridge et al [7], Wendel et al [29], Knoester et al [25], Podnos et al [23], Wang et al [27], Biswal et al [8], Hong et al [30], Bukholm et al [31], Kouda et al [38], Landelle et al [37], Dewi et al [10], Kaiser et al [13], Ito et al [14], Leung et al [24]
Faucets	8	Odom et al [11], Knoester et al [25], Majumdar et al [17], Pitten et al [36], Hong et al [30], Bukholm et al [31], Alter et al [15], Leung et al [24]
Water	3	Knoester et al [25], Ambrogi et al [18], Bukholm et al [31]
Inflatable hair wash basin	2	Wendel et al [29], Knoester et al [25]
Sensor mixer taps	1	Durojaiye et al [16]
Water/tea dispenser	2	Wong et al [19], Ito et al [14]
Shower/shower equipment	3	Betteridge et al [7], Leung et al [24], Seara et al [34]
Toilet bowl/brush	2	Breathnach et al [21], Kouda et al [38]

Kizny Gordon, A. E., A. J. Mathers et al (2017) "The Hospital Water Environment as a Reservoir for Carbapenem-Resistant Organisms Causing Hospital-Acquired Infections - A Systematic Review of the Literature." *Clin Infect Dis* 64(10): 1435-1444

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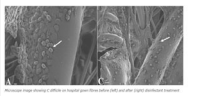
BIOFILMS ARE NOW RECOGNISED AS AN ISSUE

Hospital gowns retain superbugs even after being treated with disinfectant



Surgical gowns and other apparel masks, footwear, gloves) fill two needs: 1. protecting patients from microorganisms conveyed by the surgical team or patients themselves, and 2. protecting healthcare services from contact with irresistible microorganisms harbored by the patient.

However, a new study by the University of Plymouth suggests that surgical gowns used in hospitals retain superbugs. Even after single-use, the gowns had been infected with superbug Clostridium difficile (C difficile), even after being treated with the recommended amount of disinfectant.

Study links hospital Candida auris outbreak to reusable thermometers

A large *Candida auris* outbreak at a hospital in England appears to be linked to reusable patient-monitoring equipment, a team of researchers reports today in the *New England Journal of Medicine*.

The outbreak in the neurosciences intensive care unit (ICU) at Oxford University Hospitals involved 72 patients who were infected or colonized with *C auris*, a fungus that has become increasingly resistant to azoles, echinocandins, and polyenes—the three classes of antifungals used to treat infections caused by *Candida* and other fungal species.

An epidemiologic investigation and case-control study by investigators from the University of (Public Health England, and elsewhere found that the most compelling explanation for the prol outbreak was the persistence of the organism on reusable skin-surface axillary probes, a device placed in a patient's armpit for continuous temperature monitoring.

"Our results indicate that reusable patient equipment may serve as a source of healthcare-asso outbreaks of infection with *C. auris*," the authors of the study write.

C auris was first identified in Japan in 2009 and since then has emerged as a significant heal associated pathogen in several countries, causing hospital outbreaks on five continents. The multidrug-resistant fungus can cause severe infections in immunocompromised patients and has been associated with high mortality.

Medscape Wednesday, July 17, 2019

NEWS & PERSPECTIVE | DRUGS & DISEASES | CME & EDUCATION | ACADEMY | VIDEO

The Latest Dirt on Hospital Cleanliness

Ronald D. Adcock, MD, MBBS, MPH

DISCLOSURES | January 15, 2019

Read Comments

EDITORIAL COLLABORATION Medscape & SHEA

How 'Clean' Is the Hospital Environment?

A recent multistate survey of 183 acute care hospitals in the United States revealed that approximately 1 of every 25 inpatients developed at least one healthcare-associated infection per day.[1] *Clostridioides difficile* was reported as the most common healthcare-associated pathogen, leading to an increased focus on prevention strategies.

A growing body of evidence suggests that hospital surfaces, floors, sheets, sinks, curtains and equipment are contaminated with pathogens that can serve as sources of infection. Rigorous environmental cleaning is required to ensure that hospital surfaces, equipment, and linens are safe for patient use and to prevent transmission of such pathogens as *C difficile*.

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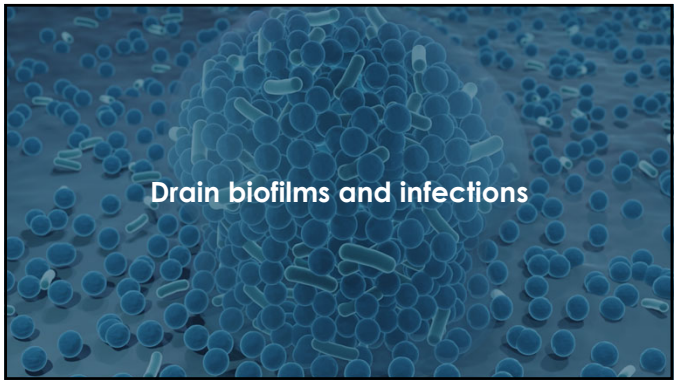

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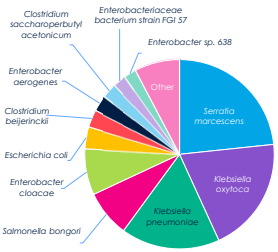
DRAIN BIOFILM COMPOSITION WORK FROM THE STAFF ROOM IN THE UNIVERSITY OF CARDIFF



84 DIFFERENT SPECIES

Klebsiella variicola	Bacillus anthracis	Citrobacter rodentium
Enterobacter asburiae	Yersinia pestis	Pseudomonas sp. UW4
Salmonella enterica	Clostridium saccharobutylicum	Alistipes shahii
Enterobacter lignolyticus	Pseudomonas putida	Bacteroides thetaiotaomicron
Pantoea ananatis	Bacteroides vulgatus	Bifidobacterium animalis
Erwinia pyrifoliae	Yersinia pseudotuberculosis	Bordetella parapertussis
Shigella flexneri	Lactobacillus johnsonii	Lactobacillus reuteri
Enterobacter sp. R4-368	Akkermansia muciniphila	Streptococcus infantarius
Raoultella ornithinolytica	Enterococcus faecalis	Yersinia enterocolitica
Shigella sonnei	Enterococcus faecium	Clostridium saccharolyticum
Cronobacter sakazakii	Eubacterium rectale	Corynebacterium variabile
Siccibacter turicensis	Pectobacterium carotovorum	Eubacterium eligens
Erwinia billingiae	Staphylococcus saprophyticus	Pectobacterium wasabiae
Shimwellia blattae	Clostridium botulinum	Serratia plymuthica
Erwinia tasmaniensis	Alistipes finegoldii	Serratia sp. AS12
Enterococcus casseliflavus	Paenibacillus terrae	Serratia sp. AS13
Erwinia amylovora	Pectobacterium atroseptícum	Bacillus tayonensis
Shigella boydii	Pantoea vagans	Bacteroides fragilis
Erwinia sp. Ejp617	Chromohalobacter salexigens	Clostridium perfringens
Shigella dysenteriae	Enterococcus mundtii	Eggerthella lenta
Paenibacillus polymyxa	Roseburia hominis	Parabacteroides distasonis
Pantoea sp. At-9b	Streptococcus thermophilus	Plautia stali symbiont
Bacillus cereus		Pseudomonas fluorescens
Achromobacter xylosoxidans		Rothia dentocariosa
Bacillus thuringiensis		Ruminococcus champanellensis
Lactobacillus amylovorus		

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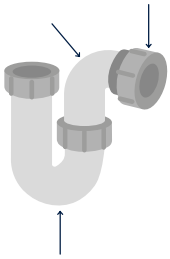
WHAT MECHANISMS ARE IN ACTION?

- The mechanism of transfer from the sink trap to a patient is poorly defined

  Kotay, S., et al (2017). "Spread from the Sink to the Patient: in situ Study Using Green Fluorescent Protein (GFP)-Expressing *Escherichia coli* to Model Bacterial Dispersion from Hand Washing Sink Trap Reservoirs." *Appl Environ Microbiol* 83(8)
- Used a hand wash sink model to examine dispersion of green fluorescent protein (GFP)-expressing *E. coli* from sink wastewater to the surrounding environment
- Built a model and then contaminated p-trap and ran water down the sink for two weeks



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FINDINGS

- No dispersal to counter tops or basin on initial priming and if there was just water flow from the tap
  - If just water was run through the sink intermittently for 14 days the organisms remained only in the p-trap
- But when nutrients were added intermittently, within 7 days *E. coli* biofilm extended upwards to reach the strainer, 24 cm above the liquid in the p-trap (approx. 2.5 cm per day)
- This reflects real life, where intravenous fluids, feeding supplements, and left over beverages would be disposed of into a sink
- This then resulted in droplet dispersion to the surrounding areas (90cm) during tap operation when the biofilm reached the strainer

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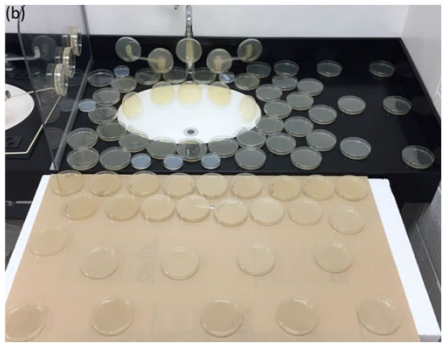

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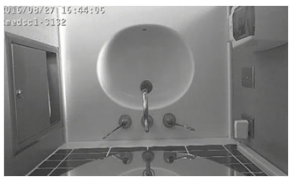
HAND HYGIENE SINK USAGE – IS IT WHAT WE THINK?

Grabowski, M. et al (2018) *J Hosp Infect* 100(3): e115-e122

Poll question:

What percentage of activities carried out at hand washing basin were hand washing?



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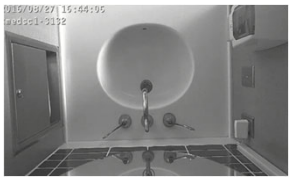
HAND HYGIENE SINK USAGE – IS IT WHAT WE THINK?

Grabowski, M. et al (2018) *J Hosp Infect* 100(3): e115-e122

- Analysis of activity from 2973 sink videos from 60 days in patient rooms and adjoining bathrooms
- Handwashing was 4.38% of observed behaviours
- But there were 56 activities where a variety of nutrients, which could promote microbial growth, were disposed of in the sink



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OBSERVATIONS OF SINK ACTIVITY (PATIENT ROOMS)

Grabowski, M. et al (2018) *J Hosp Infect* 100(3): e115-e122

- Nutrient disposal:
  - Drainage of IV bags, including medications
  - Beverage disposal
- Cleaning of medical items (also used to place items in temporarily)
- Cleaning a sink was less than 1% of all activities and less than once a day
- Cleaning supplies were placed in the sink more frequently than actual cleaning taking place

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OBSERVATIONS OF SINK ACTIVITY (BATHROOMS)

Grabowski, M. et al (2018) *J Hosp Infect* 100(3): e115-e122

- Placement of medical items was 12.5% of all activity
- Hand hygiene was 2.5% of all activity
- Cleaning a sink was 3.4% of all activities and was also less than once a day
- Patient's personal items placed in the sink was 9% of all activity (and 1.75% of all activity in the patient rooms)

Is anyone thinking of the sink as a waste disposal facility?

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JUST WATER FOR 8 WEEKS



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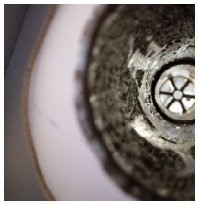
HAND HYGIENE FOR 8 WEEKS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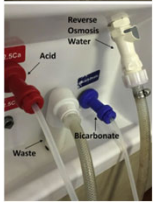
BIOFILM-MEDIATED OUTBREAK IN A DIALYSIS UNIT

- 58 cases of Gram-negative bloodstream infection
  - *Serratia marcescens* (n = 21) and *Ps. aeruginosa* (n = 12)
  - Cases had a CVC for dialysis (matched OR 54.32)

  Novosad, S. A. et al (2019). "Multicenter Outbreak of Gram-Negative Bloodstream Infections in Hemodialysis Patients." *Am J Kidney Dis* 74(5): 610-619.
- Pooling and regurgitation of waste fluid at recessed wall boxes housing connections for dialysate components and effluent drain within dialysis treatment stations
  - Samples yielded *S. marcescens* and *P. aeruginosa*
  - Organisms isolated from wall boxes and case-patients closely related by PFGE/WGS



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DISPERSAL IS LINKED WITH DRAINAGE TIME

- Significantly fewer bacteria dispersed from sinks that drained quickly (P = 0.004) and/or from rear-draining sinks (P = 0.002)
- If drainage slow, dispersal from rear-draining sinks almost 30x less than sinks with drains underneath the tap (P < 0.001)

  Aranega-Bou, P. et al 2019. *J Hosp Infect*, 102: 63-69
- Waste traps do become blocked

  Breathnach, A. et al . 2012. 'Multidrug-resistant *Pseudomonas aeruginosa* outbreaks in two hospitals: association with contaminated hospital waste-water systems', *J Hosp Infect*, 82: 19-24
- **391** notifications of blocked sinks/toilets/sluices per year
- Blockages mainly due to paper towels

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POOR DESIGN MAY CONTRIBUTE

- **36 patients exposed to the intensive care unit or transplant units of a tertiary care hospital were infected with a multidrug-resistant strain of *P. aeruginosa***
- 33% died with this organism directly implicated

Hota, S., at al (2009). "Outbreak of multidrug-resistant *Pseudomonas aeruginosa* colonization and infection secondary to imperfect intensive care unit room design." *Infect Control Hosp Epidemiol* 30(1): 25-33

- Outbreak source traced to hand hygiene sink drains, where biofilms containing viable organisms were found
- Testing by use of a commercial fluorescent marker demonstrated that when the sink was used for hand washing, drain contents splashed at least 1m from the sink, which was placed by an area used to prepare medications and equipment

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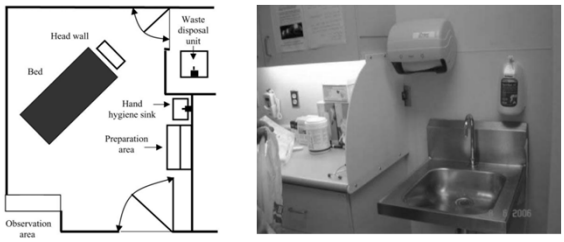
WERE IC SPECIALISTS ABLE TO INFLUENCE DESIGN?



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SINK CONTAMINATION

- **Every hand wash sink will become contaminated with pathogens; it is the purpose of them after all, to collect pathogens washed from hands**
- They may even be a good indicator of effective infection prevention
- A potential for re-contamination is always there
- **After discharge of infected patients the environment is decontaminated**
- But almost never drainage systems, so a potential source remains
- But what could we do?
- Remove them all?

Hopman, J., et al., 2017, 'Reduced rate of intensive care unit acquired gram-negative bacilli after removal of sinks and introduction of 'water-free' patient care', *ARIC*, 6: 59

- Or decontaminate and prevent?

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CLINELL DRAIN DISINFECTANT

Broad spectrum kill
Clinell Drain Disinfectant has been designed specifically with efficacy in mind for hard-to-kill biofilms. Great for use in outbreaks.

No-spill
Clinell Drain Disinfectant is a granule formulation activated by water (in the drain). Eliminates risk of spill hazard transporting liquid solutions.

Clinical evidence
Clinell Drain Disinfectant has proven evidence of inhibiting the growth for at least 4 days in and reduces biofilm growth up to the surface of the drain.

PAA Technology
Clinell Drain Disinfectant is based on patented peracetic acid technology used in Clinell Peracetic (Sporicidal) Acid Wipes.

Safe
Clinell Drain Disinfectant is near neutral pH so gentle on drains. Breaks down to non-harmful vinegar and water.

Ready-to-use
Clinell Drain Disinfectant is portioned accordingly for use on drains. Guess-work and dilutions not required, drains can be treated straight out the box.

Complete protocol
Clinell Drain Disinfectant has been designed for use in drains specifically providing a proven method to eradicate biofilms in sinks and showers.

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INSTRUCTIONS FOR USE (IFU)

First time use
Use for three consecutive days. Evidence shows this will eradicate biofilms.

Ongoing use
Use twice a week. Proven to prevent biofilm regrowth.

In outbreak situations, use daily

Placing Clinell Drain Disinfectant Indicator Tape over the treated sink/shower indicates to others that the facility should not be used for 15 minutes while the product is working.

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SINK VARIATIONS

Clinell Drain Disinfectant can be used on both sink and shower drains including:

Sinks and basins

Shower traps

P-traps, s-traps and bottle traps

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WHERE TO LOOK FOR DRAIN DISINFECTANT USEFULNESS

- Augmented care areas
- Clinical Haematology
- ICU's
- Oncology areas
- Cystic fibrosis units
- High Dependency Units
- Burns
- Renal
- Clinical areas experiencing outbreaks

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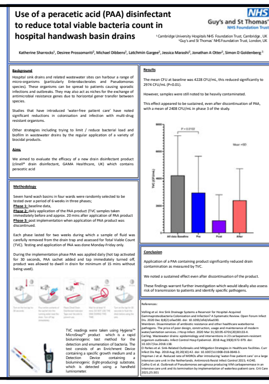
GUYS AND ST THOMAS'

Using Clinell Drain Disinfectant to reduce total viable bacteria count in hospital handwash basin drains.

Presented at FIS | HIS International Conference 2022



Use of a peracetic acid (PAA) disinfectant to reduce total viable bacteria count in hospital handwash basin drains

NHS Guy's and St Thomas' NHS Foundation Trust

[1] Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK
[2] Guy's and St Thomas' NHS Foundation Trust, London, UK

Katherine Sharrocks[1], Desiree Prossomariti[2], Michael Dibbens[2], Latchmin Gargee[2], Jessica Marashi[2], Jonathan A Otter[2], Simon D Goldenberg[2]

Background

Hospital sink drains and related wastewater sites can harbour a range of micro-organisms (particularly Enterobacterales and Pseudomonas species). These organisms can be spread to patients causing sporadic infections and outbreaks. They may also act as niches for the exchange of antimicrobial resistance genes due to horizontal gener transfer between species.

Studies that have introduced 'water-free patient care' have noted significant reductions in colonisation and infection with multi-drug resistant organisms.

Other strategies including trying to limit / reduce bacterial load and biofilm in wastewater drains by the regular application of a variety of biocidal products.

Aims

We aimed to evaluate the efficacy of a new drain disinfectant product (clinell® drain disinfectant, GAMA Healthcare, UK) which contains peracetic acid

Methodology

Seven hand wash basins in four wards were randomly selected to be tested over a period of 6 weeks in three phases;
Phase 1: baseline data,
Phase 2: daily application of the PAA product (TVC samples taken immediately before and approx. 20 mins after application of PAA product
Phase 3: post implementation when application of PAA product was discontinued.

Each phase lasted for two weeks during which a sample of fluid was carefully removed from the drain trap and assessed for Total Viable Count (TVC). Testing and application of PAA was done Monday-Friday only.

During the implementation phase PAA was applied daily (hot tap activated for 30 seconds, PAA sachet added and tap immediately turned off, product was allowed to dwell in drain for minimum of 15 mins without being used).

TVC readings were taken using Hygiena™ MicroSnap™ product which is a rapid bioluminogenic test method for the detection and enumeration of bacteria. The test consists of an Enrichment Device containing a specific growth medium and a Detection Device containing a bioluminogenic (light-producing) substrate, which is detected using a handheld luminometer.

Results

The mean CFU at baseline was 4228 CFU/mL, this reduced significantly to 2974 CFU/mL (P=0.01).

However, samples were still noted to be heavily contaminated.

This effect appeared to be sustained, even after discontinuation of PAA, with a mean of 2408 CFU/mL in phase 3 of the study.

Conclusion

Application of a PAA containing product significantly reduced drain contamination as measured by TVC.

We noted a sustained effect even after discontinuation of the product.

These findings warrant further investigation which would ideally also assess risk of transmission to patients and identify specific pathogens.

References:

Volling et al. Are Sink Drainage Systems a Reservoir for Hospital-Acquired Gammaproteobacteria Colonization and Infection? A Systematic Review. Open Forum Infect Dis. 2020 Dec 8;8(2):ofaa590. doi: 10.1093/ofid/ofaa590.
Weinbren. Dissemination of antibiotic resistance and other healthcare waterborne pathogens. The price of poor design, construction, usage and maintenance of modern water/sanitation services. J Hosp Infect. 2020 Mar 31;S0195-6701(20)30133-X.
Carling. Wastewater drains: epidemiology and interventions in 23 carbapenem-resistant organism outbreaks. Infect Control Hosp Epidemiol. 2018 Aug;39(8):972-979. doi: 10.1017/ice.2018.138.
O Parkes et al. Sink-Related Outbreaks and Mitigation Strategies in Healthcare Facilities. Curr Infect Dis Rep. 2018 Aug 20;20(10):42. doi: 10.1007/s11908-018-0648-3.
Hopman J et al. Reduced rate of MDROs after introducing 'water-free patient care' on a large intensive care unit in the Netherlands. Antimicrob Resist Infect Control 2015; 4:O40.
Catho G et al. Outbreak of Pseudomonas aeruginosa producing VIM carbapenemase in an intensive care unit and its termination by implementation of waterless patient care. Crit Care 2021;25:301

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GUYS AND ST THOMAS'

Methodology

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  - Phase 2: daily application of the PAA product (TVC samples taken immediately before and approx. 20 mins after application of PAA product)
  - Phase 3: post implementation when application of PAA product was discontinued
- Each phase lasted for two weeks during which a sample of fluid was carefully removed from the drain trap and assessed for Total Viable Count
- (TVC). Testing and application of PAA was done Monday-Friday only.
- During the implementation phase PAA was applied daily (hot tap activated for 30 seconds, PAA sachet added and tap immediately turned off, product was allowed to dwell in drain for minimum of 15 mins without being used)

Conclusions

- Application of the peracetic acid containing product significantly reduced drain contamination
- A sustained effect was noted even after discontinuation of the product

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Q&A

Dr Phillip Norville
Clinical & Scientific Director

Dr Jack Pike
Area Sales Manager

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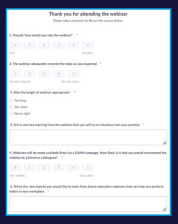

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