GAMA GLOBAL WEBINAR SERIES

Biofilms and their Clinical Significance in Healthcare

gama healthcare

NOVEMBER 2022

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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:
1 global webinar per month, 30 minutes + Q&A in English.

Possible contact sessions:
Due to different time zones, the webinars will be recorded and shared. Live Q&A sessions with the speakers can be arranged for those who cannot attend the webinar. Please contact your sales rep/channel marketeers if needed.

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BEFORE WE BEGIN

- Make sure 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.

- Feel free to introduce yourself and where you are joining from in the **chat box**!
- Due to the intellectual property of the presenter, please **refrain from recording** or **taking screen shots** during the webinar.
- Contact your salesperson for the webinar content & certificate.

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OUR SPEAKERS

Yvonne Carter
Clinical Director

While at The Royal Free Hospital, she was vital in reducing Clostridium difficile rates by 72%, winning her the National Nursing Times IPC award in 2009 and 2014.

Having helped develop UK national guidelines for the safe use of protective clothing for high consequence infectious diseases, Yvonne also provides ICP expertise to Africa, Asia, Europe and Australia.

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.

As Clinical & Scientific Director for GAMA Healthcare, Phil leads a team of experienced infection preventionists, making sure GAMA's offering is clinically proven and industry-leading.

Dan Morgan-Smith
Global Acute Strategy Director

Dan is an experienced Infection Prevention Sales leader with 25 years of experience in the UK Market. He has worked with two ambitious companies helping both grow to be strong market leaders and the outstanding company in their field.

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AGENDA

1. What are biofilms?
2. Wet and dry surface biofilms
3. Clinical significance of biofilms
4. GAMA's solution to biofilms

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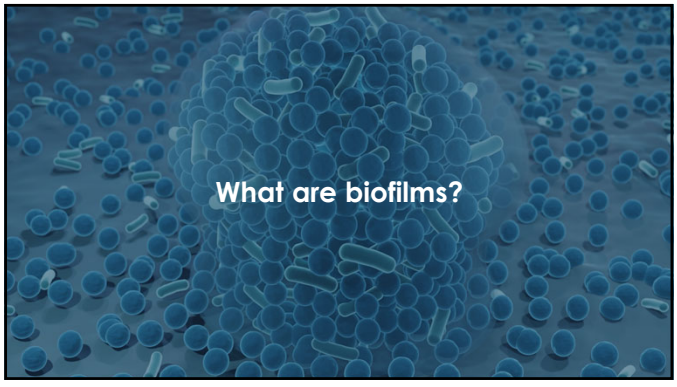

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BIOFILMS

- 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

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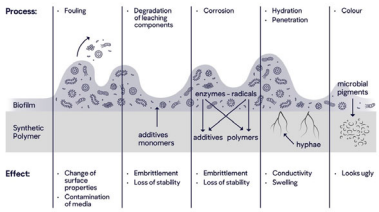
EFFECT OF BIOFILMS ON SURFACES

- Polymer degradation due to biofilm formation



Flemming, H-C. 1998. 'Relevance of biofilms for the biodeterioration of surfaces of polymeric materials', *Polymer Degradation and Stability*, 59: 309–15.

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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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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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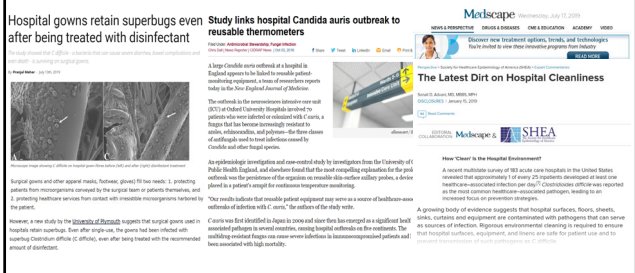
BIOFILMS ARE NOW RECOGNISED AS AN ISSUE


Hospital gowns retain superbugs even after being treated with disinfectant

Study links hospital Candida auris outbreak to reusable thermometers

Medscape

The Latest Dirt on Hospital Cleanliness

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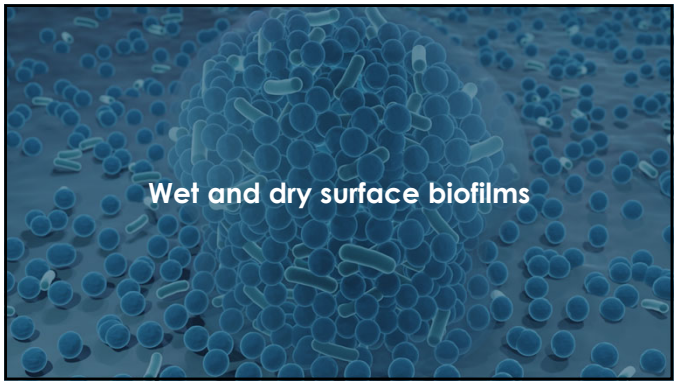

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WET BIOFILMS

- Accumulation of microorganisms embedded in biofilm within the drainage pipework leading from individual dialysis monitors in a renal dialysis centre, represents a significant threat to the safe operation of the whole centre due to blockage of the pipes and overflow of waste water.

Phillips, G., S. Hudson, and W. K. Stewart. 1992. 'Microbial growth and blockage of sub-floor drains in a renal dialysis centre: a problem highlighted', *J Hosp Infect*, 21: 193-8.

- Clinically, urinary catheters were the focus of the work.
- Followed by pneumonia, metal implants, IV devices.

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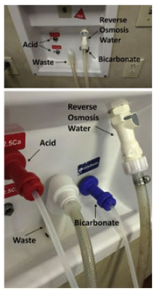
BIOFILM-MEDIATED OUTBREAK IN A DIALYSIS UNIT

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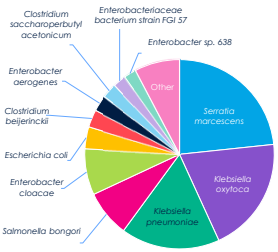
DRAIN BIOFILM COMPOSITION WORK FROM THE STAFF ROOM IN THE UNIVERSITY OF CARDIFF



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 atrosepticum	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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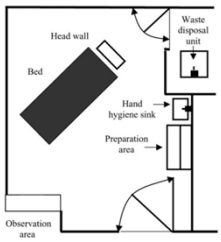
INFECTION PREVENTIONISTS CAN INFLUENCE DESIGN



Poll question

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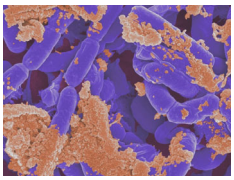
DRY SURFACE BIOFILMS

- Less attention to dry biofilms compared to most commonly researched wet/hydrated biofilm
- Colonize various materials:
  - Textiles,
  - Hard surfaces: plastic (PVC, PP),wood, metal (stainless steel),
  - Implantable medical devices,
  - Surgical instruments to many others
- Have been found in diverse environmental conditions: low moisture, varying temperature and nutrients levels



SEM image of DSB containing mixed hospital culture grown on stainless steel disc

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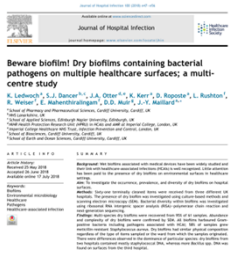
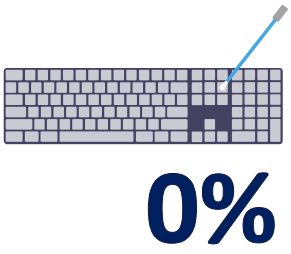
DRY SURFACE BIOFILM DETECTION BY SWABBING


Journal of Hospital Infection

Beware biofilm! Dry biofilms containing bacterial pathogens on multiple healthcare surfaces; a multi-centre study



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Ledwoch, K., S. J. Dancer, J. A. Otter, K. Kerr, D. Roposte, and J. Y. Maillard. 2018. 'Beware Biofilm! Dry biofilms containing bacterial pathogens on multiple healthcare surfaces; a multicentre study', *J Hosp Infect*. 100:3:47-5

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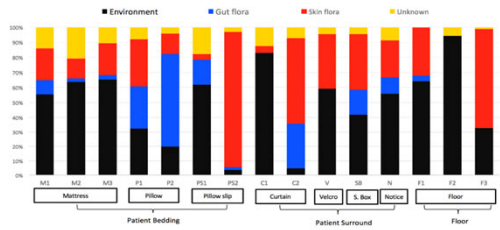
PREVALENT SPECIES IN DRY BIOFILMS



Why is there gut flora on the pillows?

hu, H. Et al. (2015) *J hosp infect*, 91: 35-44

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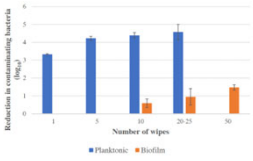
DRY BIOFILMS ARE NOT EASY TO REMOVE

- Planktonic organisms relatively easy to remove from a polycarbonate surface by wiping with a moistened viscose/polyester cloth.
  - Wiping once significantly reduced contaminating bacteria by 3.33 Log_{10} or 99.95% (P<0.001).
  - Wiping 5 times removed significantly more, removing 4.22 Log_{10} or 99.99% (P<0.001).
- In contrast, wiping DSB 10 or 20 times was not effective.
  - **Fifty wipes** needed to remove a significant amount of dry surface biofilm and equated to removing just 1.48 Log_{10}.



Parvin, F. et al (2019) *J hosp infect* 103(4): 465-467

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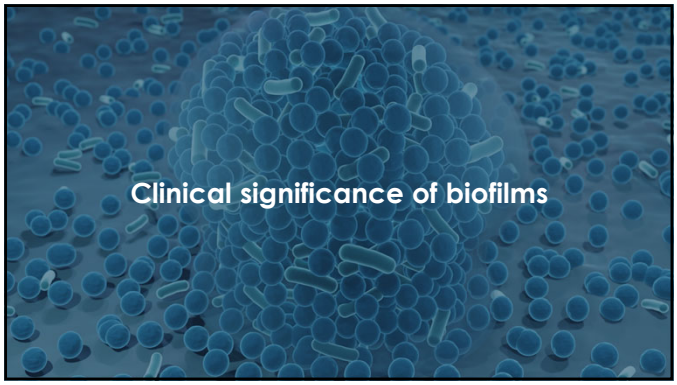

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BIOFILM SURVIVAL

- Intensive Care Unit decommissioned when a hospital closed
  - Hu, H., et 1 (2015) 'Intensive care unit environmental surfaces are contaminated by multidrug-resistant bacteria in biofilms: combined results of conventional culture, pyrosequencing, scanning electron microscopy, and confocal laser microscopy', *J Hosp Infect*, 91: 35-44.
- Two terminal cleans with Chlorine at 1000 ppm.
- Parts of ITU stored and tested.
- >1 MDRO grew from 52% of cultures a year later.

Item	N	Biofilm	Live at 12 months
Mattress	6	6	5
Pillow	5	5	3
Curtain	9	8	4

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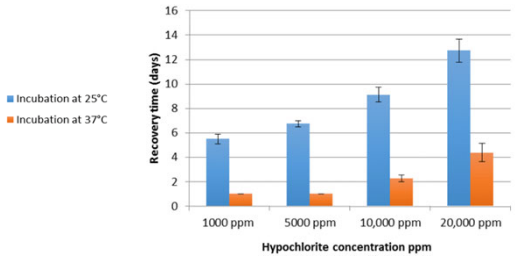
DAYS REQUIRED FOR RECOVERY OF BIOFILM BACTERIA AFTER HYPOCHLORITE EXPOSURE



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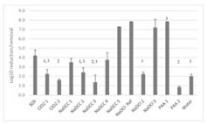
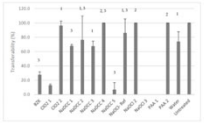
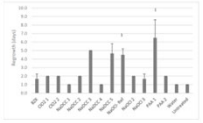
EFFICACY OF DISINFECTANTS AGAINST *C. AURIS* IN DRY BIOFILM



TRANSFERABILITY OF *C. AURIS* FROM DRY BIOFILM POST-DECONTAMINATION



REGROWTH (DAYS) FROM DRY BIOFILM



Ledwoch, K. and J. Y. Maillard (2018). "*Candida auris* Dry Surface Biofilm (DSB) for Disinfectant Efficacy Testing." *Materials (Basel)* 12(1)

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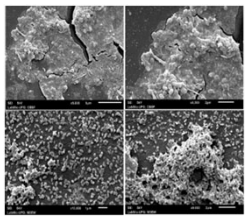
FREQUENTLY TOUCHED OBJECTS AND BIOFILMS

- Silva, L. N. et al (2020). "Microbiological contamination of clipboards utilised for patient records in intensive care units." *J Hosp Infect. (in press)*
- Presence of single adhered cells was detected on 6/8 clipboards.
- Multi-layered dry surface biofilm were detected on 2/8 clipboards.



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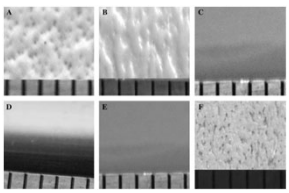
THINK BEFORE YOU BUY

- Hospital bedrails
  - Very different surfaces
  - Ease of cleaning inversely proportional to transfer of *S. aureus* from surfaces
  - Surfaces become rapidly contaminated and biofilm forms



Ali et al. *J hosp infect* 2012;80:192-8

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BIOFILM LABORATORY TESTING METHODS

- There is no standard laboratory test method available for Europe within the BPR regulation
- Approach suggested: suspension tests and simulated use tests based on scientific evidence
- Biofilm research area is developing rapidly and considering there is no method for testing in Europe - BSI group has put together a separate focus group working towards biofilms and the development of a European standard method
- EPA guidance available for wet biofilms:
  - ASTM E3161-18 (biofilm growth)
  - ASTM E2871-19 (efficacy test): Minimum 6 Log Reduction (99.9999% of bacteria within biofilm); *P. aeruginosa* and *S. aureus*

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So the evidence is building- Poll results.

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POLL question:

1. Have you encountered problems with biofilms in your healthcare organisations?
2. Are you aware of dry surface biofilms?

- First you have to accept that they are there.
- Wet you can sometimes see and feel.
- Dry biofilms are normally invisible however the literature is growing and it does explain the risk to the next patient from a visibly clean room, but Identification is the challenge.

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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

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

Multi-species dry biofilms recovered from 95% of 61 samples.

Communities of 11-27 species.

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2 products PERACETIC ACID RANGE- support each other for Biofilms


Drain Disinfectant


Indicator Tape


Peracetic Acid Wipes


Wipes Dispenser

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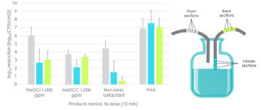
HOW TO REMOVE THEM?

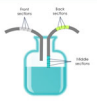
- When it comes to using a disinfectant, oxidizing agents are the best approach.
  - Best disinfectant
  - Fastest kill
  - **Cardiff study of wet surface biofilms:** PAA as the oxidiser as being the most effective

DISINFECTION TESTS: TRAP MODEL



Regrowth

- After NaDCC, NaOCl and Non-ionic surfactant treatments, the drain biofilm recovers within one day (>5 $\log_{10}$ recovered)
- Front section takes longer to regrow (>4 $\log_{10}$ reached after 4 days)
- Only PAA treatment prevented the regrowth for more than 4 days (<1 $\log_{10}$ recovered)



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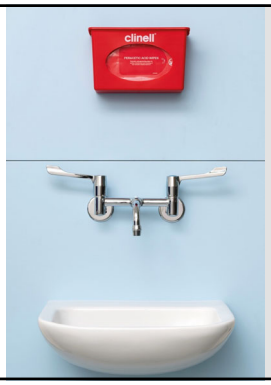
DISRUPTING EVERY LAYER OF MICROBIAL EVIDENCE

- Clinell Peracetic Acid Wipes and PAA Drain Disinfectant use patented technology to break down every layer of microbial defence.
  A synergistic blend of peracetic acid, hydrogen peroxide and added detergents work to break down the biofilm matrix and kill the microorganisms sheltering inside.



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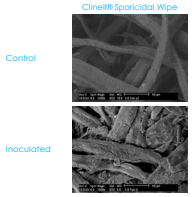
HOW TO REMOVE THEM?

- No transference Siani et al. We know that organisms can be transferred from biofilm on a surface to another surface, so a substrate that traps the organisms in the wipe (for several more swipes) is of huge benefit.



C. difficile and Wipe Interaction
Electron micrographs of inoculated with *C. difficile*
Siani *et al.* AJIC 2011; 39(3):212-8

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OTHER AREAS OF IMPORTANCE & BENEFIT

- Likely to penetrate biofilm better as takes longer to regrow (Kate Ledwoch's work on drains – Chlorine regrowth is fast (<1 day), PAA 4 days.
- Chlorine gets deactivated by organic matter, PAA is enhanced by it!
- PAA is a sustainable solution, breaks down well no harmful by products.
- Red substrate is our greenest substrate.
- Cleans and lifts really well kills the organism within the wipe.
- Also may mean that one wipe goes further for mattresses for instance

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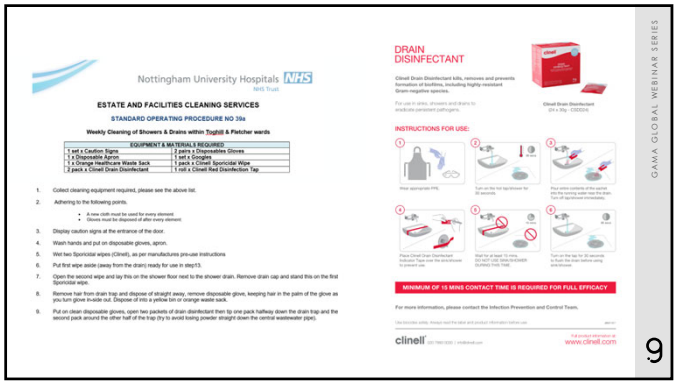

Nottingham University Hospitals NHS
NHS Trust

ESTATE AND FACILITIES CLEANING SERVICES

STANDARD OPERATING PROCEDURE NO 39a

Weekly Cleaning of Showers & Drains within Toghill & Fletcher wards

EQUIPMENT & MATERIALS REQUIRED	
1 set x Caution Signs	2 pairs x Disposables Gloves
1 x Disposable Apron	1 set x Goggles
1 x Orange Healthcare Waste Sack	1 pack x Clinell Sporicidal Wipe
2 pack x Clinell Drain Disinfectant	1 roll x Clinell Red Disinfection Tap

1. Collect cleaning equipment required, please see the above list.
2. Adhering to the following points.
   - A new cloth must be used for every element
   - Gloves must be disposed of after every element
3. Display caution signs at the entrance of the door.
4. Wash hands and put on disposable gloves, apron.
5. Wet two Sporicidal wipes (Clinell), as per manufactures pre-use instructions
6. Put first wipe aside (away from the drain) ready for use in step13.
7. Open the second wipe and lay this on the shower floor next to the shower drain. Remove drain cap and stand this on the first Sporicidal wipe.
8. Remove hair from drain trap and dispose of straight away, remove disposable glove, keeping hair in the palm of the glove as you turn glove in-side out. Dispose of into a yellow bin or orange waste sack.
9. Put on clean disposable gloves, open two packets of drain disinfectant then tip one pack halfway down the drain trap and the second pack around the other half of the trap (try to avoid losing powder straight down the central wastewater pipe).

DRAIN DISINFECTANT

Clinell Drain Disinfectant kills, removes and prevents formation of biofilms, including highly-resistant Gram-negative species.

For use in sinks, showers and drains to eradicate persistent pathogens.

Clinell Drain Disinfectant
20 x 30g - CDDD16

INSTRUCTIONS FOR USE:

MINIMUM OF 15 MINS CONTACT TIME IS REQUIRED FOR FULL EFFICACY

For more information, please contact the Infection Prevention and Control Team.

Like biocides safely. Always read the label and product information before use.

clinell

Full product information at www.clinell.com

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AFTER THE THEORY - DRY BIOFILM PROTOCOL SUGGESTED

- Problem – needs further work.
- Approval – peracetic acid is a good option.
- Evaluation of potential protocols.
- Implementation – training – who does it?
- Evaluation – how to measure improvement?

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SUMMARY OF PERACETIC ACID POTENTIAL PROTOCOLS

Biofilms

- Evidence shows us that biofilms present a big problem within healthcare and Hospitals today.
- Clinell Peracetic Acid Wipes and Drain Disinfectant are unique in using the power of peracetic acid at point of delivery to specifically targeting dry biofilms.

Prevention & Cure

- Peracetic Acid Wipes and Drain Disinfectant are ideal for dealing with outbreaks.
- Peracetic Acid Wipes and Drain Disinfectant should also be used as a twice weekly basis to control wet surface biofilms and could be considered as a protocol intervention for dry surface biofilms.

More effective than chlorine

- Chlorine Dioxide is the common solution on the market, used by most hospitals as a solution for cleaning drains.
- Peracetic Acid Wipes and Drain Disinfectant offer a much better log reduction and regrowth period than chlorine at 1,000ppm.
- Peracetic Acid Wipes and Drain Disinfectant do not damage drains.

Ease of Use

- Current solutions on the market require pre-measuring or pre-mixing which takes time and effort in a busy workplace.
- Peracetic Acid Wipes and Drain Disinfectant are ready and easy to use – just run the tap, pour down the drain and wait!

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Q&A


Yvonne Carter
Clinical Director


Dr Phillip Norville
Clinical & Scientific Director


Dan Morgan-Smith
Global Acute Strategy Director


Dr Maria Rubiano
Microbiology Sciences Team Leader

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Thank you!

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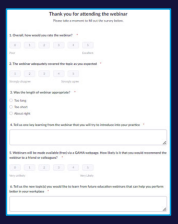
Thank you for attending the webinar

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