

## Case Study: Tallaght University Hospital

### Objective: On site evaluation of the effectiveness of BioClenz+ in hospital drains

**Hospital:** Tallaght University Hospital  
**Evaluation Area:** Ward A (12 rooms) & Ward B (10 rooms)  
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### Summary

**Background:** Whilst the emergence of *Carbapenemase Producing Enterobacterales* (CPE), *Vancomycin-resistant Enterococcus* (VRE) and *Clostridioides difficile* (C.diff) has been reported worldwide over the past decade, their presence specifically within the biofilm of drains in healthcare facilities and in the association and contribution in the colonisation or infection of patients, is becoming increasingly more recognised. Whilst strategies to disrupt and remove drain biofilm, and the pathogens within them, as well as preventing the re-establishment are essential due to significantly increased tolerance of biofilm bacteria, it has been acknowledged that they are notoriously difficult to eradicate with traditional methods<sup>1-4</sup>. BioClenz+, a hypochlorous acid solution, has been independently tested against the only registered biofilm protocol; EPA Standard Operating Procedure MB-19, Growing a Biofilm using the CDC Biofilm Reactor and U.S. EPA Standard Operating Procedure MB-20, Single Tube Method for Determining the Efficacy of Disinfectants against Bacterial Biofilm.

**Methods:** The evaluation was carried out following a SOP specifically designed for use in healthcare facilities to assist in controlling pathogens present in shower and sink drain lines. Each drain (22 in total) was treated with 5000ppm of BioClenz+ solution twice a day for Weeks 1 and 2; then twice a week for Weeks 3 and 4. Environmental sampling was carried out at Day 0, three times for Week 1, then twice a week for Weeks 2-4.

**Results:** A total of 22 environmental samples were taken in 22 drains at Day 0, with 7 swabs returning positive for CPE (32%). After treatment of BioClenz+ commenced, a total of 219 environmental samples were taken in the same 22 drains, across a 4-week period. All swabs taken during this time returned negative (100% reduction).

**Conclusion:** The results of the evaluation of BioClenz+ demonstrates the effectiveness of the product in managing biofilm and the microbes they are harbouring in the drains of healthcare facilities.

### Introduction

BioClenz+, is registered and authorised in Ireland, in accordance with the Biocide Product Regulation (BPR), under PCS Number 101956. Supplied in a tablet form, once diluted with water, it forms a hypochlorous acid solution that has been independently tested against the only registered protocol that demonstrates efficacy against ATCC 15442, *Pseudomonas aeruginosa* (*P. aeruginosa*) and ATCC 6538, *Staphylococcus aureus* (*S. aureus*) within biofilms, achieving between a 6-8 log reduction.

Additional testing has been carried out against EN Standards; such testing evaluates the efficacy of the product against bacteria (EN 13727), Viruses (EN 14476), Fungi (EN 1650), Mycobacteria (EN 14348) and Spores, in particular CPE (EN 13704).

This case study demonstrates the effectiveness of BioClenz+ against biofilm and the bacteria they

are harbouring in drains in Tallaght University Hospital (TUH).

TUH is one of the country's leading academic teaching hospitals. The hospital cares for children, adults and older people; with a total of 562 beds, 12 theatres and 14 Critical Care beds.

In the most recent National Point Prevalence Survey (PPS) of Hospital-Acquired Infections (HAI's)<sup>5</sup> & Antimicrobial Use in Ireland, 678 active HAI's were identified in 633 patients. The overall HAI prevalence was 6.1%, an increase from 5.2% reported for the previous PPS in May 2012.

One of the most concerning HAI's from this PPS was CPE. The emergence of CPE has been reported worldwide over the past decade, and has emerged in Ireland since 2009, with a rapidly increasing incidence since 2016 and declared a national public health emergency in October

2017<sup>6</sup>. This initiated the introduction of monthly CPE surveillance reports.

Bacteria such as CPE, VRE and *C difficile*, can persist in suitable environmental niches for extended periods. One such niche involves the bacteria existing within a self-produced polymeric matrix; a biofilm, commonly found in moist environments such as sink or shower surfaces and drains. The formation of such biofilm enables bacterial tolerance to environmental threats; with environmental contamination emerging as a potential reservoir that may contribute to colonisation or infection of patients. With increasing awareness of the presence and implications of environmental biofilm in healthcare facilities, efforts to implement biofilm control measures are emerging.

On the most recent summary reports on CPE<sup>7</sup> in Ireland, the provisional total of new patients for the first 52 weeks of 2022 (incl. Week 1 2023\*) was 927. The total for the corresponding period in 2021 was 712. This represents a 30% increase in detection in 2022 compared to the corresponding period in 2021. Tallaght University Hospital has reported a CPE outbreak in 5 months out of 12 in 2022. Most recently, across October, November and December.

### Situation Prior to Evaluation

Prior to the trial commencing, TUH were using a combination of Steam Cleaning followed by 2000ppm of sodium dichloroisocyanurate (NaDCC) solution to treat drains and subsequent environmental contamination and biofilm. The following process was carried out:

- Removal of the shower drain cover.
- Steam cleaning of the cover and the drain surround.
- Bathroom, washbasin and toilet are then to be cleaned.
- A 2000ppm solution of NaDCC is poured into the shower drain.
- The shower drain cover is then replaced.

Steam cleaning in Ward A commenced on Friday 7<sup>th</sup> October 2022 and was carried out once every two weeks. The process was also carried out when a positive case was discharged from a room. Steam cleaning in Ward B commenced on Friday 19<sup>th</sup> August 2022 and was carried out weekly. The process was also carried out again when a positive case was discharged from a room.

Environmental sampling was carried out at random, with the swabbing technique as per the existing hospital policy. Prior to the BioClenz+ evaluation commencing, 18 swabs from the environmental sampling had returned positive for CPE, following the steam cleaning and NaDCC treatment.

TUH were dissatisfied with the results from the Steam Cleaning and 2000ppm NaDCC, and agreed to evaluate BioClenz+ as an alternative option January 8<sup>th</sup> 2023.

### Methodology - The BioClenz+ Evaluation

Following staff training and education, the evaluation commenced on Monday 9<sup>th</sup> January, and ran for a period of 4 weeks. The following dilution was used throughout the duration of the trial:

- Product: BioClenz+
- Packaging: 200 tablets per tub (Equivalent to 40 applications per tub)
- Dosage: 5000ppm (5 tablets per litre of water)

Treatment frequency was carried out as per the below recommended guidance on usage, as per the SOP for BioClenz+

- For first time use, each drain is to be treated once a day for two consecutive weeks, to eradicate the biofilm:
  - Days 1 to 7 – Week 1
  - Days 8 to 14 – Week 2
- Use twice a week in each drain thereafter, to prevent biofilm regrowth:
  - Days 16 and 20 – Week 3
  - Days 23 and 27 – Week 4

The environmental sampling technique was carried out as per the existing hospital policy. The frequency of environmental sampling within the drains was carried out as below, as per the SOP for BioClenz+

- Day 0 (Control swabs)
- Days 1, 3 and 7 – Week 1
- Days 10 and 14 – Week 2
- Days 17 and 21 – Week 3
- Days 24 and 28 – Week 4

## Results

All drains in Ward A and Ward B were swabbed as per SOP; with the exception of Room 12 in Ward A, where Day 0 and Day 1 swabs were missed. As Day 28 fell on a bank holiday, treatment was carried out on Day 29, with swabbing carried out later that day. An additional swab of each drain was carried out on Day 32, two days after the evaluation.

In total, 240 environmental samples were taken throughout the duration of the evaluation. The results of each swab were collated by the Infection Prevention and Control Team at TUH and are detailed on Table 1.

At Day 0, a total of 21 environmental samples were taken across Wards A and B, with 14 swabs returning negative and 7 swabs returning positive for CPE; a 33% positivity rate. The results showed positive swabs in Ward A, Rooms 1, 3, 4, 5 and 11 and Ward B, Rooms 3 and 4. CPE strains from the positive samples included a mix of OXA-48, KPC and NDM.

Results obtained at Day 0 acted as the control for the study and point of comparison against which the results from Days 1 through to 32 were measured.

Following the commencement of treatment with BioClenz+, a total of 219 environmental samples were taken in the same areas of Ward A and B, following the frequency detailed in the SOP. All 219 swabs, from Day 1 through to Day 32, returned negative for CPE, a 100% reduction in the results obtained at Day 0.

Ward 1 - Sampling Results												
	Day 0	Day 1	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 29	Day 32	Comment
	09/01/2023	10/01/2023	12/01/2023	16/01/2023	19/01/2023	23/01/2023	26/01/2023	30/01/2023	02/02/2023	07/02/2023	10/02/2023	
Room 1	Positive - Oxa	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 2	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 3	Positive - Oxa, NDM	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 4	Positive - KPC	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 5	Positive - Oxa, NDM	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 6	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 7	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 8	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 9	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 10	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 11	Positive - Oxa, KPC	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 12	Not performed	Not performed	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Ward 2 - Sampling Results												
	Day 0	Day 1	Day 3	Day 7	Day 10	Day 14	Day 17	Day 21	Day 24	Day 29	Day 32	Comment
	09/01/2023	10/01/2023	12/01/2023	16/01/2023	19/01/2023	23/01/2023	26/01/2023	30/01/2023	02/02/2023	07/02/2023	10/02/2023	
Room 1	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 2	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 3	Positive - Oxa	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 4	Positive - Oxa, NDM	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 5	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	CPE OXA48 known patient accommodated in room 5 from 15/01/23 to 18/01/23 Patient admitted on 17/1/23 to Room 8 tested positive on 23/1/23 and was indeterminate case.
Room 6	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 7	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 8	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 9	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	
Room 10	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	

Table 1

## Conclusion

The on-site results of the evaluation of BioClenz+ in Tallaght University Hospital demonstrates the effectiveness of the product in managing biofilm and the microbes they are harbouring in hospital drains.

Following the successful results on-site, the team at TUH have put together a business case for hospital wide use of Bioclenz+; with additional education and training to be provided by the Mediteq team.

## Discussion

Further analysis could also be carried out locally to determine the impacts of this intervention on rates of associated Healthcare-associated infections (HCAI's).

## Summary of Abbreviations

Abbreviation	Definition
CPE	Carbapenemase Producing Enterobacterales
VRE	Vancomycin-resistant enterococcus
C.difficile	<i>Clostridioides difficile</i>
BPR	Biocide Product Regulation
P. aeruginosa	<i>Pseudomonas aeruginosa</i>
S. aureus	<i>Staphylococcus aureus</i>
TUH	Tallaght University Hospital
PPS	Point Prevalence Study
HAI's	Hospital acquired infections
HCAI's	Healthcare-associated infections
NaDCC	Sodium dichloroisocyanurate

## References

- <sup>1</sup> Staphylococcus aureus dry-surface biofilms are not killed by sodium hypochlorite: implications for infection control, 2016, Journal of Hospital Infection 1-8,
- <sup>2</sup> Activity of Hospital Disinfectants against Vegetative Cells and Spores of Clostridioides difficile Embedded in Biofilms, 2019, Antimicrobial Agents and Chemotherapy Vol. 64, No. 1
- <sup>3</sup> Surface-attached cells, biofilms and biocide susceptibility: implications for hospital cleaning and disinfection, 2014, Journal of hospital Infection
- <sup>4</sup> Presence of biofilm containing viable multiresistant organisms despite terminal cleaning on clinical surfaces in an intensive care unit, 2011, Journal of hospital Infection
- <sup>5</sup> Health Protection Surveillance Centre, Point Prevalence Survey of Hospital Acquired Infections & Antimicrobial Use in European Acute Care Hospitals, 2017: National Report Ireland
- <sup>6</sup> National Public Health Emergency - Carbapenemase Producing Enterobacterales (CPE), 2019: Department of Health
- <sup>7</sup> Summary Report on Carbapenemase Producing Enterobacterales (CPE), 2023, Health Protection Surveillance Centre