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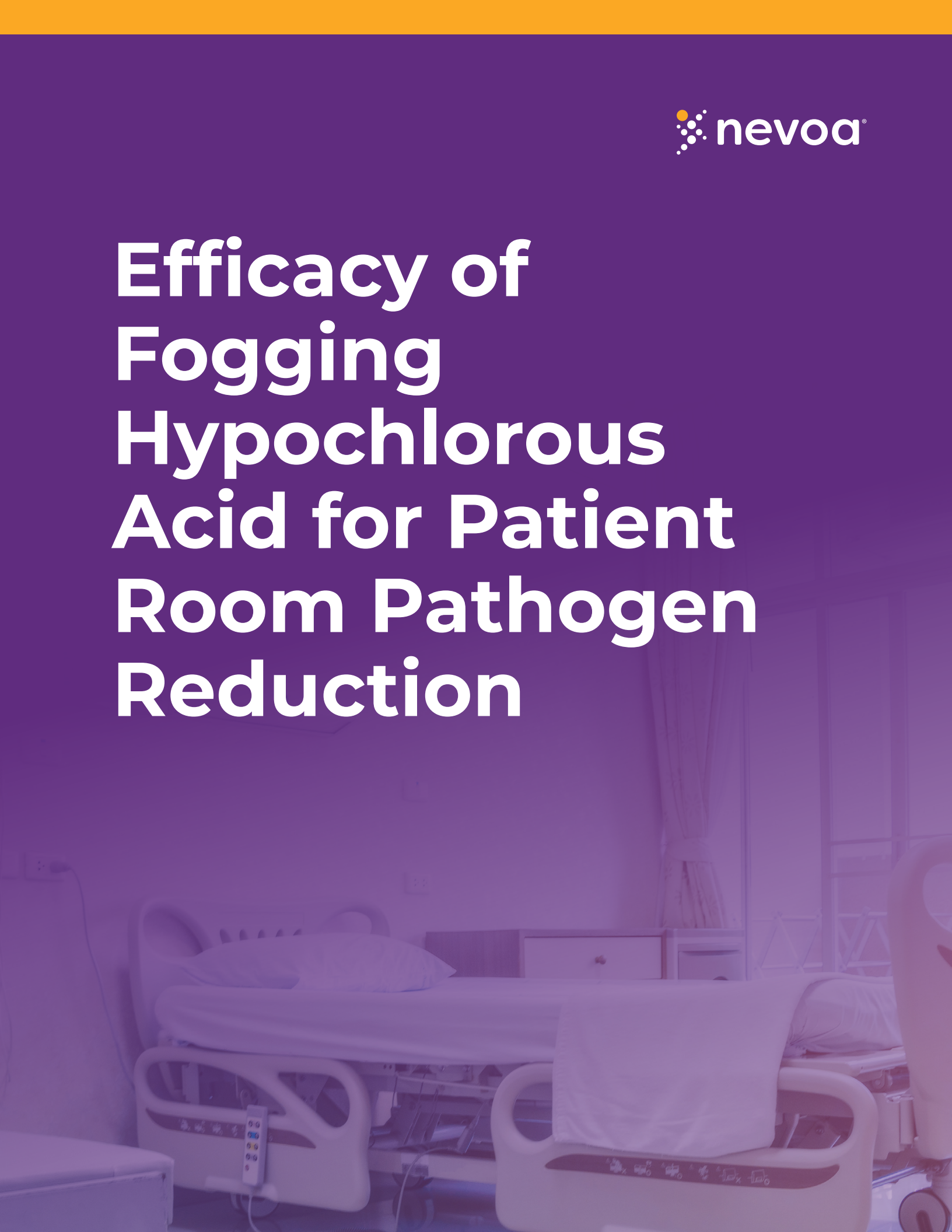
Efficacy of Fogging Hypochlorous Acid for Patient Room Pathogen Reduction



INTRODUCTION

Prevention of healthcare associated infections (HAIs) remains a priority for hospitals and healthcare facilities. Every year nearly 1.7 million hospitalized patients acquire an HAI while being treated for another health issue, and more than 98,000 patients die due to these infections[1].

Studies suggest that infection control practices including the use of whole room fogging of disinfectants will eliminate surface pathogens and minimize the opportunity for pathogen transfer[2]. This study investigated the use of the Nevoa Nimbus automated fogging technology and Microburst™ Hypochlorous acid (HOCl) solution for the disinfection and reduction of surface pathogens during patient room terminal cleaning.

BACKGROUND

One of the most frequent adverse effects of hospitalization is for the patient to develop a healthcare associated infection (HAI) during their stay. Environmental contamination has contributed significantly to pathogen transmission in major infection outbreaks of Methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant enterococci (VRE), Clostridioides difficile (C.diff), and more recently Acinetobacter baumannii.[3]

The emergence of Candida auris, a transmittable fungus, is now considered one of the most serious problems associated with infection control practices in the hospital[4]. There is documented evidence that the risk of patient colonization and infection increases significantly if the patient occupies a room that had been previously occupied by an infected or colonized patient. Elimination of pathogens from patient room surfaces is essential for the prevention of HAIs.

HAIs threaten a patient's safety. They frequently require extensive clinical care, longer hospitalization times and burden the healthcare system with excessive costs. The infected patient also has a more likely chance of hospital readmission and higher incidence of mortality.

Hospitals are estimated to spend between US $28 and 45 billion dollars annually for the treatment of HAIs[6]. To lower the risk of developing an HAI and improve patient outcomes, healthcare facilities continue to design robust infection prevention strategies including the use of tracking and surveillance systems as well as incorporating new, evidence based, disinfection technologies into their protocols.

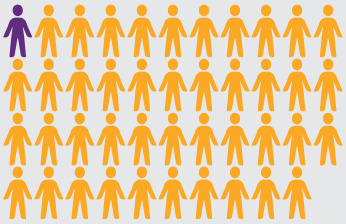
Environmental room cleaning immediately following patient discharge has widely been considered a standard of practice to assist with the prevention of HAIs. However, strong evidence supports that there are notable gaps in the manual disinfection practices of high touch environmental surfaces within the same facility. Contaminated surfaces play a major role in the development of infections via pathogen direct or indirect transfer. Several studies have shown that manual cleaning of surfaces is suboptimal with less than 50% being cleaned[7].

To enhance manual cleaning techniques, lower patient room surface bioburden and reduce the opportunity for pathogen transfer, a support services company collaborated with infection prevention leaders for a 612-bed acute care hospital in Detroit, Michigan to incorporate the use of the Nimbus automated fogging technology and Microburst disinfectant as part of the terminal cleaning practices in its medical intensive care unit (MICU) patient rooms and adjacent stepdown unit (4W).

Microburst™ is an EPA registered, hospital-grade disinfectant whose primary ingredient is hypochlorous acid (HOCl). The atomization of HOCl for whole room disinfection via Nimbus technology has been proven to be effective against common viral, bacterial and fungi pathogens including spores and C. Auris[8]. The adjunct disinfection process of atomized Microburst™ via Nimbus automated deployment was incorporated into the hospital's terminal room clean due to the lack of satisfactory results from the hospital's previous use of electrostatic spraying. UV was not considered due to prior experience with lack of efficacy.

Every day, **1 in 31 hospital patients**

and **1 in 43 nursing home residents**



develop an HAI according to the Centers for Disease Control (CDC)[5].

METHODOLOGY

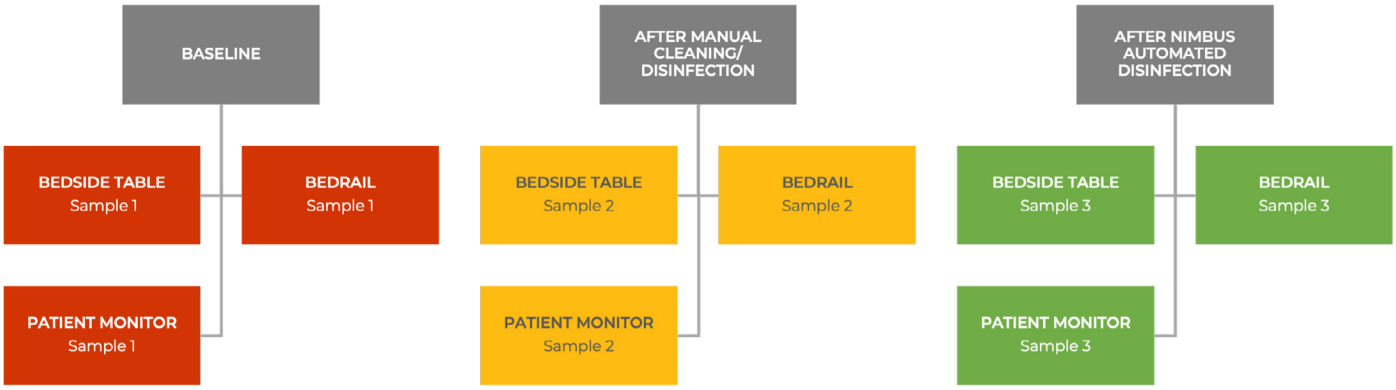
Nimbus fogging of Microburst™ protocol was developed to be used for all patient discharges and transfers in the medical intensive care units (MICU) and on a selected patient unit (4W) for a period of 90 days. Environmental Service (EVS) staff members were trained on the products and manufacturer's instructions for use (IFU). Fogging of patient rooms occurred upon completion of standard policy cleaning and after the room's final floor mop out.

The MICU and 4W stepdown room configurations and dimensions were assessed. A 30-minute automated Nimbus cycle time was programmed for MICU rooms and a 29-minute cycle was assigned for 4W rooms and operationalized.

To demonstrate the effectiveness of the disinfection fogging protocol for the reduction of aerobic bioburden, swab sample testing of three predetermined, high-touch surface locations was conducted at three different selected times for 20 discharge rooms. Baseline samples were collected immediately post patient discharge, ten minutes post manual cleaning and ten minutes after the Microburst™ fog application.

Sampled surfaces included: patient bedside table, bed rail and patient monitor. (Figure 1) The aseptic, 3M™quick swab system consisting of a five-inch, rayon-tipped swab with letheen neutralizing buffer facilitating the recovery of bacteria, was used for collection sampling per manufacturer's instructions for use. Samples were labeled with date, time, sequence, and room number location then logged on a designated collection form and immediately refrigerated.

FIGURE 1: Sequence and Location Model



A total of 180 samples from twenty discharge rooms were obtained and cultured on 3M Petrifilm plates. For chain of custody exactness and consistency, one trained individual conducted all surface sampling collection. Inoculated plates were processed, labeled and photographed at an independent location. Samples were incubated according to lab protocol and manufacturer's instructions. Colony forming unit (CFU) counts were documented and counted in triplicate for accuracy.

RESULTS

Over the course of a two-week period a total of 180 samples were collected and analyzed from twenty random discharge rooms. Fourteen of the rooms were in MICU with the remaining six rooms being located on the 4W stepdown unit.

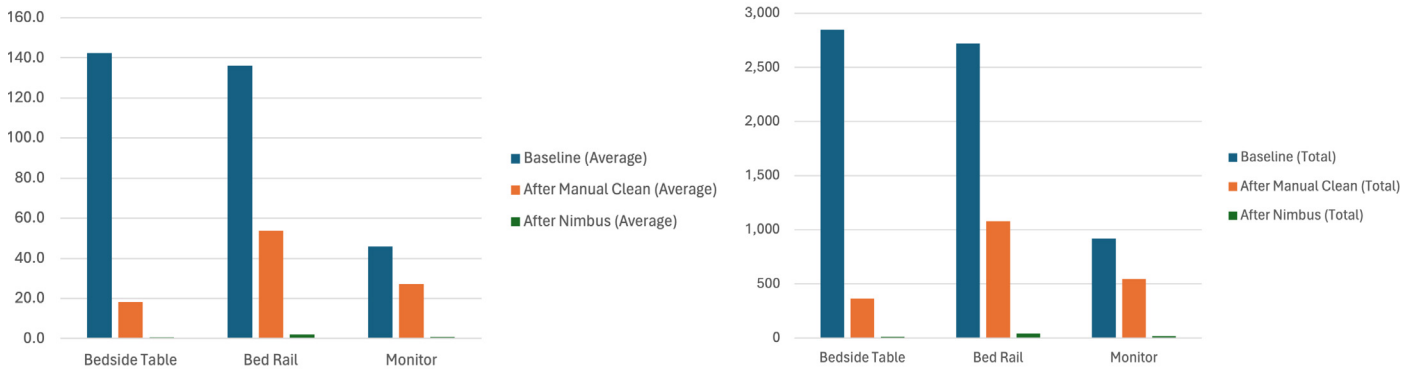
Over 6,500 CFUs were cultured from the three areas sampled in the twenty rooms. The bedside table location had the highest average of aerobic CFUs followed closely by the bedrail site. Manual cleaning delivered an average CFU reduction for all locations of 69.4% from initial baseline counts indicating 30.6% of all pathogens were missed. An average of 59.4% of the original cultured aerobic pathogens remained on the monitor after being manually cleaned. The adjunct use of the Nimbus and atomized Microburst™ solution delivered an additional 96.4% CFU reduction beyond post manual cleaning for all locations.

TABLE 1: Aerobic Colony Count Comparison Data

Aerobic Colony Count AVERAGES				Percent Reduction		
Swab Location	Baseline (Average)	After Manual Clean (Average)	After Nimbus (Average)	Manual Clean from Baseline	Nimbus from Baseline	Nimbus from Manual Clean
Bedside Table	142.5	18.2	0.6	87.2%	99.6%	96.7%
Bed Rail	136.1	53.9	2.1	60.4%	98.5%	96.2%
Monitor	45.9	27.3	0.9	40.6%	98.0%	96.7%
Grand Total	**108.1**	**33.1**	**1.2**	**69.4%**	**98.9%**	**96.4%**

Aerobic Colony Count TOTALS				Percent Reduction		
Swab Location	Baseline (Total)	After Manual Clean (Total)	After Nimbus (Total)	Manual Clean from Baseline	Nimbus from Baseline	Nimbus from Manual Clean
Bedside Table	2,849	364	12	87.2%	99.6%	96.7%
Bed Rail	2,721	1,077	41	60.4%	98.5%	96.2%
Monitor	917	545	18	40.6%	98.0%	96.7%
Grand Total	**6,487**	**1,986**	**71**	**69.4%**	**98.9%**	**96.4%**

FIGURE 2: Aerobic Pathogen Average and Total Count Comparison



Only 71 total CFUs were documented after Nimbus use, representing a **98.9% efficacy** in pathogen removal for all twenty rooms. (Table 1 and Figure 2)

Documented evidence suggests that 20%-40% of HAIs originate from contaminated environmental surfaces via direct and indirect pathogen transfer[9].

DISCUSSION

Despite the hospital's EVS personnel strictly adhering to in-house guidelines for the manual cleaning of patient discharge rooms, high-touch surfaces were still found to have significant numbers of aerobic pathogens rendering the opportunity for pathogen transfer to the next admitted patient.

Notably, surfaces tested closer to the patient bed area had higher baseline colony counts than the patient monitor located farther from the patient core area. However, post manual cleaning cultures of the same sites indicated the monitor received less attention than the bedrail and bedside table.

Manual cleaning protocols provide an opportunity for human error in disinfection practices resulting in the potential for residual pathogens. Elimination of pathogens from patient room surfaces is essential for the prevention of HAIs.

Enhanced disinfection protocols employing technology such as the Nimbus fogging of Microburst™ in conjunction with standard disinfection practices deliver improved pathogen reduction and should continue to be evaluated for the support of HAI reduction.

CONCLUSION

This study suggests incorporating the fogging technology of Nimbus with Microburst™ hypochlorous acid into discharge cleaning practices significantly reduces environmental surface bioburden as compared to manual cleaning alone and should be a requirement of a hospital's comprehensive cleaning protocol for the enhancement of infection prevention.

REFERENCES:

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