

Hialeah Nursing and Rehabilitation Center Combines Technology and Best Practices to Improve Infection Control Specific to C.diff

RB Health Partners, Inc., June 24, 2014

ABSTRACT

The purpose of this study is the analysis of the effectiveness of the Novaerus technology, which was implemented in the Hialeah Nursing and Rehabilitation Center (HNRC). The Novaerus plasma technology is advantageous clinically and financially in skilled nursing homes like HNRC as it reduces airborne infection by denaturing viruses, bacteria, mold, odor and allergens as well as harmful contaminants including MRSA, C-Diff, Norovirus and influenza. Health-care acquired infections and their related costs, and the rising incidence of Antimicrobial resistance demonstrate the necessity of Infection control technology. The nosocomial infection rates at HNRC were compared pre and post implementation of the Novaerus technology over two parallel 90-day periods with specific attention to those of respiratory and C. Diff etiologies as well as repeat infections. The HNRC nosocomial infection rate related to respiratory etiology declined by 33% when compared over a 90-day period pre and post deployment of the Novaerus technology. The nosocomial infection rate related to C. Diff etiology declined by 100% and the repeat infection rate declined by 37.5%. Implementation of the Novaerus technology has contributed significantly to the infection control as well as quality improvement efforts at HNRC. The reduction in nosocomial infections of all etiologies will have prodigious financial and clinical benefits for HNRC.

BACKGROUND

Skilled Nursing Facilities are constantly under threat from Healthcare-acquired infections due to their high transmissibility, widespread environmental contamination and associated cause for hospital readmission. In an effort to enhance their pre-existing Infection Prevention and Control Program and further protect themselves from HAIs, Hialeah Nursing Center (HNRC) implemented the Novaerus technology in select areas over a period from October 2012 through May 2013. The Novaerus plasma technology mitigates airborne infection by denaturing viruses, bacteria, mold, and allergens as well as harmful contaminants including MRSA, C-Diff, Norovirus and influenza.

Healthcare-acquired infections (HAIs) represent a significant and growing threat. HAIs account for 4.5 infections for every 100 hospital admissions and 1.8 million people per year acquire an infection during their hospital stays. Hospital patients with a positive clinical culture for Methicillin-resistant *Staphylococcus aureus*, Vancomycin-resistant enterococci or *Clostridium difficile* are 40 percent more likely to be readmitted within a year than other patients, according to a study in the June 2012 issue of *Infection Control and Hospital Epidemiology*. About 20 percent of Medicare patients are readmitted within a month, costing \$17.4 billion annually, according to an April 2, 2009, study in the *New England Journal of Medicine*.

According to the Centers for Disease Control and Prevention, 94 percent of *C. difficile* infections are related to receiving medical care, and hospital stays from this infection tripled in

the last decade, posing a patient safety threat especially harmful to older Americans. The infection causes diarrhea linked to 14,000 American deaths each year.

The Centers for Disease Control and Prevention (CDC) March 2009 report on the direct medical costs of HAIs estimates that \$35.7 to \$45 billion in 2007 dollars is added to the nation's annual healthcare costs to treat these infections. The yearly national excess hospital cost associated with hospital-onset *C. difficile* is estimated to be upward of \$1.3 billion. These estimated costs demonstrate the necessity of an effective HAI prevention program.

The challenge to maintain that effectiveness is antimicrobial resistance (AMR), which refers to the resistance of a microorganism to an antimicrobial medicine to which it was previously sensitive. Resistant organisms (e.g., bacteria, viruses and some parasites) are able to withstand attack by antimicrobial medicines, such as antibiotics, antivirals, and antimalarials, so that standard treatments become ineffective and infections persist and may spread to others. More than 70 percent of bacteria that cause HAIs are resistant to at least one of the drugs most commonly used to treat them.

METHODS

A 28-month review was performed on HNRC to evaluate the results the CEO stated his facility had benefitted from. Specifically, Nosocomial infection rates at HNRC were compared pre and post implementation of the Novaerus technology over two parallel 90-day periods with specific

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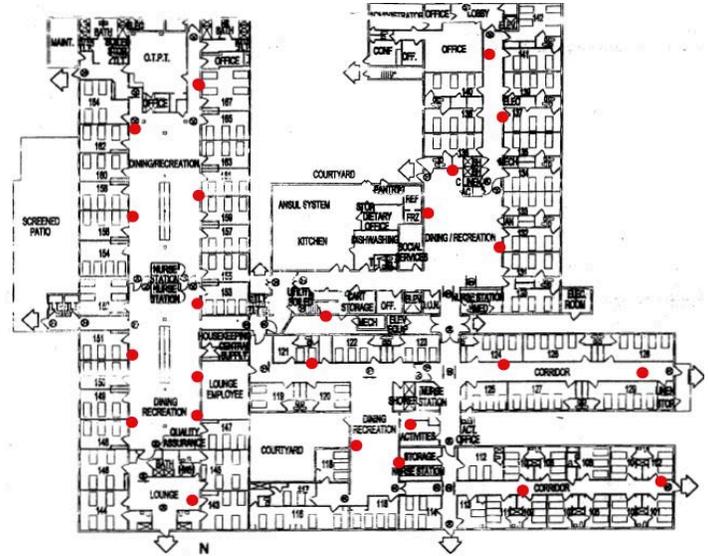
attention to those of respiratory and C. Diff etiologies as well as repeat infections. HNRC is a 276-bed facility that provides short and long-term rehabilitation and skilled nursing services. The facility initially implemented the Novaerus technology in hallways, activity rooms, dining rooms, and therapy departments during October 2012. In May of 2014, a 28-month review was performed on HNRC to evaluate the results the CEO stated his facility had benefitted from.

January-April, 90 day timeframes, of 2012 and 2014 were selected during the 28-month range to compare nosocomial infection rates pre and post implementation of the technology with specific attention to those of respiratory and C. Diff etiologies as well as repeat infections. Comparison of like periods in both years reduces the risk of skewed data related to seasonal variances that might otherwise occur with infection rates.

Subsequent to this comparison, the overall (linear) trend of nosocomial infections related to respiratory and C. Diff. etiologies as well as repeat infection rates over a 90-day period in comparison to the entire 28-month period was also reviewed.

In May of 2014, a Nurse Risk Manager Consultant visited the facility to extract and review the following data:

- Admission, transfer, and discharge data for all residents,
- Monthly infection control records, reports, and surveillance,
- Individual resident infection control examination results (x-rays, cultures, etc.), and
- A map of the facility, which displays selected areas where the Novaerus system was implemented.



Picture showing first floor deployment plan of wall mounted units at Hialeah Nursing and Rehabilitation Center



Picture showing second floor deployment plan of wall mounted units at Hialeah Nursing and Rehabilitation Center

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RESULTS

The HNRC nosocomial infection rate related to respiratory etiology declined by 33% when compared over a 90-day period pre and post deployment of the Novaerus technology. The nosocomial infection rate related to C. Diff etiology declined by 100% and the repeat infection rate declined by 37.5%.

- When comparing the facility's repeat infection rate over a 90-day period, prior to and after implementation of the Novaerus technology, the facility rate declined significantly by 37.5%.
- When comparing the facility's nosocomial infection rate related to C. Diff. etiology, prior to and after implementation of the Novaerus technology, the facility rate declined significantly by 100%.
- When comparing the facility's nosocomial infection rate related to respiratory etiology, prior to and after implementation of the Novaerus technology, the facility rate declined significantly by 33% approximately.
- Lastly, the overall (linear) trend lines in each category exhibit significant declining trends.

Table 1

	Jan.'12	Feb.'12	March.'12	Apr.'12	4 M Total 2012
Repeat Inf.	6	3	4	3	16
C. Diff. Nos.	4	2	1	4	11
Resp. Inf. Nos.	6	17	12	7	42

The facility's nosocomial infection rates related to respiratory and C. Diff. etiologies as well as repeat infection rates over a 90-day period in the aforementioned period, January-April 2012, prior to Novaerus implementation.

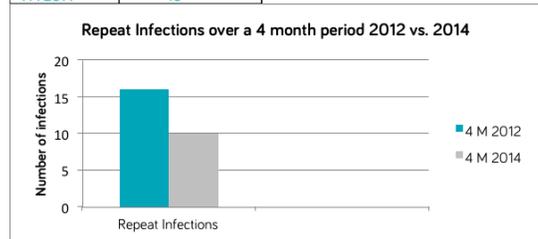
Table 2

	Jan.'14	Feb.'14	March.'14	Apr.'14	4 M Total 2014
Repeat Inf.	0	2	2	6	10
C. Diff. Nos.	0	0	0	0	0
Resp. Inf. Nos.	8	5	2	13	28

The facility's nosocomial infection rates related to respiratory and C. Diff. etiologies as well as repeat infection rates over a 90-day period in the aforementioned period of 2014, subsequent to Novaerus implementation.

Table and Graph 3a

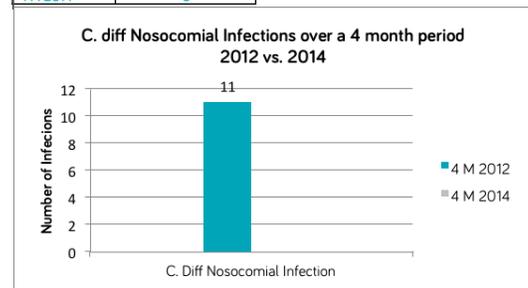
Repeat Infections	
4 M 2012	16
4 M 2014	10



Sum total of Repeat Infections comparing 2012 and 2014. Graph showing the decrease in repeat infections in 2012 vs. 2014

Table and Graph 3b

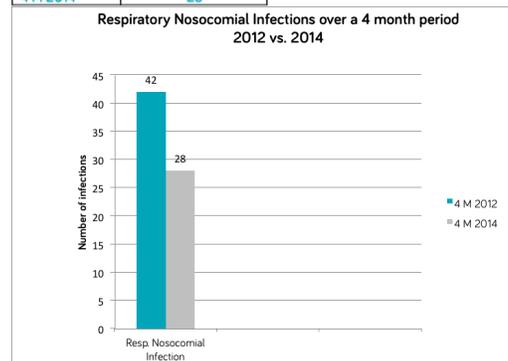
C. Diff Nosocomial Infection	
4 M 2012	11
4 M 2014	0



Sum total of C. Diff infections comparing 2012 and 2014 with associated graph showing zero C. Diff cases reported in 2014

Table and Graph 3c

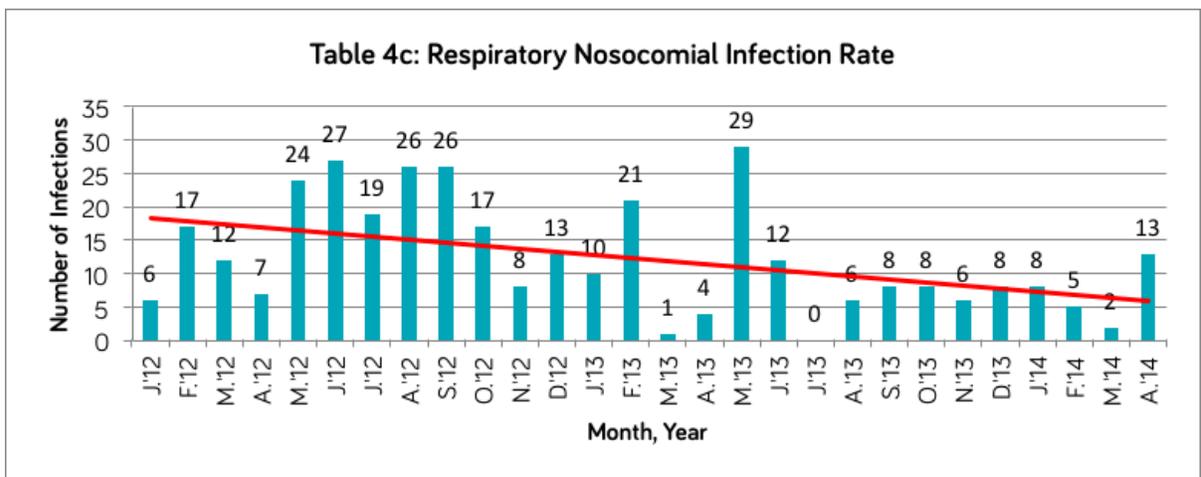
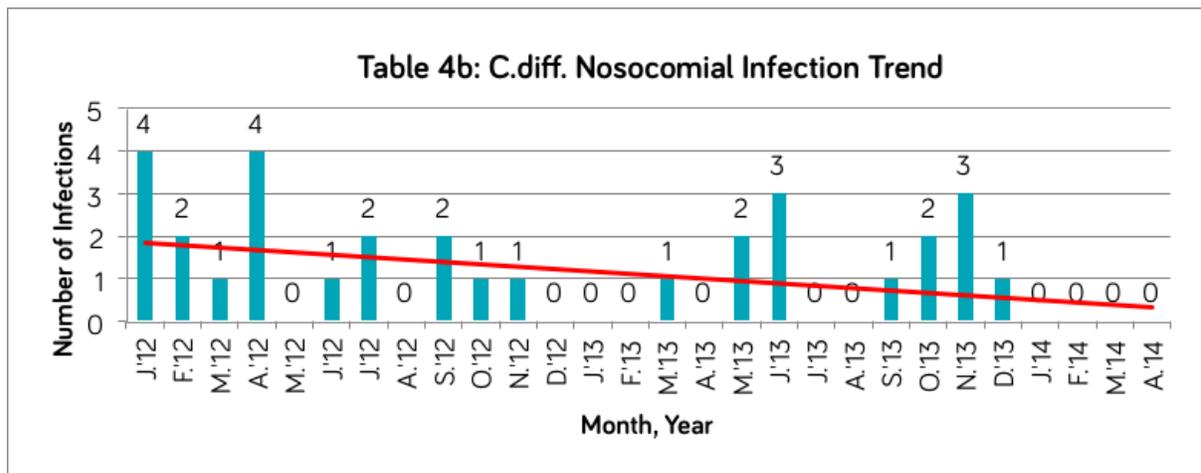
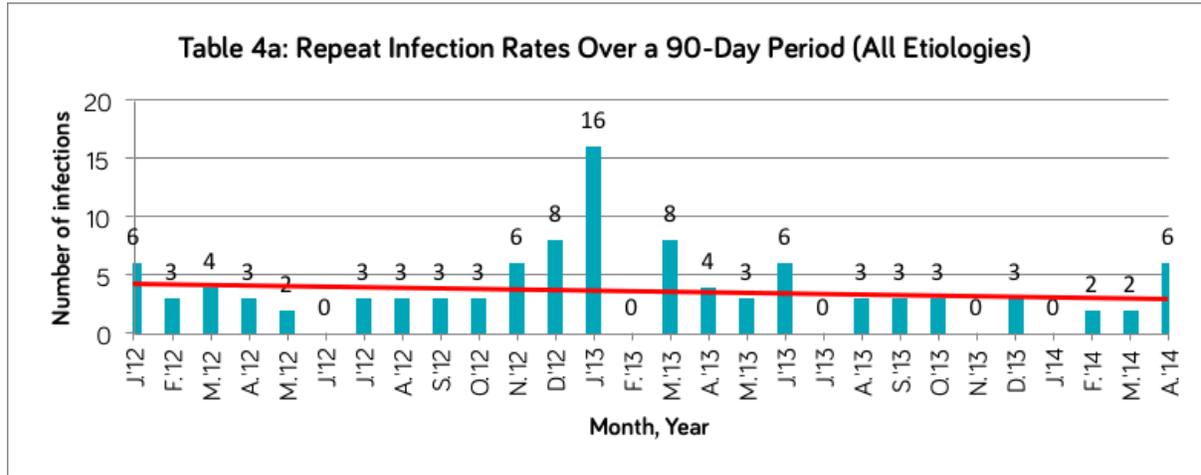
Resp. Nosocomial Infection	
4 M 2012	42
4 M 2014	28



Sum total of Respiratory infections comparing 2012 and 2014 with associated graph.

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Table 4a, 4b, and 4c showing sum totals in each category with differences listed as percentages and plotted monthly totals for each category spanning the entire 28-month period under review with linear trend line.



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DISCUSSION

The study differentiated between three different types of infections that occur in long-term care facilities; repeat infections, C.difficile and respiratory infections. Residents in these facilities are typically immune-suppressed due to their age and or are suffering from an active comorbid underlying infection/illness which makes them highly susceptible to infection in the clustered and confined environment. The implementation of Novaerus was able to eliminate occurrences of C. difficile but in this particular facility it only reduced other infections by roughly one-third.

C. difficile causes increased osmotic activity in the intestines and the resulting symptoms. C. difficile is spore forming allowing survival for a very long time ex-vivo. These spores disseminate in the air, are very resilient and can turn innocuous medical devices and everything in the nursing home into fomites. Luckily, infection usually requires a significant bacterial load to cause infection. Use of Novaerus, ignoring other infection control activities, would have decreased the amount of spores present in the environment sufficiently to prevent infection by other methods of transmission.

Respiratory infections, which are not highly differentiated between in nursing home facilities, can be caused by many different pathogens making it difficult to isolate a specific culprit. In a nursing home environment there are typically many visitors who carry pathogens, which can be transmitted via contact transmission, and are thus difficult to prevent even with the highly effective sterilization device Novaerus implemented in the common areas. Evaluation of floor plan and load on device may be considered as well as ensuring facility staff maintains the devices effectively. Additionally, the efforts taken to isolate residents infected with C. Difficile may have been more stringent than those with a slight cough, or upper respiratory infection.

CONCLUSIONS

Implementation of the Novaerus technology has contributed significantly to the infection control as well as quality improvement efforts at HNRC. The reduction in nosocomial infections of all etiologies will have prodigious financial and clinical benefits for HNRC. Since there were

no administrative or ownership changes during the course of this study it can be assumed that the Novaerus technology is solely responsible for the significant reduction in infections at HNRC.