Evaluation of a Novel Antimicrobial Textile Intervention For Inclusion in an Infection Control Program Through a Retrospective Analyses of Hospital Acquired Infection (HAI) Rates

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BACKGROUND

Healthcare textiles are recognized as an increasingly epidemiologically important environmental surface in the transmission of and outbreak caused by bacterial and fungal pathogens within the hospital environment[1-3]. Numerous studies have demonstrated that the use of antimicrobials on soft and hard surfaces in hospitals reduce the transmission of healthcare-associated pathogens and consequently leading to reductions in the associated infections[4-8].

We have previously demonstrated that healthcare gowns and sheets treated with ionic silver (SilvaClean®, a residual silver ion-based textile treatment) delivered during each laundry rinse cycle resulted in over 80% reduction in post-laundry levels of aerobic bacteria, *Staphylococcus aureus* and MRSA (pre- and post-patient use)[8]. In this follow-on retrospective multi-year, multi-site evaluation, we monitored the impact of an automated, passive antimicrobial intervention in the form of SilvaClean on HAI rates at three hospitals when used as a component of an infection prevention program, delivered through the standard laundry process. Two hospitals within the same system served as control sites for the evaluation.

SilvaClean is registered with the EPA as a residual antimicrobial laundry additive with public health claims for the reduction of post-laundry contamination (Reg. No. 90335-1).

METHODS

Evaluation sites: This evaluation was conducted at three community hospitals (Hospitals S1, S2 and S3), with similar patient acuity levels, demographics, infection control programs and serviced by a common HLAC accredited laundry (total 433 staffed beds).

Control sites: Two additional hospitals (Hospitals C1 and C2) within the same hospital system, with similar patient acuity levels, demographics and infection control programs served as control sites. The control sites were serviced out of a different HLAC accredited laundry site.

SilvaClean antimicrobial silver-ion based textile treatment: SilvaClean System dosing unit was installed at the hospitals' laundry and service was initiated in January 2016. The evaluation sites received SilvaClean treated flat sheets, fitted sheets, pillowcases and patient gowns.

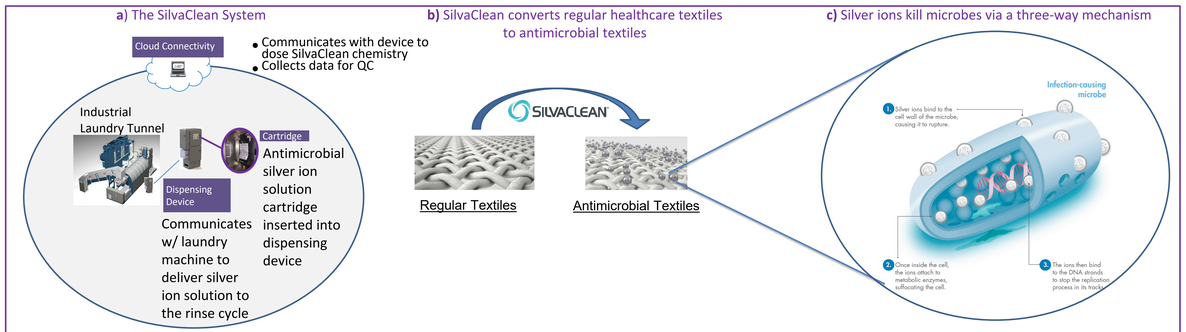

Figure 1. a) The SilvaClean System is installed at the laundry facility to provide antimicrobial textiles through a seamless, automated, cloud-monitored process. **b)** Regular textiles are converted to antimicrobial textiles with residual pathogen killing properties via the action of silver ions delivered during the rinse cycle. **c)** Silver ions completely kill microbes through a 3-way killing mechanism : Cell lysis, cell suffocation and inhibition of DNA replication

Cleaning protocols and data collection: Cleaning protocols across all hospitals during the entire period of study were similar. HAI rates for CAUTI, CDI, CLABSI and SSI were collected as part of standard NHSN reporting.

Data analyses: Results were reported as percentage change for HAI rates before/after textile intervention. Statistical analyses were conducted using the Fisher exact test. Analyses were conducted in two ways: a) 18 months before (April 2014 to December 2015)/after intervention (January 2016 to September 2017), during which time Hospitals C1 and C2 served as secondary controls; b) 30 months before (July 2013 to December 2015)/after (January 2016 to June 2018) intervention at test sites only (during this extended time, the two control hospitals adopted the technology and no longer served as secondary controls). The periods selected allowed for an accurate capture of seasonal variations in the HAI rates. Infection rates were normalized per 10,000 patient days[9].

RESULTS

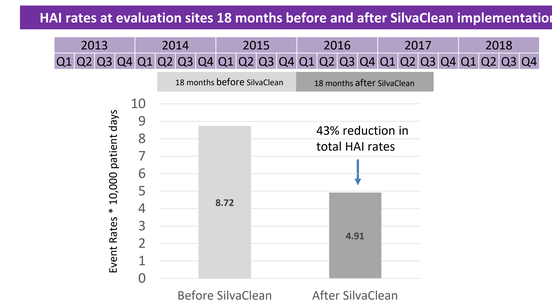

Figure 2. HAI rates (calculated per 10,000 patient days) for CAUTI, CLABSI, CDI and SSI at the three evaluation hospital sites (S1, S2 and S3) demonstrated a 43% decline during a 36-month evaluation period. In this retrospective analysis, HAI rates from 18 months before SilvaClean treatment (period 1; 2014 Q3- 2015Q4) were compared to 18 months after SilvaClean treatment (period 2; 2016Q1-2017Q2).

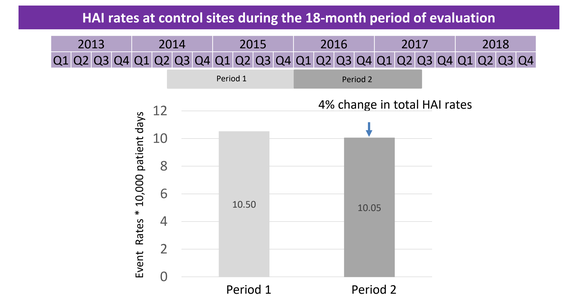

Figure 3. HAI rates (calculated per 10,000 patient days) for CAUTI, CLABSI, CDI and SSI at the control hospitals (C1 and C2) demonstrated a 4% change during the same 36-month period as with test hospitals in Figure 1; period 1is 2014 Q3-2015Q4 and period 2 is 2016Q1-2017Q2.

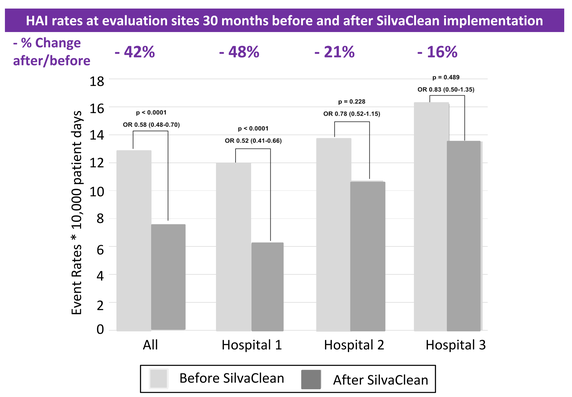

Figure 4. HAI rates (calculated per 10,000 patient days) at each of the three test hospitals demonstrated declines in the after-SilvaClean treatment period. 30 months before-SilvaClean treatment period is 2013 Q3- 2015Q4; 30 months after SilvaClean treatment is 2016Q1-2018Q2.

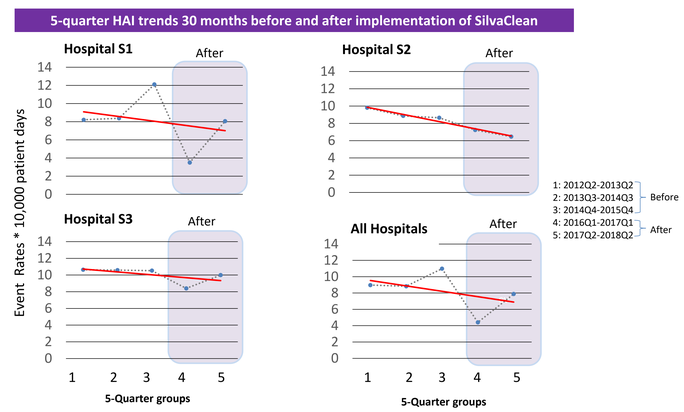

Figure 5. Two cycles of seasonality before and after SilvaClean implementation were evaluated across all the infection types. Observed rates demonstrated a declining trend in each of the evaluation sites over the period of evaluation.

HAI rates for individual infection types before and after SilvaClean implementation

Infection Type	Before SilvaClean Event Rate	After SilvaClean Event Rate	p-value	Odds Ratio (95% Confidence Interval)
CAUTI	8.8	5.2	0.08119	0.623 (0.352-1.067)
CLABSI	4.8	5.0	1	1.036 (0.458-2.298)
SSI	70.2	66.2	0.69318	0.943 (0.72-1.23)
CDI	4.7	2.4	0.00139	0.588 (0.418-0.823)

***per 10,000 units**

Table 1. HAI rates (calculated per 10,000 patient days) for individual infection types across the three evaluation sites demonstrated declines in the post-SilvaClean treatment period. 30 months before SilvaClean treatment period is 2013 Q3- 2015Q4; 30 months after SilvaClean treatment is 2016Q1-2018Q2.

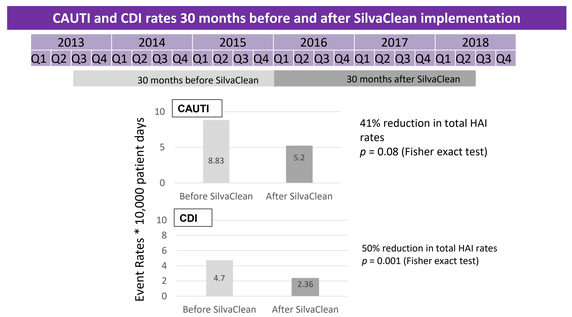

Figure 6. HAI rates (calculated per 10,000 patient days) for CAUTI and CDI at the three test hospitals demonstrated declines in the post-SilvaClean treatment period that were statistically significant by the Fisher exact test. 30-months before SilvaClean treatment period is 2013 Q3- 2015Q4; 30 months after SilvaClean treatment is 2016Q1-2018Q2.

CONCLUSIONS

This product evaluation demonstrates that an infection prevention program that includes antimicrobial textile intervention such as SilvaClean resulted in a significant reduction in HAI rates at three community hospitals. The method is fully automated, does not require additional hospital staff training for implementation or require purchase of new or special linens. Such a product augments existing infection prevention measures by mitigating the risk from environmental sources such as soft surfaces.

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