



Return on Investment White Paper for the BioArmour™ Blood Pressure Cuff Shield

Summary

Healthcare-Associated Infections (HAIs) continue to endanger patient health while costing healthcare institutions and facilities for their treatment. Current measures to prevent the spread of HAIs include diligent hand-washing and disinfection of medical equipment. Unfortunately, these measures are at best sporadically implemented, and at worst disregarded and therefore require staff accountability and behavioral change.

Several studies have shown the widespread contamination of patient care equipment inclusive of blood pressure cuffs. While prophylactic measures such as disposable cuffs and cotton cuff covers are currently available, neither product maintains antimicrobial protection nor are they intended for multi-patient use. This paper makes the case for the adoption of a new infection control measure. Specifically, an antimicrobial blood pressure cuff shield (BPCS) with efficacy for multi-patient use.

Background

Healthcare-Associated Infections

According to the US Centers for Disease Control and Prevention (CDC), in 2011 there were an estimated 722,000 Healthcare-Associated Infections (HAIs) in the US, alone. Approximately 75,000 hospital patients with HAIs died during their hospitalizations and more than half acquired the infection outside of the intensive care unit. The most recent CDC survey¹ found that on any given day approximately 1 in 25 hospital patients acquires at least one HAI. The most recent CDC Progress Report on National and State Healthcare Associated Infections², issued January 2015 for the report year 2013, showed significant reductions between 2008 and 2013 for nearly all infections at the national level. However, the goals established by the HAI Action Plan³ were not met and “more action is needed at every level of public health and health care to improve patient safety and eliminate infections that commonly threaten hospital patients.”

Of course, the problem of HAIs is not confined to the US. The World Health Organization (WHO) reports that 7 out of every 100 hospitalized patients in developed countries and 10 out of every 100 hospitalized patients in developing countries will acquire at least one HAI⁴. The prevalence of healthcare-associated infections in developed countries varies between 3.5% and 12%. Specifically, in Europe the average prevalence of HAIs was 7.1% and in the USA averaged 4.5% in 2002.

Economics & Occurrence

The cost of HAIs is a major concern for providers and patients alike. Numerous studies have reviewed the expenses related to HAIs at both the national and global level. A 2009 study found the overall direct costs of HAIs to hospitals range from \$28 billion to \$45 billion⁵ (USD). The CDC's report on Direct Medical Costs of HAIs, published in 2009, found the cost of a single HAI ranged from \$1,000 to more than \$34,000, at 2007 costs, with an estimated mean of nearly \$14,000.⁶

Though most reviews or study collections of HAI data are from an acute care hospital, an operating room or an emergency room as the location of infection, the general medicine locations such as family practice or physician's office may also contribute to HAIs exposure. According to the CDC, 150,000 people who hadn't been in a hospital were infected with *Clostridium difficile*, a common HAI in 2011, and 82% of those infected had visited a doctor or dentist within the 12 weeks prior to their diagnosis⁷.

Potential Role of Blood Pressure Cuffs

Often when investigating HAIs, medical equipment and adherence to disinfection protocol is initially targeted as the potential source and mode of transmission. Blood pressure cuffs have been shown to be potential vectors for the transmission of HAIs including multi-drug resistant organisms⁸. This is not a new phenomenon as a study published in 1978 found a cuff used for all infants in a pediatric nursery was associated with an increased rate of infection⁹. Contamination of blood pressure cuffs to varying degrees¹⁰ has been found in multiple patient care settings throughout a healthcare facility.

Nearly 38% of all HAIs are due to transmission¹¹ via contaminated medical equipment and a potential vector may be the standard unprotected blood pressure cuff. Two studies have evaluated the contamination levels on standard blood pressure cuffs and other hospital equipment^{12, 13} and found the *Methicillin-Resistant Staphylococcus aureus* (MRSA) contamination rate on blood pressure cuffs to be between 13% and 33%, with an average contamination rate of 21%.

Methods of Prevention

Routine disinfection of blood pressure cuffs and systematic hand washing is designed to curb the transmission of HAIs from caregiver to patient and from patient to patient. The CDC recommends that equipment used on multiple patients be cleaned and disinfected between patients to prevent the transmission of disease¹⁴. However erroneous, blood pressure cuffs had initially not been perceived by healthcare staff as problematic and requiring of special care¹⁰. Currently, several product offerings within the market, such as disposable cuffs and disposable barrier sleeves, are intended to reduce the transmission of HAIs. Since these products are indicated for single-patient use, implementation of these solutions becomes prohibitively expensive and negatively impacts the environment.

The BioArmour Antimicrobial Blood Pressure Cuff Shield (BPCS), a new cost effective and multi-patient use alternative is becoming available to the worldwide market. This product comprises a microbe barrier applied to the inside of a standard blood pressure cuff to prevent direct contact of the patient with the cuff. It contains an antimicrobial agent that has been shown to be biocompatible and effective for up to 24 hours.



ROI Analysis

The following calculations (in US dollars) show the return on investment afforded by using the BioArmour BPCS product to prevent cross transmission and the spread of the common HAI, MRSA, as a specific example within a small general medical practice setting operating five days per week. The price used for calculating the BioArmour product cost is the manufacturer’s suggested retail price of \$148.50 for a package of 50 pieces. The calculations utilize cost estimates established earlier for the likely MRSA contamination rate and for the health care expenses associated with one MRSA infection.

Cost of use on one standard blood pressure cuff per year	\$775
Number of cuffs in use	15
Total BioArmour annual cost	\$11,625
Likely number of cuffs contaminated with MRSA	3
Likely number of HAI transmitted from blood pressure cuff	1
Median cost of one MRSA infection ¹⁵	\$34,657

This simple calculation demonstrates that utilization of the BioArmour BPCS product within a small general practice with 15 cuffs in regular use is approximately one-third the cost of one MRSA infection.

To consider the impact of the BioArmour BPCS product used in an acute care facility or emergency room, it is reasonable to believe that at least one MRSA infection will be transmitted annually by a blood pressure cuff. In such settings, cuffs are used seven days per week therefore the expense of annual protection for 30 cuffs still will not be surpassed by the expense of that one MRSA infection.

Cost of use on one standard blood pressure cuff per year	\$1,081
Number of cuffs in use	30
Total BioArmour annual cost	\$32,432
Median cost of one MRSA infection ¹⁵	\$34,657

Lastly, it is worth noting that in the US effective October 2008, the Centers for Medicare and Medicaid Services (CMS) have taken the action to stop payment for treatment of some HAIs. In addition, Medicare is penalizing facilities with sub-par rankings for hospital HAI rates and conditions by imposing a reduction in reimbursement of 1% over a year, until a new ranking is performed and the affected facilities can show improvement. Clearly, an HAI event is cost prohibitive with respect to both the impact on the patient’s health and the financial impact to the facility, both for the near term and long-term. The measures levied by CMS are designed as an effort to incentivize healthcare facilities to become more proactive in their approach to HAI prevention.

Conclusion

A new weapon in the arsenal for protection from and reduction of HAIs, such as MRSA, for example, may be the use of an antimicrobial blood pressure cuff shield, such as the BioArmour BPCS product which is designed for use with multiple patients up to 24 hours. Products like the BioArmour BPCS augment the standard proper handling and disinfection protocols for blood pressure cuffs. Use of products like the BioArmour BPCS could afford significant cost savings and patient protection throughout various types of healthcare facilities.



References

1. Magill SS, Edwards JR, Bamberg W, et al. Multistate Point-Prevalence Survey of Health Care–Associated Infections. *N Engl J Med* 2014; 370:1198-208.
2. Centers for Disease Control and Prevention (CDC). Retrieved from <http://www.cdc.gov/HAI/pdfs/progress-report/hai-progress-report.pdf> on March 13, 2015.
3. Office of Disease Prevention and Health Promotion, Department of Health & Human Services. Retrieved from http://www.health.gov/hai/prevent_hai.asp#hai_plan on March 13, 2015.
4. World Health Organization (WHO). Retrieved from http://www.who.int/gpsc/country_work/gpsc_ccisc_fact_sheet_en.pdf on April 29, 2015.
5. Stone PW. Economic burden of healthcare-associated infections: an American perspective. *Expert Rev Pharmacoecon Outcomes Res*. 2009; 9(5): 417–422.
6. Centers for Disease Control and Prevention (CDC). Retrieved from http://www.cdc.gov/HAI/pdfs/hai/Scott_CostPaper.pdf on March 13, 2015.
7. Lessa FC, et al. Burden of Clostridium difficile Infection in the United States. *N Engl J Med* 2015; 372:825-834.
8. Base-Smith V. Blood pressure cuffs as a vector for transmission of multi-resistant organisms: colonization rates and effects of disinfection. *Emerg Med Australas* (2013); 25(3):222-6
9. Myers MG. Longitudinal evaluation of neonatal nosocomial infections: association of infection with a blood pressure cuff. *Pediatrics* (1978); 61(1).
10. Base-Smith V. Nondisposable Sphygmomanometer Cuffs Harbor Frequent Bacterial Colonization and Significant Contamination by Organic and Inorganic Matter. *Journal Amer Assoc Nurse Anesthetists* (1996); 64(2), 141–145
11. Weist K et al. How many nosocomial infections are associated with cross-transmission? A prospective cohort study in a surgical intensive care unit. *Infect Control Hosp Epidemiol*. 2002 Mar; 23(3):127-32.
12. Rampling A, et al. Evidence that hospital hygiene is important in the control of methicillin-resistant staphylococcus aureus. *Journal Hosp Infect*. 2001 Oct; 49(2): 109-16.
13. Boyce JM, et al. Environmental contamination due to methicillin-resistant staphylococcus aureus: possible infection control implications. *Infect Control Hosp Epidemiol*. 1997; 18: 622-27.
14. Centers for Disease Control and Prevention (CDC). Retrieved from http://www.cdc.gov/hicpac/Disinfection_Sterilization/2_approach.html on March 13, 2015.
15. Filice G et al. Excess costs and utilization associated with methicillin resistance for patients with staphylococcus aureus infection. *Infect Control Hosp Epidemiol*. 2010 April; 31(4).