

Improving quality of care

Justifying the cost for a single-patient-use blood pressure cuff

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INTRODUCTION

Hospital-acquired infections (HAIs), which have been a serious concern for healthcare professionals for decades, have become a topic of concern for healthcare consumers as well.¹ A March 2009 study by the CDC reported that the estimated 1.7 million HAIs annually cost U.S. hospitals between \$35.7 billion to \$45 billion.² This does not include the indirect costs to patients and their families. The report also evaluates the effectiveness of measures to prevent infections and estimates that as much as 70% of HAIs could be prevented, resulting in potential cost savings of \$25.0 to \$31.5 billion. While there are many causes of HAIs, the use of single-patient-use blood pressure cuffs can eliminate one source of contamination. While the direct cost of single-patient-use cuffs may be more than reusable cuffs, it is balanced by the savings to the hospital through the reduction in potential infections, as explained later in this article.

Hospital-acquired infections, also known as healthcare-associated infections, encompass almost all clinically evident infections that do not start from a patient's original admitting diagnosis. Understanding the factors that contribute to these infections will help prevent and reduce their prevalence. Switching from reusable cuffs to single-patient-use cuffs can reduce the risks and cost related to HAIs.

A recent analysis of catheter-related blood stream infections (BSIs) in the ICU showed that while the overall incidence of BSIs decreased, the percentage caused by Methicillin-resistant *Staphylococcus aureus* (MRSA) increased.³ A 2005 study showed that MRSA is primarily related to health care, but is no longer confined to acute care facilities.⁴ MRSA infections are associated with greater lengths of stay, increased costs and higher mortality.⁵

A survey of acute care hospitals conducted in 2011 reported that while the estimated number of HAIs in acute care hospitals had dropped to 722,000, still approximately 75,000 patients with HAIs died during their hospitalizations. The survey also indicated that over 50% of all HAIs occurred outside of the intensive care unit.³⁴

IMPACT OF BLOOD PRESSURE CUFFS ON HAI

Numerous studies have demonstrated the contamination of blood pressure cuffs with *clostridium difficile*,⁶ Methicillin-resistant *Staphylococcus aureus*,^{7, 8, 9, 10} *acinetobacter baumannii*,^{9, 11} *e.coli* and *pseudomonas*.⁷ Bacteria, such as MRSA and Vancomycin-resistant Enterococci (VRE), can remain viable on cuffs and other environmental surfaces for days.^{8, 12} High levels of contamination have been demonstrated in all hospital units, with the highest in ICUs.^{13, 14, 15}

Cuffs are reportedly one of the most frequently used medical devices, but routinely are ignored when it comes to cleaning.^{16, 17} Contamination with pathogens have been cultured from cuffs even after cleaning.¹⁷ A study published in 2015 found the MRSA contamination rate on blood pressure cuffs was 22.2 %.³⁵

There is increasing recognition of the potential role of blood pressure cuffs as a vector for hospital-acquired infections. A report from a National Health Service (NHS) trust stated, "The infection prevention and control team believe that shared blood pressure cuffs are a serious potential risk for transmitting MRSA."¹⁸ A clinical guideline from the Massachusetts Department of Public Health recommends the use of disposable blood pressure cuffs in acute care hospitals.¹⁹ The Society for Healthcare Epidemiology of America (SHEA) guideline for preventing transmission of MRSA and VRE indicates that shared patient equipment, such as blood pressure cuffs, can transmit infections between patients.²⁰

ADOPTION OF SINGLE PATIENT CUFFS DECREASES THE RISK OF INFECTIONS

Infections have been clearly shown to cause significant increases in the cost of patient care, length of stay and mortality rates.^{21, 22} Starting October 2008, the Center for Medicare and Medicaid Services no longer pays for the extra costs of treating urinary and vascular catheter-associated infections and certain surgical site infections, which will result in increased costs for the hospital.²³ The adoption of single-patient-use blood pressure cuffs could help reduce HAIs, improve patient outcomes, decrease mortality and markedly reduce the extraordinary financial burden.

One method of calculating the financial benefit of a device intended to prevent or reduce adverse events (such as HAIs) is a formula used in risk assessment cases.²⁴ The formula demonstrates that the cost of precautions taken to reduce an adverse event (B) can be economically justified if it is less than the product of the probability of occurrence (P) and the magnitude (L) of the resulting harm (the cost to treat the infection). This can be expressed by the formula:

$$B < P \times L$$

The cost of increased patient care due to HAIs varies significantly depending on the site of the infection, the location within the hospital and the patient's condition. Reports in the literature show that median cost ranges from \$25k to \$40k.^{14, 21, 25} This cost will be used for the term L in the equation above.

Reported rates of HAIs range from 9.8 to 23.7 per 1,000 patient days.^{26, 27} These rates are based on the occurrence of HAIs across a population. Since we are interested in determining the costs associated with single-patient-use blood pressure cuffs, the HAI rates need to be adjusted for the length of stay (LOS).²⁷ Data from the Agency for Healthcare Research and Quality indicates the average LOS for acute care hospitals is 4.6 days.²⁸

$$\begin{aligned} \text{Rate of HAIs} &= 0.0098/\text{day} \\ \text{ALOS} &= 4.6 \text{ days} \\ \text{Probability of an HAI occurring in an individual patient} \\ \text{during their stay} &= \text{HAI} \times \text{ALOS} = 0.0098/\text{day} \times 4.6 \text{ days} = \\ &0.0451 \end{aligned}$$

Placing this data into the risk formula yields the following result.

$$\begin{aligned} B &< P \times L \\ 0.0451 \times \$25,000 \\ & \$1,127 \end{aligned}$$

The cost computed above does not take into account the likelihood that the use of non-disposable cuff would cause an HAI.

While the use of single patient use blood pressure cuffs has been recommended as a way of reducing HAIs,²⁹ the impact of this practice has not been assessed by scientific studies. However, a number of studies have looked at the transmission of infections by healthcare workers (HCW). McBryde found that 17% (CI 9% to 25%) of contacts between a HCW and a patient colonized with MRSA result in transmission of MRSA to the healthcare worker's gloves.³⁰ A study of the transmission dynamics of VRE in the ICU estimated that the likelihood of contamination of HCW was 40% and the likelihood of colonization was 6%.³¹

While HCW change gloves and/or wash their hands between patients, cuffs are not always cleaned if it is believed that the patients are not colonized³⁷. Beggs' study on the effect of hand washing used a 10% probability of patient to HCW transmission and the same probability that a HCW would transmit the infection to another patient,³² resulting in a transmission rate of 1% with the HCW as a vector between patients. If we assume that rate of transmission for contaminated blood pressure cuffs, then the acceptable cost per patient would be:

$$(\$1,127 \times 1\%) = \$11.27.$$

Since single-patient-use cuffs cost well less than the estimated \$11.27 cost based on the above risk assessment, the use of single-patient-use cuffs in reducing the risk of infection can be clearly justified³⁶. This analysis does not include the initial purchase cost of reusable cuffs, or the cost of cleaning and disinfection, which would provide further justification for the use of single-patient-use cuffs.

NURSING CONSIDERATIONS

The number of higher acuity patients admitted to hospitals and the incidence of patients with hypertension is increasing.³² Blood pressure management is one of the fundamental tasks for the nurse. Vigilant blood pressure management combined with higher acuity patients and HAIs make special challenges for the nursing staff. The nursing staff needs better ways to prevent infections using evidence-based research.³³ Single-patient-use blood pressure cuffs can provide confidence one source of contamination is eliminated.

CONCLUSION

Numerous studies have demonstrated that reusable blood pressure cuffs are contaminated with pathogens and could be vectors for infection. The perceived increase in cost of the adoption of single-patient-use cuffs does not take into account the costs associated with any infections caused by contaminated reusable cuffs.

Single-patient-use cuffs reduce the overall risk of HAIs, improve patient safety, and could actually reduce overall hospital costs.

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