

IHI Bundles and Oral Care Reduce VAP and CRBSI

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BACKGROUND

Healthcare-acquired infections (HAIs), such as ventilator-associated pneumonia (VAP) and bloodstream infections due to central line placement (CRBSI), are negative patient healthcare outcomes. VAP is a common complication of mechanical ventilation, occurring in 10–20% of intubated and mechanically ventilated patients.¹ In 2004, the National Nosocomial Infection Surveillance System (NNIS) reported pooled mean CRBSI rates of 3.2 to 7.4 (number of CLBSI central line days x 1000) for all types of ICUs.² The most common pathogens isolated in HAIs as a group (including CRBSIs, VAP, surgical site infections, and catheter-associated infections) are coagulase-negative staphylococci (15%), *Staphylococcus aureus* (15%), *Enterococcus* species (12%), *Candida* species (11%), and *Escherichia coli* (10%).³ Of the isolates identified from HAIs, 16% were associated with multidrug-resistant pathogens.³

Despite the frequency of occurrence, these HAIs are considered preventable.^{4,5} The Institute for Healthcare Improvement (IHI) has provided information on the prevention of VAP and CRBSIs in the form of care bundles,^{6,7} which have been shown to reduce CRBSI^{8,9} and VAP rates.^{8,9} An oral care protocol may also decrease the rates of VAP. One controlled study showed that the addition of tooth brushing to a ventilator bundle reduced the rate of VAP (from 2 cases/1000 ventilator days to 0.63 cases/1000 ventilator days) compared with a standard oral care protocol with no tooth brushing.¹⁰ Other studies showed that the addition of an oral care protocol involving a 0.12% chlorhexidine gluconate (CHG) rinse with alcohol reduced VAP rates in surgical patients.^{11,12}

Methods

Rates of VAP and CRBSI were monitored during the study in all patients in the critical care unit, medical-surgical ICU (MSICU), trauma ICU (TICU), neurosurgical ICU (NSICU), intermediate care unit (IMC), coronary care unit (CCU), and cardiovascular ICU (CVICU). These rates were then compared with historical baseline rates of VAP and CRBSI.

VAP was defined as pneumonia that first developed more than 48 hours after a first episode of intubation and mechanical ventilation. Pneumonia was diagnosed if the patient developed a new and persistent (at least 72 hours) radiographic infiltrate in addition to radiographic cavitation, histopathologic evidence of pneumonia, or positive pleural/blood cultures for the same organism recovered from the tracheal aspirate or sputum. Pneumonia was also diagnosed if a new and persistent radiologic infiltrate plus 2 of the following conditions were observed: fever (rise in core temperature of $\geq 1^\circ\text{C}$ and a core temperature $>38.3^\circ\text{C}$), leukocytosis (25% increase from baseline in circulating leukocytes and a value $>10,000\text{ mm}^3$ or <1500 or $>12,000\text{ mm}^3$), or purulent tracheal or sputum aspirate (purulent if abundant neutrophils were present).

For the CRBSI portion of the study, patients were included if they had a non-tunneled catheter, a peripherally inserted central catheter, or an arterial line. The patient had to be older than 18 years of age and free of bloodstream infection at the time the vascular line was inserted and during the first 48 hours after insertion of the line. Patients were excluded if the intravascular catheter was inserted in a facility other than Inova Fairfax Hospital or if they had an intra-aortic balloon pump or a Hickman, Groshong, or ventricular assist device in place.

CRBSI was diagnosed if a positive blood culture was obtained ≥ 48 hours after insertion of a vascular catheter. The cultured infection had to be due to a recognized pathogen cultured from one or more blood cultures, and the pathogen cultured could not be related to an infection at another site. The patient had to have a fever (temperature of $>100.4^\circ\text{F}$, or $>38^\circ\text{C}$), chills, or hypotension. Alternatively, the patient had to have signs and symptoms of an infection, had to have a positive laboratory result not related to another infection, and had to meet ≥ 1 of the following criteria: infection with a common skin contaminant cultured from ≥ 2 blood samples drawn on separate occasions, infection with a common skin contaminant cultured from ≥ 1 blood sample obtained from a patient with an intravenous line, be receiving physician institute-appropriate antimicrobial therapy, or have a positive result for a pathogen from antigen testing in blood.

In addition to the bundles, a Champion group was established, which met every 2 weeks to ensure that the bundle criteria were being used. This group consisted of physicians, nurses, infection control practitioners, pharmacists, respiratory care practitioners, and clinical nurse specialists. All cases of infection were reviewed by the unit Champions, the results were shared with staff, and recommendations for improvement were made.

Objective & Purpose of Intervention

On the basis of preexisting evidence, it is apparent that the implementation of preventive measures improves VAP and CRBSI rates. The purpose of this quality-assurance intervention was to use the IHI Ventilator Bundle, the IHI Central Line Bundle, and an oral care protocol/kit to reduce VAP and CRBSI rates in ICU populations.

The IHI Ventilator Bundle involved the following procedures:

- Elevation of the head of the bed to 30°
- Provision of a daily sedation vacation and assessment of readiness for extubation
- Provision of prophylaxis for peptic ulcer disease
- Provision of prophylaxis for deep vein thrombosis (unless contraindicated)

The ventilator bundle was initiated in the MSICU in January 2005, in the TICU and NSICU in June 2005, and in the IMC, CCU, and CVICU in October 2005. A checklist to ensure compliance with the bundle was created and reviewed each morning during the study.

The Oral Care Protocol involved the following procedures:

- Tooth brushing twice daily
- Rinsing with an oral anti-plaque solution every 12 hours, swabbing with 1.5% hydrogen peroxide, and suctioning of secretions. Application of a moisturizer to the mouth every 4 hours in all ICUs and IMCs
- Rinsing with an oral CHG solution every 12 hours and tooth brushing, suctioning of secretions, and application of a moisturizer to the mouth every 2 hours in the TICU (beginning in February 2008)

The oral care protocol was initiated in the MSICU in January 2005, in the TICU and NSICU in June 2005, and in the IMC, CCU, and CVICU in October 2005. A checklist to ensure compliance with the bundle was created and reviewed each morning during the study.

The IHI Central Line Bundle involved the following procedures:

- Emphasis on hand hygiene
- Provision of maximal barrier precautions upon insertion of the central line
- Use of CHG for skin antiseptics
- Determination of the optimal catheter site (the subclavian vein was the preferred site)
- Daily review of the need for central lines; prompt removal of the lines when determined to be unnecessary
- Establishment of line carts in each ICU, which housed all of the supplies needed to insert a central line at the bedside (included progress notes and protocol)

The central line bundle was initiated in the MSICU in January 2005, in the TICU and NSICU in June 2005, and in the IMC, CCU, and CVICU in October 2005. A checklist to ensure compliance with the bundle was created and reviewed each morning during the study.



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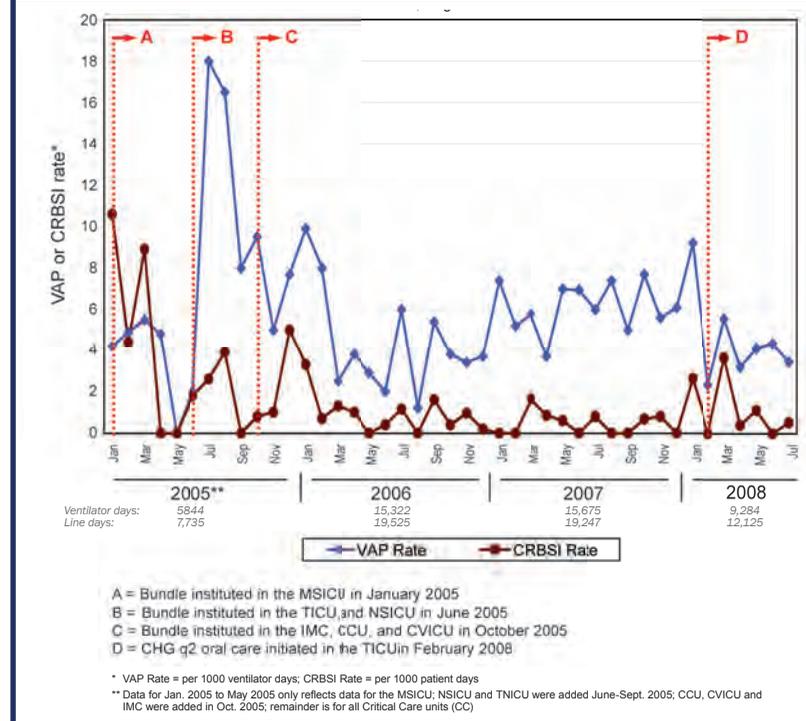
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RESULTS

The interventions, which began in 2005 and continued through 2008, resulted in decreased rates of VAP and CRBSIs in all critical care units (Figures 1 and 2). The most notable change occurred in the TICU, where the number of VAP cases decreased by 77%, from 10 cases (a rate of 31) in January 2008 to 2 cases (a rate of 7) in July 2008 (Figure 3). During this same time period, no CRBSIs were reported.

Figure 1: VAP and CRBSI Rates in Critical Care Units: 2005–2008



CONCLUSION

Introduction of the IHI Ventilator Bundle, IHI Central Line Bundle, and an oral care protocol reduced rates of VAP and CRBSIs in the MSICU, NSICU, and TICU at Inova Fairfax Hospital (Falls Church, VA).

Figure 2: VAP and CRBSI Rates in the TICU: 2005–2008

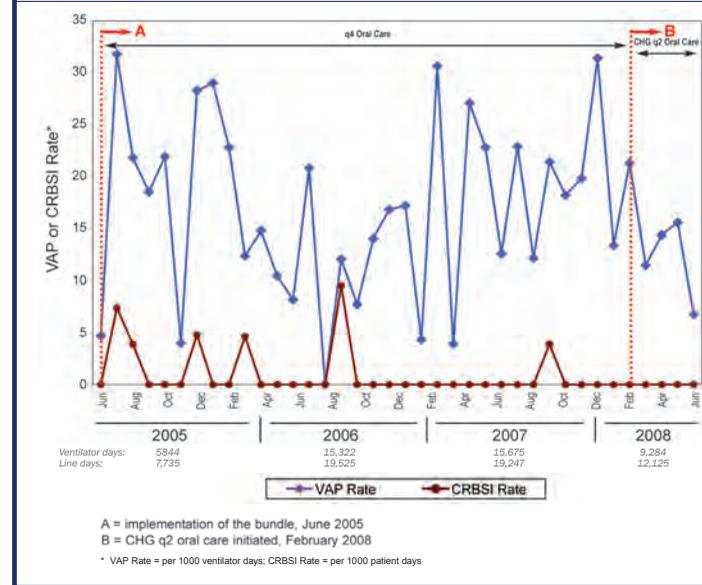
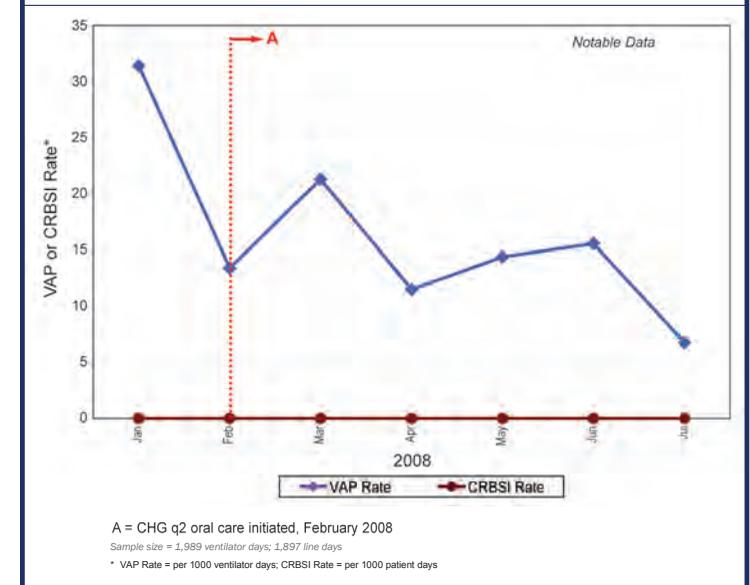


Figure 3: VAP and CRBSI Rates in the TICU: 2008



LESSONS LEARNED

- Implementation of the IHI Ventilator Bundle contributed to a reduction in VAP rates
- Implementation of the IHI Central Line Bundle contributed to a reduction in CRBSIs
- Provision of oral care every 2 hours and tooth brushing twice daily contributed to a reduction in VAP rates
- Use of a daily checklist and documentation of the oral care procedures followed on a bedside chart helped to ensure staff compliance with the bundles and oral care protocol
- Establishment of the multidisciplinary Champion group to track compliance and provide valuable feedback to the staff reinforced the benefits of the prevention measures and encouraged staff compliance with the bundles and oral care protocol