BACKGROUND

Ventilator-associated pneumonia (VAP) is a common nosocomial infection (NNI) that accounts for 20% to 30% of all nosocomial infections. In a medical-surgical ICU, VAP is the most common NNI and the leading cause of death. VAP occurs in 6 to 12% of ventilator-days in surgical patients and 2 to 8% in medical patients. VAP is preventable, and reducing VAP is a national priority. The Institute for Healthcare Improvement (IHI) has played a major role in the development and implementation of evidence-based practices to reduce VAP in the United States and around the world. The IHI Ventilator Bundle, introduced in 2005, is a set of interventions that have been shown to reduce VAP rates by 30% to 80% in surgical patients. The bundle includes six key interventions: 1) antibiotics within 6 hours of the first episode of fever or hypotension; 2) use of an oral care protocol involving a 0.12% chlorhexidine gluconate (CHG) rinse with alcohol reduced VAP rates in surgical patients; 3) use of CHG for hand hygiene; 4) use of maximal barrier precautions; 5) provision of prophylaxis for deep vein thrombosis (unless contraindicated); and 6) assessment of readiness for extubation. The IHI Central Line Bundle, introduced in 2005, is a set of interventions that have been shown to reduce CRBSI rates by 40% to 50% in surgical patients. The bundle includes five key interventions: 1) use of an oral care protocol involving a 0.12% CHG rinse with alcohol reduced VAP rates in surgical patients; 2) use of an oral CHG solution every 12 hours and tooth brushing, suctioning of secretions, and application of a moisturizer to the mouth every 2 hours; 3) use of a central line bundle; 4) use of CHG for skin antisepsis; and 5) use of CHG for line dressing. The IHI Central Line Bundle is intended to be used in combination with the IHI Ventilator Bundle to reduce the risk of VAP and CRBSI in surgical patients. The IHI Oral Care Protocol, introduced in 2005, is a set of interventions that have been shown to reduce the risk of VAP and CRBSI in surgical patients. The protocol includes six key interventions: 1) use of an oral care protocol involving a 0.12% CHG rinse with alcohol reduced VAP rates in surgical patients; 2) use of an oral CHG solution every 12 hours and tooth brushing, suctioning of secretions, and application of a moisturizer to the mouth every 2 hours; 3) use of a central line bundle; 4) use of CHG for skin antisepsis; 5) use of CHG for line dressing; and 6) use of CHG for line dressing. The IHI Oral Care Protocol is intended to be used in combination with the IHI Ventilator Bundle to reduce the risk of VAP and CRBSI in surgical patients.

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 (IMCU), coronary care unit (CCU), and cardiovascular ICU (CVICU) at Inova Fairfax Hospital. The central line bundle was initiated in the MSICU in January 2005, in the TICU and NSICU in June 2005, and in the IMCU, 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 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 NSICU in January 2005, in the TICU and NSICU in June 2005, and in the IMCU, CCU, and CVICU in October 2005. The oral care protocol 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 antisepsis
- 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 bedsite (included progress notes and protocol)

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

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

References:

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 30 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.

**RESULTS**

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Ventilator Days</th>
<th>Line Days</th>
<th>VAP Rate</th>
<th>CRBSI Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>5844</td>
<td>7,735</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>2006</td>
<td>15,322</td>
<td>19,525</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>2007</td>
<td>15,675</td>
<td>19,247</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>2008</td>
<td>9,284</td>
<td>12,125</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

* VAP Rate = per 1000 ventilator days; CRBSI Rate = per 1000 patient days

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

<table>
<thead>
<tr>
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* VAP Rate = per 1000 ventilator days; CRBSI Rate = per 1000 patient days

**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

**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).

**Introduction**

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).