Sustained Reduction in Ventilator-Associated Pneumonia (VAP) Using a Two-Hospital, Multidisciplinary Approach that Includes Oral Care and Regular Staff Education

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Abstract

Sustained Reduction in Ventilator Associated Pneumonia (VAP) Using a Two-Hospital, Multidisciplinary Approach that Includes Oral Care and Regular Staff Education

Background:

Ventilator-associated pneumonia (VAP) develops in about 9% of mechanically ventilated patients admitted to the intensive care unit (ICU), leading to longer duration of ventilation and longer stay in the ICU as well as additional medical care costs of more than $40,000 per patient case.

The high rate of VAP can be reduced with a multidisciplinary approach to reduce risk. The Institute for Healthcare Improvement (IHI) has initiated a "ventilator bundle" to reduce the risk of VAP, which includes elevating the head of the bed 30°, daily breaks in sedation, peptic ulcer disease prophylaxis, and deep venous thrombosis prophylaxis. The benefits of ventilator bundle usage have been demonstrated, but sustaining these benefits requires ongoing staff commitment.

Objective:

In 2004, our hospitals instituted a multidisciplinary task force to implement a risk reduction strategy with the goal of reducing VAP rates.

Methods:

The Task Force implemented the IHI ventilator bundle, as well as an oral care protocol, a protocol check sheet, and initial and regularly scheduled review education courses for the ICU nurses and respiratory care staff with the goal of reducing VAP rates. The protocol check-sheet was used to verify that each evidence-based component was being completed. Oral care was done every 4 hours with deep oropharyngeal suctioning. Tooth-brushing and an extubation assessment were conducted every 12 hours. The oral care kits and laminated protocols were affixed to the wall of each ICU room for easy staff access.

The initial education for all shifts of ICU nurses and respiratory staff was followed by a hands-on session that stressed hand hygiene, adherence to aseptic techniques, and oral cavity assessments. Infection control personnel and respiratory managers measured compliance using walking rounds and daily protocol check-sheets. Regular refresher sessions on the rationale for, and components of, the risk-reduction strategy were provided to ICU nurses, respiratory staff, and new staff every 6 months. The oral care kit vendor was present at all classes and fully supported the program.

Results:

Our results showed a steady zero rate of VAP after 1 year. It was determined, however, that to sustain this rate, the periodic refresher sessions would be required. Furthermore, at the end of 2006, the VAP rates were maintained at zero. In addition, we have continued to maintain a zero VAP rate through December 2007, despite adding 9 ventilator-capable beds to the ICU.

Combined Ventilator-Associated Pneumonia Rates Before and After Ventilator Bundle and Oral Care Program was Initiated

Year	2004	2005	2006	2007
Total VAP cases	7	0	0	0
Total ventilator days	1785	1875	2229	2134

Conclusions:

Implementation of a comprehensive program, including both oral care and regularly scheduled staff education, can result in a significant reduction in VAP rates that are sustainable over time. The inclusion of both ICU nurses and respiratory care teams into the protocol which includes oral care ensures patients get all evidence-based recommended interventions routinely, while successfully building a productive collaboration between the two disciplines. Furthermore, documentation using a daily ventilator check-sheet allows for measurement of task completion. It is important to note, regularly scheduled VAP prevention education ensures training and focus engrained into daily clinical practice.

Objective

In 2004, our hospitals instituted a multidisciplinary task force to implement a risk reduction strategy with the goal of reducing ventilator-associated pneumonia (VAP) rates. Both of our hospitals are community hospitals that admit between 9,300 and 10,440 patients each year. Both hospitals offer a full range of medical services, skilled nursing units, intensive care units (ICUs), birthing and women's care services, inpatient and outpatient surgery, cancer treatment, bariatric approaches to obesity treatment, and diabetes management.

Background

VAP, defined as an airway infection that develops more than 48 hours after intubation, occurs in about 9% of mechanically ventilated patients admitted to the ICU. The rate of VAP increases as the duration of ventilation, and the rate of VAP increases to 20% in patients ventilated for longer than 72 hours.[1]

- **Infection with multidrug-resistant bacteria occurs in up to 57% of patients with VAP.[1,2]**
  - → In a study of VAP by Schorr et al,[2] 31% of VAP cases were caused by *Staphylococcus aureus*, of which 38% were due to methicillin-resistant *S. aureus* (MRSA) strains.
  - → Other common causative organisms of VAP are *Pseudomonas aeruginosa, Haemophilus influenzae, Klebsiella pneumoniae,* and *Escherichia coli*.[2]
- **VAP increases the risk of mortality, length of mechanical ventilation and ICU stay, and medical costs.**
  - → The risk of death can be twice as high in patients who develop VAP during mechanical ventilation than in those who do not develop pneumonia[3,4] and even higher if caused by multiresistant organisms.[4]
  - → Development of VAP can lead to up to 3 times longer duration of ventilation and up to 2 times longer stays in the ICU.[3]
  - → Additional medical care costs can be more than $40,000 per patient case.[5] The presence of drug-resistant strains increases costs further.[2]

The high VAP rate in ICU patients can be reduced with a multidisciplinary approach to reduce risk.[6,7] The Institute for Healthcare Improvement (IHI) has developed a national initiative, the 5-Million Lives Campaign, that seeks to improve the quality of health care by reducing incidents of medical harm. The IHI initiative[8] includes recommendations to reduce the risk of VAP through the use of a "ventilator bundle":

- elevation of the head of the bed to 30°
- daily breaks in sedation
- deep venous thrombosis prophylaxis
- peptic ulcer disease prophylaxis

The benefits of ventilator bundle use in reducing VAP rates have been shown,[9] but sustaining these benefits requires an ongoing staff commitment.

Methods

Primary end-point of the study = VAP
defined as per the National Nosocomial Infections Surveillance System (NNIS) criteria[10]

Implementation of the IHI ventilator bundle and oral care protocol included use of the following products and procedures:

- Oral care kit (Q4 Care® Oral Cleansing and Suctioning System, Sage Products, Inc, Cary, IL)
- Protocol checklist: used to verify completion of each component of the protocol
- Initial and regularly scheduled education courses for the ICU nurses and respiratory care staff with the goal of reducing VAP rates
- Deep oropharyngeal suctioning and oral rinsing every 4 hours
- Extubation assessment every 12 hours
- Tooth and oral care every 4 hours:
  - → use of suction toothbrush to remove plaque and oral secretions
  - → use of 0.05% cetylpyridinium chloride antiplaque solution
  - → use of 1.5% hydrogen peroxide solution to mechanically clean the teeth and oral tissues
  - → application of a water-based oral moisturizer for the oral tissues and lips
- Affixation of the oral care kits and laminated protocols to the wall of each ICU room for easy staff access

The initial education of all ICU nurses and respiratory staff was done with an education program led by a representative from the manufacturer. This program was followed by a hands-on session that stressed hand hygiene, adherence to aseptic techniques, and oral cavity assessments. Infection control personnel and respiratory managers measured compliance by conducting walking rounds and using daily protocol checklists. Regular refresher sessions on the rationale for, and components of, the risk-reduction strategy were provided to ICU nurses, respiratory staff, and new staff every 6 months. The oral care kit vendor was present at all classes and fully supported the program.

St. Luke Hospitals

VENTILATOR BUNDLE CHECKLIST
(Individual Patient)

Patient:_____ **Admit Date:**_____

	Day 1		Day 2		Day 3		Day 4		Day 5		Day 6		Day 7	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Head of the Bed 30°														
Daily Sedation Vacation and daily assessment of readiness to extubate														
PUD Prophylaxis														
DVT Prophylaxis														
Sage Product														

Non-compliance
Date/Reason

_____
_____
_____
_____
_____
_____
_____
_____
_____

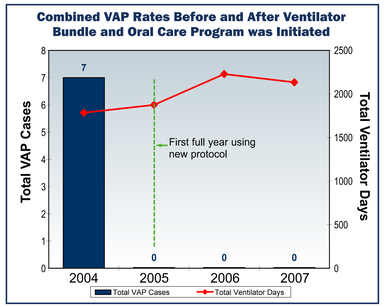
*Adapted from a tool created by Dominical Hospital.

Results

Steady zero rate of VAP after 1 year of using the new intervention protocol

It was determined, however, that to sustain this rate, the periodic refresher sessions would be required. Therefore, we instituted ongoing refresher education sessions.

Successful reduction of VAP rates to zero continued through 2006 and 2007, despite the addition of 9 ventilator-capable beds to the ICU



Conclusion

We were able to reduce VAP rates to zero using a comprehensive program that included the use of a ventilator bundle, an oral care program, and ongoing staff education. Although reductions in actual mortality or medical costs could not be determined from our data, it is possible that savings of **up to $840,000 ($40,000 per VAP case)[5] were realized over the 3 years that VAP rates were zero.**

Lessons learned:

- **Use of a comprehensive program that includes a ventilator bundle and thorough oral care can reduce VAP rates to zero.**
- **Ongoing staff education is an important factor in the success of this program because it ensures that a focus on VAP prevention is engrained into daily clinical practice.**
- **Inclusion of both ICU nurses and respiratory care teams in the protocol ensures that patients receive all evidence-based recommended interventions routinely, and that a productive collaboration between the 2 disciplines develops.**
- **Use of a daily ventilator checklist ensures completion of the tasks.**

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Author Financial Disclosures: Funded research on Sage 2% CHG Skin Cleansing Product, Sage Advisory Board for Skin Cleansing Products

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